Payment Method Design:

Psychological and Economic Aspects of Payments

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Abstract

Paying for goods and services creates disutility for the payer. Based on ideas from behavioral economics, we contend that the disutility of paying can be substantially influenced by the method of payment. We develop a model of the consumer that takes into account phenomena such as the pain of paying, the sunk-cost effect, and self-control issues. In a laboratory experiment we test this model and the relative magnitudes of these different psychological effects: pain of paying is separated out using a micro-payment method (small payments that require specific confirmation), sunk cost is gauged by comparing the effect of pre-payment with post-payment, and the desire for self control is ascertained using stated preference across different payment methods. The experimental results showed that the pain of paying has a substantial influence on payment, and to a lesser degree so does the sunk cost effect. Subjective preferences for the different payment-methods indicated that respondents are generally aware of the aversiveness of payment, yet are not concerned with self-control.

1 Introduction

An analysis of payment methods using standard economic theory suggest that the main issues involved in payments are the disutility of the price itself (the utility of the other things that could be bought with the money spent), the effort of making a decision, and the hassle of making a payment[1]. Within these components most of the work on pricing concerns the selection of the price itself. This focus on the magnitude of price as opposed to other aspects of the payment experience spawns most likely from the availability and applicability of economic theory. Other aspects of price, such as its salience in the payment process, its objective nature, the ease of manipulating prices, and the comparability of price across different options, contribute further to this focus. In addition, the focus on price might be due to the fact that price is easier to communicate than other, non-numerical, aspects of the product, service, or payment.

In contrast to the view of standard economics, the main thesis of the current work is that payment methods can influence behavior in ways that are not captured by the economic model. Psychological aspects that are not included in the standard economics view include: the timing of payments, (payment before or after consumption); whether the payments are coupled with consumption or separate from it; whether the price is presented in aggregate, as the total expenditure, or as a set of smaller payments; and whether the payment method allows for flexible arrangements. Combined, these elements can create systematic effects of the design of different payment methods on willingness to pay for otherwise identical products and services. For example, Prelec and Simester (2001) show that availability of a credit card logo leads to more consumption.

Questions regarding the effects of different payment methods are becoming particularly pertinent as menu cost is reduced, as the flexibility of using different payment methods increases, and as the cost of implementing different payment methods is reduced — all of which become particularly feasible in digital exchange markets such as the World Wide

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[1]Such analysis would suggest that there are two general types of payment method consumers should react to: whether the payment is bundled or unbundled.

Web. The low menu cost suggests that sellers can efficiently create very targeted pricing schemes. The increase flexibility means that providers can facilitate different payment mechanisms (e-wallets, anonymous transactions, micro-payments, etc.) at their discretion and in a cost-effective way. With the ease of controlling payment methods to a larger degree, the psychological effects of payments can have an increased effect on payment, and as such are more important to study and understand.

Structure of the paper: In the next section we will present in more detail the psychological phenomena that bear on the design of payment methods. In section three we will develop a framework for analyzing the effects of these phenomena using different payment methods. Section four describes the content selling experiment, and its results. Section five discusses these results in the context of the model. The paper ends with a summary of results and discussion of future research.

2 Psychological phenomena and their effects on payment methods

2.1 Timing of payments and the "pain of paying"

The total aversion to making a payment can be divided into three elements. The first is the disutility of payment, the opportunity cost — in utility — of the money that is spent. The second element is the hassle associated with paying: for example, clicking on a link is much less hassling than filling in all information in a credit card slip. The third element, the remaining aversion to making a payment when the effects of foregone utility and hassle are taken into account, is called the "pain of paying" (Prelec and Loewenstein, 1998).

Prelec and Loewenstein (1998) propose that paying decreases enjoyment, but that due to the saliency of the payment that this decrease is concentrated around the payment time. Thus, the momentary enjoyment with an experience is based on the intensity of the experience at that moment as well as on the distance in time from payment. In addition,

Prelec and Loewenstein (1998) propose that the effects of the time distance from payment are nonsymmetrical for payments that take place before and after consumption. Based on anticipation and dread (Loewenstein 1987), it is argued that paying after the consumption experience causes larger negative effects on consumption. As an illustration of these points consider an exotic vacation: When will you enjoy such a vacation more, if you pay for it a month before you go or just as you return home from your vacation? The pain of paying implies that the enjoyment from the last few days of an exotic vacation would be tinted by the knowledge that payment for the vacation is due and thus the enjoyment from these last days will be diminished. In contrast, paying early for the vacation (and even better much in advance) will eliminate the pain of paying. The implication for payment methods is that, absent any self-control issues, prepayment of hedonic consumption should be preferred to post-payment. Preference for a pay-per-use approach relative to these other two approaches is less predictable and covers the range from being the least preferred to being somewhere between the pre- and post-payment. On one extreme, since the overlap of the pain of paying with the consumption experience is highest in the pay-per-use payment method, this could lead this payment method to be least preferred. On the other hand, when using a pay-per-use method, the dread of payment is reduced and to the extent that the component of the dread is large, preference for pay-per-use can be lower than pre-payment but higher than post-payment.

Thus, whether pay-per use will be preferred to or over pre-payment will depend on the degree of dread and also on the time scale differences between consumption and payment. The closer in time payment is to consumption; the smaller will be the difference between pre-payment, post-payment, and pay-per-use. The time scale used in our experiment is rather short and as such our estimation of the pain of paying is likely to be too low.

2.2 Mental accounting and the pseudo sunk cost effect

If consumers consider the money deposited in a mental account to be non-fungible across accounts (Thaler, 1980, 1985, 1990, 1999; Gourville and Soman, 1998), then an effect

similar to that of a sunk cost can occur. Consumers depositing money into an account (such as an electronic wallet) that is earmarked for a specific purpose will see this money as not fungible, and treat it as gone. Under such circumstances consumers will acquire all objects x in the domain of the mental account that provide some utility $u(x) > 0$ until they runs out of money in the account. On the other hand, even if there are objects y that are not in the domain ot that mental account, such that $u(y) > u(x)$, the consumer might still not buy objects y instead of x because the consumer considers the money in the account sunk, making x "free", whereas y is costly. This type of mental accounting can lead to overconsumption (and overspending) of objects in the domain of the account x, and the corresponding underconsumption of objects outside the domain of the account, y. Note that this is not the same as the sunk cost bias, where consumers' decisions are influenced by costs that are actually sunk (Thaler, 1990).

We propose that the effects of such non-fungible mental accounts is particularly likely to be activated in cases where the method of payment is pre-payment, and moreover, that this effect will even take place in settings where it is clear that the account is perfectly fungible (when the non-used part of the pre-payment is returned at the end of consumption). For example, if a web site allows pre-payment into an electronic wallet, and the money in the wallet is considered by consumers as sunk, consumers will overspend on that web site. In this case, overspending occurs because the apparent cost of consumption is zero, despite the fact that there is a real opportunity cost, since the money in the electronic wallet is *really* fungible and could be used for different purposes.

2.3   Self-control issues

The negative effects of payment methods (such as the pain of paying and hassle costs) can also have a positive side for individuals who have self-control problems, helping these individuals to control their consumption. Suppose a buyer, Luisa, knows that once in front of a computer she will spend too much time browsing content and not enough working on productive tasks. Imagine further that Luisa's favorite content site is a for-pay site

offering a variety of different payment methods. Luisa might pick a payment method that would help her combat her desire to browse the site and avoid work. She might opt for a cumbersome micro-payment method (small payments made separately for each individual consumption) to a straightforward subscription method in order to make the transactions visible and help lower her consumption. Evidence for sophistication of using external devices to control behavior was shown by Ariely and Wertenbroch (2002), and use of payment mechanisms for self-control was shown in Wertenbroch (1998). In a multiple selves framework commonly used to analyze dynamic decisions where preferences change over time (Strotz, 1956; Pollak 1968; Peleg and Yaari, 1973; Goldman 1980; Ainslie, 1991; Laibson, 1997), Luisa's choice of method of payment is a decision that an earlier self (Luisa at time 0) makes in order to force later selves (Luisa at times 1,2,...) into a desirable pattern of behavior (from the viewpoint of the earlier self, Luisa at time 0).

It is important to note that there are two preconditions for the consumer to choose a more cumbersome method of payment (eg. having to approve each small payment separately). First, the consumer has to desire self-control. Second, the consumer must perceive the different methods of payment as having different implications for self-control. If Luisa doesn't care about self-control, or if she perceives all methods of payment as equally effective in curbing her consumption, then she will have no preference for a method that is more cumbersome. The results of Ariely and Wertenbroch (2002), as well as Wertenbroch (1998) suggest that in many cases individuals desire self-control and that they understand how to use their environment to curb their behavior. Whether the same applies in the domain of payment used in our experiment is an open questions that will be tested.

2.4 Categorization of payments

As the units sold become more and more atomistic, the per-unit price decreases. At very atomistic levels, the price becomes very small, and there is the possibility that it will be close to zero. It is possible such small amounts (for instance, small fractions of a cent)

can be categorized and perceived as zero. Consider a consumer, Sumi, who can buy news items at 0.03 cents per item, with a system in place to aggregate payments into a monthly bill. Sumi might categorize the price as zero (in a sense, Sumi considers 0.03 cents too low a sum to warrant intellectual consideration) and, acting in accordance, will consume as if the news items were free. The counterpoint of this categorization is the bill shock that Sumi will experience at the end of the period.

The aggregation and disaggregation of payments can influence behavior even if the amounts are not categorized as zero. Based on Kahneman and Miller (1986) norm theory, we propose that the comparison class of purchases will be influenced by the nominal amount of the decision — purchases entailing small sums of money will be compared to other small purchases and purchases entailing large sums of money will be compared to other large purchases. By combining or separating payments, the nominal amount and hence the mental category to which these payments are compared can be changed, which ultimately change willingness to pay (Gourville, 1998). For example, if the price per news item were 5 cents, a consumer would compare the utility of the news item with that of a stick of gum. If the price were $2.50, the same consumer would compare the utility of the news item with that of a cup of espresso. The implication here is that as micro-payments decrease in value, the mental accounts used will generate comparisons with different types of expense, changing the shadow cost of the money consumers use to evaluate their purchases.

In summary, there are two effects of categorization: with small payment amounts, categorization into zero, and, with larger payment amounts, the allocation into different comparative categories.

3   Model

In this section we develop a model of consumer decision making that takes into account the various economic and psychological issues mentioned above (effort of payment, pain of paying, mental accounting and the pseudo sunk cost, and categorization of payments).

The model, as well as the experiment, are set in a context of purchasing digital context on the world wide web, where consumers pay for information they browse and consume. The context of content selling was selected because it is familiar to our respondents, because it allows us to sell content for real in the lab, because it provides a very high flexibility in payment method design, and because it is an important application area for payment methods.

Based on the model, five different payment methods were designed (implemented, and tested in the experiment) to tease apart the importance of the different psychological aspects. Specifically, we examined three types of measures to provide support for the model and estimate of the different effects: First, we compared quantities of content consumed across the different methods to measure the pain of paying and the sunk cost effect. Second, we compared the distributions of quantities of content consumed, taking into account the heterogeneity in valuations. Finally, we use self-reports of preference and impressions to determine whether self-control is a relevant concern in this environment.

3.1 Modeling pain of paying and sunk-cost effect from cross-condition quantities

We will now show how comparisons of quantities consumed in each method of payment can be used to back out the importance of the pain of paying and the sunk-cost effect.

We assume that each consumer j has a valuation $v_j(i)$ for each piece of content i. There are M (for many) pieces of content, so $i = 1, \ldots, M$. We represent unobserved factors beyond the experimenter's control with an i.i.d. additive stochastic disturbance to the cost of each decision, ϵ_{ij}, with $\mathrm{E}[\epsilon_{ij}] = 0$ and $\mathrm{Var}[\epsilon_{ij}] < \infty$. We denote the different costs thus:

$$
\begin{aligned}
p &= \quad \text{Unit price} \\
h &= \quad \text{Hassle of approving a payment} \\
d &= \quad \text{Effort to make a decision} \\
n &= \quad \text{Pain of paying}
\end{aligned}
$$

The pain of paying n is divided in two parts: one, the intrinsic part, is associated with the actual payment, regardless of its salience; the second part is associated with the salience of the payment. We denote the influence of salience by α, so that $(1-\alpha)n$ is the non-salient pain of paying and αn is the salient part.

In the context of purchase of digital content, we consider five methods of payment: a subscription method (sub), where the subject buys unlimited access to all content for a fixed fee; a subscription + hassle method (sub+h), which proceeds like in the subscription method, but with the addition of a dummy approval of a payment of zero before accessing subscribed content; a pre-payment method (pre) where the subject deposits money in an electronic wallet, then proceeds to spend it, buying pages at a per-unit rate p, with the balance of the account resolved at the end; a post-payment (post), or metered method of consumption where the subject account is charged during the browsing process and the account is settled at the end; and a micro-payments method (micro) where the process is similar to post-payment, but each transaction requires a confirmation at the instant of consumption, making the payment salient (and therefore identifying αn).

Given a payment method, the consumer acquires all pieces of content that provide a value higher than its marginal cost. For example, in the subscription method this cost will be zero, so consumer j will buy all i that obtain $v_j(i) > \epsilon_{ij}$. Different methods will lead to different stopping points, as shown in the following equation (we postpone discussion of pre-payment for later)

$$
\begin{array}{lll}
\textsf{sub} & j \text{ buys } i \text{ if } v_j(i) > \epsilon_{ij} & \\
\textsf{sub} + \textsf{h} & j \text{ buys } i \text{ if } v_j(i) > \epsilon_{ij} + h & \\
\textsf{post} & j \text{ buys } i \text{ if } v_j(i) > \epsilon_{ij} + d + p + (1-\alpha)n & \\
\textsf{micro} & j \text{ buys } i \text{ if } v_j(i) > \epsilon_{ij} + d + p + h + n &
\end{array}
\tag{1}
$$

We note that the effects of price, non-salient pain of paying, and decision effort are not separable in this formulation. Setting price to zero, for instance, would nullify the need for a decision, and the pain of paying would have no meaning in this case. We will take price to be the proxy for the three effects combined (i.e. $d + p + (1-\alpha)n$).

Also, as the buying rules for post and micro show, the salient part of the pain of

paying, αn, is confounded with the hassle of making a payment, h. If we are to interpret the difference in $Q(\mathsf{post})$ and $Q(\mathsf{micro})$ as a reflection of the magnitude of αn, we need to establish that h is very small. In order to test whether h is indeed very small, we create a rather artificial method of payment, subscription + hassle ($\mathsf{sub+h}$), to test the hypothesis that $h \approx 0$. In this method the experiment proceeds like in the subscription method, but with a dummy approval of a payment of zero before accessing subscribed content. If $Q(\mathsf{sub}) \approx Q(\mathsf{sub+h})$, then we can be confident that in our setting $h \approx 0$.

Regarding the pain of paying (and assuming that we can separate it from hassle by using the subscription + hassle method to verify that $h \approx 0$), our model predicts that

$$\frac{\partial}{\partial n}\left(Q(\mathsf{post}) - Q(\mathsf{micro})\right) > 0. \tag{2}$$

In other words, high pain of paying will make a significant difference in the consumed quantities in post-payment methods versus micro-payment methods.

We now look at the pre-payment condition. Absent mental accounting, this condition should be equal to the post-payment condition, since all relevant costs at each decision occasion are the same (the consumer should compare $v_i(j)$ with $d + p + (1 - \alpha)n + \epsilon_{ij}$). On the other hand, if the mental accounting effect causes the money deposited in the pre-payment method to be considered as sunk (and therefore non-fungible with other expenses), the pre-payment method should yield similar result to the subscription method of payment. The more the account is considered sunk, the more similar pre and sub results should be. So, by comparing the quantity consumed in the pre-payment mode, $Q(\mathsf{pre})$, with $Q(\mathsf{sub})$ and $Q(\mathsf{post})$, we can gauge the magnitude of the pseudo sunk cost effect. When this effect is strong, $Q(\mathsf{sub}) - Q(\mathsf{pre})$ should be small and $Q(\mathsf{pre}) - Q(\mathsf{post})$ should be large; when the pseudo sunk cost effect is small, $Q(\mathsf{sub}) - Q(\mathsf{pre})$ should be large and $Q(\mathsf{pre}) - Q(\mathsf{post})$ should be small.

Formally, let $k \in [0, 1]$ denote the extent of the sunk cost effect. Then, the following relationship between quantities consumed in subscription, $Q(\mathsf{sub})$, pre-payment, $Q(\mathsf{pre})$, and post-payment conditions, $Q(\mathsf{post})$, should hold:

$$Q(\mathsf{pre}) = k\,Q(\mathsf{sub}) + (1 - k)\,Q(\mathsf{post}). \tag{3}$$

We determine the importance of αn and k from comparisons of quantities, using the predictions of equations (2) and (3), conditional on hassle not being important. (See Figure 1 for illustration.) In summary, our use of the conditions is as follows: sub is the baseline case; post allows us to look at the effect of price; micro allows us to look at the effect of salient pain of payment; we use pre to determine the extent of the sunk-cost effect; and to verify that the hassle involved in micro is not relevant we use a sub+h method.

$$= = = = = = = = = = = = = =$$

Insert Figure 1 about here

$$= = = = = = = = = = = = = =$$

3.2 Heterogeneity in valuations and distribution of quantities consumed within each condition

In order to further validate the results of the comparisons of quantities predicted in the previous section, we make some predictions regarding the distribution of purchases within each method. We note that these will be different depending on the marginal cost of the method, and use these predictions to add face validity to the framework.

We allowed for different preferences $v_j(i)$ and for stochastic disturbances ϵ_{ij} in the model above, and made aggregate predictions for comparisons across methods. We now make predictions regarding the effect of heterogeneity on the distribution of quantities within methods. NOTATION: the $v_j(\cdot)$ are drawn from a set $\mathcal{J}$, with c.d.f. $F_J(j)$; the ϵ_{ij} have c.d.f. F_ϵ; and we assume both v and ϵ draws are i.i.d. We denote the marginal cost of a mode of payment by c and without loss of generality assume it continuous. The critical marginal costs (the stopping points) for each method are the following:

$$
\begin{aligned}
\text{sub} \;:\quad & c(\text{sub}) = 0 \\
\text{sub+h} \;:\quad & c(\text{sub+h}) = h \\
\text{post} \;:\quad & c(\text{post}) = p + d + (1-\alpha)n \\
\text{micro} \;:\quad & c(\text{micro}) = p + d + h + n
\end{aligned}
\tag{4}
$$

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Regarding the pre-payment method, we could assume that $c(\mathsf{pre}) \approx k(p+d+(1-\alpha)n)$, a linear interpolation, but in fact all that we need is that $c(\mathsf{post}) \geq c(\mathsf{pre}) \geq c(\mathsf{sub})$, which is implied by equation (3). We also assume, as above, that $h \approx 0$ so that $c(\mathsf{sub}) \approx c(\mathsf{sub+h})$.

The probability of consumer j choosing to see zero content is $\prod_{i=1}^{M} \left[1 - F_\epsilon\big(v_j(i) - c\big)\right]$. As the cost increases the probability of observing consumers who buy no content increases:

$$\frac{\partial}{\partial c} \int_{\mathcal{J}} \prod_{i}^{M} \left[1 - F_\epsilon\big(v_j(i) - c\big)\right] \, dF_J(j) \geq 0. \tag{5}$$

Therefore, for the methods with higher cost, we should see more instances of zero consumption. On the other hand, the probability of subject j consuming all pieces of content is $\prod_{i}^{M} F_\epsilon\big(v_j(i) - c\big)$, and the probability of observing consumers who buy all content decreases with c:

$$\frac{\partial}{\partial c} \int_{\mathcal{J}} \prod_{i}^{M} F_\epsilon\big(v_j(i) - c\big) \, dF_J(j) \leq 0. \tag{6}$$

We can make predictions regarding the distribution of mass on the histograms for the quantities consumed by payment method: the higher the cost, the more mass to the left the histogram should have. Specifically, the number of zero purchases, call it $N_0(\mathsf{method})$, should be ordered as follows (combining equations (4) and (5)):

$$N_0(\mathsf{micro}) \geq N_0(\mathsf{post}) \geq N_0(\mathsf{pre}) \geq N_0(\mathsf{sub+h}) \geq N_0(\mathsf{sub}), \tag{7}$$

and the number of subjects purchasing all content, call it $N_A(\mathsf{method})$, should be ordered as follows (combining equations (4) and (6)):

$$N_A(\mathsf{micro}) \leq N_A(\mathsf{post}) \leq N_A(\mathsf{pre}) \leq N_A(\mathsf{sub+h}) \leq N_A(\mathsf{sub}). \tag{8}$$

With some cumbersome math, it can be shown that the pattern of histogram mass follows the extremes of equations (7) and (8): as the cost increases, there is more mass closer to zero (i.e. to the left of the histogram). We can test these predictions on the data to add validity to the results of the individual model described in the previous section.

3.3 Evaluating desire for self-control through stated preferences

How could one test whether consumers use payment methods as self-control devices? Self-control by itself is not directly evident from behavior since it involves a behavior with a particular intention. Thus, we need to measure behavior as well as impressions and intentions in order to classify it as self-control. More specifically, for a behavior to be considered as self-control, it must exhibit two components: First, the consumer must consider that controlling one-self is desirable, and second the consumer must follow-up and engage in self-control. In our payment scenarios, the translation of these conditions implies that a consumer considers that she will make better decisions with the micro-payment method compared with other methods, and that she will indeed prefer micro-payments to the other methods. We now use our model to test these predictions/implications.

The stopping points in equation (1) imply that the average quality of a decision $E(v_{ij}|j$ consumes $i)$ is increasing in the marginal cost of the method. When ranked by average quality, the payment methods yield:

$$
\begin{aligned}
E(v_{ij}|j \text{ consumes } i; \text{ Method} = \textsf{micro}) \geq \\
E(v_{ij}|j \text{ consumes } i; \text{ Method} = \textsf{post}) \geq \\
E(v_{ij}|j \text{ consumes } i; \text{ Method} = \textsf{pre}) \geq \\
E(v_{ij}|j \text{ consumes } i; \text{ Method} = \textsf{sub}).
\end{aligned}
\tag{9}
$$

Knowing this, a subject with strong interest in controlling the quality of the content would have the following preferences over modes:

$$
\textsf{micro} \succsim \textsf{post} \succsim \textsf{pre} \succsim \textsf{sub}.
\tag{10}
$$

Note that for this to be true, the subject has to be aware of the rank order equation (9); otherwise, even with a strong preference for self-control, there is no guarantee that she will have preferences over methods as those in equation (10). The consumers being aware of the order in equation (9) is not a trivial assumption, and needs to be established empirically.

On the other hand, a consumer interested only in minimizing the psychological costs of browsing (and implicitly in making the experience as pleasurable as possible) should have the opposite preferences over methods of payment:

$$\mathsf{sub} \succsim \mathsf{pre} \succsim \mathsf{post} \succsim \mathsf{micro}. \tag{11}$$

We can test the preference for self-control by checking whether the subjects are aware of the quality ordering in equation (9) and if so, whether their preference for methods is more consistent with equation (10) — indicating a preference for self-control — or with equation (11) — indicating a preference for pain avoidance.

4 Experimental validation

4.1 Interactive Content Purchasing Experiment

The experimental setting was content selling, similar to the emerging attempts to sell content on the World Wide Web. Within this general environment, we implemented five different payment methods as discussed earlier (sub, pre, post, micro, and sub+h).

Subjects: One hundred and thirty-three students in the University of California at Berkeley participated in the experiments in exchange for payment. Subjects were randomly assigned to one of the five experimental conditions.

Procedure: As participants came to the lab, they signed a receipt for the $10 show-up fee and were randomly assigned to one of the five experimental conditions (sub, pre, post, micro, and sub+h). Participants, sat individually next to a computer and the instructions were presented for them to study. The instructions explained that the duration of the study is 45 minutes, during which the respondents must look at the computer screen. Within this time frame respondents could use four different information web sites, in any way they wanted. The information web sites were: "cultural studies," news, science, and cartoons. Each of the sites contained 50 articles (or cartoons). The "cultural studies" web site was created to have very low appeal (see example below). The 50 articles in it were taken from an automatic "post-modern" text generator

(`http://www.elsewhere.org/cgi-bin/postmodern/`). The news and science information pages were created to be at a middle level of interest and were taken from major web sites. We took particular care to make sure that the appeal of all articles in this category would not diminish over time, and in particular that their relevance would not change during the weeks we conducted the experiment. Because we selected news and science information pages that were not time sensitive, they were also less interesting in our subjective assessment. Finally the cartoon category was chosen as one in which the students had the most interest. We selected genres of cartoons that a pretest indicated the students like the most (New Yorker, Doonesbury, Dilbert, For better or for worse, Jump start, Monty, and Rose). When choosing the specific cartoons within the genre, we picked ones that appeared in press years before the study to maximize the chances that the students had no knowledge or memory of these cartoons.

> Example of cultural studies content: *Sexual identity is intrinsically impossible, says Foucault; however, according to de Selby [1], it is not so much sexual identity that is intrinsically impossible, but rather the dialectic, and some would say the stasis, of sexual identity. Thus, one has to choose between premodern dialectic theory and subcultural feminism as the main theme of the works and the role of the observer as a poet D'Erlette [2].*

To ensure that respondents knew what to expect in each of the categories before ever having to pay for it, the experimental instructions provided them with examples of the content from each of the four categories. Respondents were also told that while they can browse the information in the "cultural studies" category for free, the information in the other three categories would cost them money, to be deducted from their payment check at the end of the study (the amounts and payment methods differed across the five conditions). After the 45 min of browsing, respondents were presented with a set of questions about their familiarity with the web and experience with web-payments. After this section, the four main payment methods (micro-payments, pre-payments, post-payments, and subscription) were described to each participant. These included the

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payment method they had just used during the experiment, plus the three methods they did not experience. Once all payment methods were explained, respondents were asked to divide a sum of 100 points to indicate their relative preference and predicted usage across these four methods. These relative ratings were used to understand respondents' intuitions about they behavior and also to contrast their intuitions to their real behavior.

Design: The experiment had 5 conditions: micro-payments, pre-payments, post-payments, subscription, and a subscription+hassle condition. In each condition respondents could look at four types of information: cultural studies, news, science, and cartoons. Respondents were asked to pay for all but the cultural studies category. In the three pay-as-you-go methods (micro-payments, pre-payments, post-payments) payment was 0.5 cents for each the news and science articles and 3 cents for each cartoon. Once a respondent paid for an article or a cartoon, they could view it for as long and as frequently as they wanted. In the two subscription methods (subscription, and subscription+hassle) payment was 10 cents for the news and science categories and 60 cents for the cartoons category[2]. In these cases, a one-time subscription payment entitled the respondent to view all the information in the category they subscribed to. In all conditions the software included an electronic wallet that allowed respondents to view their spending during the experiment. Figure 2 depicts the activity flowcharts in the different conditions. The conditions were as follows:

Micro-payments: In this condition respondents paid for each page they saw. After clicking on a link to one of the four categories, and one of the 50 items in each category, respondents were asked if they wanted to pay the specified amount (0.5 cents for an article, 3 cents for a cartoon). Note that an item that has been paid for was considered purchased, which meant that respondents could revisit previously bought pages as many times as they wanted without incurring additional charges. At any point during the experiment, respondents could examine their electronic wallet, which indicated the sum of money they have spent up to that point. At the end of the study the sum of payments (as indicated in the electronic wallet) was

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[2]The base prices and the subscription volume discount were determined in a pre-test.

deducted from the show-up fee.

Post-payments: This condition resembled the micro-payments condition with one main difference: respondents were not asked to approve each transaction. At any point during the experiment, respondents could examine their electronic wallet, which indicated the sum of money they have spent up to that point. At the end of the study the sum of payments (as indicated in the electronic wallet) was deducted from the show-up fee.

Pre-payments: This condition resembled the post-payments condition with one main difference: respondents were not allowed to view any article or cartoon unless they had sufficient money in their electronic wallet to cover this expense. When the amount of money in the electronic wallet was not sufficient, respondents were informed that their electronic wallet was short of cash, and they could deposit more money into it. As long as the amount of money in the electronic wallet was sufficient to cover the pages, the process continued much like the post-payment condition. At any point during the experiment, respondents could examine their electronic wallet, which indicated the sum of money that was deposited into it as well the amount that has not been spent. At the end of the study the sum of payments deposited to the electronic wallet minus the amount that was not spent (as indicated in the electronic wallet) was deducted from the show-up fee.

Subscription: When respondents entered a category they had not subscribed to, they were prompted with a window asking them if they want to subscribe to this category. If they answered positively, they were charged the appropriate amount, and were presented with a screen showing them all the information available to them (names of all the articles or cartoons). Subsequent entries to the same category did not involve the subscription window and respondents had free access to view and browse this category as much as they wanted. At any point during the experiment, respondents could examine their electronic wallet, which indicated the sum of money they have spent up to that point. At the end of the study the sum of payments (as indicated

in the electronic wallet) was deducted from the show-up fee.

Subscription+hassle: Overall, this condition was very similar to the subscription condition with one major difference: before showing any article or cartoon, respondents were asked to approve that indeed they wanted to see that item. Note that this added hassle was such that the physical activity in this condition was the same as in the micro-payments condition.

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Insert Figure 2 about here

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4.2 Results

4.2.1 Expenditures:

We first examined the total expenditure across the five different conditions. The results show that there was no difference ($t(52) = 0.138, p = .891$) in spending between the subscription+hassle and the subscription conditions. We therefore collapse the two subscription conditions into a single category, subscription, for this analysis. An Overall ANOVA showed that payment method had a significant effect on total expenditure ($F(3, 129) = 7.83, p < 0.001$). As can be seen in Table 1, payment was highest in the subscription condition (M = 28.3), lower in the prepayment condition (M = 17.8), lower still in the post payment condition (M = 12.3), and lowest in the micro-payment condition (M = 3.9). Payments in the micro-payments condition were significantly below post-payment ($t(51) = 2.93, p = 0.005$), pre-payment ($t(5) = 2.96, p < 0.005$), and subscription ($t(78) = 4.21, p < 0.001$). The difference between the pre-payment and post-payment conditions was not significant ($t(51) = 1.04, p = .3$). The payments in the subscription condition were clearly above those in the micro-payments, they were also significantly above the post-payment condition ($t(79) = 2.69, p = 0.009$), but only marginally significantly above the pre-payment condition ($t(78) = 1.6, p = 0.11$). For effects in the different

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content categories, see figure 3.

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Insert Table 1 about here

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Insert Figure 3 about here

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4.2.2   Quantity:

Next, we examined the number of items respondents saw in each of the content categories, across different payment methods. Again, there was no difference between subscription and subscription+hassle — showing that the added hassle component of physically approving a payment did not influence browsing quantity[3]. Based on this similarity, the subscription and subscription+hassle were combined into a single category, subscription, for this analysis. In terms of the categories of information we expected the news and science categories to have approximately equal appeal; indeed there were no differences in viewing or payments for these two categories. Thus, we collapsed news and science together for analysis and presentation. Respondents in the subscription conditions viewed many more cartoons than the respondents in the other three conditions ($F(3, 129) = 5.32, p = 0.002$). The reverse was true of the information in the cultural studies category where respondents in the subscription conditions viewed this information much less than the other three conditions ($F(3, 129) = 6.59, p < 0.001$). As for the news and technology categories, again we see that respondents in the subscription conditions viewed more articles than the respondents in the other three conditions. By comparing with Figure 4 we also see that the quantities purchased in the pre-payment condition exhibit higher dispersion than those

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[3]In other words, the effect of h was negligible, which means that any effects of micro-payments could not be attributed to hassle.

in the post-payment and micro-payments conditions. This dispersion pattern for the pre-payment condition is the cause for the somewhat higher overall payments of this condition. Note that the effect of the pre-payment condition (compared with the post-payment condition) seems to be stronger for the two cheap categories (news and technology) and lower for the more expensive category (cartoons) — suggesting that pseudo-sunk-cost can have an effect but that this effect is limited (at least relative to the pain of paying) to low levels of payments.

4.2.3   Within-method analysis

At this point we can analyze the distribution of purchases within each method of payment. The relevant predictions were made in equations (7) and (8). In summary, we expect the histograms to have more mass to the left as the cost increases, so subscription will be the one with less mass to the left and micro-payments will be the method with most mass to the left. Figure 4 has the histograms for the quantities. For this analysis we have collapsed the news and science content categories, as there was very little difference between them.

We expected that the cartoon category, being the preferred content and also the one with the highest prices, would be the one that has more dramatic results. As Figure 4 shows, the histograms of purchase quantity are as expected: the number of no-purchase increases as costs go up (as predicted by equation(7)), and the distribution expands to the right as costs decrease (as predicted in equation (8) and following paragraph). The same general pattern is visible in the news and science quantities, but is less pronounced. This is not surprising given the lower preference and price for these, leading to a higher relative importance of the individual factors (the ϵ_{ij}, whose distribution we don't know). The free category, cultural studies, exhibits the reverse pattern. By design, since the time of the study was fixed, this category (as well as watching a blank screen) functioned as a default substitution to the paid categories (with nothing else to do, the fewer for-pay pages one subject browses, the more free pages she may browse). Note that when the price is zero all other effects except the hassle, h, are also zero: there is no need for a

decision if there is no payment, and there is no pain associated to not paying; plus, our data shows no effect of h, therefore only the time constraint and alternative uses for time are relevant in decisions to browse cultural studies content.

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Insert Figure 4 about here

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4.2.4 Self reported perceptions and preferences over methods

Finally, we examined the predictions of our respondents about their own behavior across the different payment methods. Before asking participants to compare the four payment methods, they were presented with description of all methods. This was followed by questions that required subjects to divide 100 points between the methods in a way that reflected their relative preferences. There were no effects of the condition respondents experienced during the study (the one they had the most first hand information about) and the three other conditions (that were only described to them) when answering these questions, which we take as an indication that the explanations were clear. The first question simply asked which of the payment methods would they prefer. As can be seen in the top row of Table 2, the preference was highest for the subscription condition compared to the other three, which were not different from each other. Respondents were also asked for their intuitions about what payment method would lead to higher overall payments. As can be seen in second row of Table 2, respondents' intuitions were generally similar to the real behavior, but the intuition included a significant effect between post-payment and pre-payment and a non significant difference between pre-payment and micro-payments. The next four questions all examined aspects of decision quality across the different payment methods. In these questions respondents indicated in which method they: expect to view more content; expected to be more careful when making decisions; expect to view higher quality content, and expected to spend more time per article. As can be seen from the last four rows of Table 2, the main conclusions from these comparisons are that respondents

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understand the decision-improving aspects of pay-as-you-go methods (fewer pages, more time, higher quality pages, more careful decisions) and that they understand that these effects will be particularly large when the saliency of the payment (pain of paying) is highest — that is, when using micro-payments. This shows that they understand the rank order in equation (9).

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Insert Table 2 about here

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4.2.5 Self reported data vs. actual behavior

One of the advantages of having both decisions and self-reports is that we can compare what respondents stated they would have done (in the questions following the browsing) with what they actually did during browsing. In terms of overall expenditure respondents expected subscription to be higher than the other three methods, and also post-payment to be higher than pre-payment and micro-payments. The intuitions in this case were generally accurate.

In term of quantity of pages viewed (consumed), respondents expected subscription to be much higher than the other three payment methods, which were expected to be the same as each other. This prediction is consistent with an intuitive model that is concerned solely with price. On the other hand, the results of the actual behavior, revealed a different (almost opposite) pattern. The real expenditure showed that micro-payments were different from the other payment methods, indicating that for real behavior it is the awareness of payment at the time of consumption (and not the cost) that has the largest effect in our experiment (as shown in Figure 3).

5   Discussion

The goal of the current work was to examine a few factors that influence the feasibility of different types of mechanisms for small payments. The factors considered were the

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pain of paying, mental accounting (particularly pseudo sunk cost), and self-control. We believe that all of these factors are (or can be) present but their relative importance can be different depending on the environment. The behavior of our participants showed that in our case the pain of paying is the most important consideration, while the pseudo sunk cost factor was only weakly supported, and self-control received virtually no support.

The pain of paying in all the pay-as-you-go methods, and particularly in the micro-payments condition, was so large that respondents spent their time viewing very few of the desirable content and a lot more time viewing the undesirable content — the cultural studies. In fact, the cultural studies content was so aversive that respondents in a pilot study reported that they prefer listening to screaming compared to reading such material (at the same they rated this type of text as scholarly). We suspect that the pain of paying was so large that it made the pain of reading the cultural studies smaller in comparison. The effect of mental accounting and the pseudo sunk cost reveled itself only to a limited degree and only at the low payment level. In fact, the subjects in the pre-payment condition consulted their wallet many more times than those in other conditions ($M_{\mathsf{Pre}} = 8.81$ times checked against $M_{\mathsf{Post}} = 4.22$, $M_{\mathsf{Micro}} = 2.65$ and $M_{\mathsf{Sub}} = 2.24$; $F_{3,129} = 23.37, p < .0001$) and that might be why the money was never considered sunk. In terms of self-control, the self-reports of our respondents showed that they believe that pay-per-use is a good way to control their behavior in terms of quality, quantity, time and spending. However, the subjective reports also showed that when given the choice between payment methods they prefer subscription, which they cannot use as a self-control device, but reduce substantially the pain of paying. Thus, there is no support for he consideration of self-control in our setting. It should be noted, however, that in our setting the prices were relatively low (0.5 and 3 cents), which might be below the threshold needed to activate any self-control mechanisms.

Next, we will now look more closely into the results and get a sense of the magnitude of the pain of paying and the sunk cost effect. We ignore the influence of the hassle of approving for two reasons: first, it does not lead to any significant differences between the two subscription conditions; second, we consider that the task itself is not very complex

(clicking a button) and the delay in consumption is very small compared to the time spent in other tasks. If the hassle had been significantly higher, for instance if the subjects had to enter personal data to confirm, we would not be able to do this.

The results suggest that consumers are both aware of and influenced by the pain of paying when browsing content. Using a linear approximation and taking the average $Q(\cdot)$s for the categories as given, a first-cut measure for the cartoon category is $\alpha\hat{n} = 1.324$ cents, indicating that the pain of paying is approximately equivalent to a 44% increase in price. (To be more precise, what this means is that under the separability assumption of equation (1) and the linear approximation, the removal of the pain of paying together with the 44% price increase would leave the results for that condition unchanged.). When we examine the sunk cost effects, even though the differences in quantities consumed are not all significant, we can use the formulation in equation (3) to get a sense of the size of the pseudo sunk cost effect. Using the means of the data, we get the $\hat{k} = 0.306$ for cartoons. In other words, the average consumer acts as if 31% of the money put in the electronic wallet was lost to other consumption. (Note that these 31% are just an indication, as we cannot reject the hypothesis that $Q(\text{post}) = Q(\text{pre})$ and $k = 0$ or $Q(\text{pre}) = Q(\text{sub})$ and $k = 1$.). Figure 6 illustrates the implications of pain of paying and sunk-cost effect in consumption (under-consumption due to the pain of paying and over-consumption due to the sunk cost effect).

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Insert Figure 5 about here
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6   Conclusion

The design of payment method is becoming increasingly more important as electronic commerce becomes more popular, and as the flexibility in implementing different payment methods is increasing. Within the general goal of understanding payment methods, the current work was aimed at two related goals. The first was to examine some of the

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psychological aspects involved in payment. The second was to examine the effects of different payment methods on expenditure and consumption.

The results demonstrated that psychological aspects (particularly the pain of paying) play a large role in the effectiveness of payment methods. The results also showed that while consumers might be aware of some of the effects of payment methods, they are not perfectly aware of the effects of payment methods on spending and consumption. Whether consumers wrong intuitions reflect the novelty of the different payment methods we used (which could be amended with experience), or whether they reflect a more deeply rooted bias is an important question for future work.

The experimental design we employed is not without its flaws. In particular, in our environment respondents were exposed to the information and to the payment method for about an hour. One possible implication of this short time frame it is that the effect of sunk cost was underestimated. It is possible that for a payment to be considered fully sunk, more time is need to pass, and perhaps other activities have to take place (especially given the number of times the subjects checked their electronic wallet in the pre-payment condition). Understanding at what point pre-payments become sunk, to what degree, and what kind of factors can moderate this duration are an important area for future research. Another possible implication of the short time frame has to do with the proximity of the end payment. Since the final payment was at most forty-five minutes away, it is possible that the post-payment method did not get all the benefits of delaying payments. A different set of issues has to do with the fact that we paid respondents for their time, which might have increased their focus on payments in general from this period.

A final important aspect has to do with reactions of consumers to payment methods in a marketplace where multiple payment methods co-exist. Will the effects of such payment methods be as strong when consumers are aware of the different payment options? Will consumers use these methods to control their own behavior? Will consumers chose different payment methods for different types of products (hedonic vs. utilitarian)?

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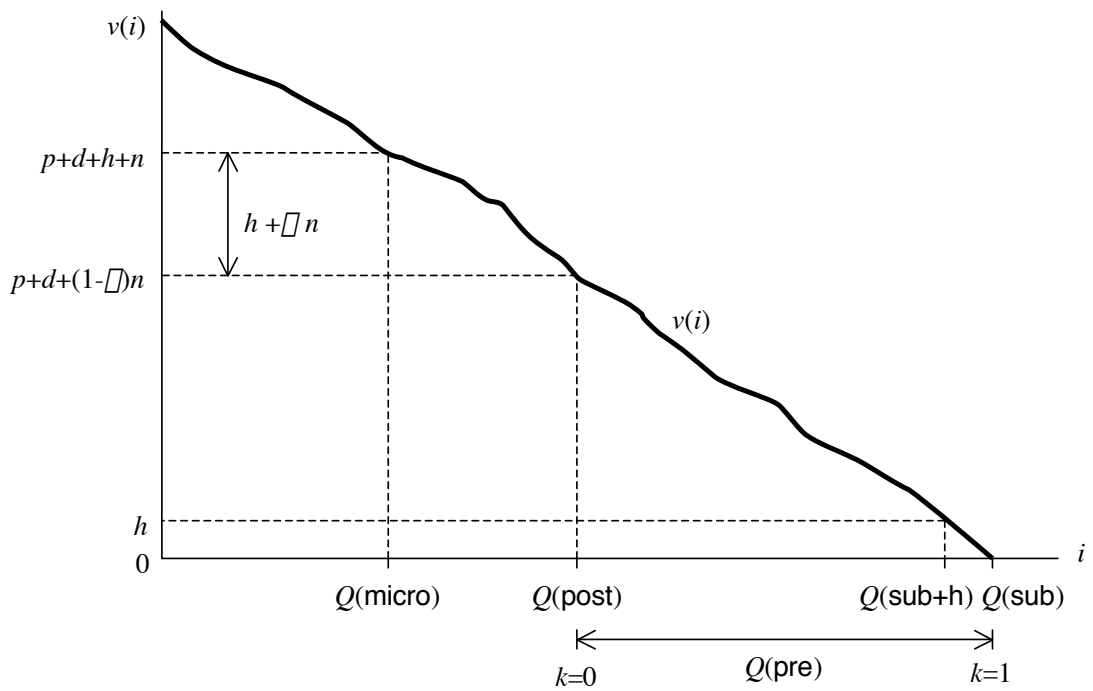
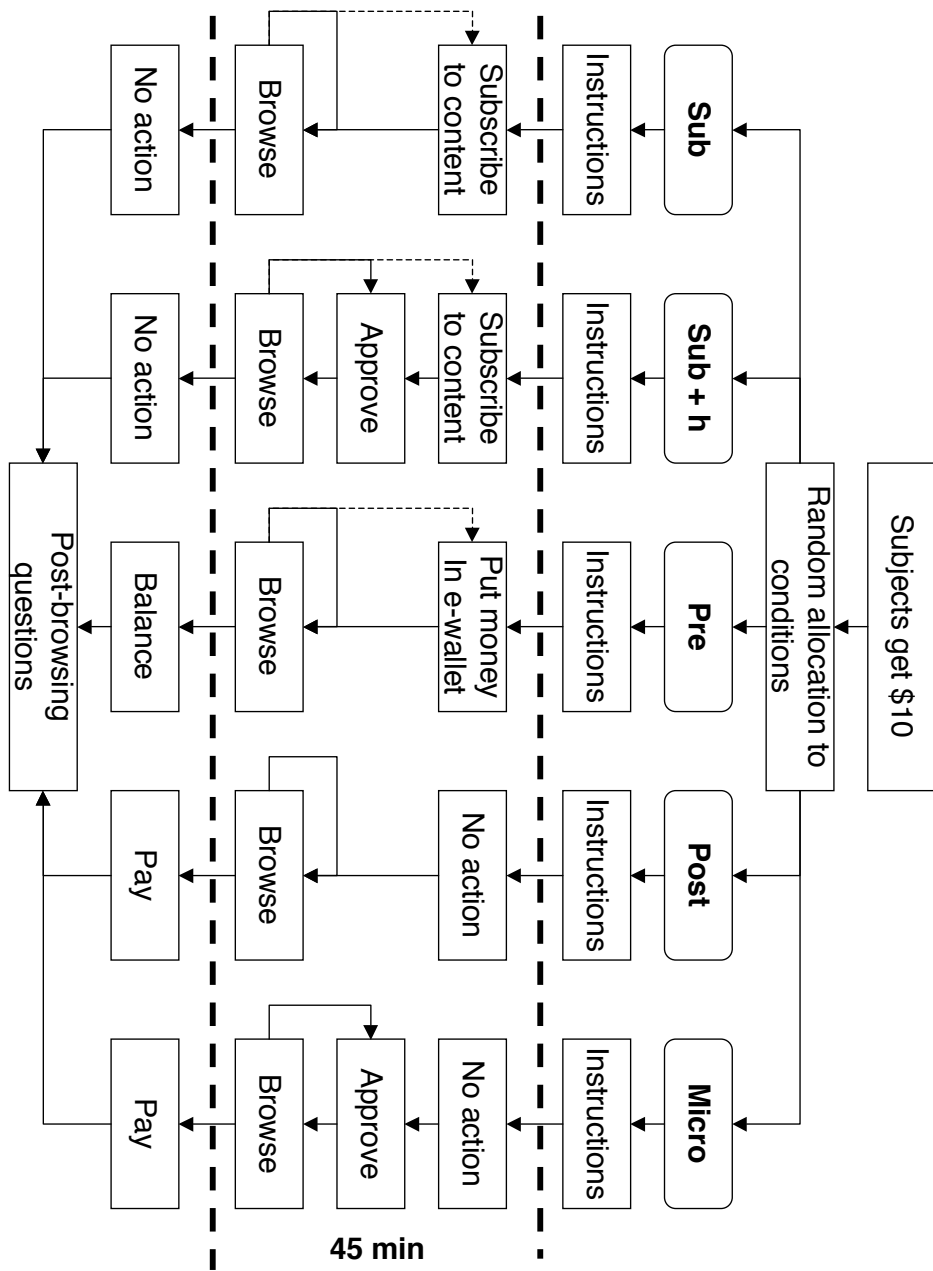Figure 1: Stopping points for each payment method.

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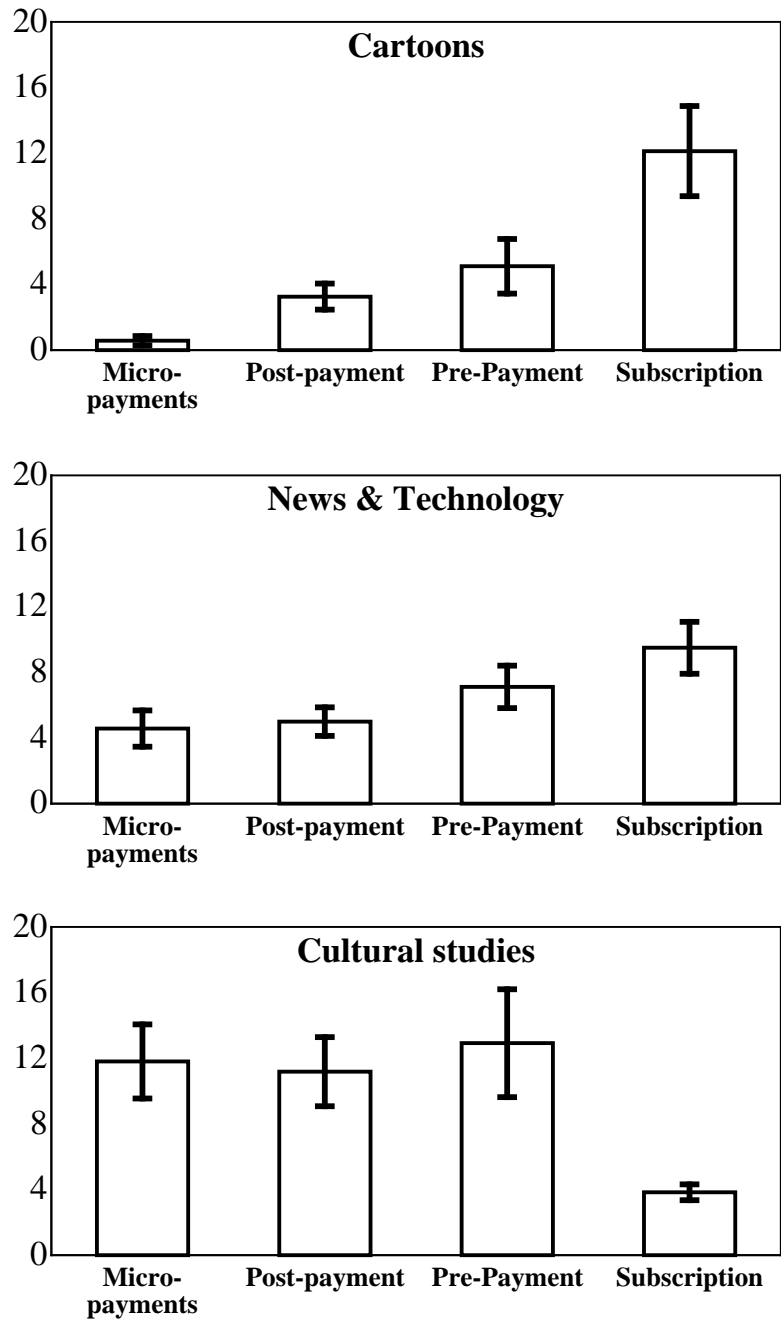
Figure 2: THE FIVE CONDITIONS IN THE EXPERIMENT.

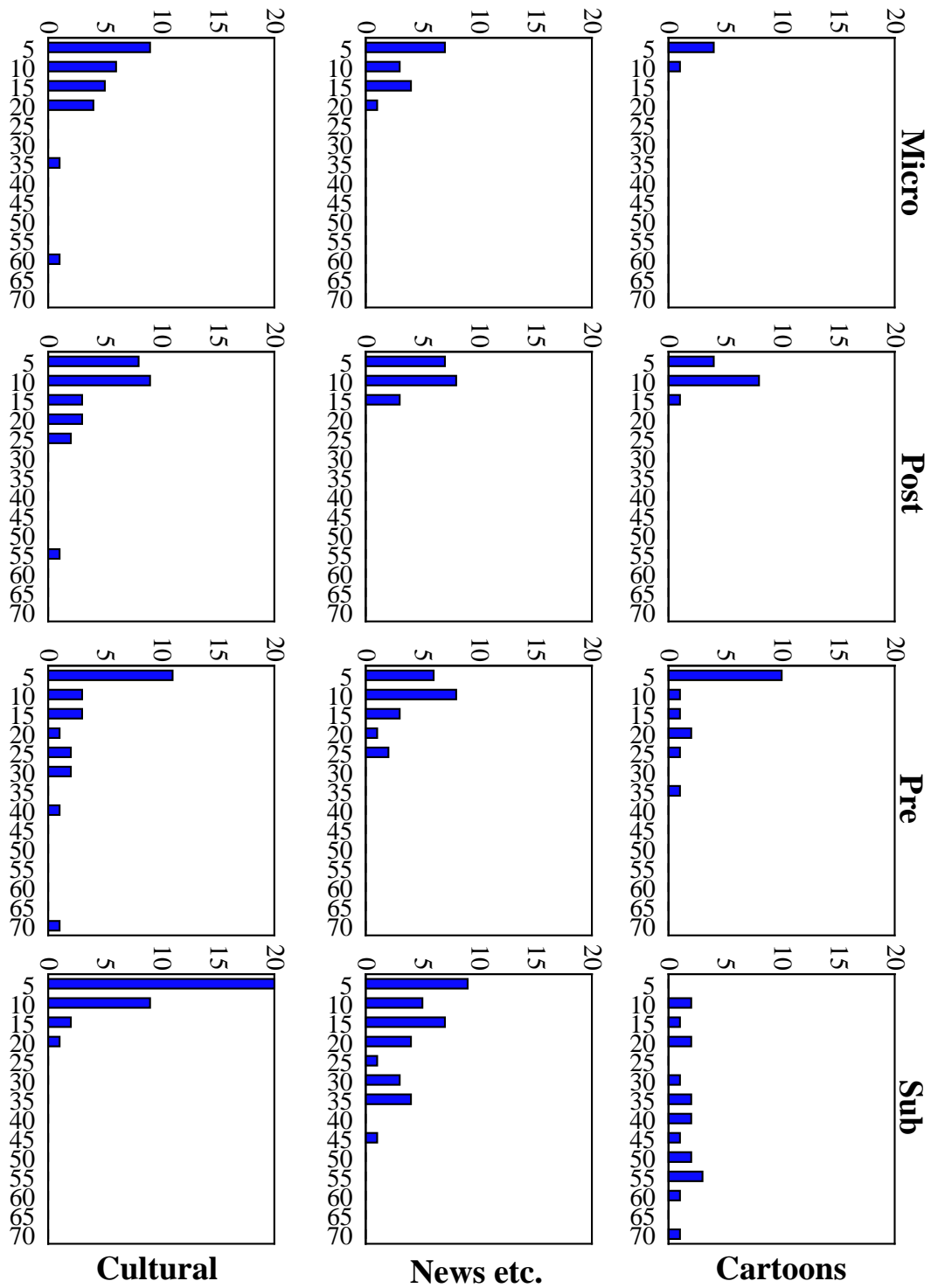Figure 3: Expenditure per condition and content.

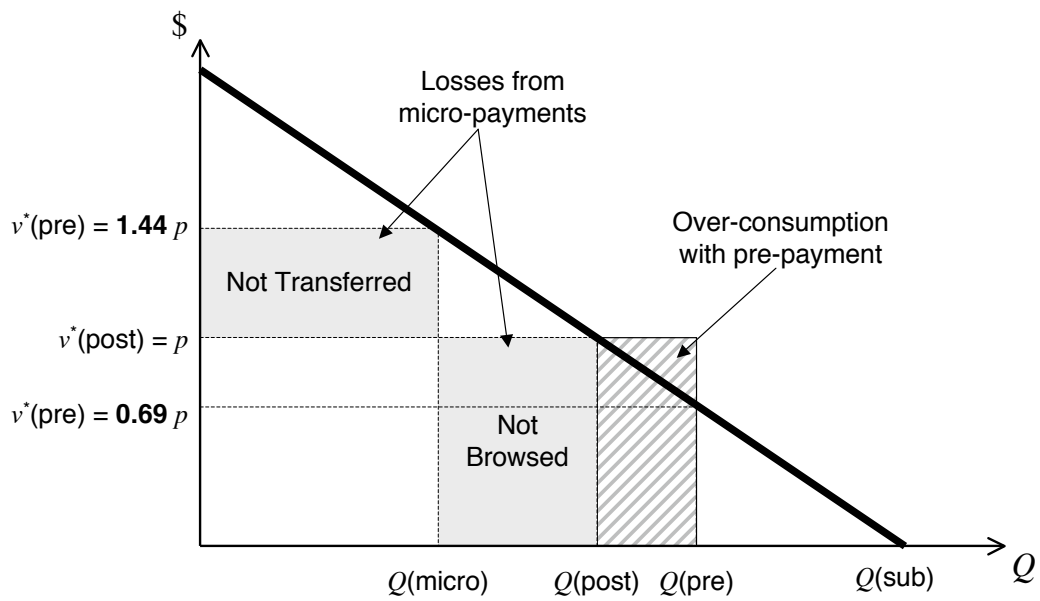Figure 4: Distribution of number of purchases per method and content.

Figure 5: ILLUSTRATION OF THE EFFECTS OF PAYMENT METHODS ON EFFICIENCY.

Table 1: EXPENDITURE AND QUANTITY PER CONDITION.

Condition	Expenditure (SE)	Quantity (SE)	N
Micro	.039 (.010)	5.154 (1.134)	26
Post	.123 (.027)	8.259 (1.486)	27
Pre	.178 (.046)	12.231 (2.120)	26
Sub	.278 (.053)	19.111 (3.216)	27
Sub+h	.289 (.060)	24.148 (5.258)	27

Table 2: SELF-REPORTED DATA.

Question	Micro (SE)	Post (SE)	Pre (SE)	Sub (SE)	Test[†]
Preferred method	18.04 (1.49)	15.62 (1.58)	16.99 (1.66)	49.34 (2.50)	$F = 57.822$
Spend More	19.78 (1.74)	27.57 (2.23)	16.88 (1.58)	35.73 (2.89)	$F = 11.385$
View more pages	9.06 (1.69)	12.61 (1.95)	14.86 (1.64)	63.48 (2.87)	$F = 113.265$
More time per page	44.49 (3.00)	15.87 (1.62)	16.85 (1.66)	22.79 (2.41)	$F = 26.552$
Higher quality pages	49.49 (3.00)	16.74 (1.73)	15.47 (1.63)	18.30 (2.05)	$F = 42.731$
More careful deciding	43.77 (2.85)	28.70 (2.41)	20.29 (2.07)	7.54 (1.35)	$F = 34.685$

[†]All significant with $p < .0001$.