market platform dynamics

INNOVATION IN PAYMENTS

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ABSTRACT

Three major technological trends will lead to a significant transformation of the payments industry: the development of online advertising technologies that will increasingly rely on transaction data, the movement of payment innovation from the existing jerry-rigged linkages of hardware and software to cloud-based computing, and the proliferation of mobile telephones and other handheld devices that are connected to the Internet. Innovation will result from the integration of these new technologies and will transform the payment and shopping experience in ways that promise to bring enormous benefits to consumers and businesses.

INTRODUCTION

Technological developments involving the Internet, web-based software, wireless communication, computers, and data analytics are coming together in ways that promise to transform how consumers and merchants transact with each other.[1] Payments, behavioral targeting of advertising and marketing messages, location-based targeting of advertising and marketing messages, and e-commerce including mobile commerce are being integrated in ways that will transform how consumers and merchants interact with each other. Unless public policy interferes, these "mashups"[2] will likely reshape—and enhance—the payment experience for consumers and merchants.

Many commentators focus on ***how*** we will pay at the point of sale and the role that Near Field Communication (NFC) on contactless cards or mobile phones will play in that.[3] In fact, we posit that the physical method of payment—what is often called the "form factor"—will vary across geography and over time as a result of past investment decisions in hardware, software, and processes in the payments ecosystem. The mashups that we believe will reshape the industry as we know it today will not, however, depend critically on the form factor. The physical method of payment at the point of sale is a detail in a much larger transformation of the purchasing experience for consumers and merchants. To dwell only on the payment factor as the enabler of innovation in payments, in fact, minimizes the impact that technology will have on this industry.

This article describes how these mashups could affect the evolution of payments over the next decade. Section II provides a brief history of the U.S. electronics payments industry and how it works today. Section III presents an economic framework for understanding the adoption of innovation in payments. It highlights the fact that the key players in payments are multi-sided platforms that must get shoppers, merchants, and other stakeholders on board a common

platform and therefore solve some difficult chicken-and-egg problems. Section IV describes the holy grail of the payments industry today: how to monetize the massive amount of data that flows through the system but is largely unused today. The online advertising business has demonstrated how valuable these kinds of data can be and provides examples of how consumer data can be used to benefit both consumers and advertisers and to create fortunes along the way. Section V explores the integration of mobile phones in the payment experience. It shows that the possibilities extend well beyond the current focus on using mobile phones with contactless chips to pay at the point of sale, as has proved popular in Japan. Section V describes the role of cloud-based computing—where the computer power and software resides in multiple linked computers on the Internet—in the payment industry. Current efforts to develop a "software platform" in the cloud for the payments industry could lead to the explosion of applications that integrate payments into other businesses and technologies. Section VI concludes by exploring ways in which these various technology mashups will themselves become mashed up. It shows how the integration of data analytics, cloud-based computing, and mobile communications could provide significant benefits to consumers, retailers, and the ultimate providers of goods and services. It also explores the role of public policy.

As we discuss below, history has shown that nothing is inevitable in the payment card industry. The cost of changing already good methods for buyers to pay sellers can well exceed the benefits of innovations. Government policy can also alter the direction of change by overruling the market and by adopting policies that, while despite the best of intentions, have unanticipated adverse consequences for consumers and businesses in the complex payments industry. During this current period of creative destruction that is sweeping the payments industry globally, policymakers should especially heed the Hippocratic warning: "Do no harm."

I. THE U.S. ELECTRONICS PAYMENT CARD INDUSTRY TODAY AND HOW IT GOT HERE

The U.S. electronic payments industry[4] is based on a network that moves money between consumer and merchant bank accounts using computers, software, and communication links.

A. The Origin of Today's Payment Card Networks

The technology that underlies today's payment card networks was first widely deployed in 1979 when Visa introduced the first electronic data capturing terminal.[5] Mainframe computers did most of the processing and storage in central locations. Consumers had magnetic stripe cards and merchants had electronic terminals. At that time the merchant swiped the card through the reader to start the process of authenticating the consumer and authorizing the transaction. The swipe started a signal that travelled to a series of intermediate computers that switched the transaction to a central processing unit. This unit then decided whether to authorize the transaction and returned signals to other computers on the network to move money from the cardholder's bank to the merchant's bank and to assess the cardholder's account. The various computers were connected over private networks that interconnected as necessary.

One can think of this computer system as being based on the interaction of two thin clients[6] at the point of sale: the magnetic stripe card which contained a small amount of data on the consumer, and the point of sale device which contained little intelligence. Most of the work for the network was done at various hubs, especially the central one belonging to the owner of the card scheme, which consisted of multiple large computers. MasterCard and Visa have upgraded their systems over time but the basic architecture has remained the same.

These networks are more complicated than they might seem at first glance. At the periphery of the networks are individual merchants, the larger of which operate in many locations. These merchants have installed various software and

hardware for accepting cards over time. More than 45 vendors supply the point of sale equipment and there are nearly 1,000 software systems on the market which get incorporated into the point of sale equipment.[7]

The merchants on the network typically have a relationship with an acquiring bank and a merchant processor, which in turn operates remote computer-based platforms that perform a variety of steps between the merchant and the card system. There are nine major processors in the United States. The larger ones operate several different platforms. For example, Chase Paymentech has two major platforms and First Data Corporation has between four and ten processing platforms depending on payment type.[8]

Over time, every application vendor has developed its software in order that it works with the other essential parts of the overall network. But the modern payment card industry is much like a large corporation which, through mergers and changes in vendors over time, has numerous computer systems and software packages that are jerry-rigged together. Much of the software is based on older languages rather than what is being used to build modern web-based companies.

This fragmented structure imposes significant practical constraints on innovation. It is difficult to make a change at any point in the network if that change is incompatible with hardware or software used at other points on the network. The innovator would have to convince other participants in the network to shift on board to make changes. These changes require significant investments. The innovator has to either absorb these costs or persuade other participants that it is worth incurring them without their necessarily knowing that the other participants will. As a result, innovation can be slow and may be biased towards improvements that are compatible with the existing infrastructure. We will also see below how this disjointed structure impedes the collection and analysis of data from merchants and consumers. But as we will also discuss, it is this infrastructure that has fueled much of the innovation that is emerging as entrepreneurs utilize new computing technologies that essentially work around these constraints.

B. Technological Progress in the Face of Inertia

Despite this seemingly archaic structure, and the legacy hardware and software beneath it, the payment card system has experienced great technological progress in the last three decades and works extremely well. The average time that it takes a consumer and merchant to complete a card transaction has declined dramatically (as anyone older than 40 is well aware of). Although the time varies depending on the point of sale equipment used by the merchant, the average time for completing a credit card transaction is now approximately 17 seconds compared with 73 seconds for checks.[9]

This technological progress has resulted in part from the broader revolution in computers and communications. Improvements in computer speed and capacity have more than kept pace with the increase in the volume of transactions. Telecommunications have become cheaper and more reliable. Point of sale equipment has benefited from the miniaturization of computers. Improvements in computing capacity and software have enabled better and faster risk management.

Most important, consumers are generally happy with the payment experience at the point of sale. In a recent survey, we asked 550 consumers to rank the importance of various aspects of their payment experience in physical stores.[10] The results revealed that most consumers are generally content with their current payment experience. They had little interest in changing their current use of magnetic swipe cards to contactless cards, mobile phones, or other emerging technologies.[11] What they want is security, convenience, ease of use and the availability of flexible financing options.[12]

We have not performed a survey of merchants but we have seen no evidence that they are dissatisfied with the mechanics of accepting payment by cards at their point of sale. Thus far the vast majority of merchants have not embraced any of the various alternative methods of payment that have been introduced in the last several years such as contactless.[13] They, of course, would like

to pay lower merchant fees when a consumer does pay with plastic.[14] The payment card system is based on technology that is several generations old. To understand why this system nevertheless forms the basis for the mashups that we believe will reshape the payment industry, it is useful to digress on the evolution of modern computer systems.

C. Modern Computer Systems

Until recently, computer networks connected client computers over private local area networks or private wide area networks to server computers which thereby provided access to centralized resources for those client computers. For example, a spreadsheet constructed on a local computer using a spreadsheet application quite possibly accessed data stored on a server computer and was sent to colleagues by e-mail via another server computer. The payment card system is one large private network based on mainframe computers, servers, and proprietary software running on many interconnected systems.

With the rise of the Internet, this model has begun shifting to what is known as "cloud computing," in which much of the processing and storage takes place on server computers owned by a third party and accessed over the Internet. Many widely used applications such as Facebook, Google Calendar, MSN Instant Messenger, iTunes, and Salesforce.com are "in the cloud." As we will see, many of the interesting innovations in payments will likely take place in the cloud rather than on private networks.

As computation has moved from the desktop to servers on private networks to servers in the cloud, clients can become thinner—at least in terms of the fraction of the overall workload they perform. Moreover, over time computer networks have become more interoperable. The standardization of the industry on the Wintel platform during the late 1980s and 1990s made it easier to interchange software and hardware compared with the fragmented world that preceded it. The development of HTML, HTTP, and other Internet protocols has provided a standard

platform for web-based/cloud-based computing. It has also made the standardization of desktop software and hardware less important, as the Internet standards define an interface between the cloud and the desktop that can be used by any standards-compliant browser running on *any* operating system.

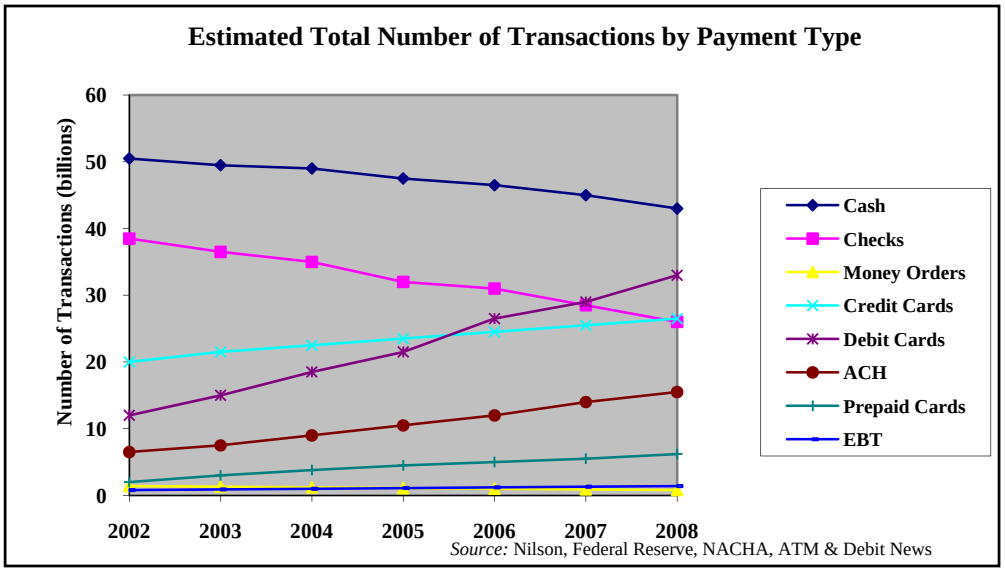
Yet, as thin as clients could be in the cloud-based world, nothing is as slim—or as dumb—as the magnetic stripe card, which uses a technology that one might have thought would have phased out alongside cassette tapes. There has, however, always been great inertia in the payments industry since change requires a vast multitude of buyers and sellers to modify their behavior and make new investments. The magnetic stripe card itself became the standard in the payment card industry in part because MasterCard and Visa subsidized, through reduced interchange fees, the adoption of electronic terminals at the point of sale.

D. The Possibilities for Change

Indeed, cash has remained the most popular form of payments worldwide because of its tremendous convenience and simplicity.[15] The widespread availability of cash dispensing machines that the consumer accesses with a card has even given cash a new lease on life. In the United States, it has also proved difficult to wean consumers and businesses away from checks. Despite the proliferation of new methods of paying bills online, many households write paper checks. A recent survey of small businesses found that these entities prefer to send out paper invoices and receive payments by check.[16] Such inertia applies to cards themselves. The magnetic stripe card is the preferred form factor for credit and debit card transactions in many countries, including the United States. A recent survey found that, after over 3 years of effort to put contactless cards in the hands of consumers and to persuade merchants to install contactless terminals at the point of sale, 83 percent of American consumers had still not used contactless and only 1 percent of store locations accepting credit cards have installed the necessary technology to accept these cards.[17]

While change in the payments industry may seem glacial, even glaciers can make substantial progress over time. The most important trend in payments is the movement to digital money, in which a computing device captures the transaction. The share of payments that are electronic has steadily increased over time. Figure 1 shows estimates of the share of various electronic payments methods over time for the United States.

Figure 1:
Estimated Total Number of Transactions by Payment Type



As of 2007 in the United States, electronic payments accounted for two-thirds of all noncash payments by number and 45 percent by value.[18] When payments involve the transmission of bits, it becomes easier to integrate the payments aspect of a transaction into many other complementary services and to create synergies among these various services. It does not matter whether the payment is captured by a computer in the cloud using a not very smart magnetic stripe card as the authentication device or a browser-based mobile phone. So long as the transaction is digital, numerous mashup possibilities reveal themselves. Moreover, the development of these complementary services (which are based on the transaction being digital) will increase the value of digital relative to non-digital

forms of payment and thereby accelerate the adoption of digital forms of payment. Thus, while paper-based payments will no doubt persist for the foreseeable future, even in developed economies, a revolution in the "transaction experience"—i.e., all the services that relate to buyers and sellers getting together—will likely lead to a rapid increase in the rate of adoption of digital forms of payment.

Before describing the mashups this will likely involve, we explore some economic aspects of the adoption of new technologies and business models in the payments industry.

II. TECHNOLOGY ADOPTION IN THE PAYMENTS INDUSTRY

Anyone talking about revolutionary change in the payment industry—especially when it comes to how we pay—should be greeted with significant skepticism. Cash has remained the main form of payment ever since metallic money was introduced in 700 BC. Every few years someone predicts its imminent demise. Figure 2 shows sample obituaries from the last 50 years.

Figure 2:
The Elusive Cashless Society

'Cashless Society' Seen Due by 1970

By ANDREW BERNHARD

FOR YEARS I have taken a sort of perverse pride in the fact that I never read "Gone With the Wind," and never saw the picture made of the book. More recently I have come to believe myself to be the only man in the United States who never has seen "Batman" on television.

Of course, there is an endless series of things I have intended to do but never got around to. Such as reading Gibbon's "Decline and Fall of the Roman Empire," for example. One of

Mr. Diebold said the retail process he foresees will involve the electronic transfer of money and credit. International Business Machines Company

2 C DESERET NEWS, THURSDAY, DECEMBER 9, 1976

United States — a cashless society?

By Betty Tarsus

CASH PLEASE

solutions, and the odd assortment of biometric methods including the fingerprint.[19] Figure 3 presents a few of the predictions. However, just as cash has endured, so has the technologically "unhip" mag-stripe card—the form factor of choice for most of the world's credit and debit account users.

Figure 3:
Recent Analyst Forecasts of Adoption of Alternative Payment Form Factors

Contactless credit and debit card payments (sometimes called proximity payments), mobile payments (m-Payments) and biometrically authenticated payments will each levy its own unique impact over the next five years. Together, they could garner over $400 billion in revenue by 2011."	*The Pelorus Group 2006*
57 million consumers will be using chip-embedded credit cards to make contactless payments by 2013, which is more than double the 24.8 million in 2008 and will be bolstered primarily by expansion of contactless products into gift cards and private label cards.	*The Javelin Group 2008*
The gross transaction value of mobile payments will exceed $300 billion internationally by 2013.	*Juniper Research 2008*
As many as 612 million mobile users will generate transactions in the order of USD 587 billion during 2011 via their phones.	*Jupiter Research 2008*

This section explores the apparent resistance of the payments industry to innovation. We show that it stems from a basic economic characteristic of all payments systems.

A. The Chicken and Egg Problem for Two-Sided Platforms

The payments industry creates value by providing a method that both buyers and sellers will use to consummate transactions. The insight of the ancient inventors of standard gold coins was that it would make trade much easier if there were a generally accepted and uniform method of payment. Fixing prices in standard gold coins was easier than using irregular lumps of metal or oxen or roosters. The invention of the general purpose payment card was hardly as profound. But in many circumstances, having cards with deferred billing and payment to the consumer enabled consumers and merchants to engage in transactions that could not occur otherwise, as the consumer did not carry or did not want to carry enough cash to pay.

To create a standard of payment requires, however, that buyers and sellers agree to use it and accept it. Buyers will not use a payments instrument if they cannot use it to pay where they shop, and sellers will not go to the trouble of accepting a payment instrument if few shoppers want to pay with it. Entrepreneurs looking to introduce a new way of paying must solve this fundamental chicken-and-egg problem. Doing so has become harder over time because these entrepreneurs compete against increasingly secure and convenient payment methods through which transactions take only a few seconds to complete. It is hard to convince merchants and consumers to change when what they currently rely on works very well.

The payment industry is based on what economists call a two-sided platform.[20] A two-sided platform is a business that creates value by inducing two groups of customers to come together, each of whose members obtain value by interacting with members of the other group. Shopping malls, financial exchanges, auction markets, multiple listing services, advertising-supported media, software platforms, and video game consoles are a few other examples of two-sided platform businesses. In all these cases, a participant on one "side" gets more value from being part of a platform with more participants on the other side. Video game console users get more value from consoles that have more games, and game developers get more value from consoles that have more users. For many two-sided platforms—and this is particularly true of payments—it is very difficult to get users on one side unless there are users on the other side. The chickens and eggs have to appear almost simultaneously.

B. Basic economics of consumer and merchant adoption

Merchants consider upfront and variable costs of using a payment method. The upfront costs include training sales staff in how to handle the payment, modifying accounting systems, and—especially with solutions that involve authentication at the point of sale such as payment cards—equipment and possibly

integration with their information technology systems. Variable costs include merchant fees for cards or cash and check handling costs, as well as changes in the numbers of checkout lanes and clerks needed to process transactions. If that were the end of the story, merchants would only adopt a new payments system if it were cheaper[21] and if enough consumers switched their transactions to this cheaper alternative to warrant the investment in upfront costs.

But cost is not all that matters. Accepting a new payment method at a store may also result in customers shopping there who would not have shopped there if the store did not accept that method. Likewise, accepting a new payment method may function to convince customers to buy more as a result of using that method. Shoppers may like a payment method more because it is more convenient or secure for them or because they are getting "rewards" for using it. Having more shoppers (and more shopping) results in incremental sales. The merchant makes a profit margin on these sales, and so accepting a new payment method may in fact lead to incremental margins.

The key insight concerning the acceptance of new payment methods is that incremental margins are often a more significant economic factor in merchant acceptance decisions than saving money on merchant fees and other ongoing costs of processing transactions. The profit margin on additional sales averages 29 percent for large merchants that account for two-thirds of all payment transaction by volume. The average cost of accepting a payment method is in the range of 1- 2 percent of the transaction size.[22]

Consider two payment alternatives for a merchant with $100,000,000 of annual transactions. One promises a 50% reduction in payment costs—1%—for 20 percent of transactions that would take place using that method. That leads to a cost savings of .01 x $20,000,000 or $200,000. The other promises a 3% increase in overall sales as a result of attracting new shoppers. That increases sales by $3,000,000 and leads to increased profits of $870,000 on average. In fact, it would

only take a .7 percent increase in sales to beat the method that offers a 50% reduction in payment costs.

A card system that can build up a significant number of users therefore has a very compelling proposition to merchants and for which it can charge a significant merchant fee. Consider a card that 10% of shoppers would use for transactions and assume that 7% of those transactions displace other transactions and 3% of those transactions are incremental transactions. As in the example above, the increase in incremental margin is $870,000. The merchant would therefore be willing to pay, roughly, up to $870,000 of additional transaction fees on the 7% of the transactions that are displaced. That works out to a transaction fee of 12.4% (870,000/(0.1*0.7*100,000,000)=.124).

Of course, consumers will not take a card if they cannot use it. They must believe that they will be able to use it at a wide range of merchants to pay. That gives rise to the chicken-and-egg problem that we mentioned previously. Diners Club conquered this problem when it entered in 1950 by signing up a small number of restaurants that would be of interest to its Manhattan account holders and a small number of account holders that would be of interest to those restaurants. There was apparently enough value for both sides to get on board initially. The restaurants just had to keep track of a few receipts, and the account holders did not yet have a wallet full of competing cards. American Express conquered the chicken-and-egg problem by buying merchant and cardholder accounts from other small systems. MasterCard and Visa, as cooperatives, did this by having individual banks sign up merchants and cardholders in several local areas.

Consider the introduction of the Discover Card by Sears in 1986. It was one of the greatest business success stories of the 1980s. In its first year, Sears persuaded over 11 million out of 25 million Sears store card holders to sign-up for a Discover Card which would enable them to pay at a variety of merchants that accepted this card. Sears persuaded merchants (some 500,000 locations) to accept the card in the first year.[23] Sears had a relatively easy time cracking the chicken-

and-egg problem given its store card predecessor. Merchants had good reason to believe that millions of consumers would be carrying the Discover Card, since Sears already had access to 25 million Sears cardholders and was offering the Discover cardholders 5 percent cash back on purchases. Accordingly, enough merchant locations accepted the card in its first year to make it valuable to the cardholders.

Economics and experience point to a critical lesson. It is very difficult to persuade merchants to adopt a new payment alternative unless enough consumers value the alternative so much that they will not shop at that merchant or will buy less unless the merchant offers that alternative. The prospect of incremental sales can provide enough value to pull merchants into accepting a new alternative payment method. Shaving the already small transaction fees by switching consumers to a cheaper payment alternative generally cannot. Many new payment alternatives in recent years have bought into the "fools gold" of merchants clamoring for cheaper payment alternatives. Merchants would, of course, like their existing payment alternatives to be cheaper, but they will not eagerly incur upfront costs and change processes just for slightly lower merchant fees.

C. The Role of Inertia

As the payment card system has developed over the last half century, considerable investments have gone into developing networks that connect millions of merchants around the globe to hundreds of millions of cardholders. Merchants, merchant processors, merchant acquirers, card networks, card processors, issuers, and many other suppliers to these entities have invested in hardware and software for handling payments. They have also invested in internal processes that result in human capital investments. This legacy leads to inertia for two reasons.

The first reason is that many participants in the payment ecosystem have made sunken investments in equipment, software, and people. In many cases these investments have been largely depreciated. New technology is therefore competing with old technology that has little, if any, ongoing cost.

The second reason is that many of these investments are interdependent, as mentioned earlier. It may not be possible to change the point of sale technology without also changing the point of sale software and the merchant processing platforms. It may not be possible to change the merchant processing platforms without changing point of sale technology or the network software.

The investments made in payment systems also lead to what is called "path dependence." The value of adopting new technology at a point in time depends on the history of previous investments. A country that has made no investments can choose the best of new technology based on the net benefits of those alternative technologies. A country that has made significant past investments will have to factor in the cost of changing its infrastructure and the fact that the marginal cost of its old technology may be very low. Many countries—from China to Mexico—with low penetration of point of sale equipment and other investments in payment systems face very different economic decisions concerning adopting new technology than those countries with high levels of penetration and investment.

The consumer also has some inertia. People have gotten used to using cards in a particular way at the checkout. It usually works quite well: people sign or enter a PIN and either way the transaction takes place in a matter of seconds. Any change—any innovation—has to overcome this inertia. It must provide enough value to merchants and consumers alike so that both have an incentive to try something new.

D. Success and Failure in Cracking the Chicken-and-Egg Problem

Several new card innovations that have been introduced in the last few years illustrate the practical impact of inertia in payments.

Pay by Touch was founded in 2002 as a new system based on fingerprint authentication. The consumer registered her fingerprint at a kiosk and assigned her fingerprint to a particular payment method. Pay by Touch encouraged consumers to associate their fingerprint with their checking account just as PayPal encourages its

accountholders to utilize their checking accounts. This eliminated the merchant fees from the card systems and enabled Pay by Touch to offer merchants a potentially cheaper way of paying for transactions.

To use Pay by Touch consumers had to accept registering and paying with their fingerprints. Merchants had to install point of sale equipment that authenticated payments with fingerprints and had to switch transactions to the Pay by Touch system. Pay by Touch also needed at least some merchants to install kiosks where consumers could register their fingerprints.

Pay by Touch raised more than $300 million of capital. Targeting independently owned grocers, between its launch and 2007 it persuaded only one significant such merchant to accept this new payment method—PigglyWiggly, a chain of 600 independently owned stores primarily in small to midsized towns in the Midwest and Southern United States.[24] Pay by Touch filed for bankruptcy on December 14, 2007 and closed its system down shortly thereafter.[25] Although the firm faced many problems, including squabbles among its partners, the fact remains that it obtained little merchant or consumer participation and no one has further pursued its proposed model.

The problem Pay by Touch faced is obvious in retrospect: it required merchants to make significant investments in point of sale technology. These investments would make sense only if enough consumers started paying with their fingers (associated with a checking account) rather than with a card so that merchants could save on card fees, or if enough consumers decided they would transact only if they could pay with their fingers so that merchants would capture incremental sales. Pay by Touch, however, did not have a compelling enough proposition for the consumer. The consumer had to go to the trouble of registering her fingerprint. Since she could then pay with her finger only at a limited number of locations, she still had to carry cards. It is unclear how much time the consumer saved at checkout when she paid with her finger. Pay by Touch counted on the

novelty of paying with the finger to convince consumers to come on board their platform, but it was not enough.

The Octopus card is a contactless prepaid payment method in wide use in Hong Kong. It was initially sponsored by the Hong Kong subway as a convenient way for customers to pay and as a way for the subway to reduce queues and save on resources. In 1997, in the first three months of its entrance into the market, over 3 million cards were in consumers hands. Today, with 17 million Octopus cards in circulation, over 95% of Hong Kong residents between the ages of 16 and 65 carry the card.[26] With this base of cardholders Octopus has persuaded merchants to accept the card for payment. This has been a particularly attractive proposition to merchants in the malls at the subway stations. Since 2000 when the card was offered to merchants, 16,000 retail outlets have agreed to accept it and many have also installed equipment for consumers to load the card with money.[27] Octopus has expanded its contactless payment devices to include many other form factors with contactless chips including watches.[28] The key to Octopus's success was obtaining a critical mass of accountholders through its initial alliance with the subway system.

The experience with contactless in the United States has been quite different. MasterCard and Visa introduced contactless cards in 2003 and 2005 respectively. Over the next several years MasterCard and Visa issuers distributed 35 million contactless cards, most of which were replacements of cards for existing accountholders. These cards also had magnetic stripes and therefore could be used in the usual way—by waving at a contactless reader at merchants that had these readers. MasterCard and Visa persuaded a few large national chains to install contactless readers. These included McDonald's, 7 Eleven, Walgreens, and CVS. However, the rate of installation of contactless readers at the point of sale has gone much more slowly than was anticipated.[29] Out of approximately 6 million merchant locations in the United States only 40,000 of them – or less than 1 percent – have contactless readers installed, with most concentrated in multi-state quick service restaurants and convenience stores.[30]

Merchants have not installed contactless readers because they do not see the economic benefit. The cards do not lead to significant cost savings at most merchants since they have the same merchant fees as regular credit and debit cards, and the cost savings from increased transaction speed is modest compared to the cost of changing point of sale technology. The main benefit to merchants would therefore be margins from incremental sales. But to make an investment in more expensive point of sale technology merchants have to be persuaded that enough consumers would adopt contactless cards and enough of those cardholders would refuse to shop at a merchant that did not accept contactless cards. However, there is not a strong interest on the part of consumers, even though millions have the cards in their wallets. Consumers save time mainly in situations where they can wave the card and not sign a receipt. The card systems, though, require signatures for transactions over $25 (which is sometimes waived by the merchant and increased to $50) which means that the consumer saves little time for many of the transactions where they normally use cards. In the United States, predictions of contactless penetration have fallen steadily with experience. Five years after the introduction of contactless by MasterCard, 91 percent of cardholders, based on a recent survey, have never paid with contactless.[31]

BillMeLater is an example of a successful entrant into the payments business in the United States. Consumers who click on the BillMeLater alternative at the checkout for an online retailer are prompted for the last four digits of their social security number and date of birth. If the consumer is approved after a credit-risk analysis, BillMeLater pays the e-tailer and bills the consumer later. BillMeLater often provides promotional financing, such as to pay in 90 days or to pay in installments, in concert with the e-tailer. Consumers who choose to do this become BillMeLater account holders and, depending on their payment history, will be approved for larger transaction amounts in subsequent transactions.

To begin operations, BillMeLater had to persuade a merchant that if it offered BillMeLater on its website enough consumers would use it to drive

incremental sales to those merchants. Consumers did not have to have existing accounts; they just needed to be attracted to the convenience of the BillMeLater payment alternative and the finance offer. The chicken-and-egg problem was therefore less serious than it would have been if consumers had to go through the tedious process of applying for a card and carrying it around, or if merchants had to incur significant costs for upgrading their hardware and software. Since starting in 2001, as of August 2008 BillMeLater has over 450 online retailers that accept its payment method and has more than 4 million accountholders.[32]

Much of the discussion about payment card alternatives has focused on methods that provide services to merchants and cardholders that are similar to those offered by traditional payment card systems but at a lower cost to the merchant, or has focused on some form factor innovation that is appealing to consumers. The leading alternative payment methods for the physical point of sale introduced in the United States in the last several years include Tempo, Revolution Money, and Pay by Touch. Their business models all entailed offering lower fees to merchants than what is offered by the traditional card systems. Other technological changes such as contactless and various methods of using the mobile phone to make payments offer the consumer a somewhat different way of paying. These have largely flopped because they do not offer consumers enough additional convenience or value to modify how they have been paying at the point of sale for the majority of their lives.[33]

We believe that the real revolution in the payments industry is not going to come from improving the basic payment transaction between consumers and merchants: there is not much room for making transaction processing faster or cheaper and therefore relatively few benefits accrue to consumers or merchants. Instead, the revolution will come from the mashup of payments with technologies and business models that lie outside of the traditional payment card industry. Those have the potential to provide significant additional value to consumers and

merchants above and beyond efficient transaction processing. The form factor is relevant for these mashups only insofar as it can facilitate their occurrence.

III. MONETIZING TRANSACTION DATA

In the United States alone, each day millions of transactions flow through the electronic payment systems. In the course of authenticating the cardholder, authorizing the transaction and settling the charges, the various players in the payment card ecosystem collect a great deal of data. Data is captured on who the consumer is, what her socioeconomic background is, what merchant she shopped at, how much she spent, and even potentially what she bought since many merchants collect sku-level data on purchases.[34]

It goes too far to say that these data are flushed down the drain. But to the extent they are used, it is only in primitive ways such as for some cross-promotional activities with merchants and for some merchant loyalty programs. The online advertising industry has revealed, however, that these data have immense value. Not surprisingly, many firms in and outside of the electronics payment card industry are exploring ways to use these data.

We begin by describing how the online advertising industry uses data collected from what users do online today and then explain how transaction data could be used to add more value to consumers and merchants.

A. The Online Advertising Industry

The online advertising industry accounted for 14 percent of advertising spending in the U.S. in 2007 and is predicted to grow to about 17.4% percent in 2008. In part advertisers are following the audience. Search and display advertising are the most revolutionary aspects of online advertising and together accounted for 72 percent of online advertising spending in 2007—the remainder went to email advertising and classified listings.[35]

The companies that provide search engines sell advertisers space on the pages that display the search results. The user who clicks on the ad is taken to the advertiser's web site, where often the advertiser will try to sell the searcher something. Advertisers can bid on placing ads on the search results pages for particular keywords or combinations of keywords. Advertisers pay a "cost-per-click" (CPC) when a consumer clicks on their ad. Roughly speaking, companies auction off slots on the search-results pages based on how much in total advertisers are willing to pay for the slot. This depends on the CPC and the number of clicks they draw in.

Advertising also appears on web pages that attract viewers with content other than search results. This could be content that is provided by portals such as yahoo.com, publisher sites like CNN.com, and social networking sites such as Facebook. These "display" ads, as they are called, look similar to those in newspapers and magazines. Several slots on the page are devoted to ads which contain text, pictures, or video. Unlike traditional advertisements, however, when the viewer points and clicks she is taken to a web page just as she is when she completes a search. Nevertheless, like traditional advertisements, advertisers pay for display ads based on the "cost-per-thousand" (CPM) viewers where the CPM is adjusted based on the demographic characteristics of the audience. These ads are sold just like traditional advertisements.

Online advertising is not just a PC phenomenon. Many other devices are now connected to the Internet and therefore are capable of delivering online advertising. These include mobile phones, which many argue will be a larger source of online advertising than PCs, and eventually video game consoles, televisions, and other handheld devices.[36]

Online advertising can provide much more measurable and relevant ads than traditional advertising in a couple of ways.

First, consumers reveal something about themselves when they search on a set of keywords ("thin crust pizza Boston") or go to a particular site (one that carries

reviews of laptop computers). Computers can instantly present that viewer an advertisement that is likely to be far more relevant to them than what they would get in traditional media.

Second, the IP address of the person looking at a web page at a particular time, coupled with a variety of other information that can be correlated with that IP address can provide a great deal of information about the viewer. For example, they might easily find out that the browser lives in New Canaan, Ct., has recently looked for baby clothes on the web, and was browsing at 11A.M. on a weekday.

The online advertisements are also more actionable because it is possible to insert a web link in an advertising copy. When a viewer clicks on the ad—which most every web user now knows they can do—they are redirected to a web site chosen by the advertiser. This website could be one that provides more information or that enables the viewer to buy the good or service. Whether the viewer is driven by the desire for instant gratification or the convenience of finding and buying things online, the advertiser is happy to achieve its ultimate objective: to make a sale or, as it is sometimes known, a "conversion."

An important development in online advertising now concerns "behavioral targeting." By collecting and processing more data on consumers it is possible for sellers of advertising to target advertising more precisely and potentially in real time. Such targeting would enable these sellers to provide consumers and advertisers much more relevant advertisements that are more valuable to both parties. On the other hand, this sort of targeting has raised significant concerns over privacy that may drive public policy in directions that would retard or even prevent value-creating innovation.

We hope that public policy reflects the fact that this revolution in advertising, if it is allowed to occur, will make both consumers and merchants better off. Consumers will receive more relevant ads and will endure far fewer ads that they do not care about. It is a better use of their time and provides more

valuable information to them. Advertisers will more efficiently provide information to consumers who value it and who are therefore more likely to buy the advertised goods or services. Technological advances that can provide more relevant and actionable ads for merchants and consumers will provide tremendous benefits to the economy.

Despite its clear technological advantages over traditional advertising today, the online advertising industry still relies on brute force targeting viewers. Most computer users have one or more "cookies" on their machines that have been inserted by some player in the online advertising business. These cookies track the user's visits to web sites. In addition, the search-engine provides record of and stores the search history of users. Google even scans the email of its Gmail users. Much of this data can be correlated with other databases that contain personal details on users. If combined, entities in the online advertising business could have rich detail on almost every Internet user. Great effort is going into the development of "behavioral targeting" which tries to glean from these sorts of data what's on people's minds in terms of shopping, in addition to their personal characteristics.[37] Most online advertising today, however, does not use much of this information. It is more typical for display ads to be based almost entirely on location, time of day, and some knowledge of the profile of the "typical" visitor to a particular web site.

There are two challenges to the development of sophisticated methods for targeting. One, which we have already mentioned, concerns privacy. There has been backlash from privacy advocacy groups, from the government, and from some user groups over the use of private information.[38] Facebook was heavily criticized for its launch of the Beacon advertisement system in November 2007 that pushed data from third party sites (you just bought some concert tickets) to someone's Facebook friends (all of your friends see an update that you bought those tickets). Part of the backlash has resulted from participants in the online advertising industry tracking and retaining data on users without their knowledge and consent.[39] There is now a race between self-regulation and government regulation of the use of data. In the

last year Google, under intense pressure from European regulators, moved from keeping search data forever, to keeping it for 18 months, to keeping it "just" 9 months.

The other challenge is technological. Most online advertising is delivered in what appears to be real time. When you go to a web page, the advertising looks as though it is just part of the web page, just like the page of a magazine would look. In fact, when you click on that page, various server computers in the online advertising business are making quick decisions on what ad to show you. It all happens so quickly that the human eye is incapable of noticing. An important problem with behavioral targeting and other sophisticated methods for using data is that vast amounts of data and computations need to be performed in nanoseconds if advertising is to be delivered without viewers noticing any delay.

B. Economic Value of Consumer Preference Data Based on Transactions

The information that is being used for online advertising is a weak sister of what is available through the electronic payments industry. Take the earlier example of the person whose IP address identified them as being in New Canaan. Online advertising infers that the person is a young mom because she looked at a web site involving baby clothes, that she is not working because she was surfing at 11 A.M. and that she is well-off financially because her IP address correlates to New Canaan. But the surfer could have been the housekeeper, a grandmother or aunt, or a friend who wants to buy a baby present for her friend with a new baby. The individual may or may not be well off since not everyone in New Canaan is. Now suppose online advertisers had access to the person's credit card purchasing history. The amount spent, where the person has shopped, and possibly what the person has bought would provide a great deal of highly relevant information on this individual. Moreover, the credit card purchasing history is factual information, while the online advertisers are often making educated guesses.

Now consider another aspect of online advertising. Advertisers would like to know how effective their advertisements have been. Have they resulted in the viewers of those ads buying the advertiser's product? Online advertisers often know because there are ways to determine whether an individual who saw a display ad for a new electronic device went to the advertiser's online store to purchase it (as a result of cookies and other methods for tracking behavior online). But since most goods continue to be sold in physical stores—and probably will continue to be—there is no convenient way to track what happens once a person leaves the Internet. Maybe our Internet user in New Canaan saw a promotion for CVS which is having a sale on Pampers. Her or his credit or debit card transaction would provide information on the fact that they actually went to CVS and could in the future also confirm that the user purchased Pampers (including what size).

This level of information is obviously quite valuable for both the consumer and the advertiser. Once the online advertising industry knows that the individual is a well-off young mom with a new born baby, it can present her with ads that are tailored to her likely needs. With the online advertising industry acting as an intermediary, advertisers such as Procter & Gamble can target their advertising to this woman. Instead of wasting her time with products that might be more suitable for men or older women, she will get ads that are relevant to her. Moreover, Procter & Gamble will value the fact that it can determine how effective its advertising has been. They can examine whether the people who actually viewed the ad actually went out and bought the product; they can only approximate that now through very aggregate data on viewership and sales.

The payment transaction data could be mashed up in three possible ways.

- It could be used to better target traditional display and search ads and assess the effectiveness of these ads. We surmise that Google Checkout will be used for this purpose although Google has not formally disclosed this.

- It could be used to enhance existing direct marketing efforts such as sending individuals a coupon that could be used to purchase the good or offer a rebate directly to a particular payment card. American Express and others have done this by mailing promotions to cardholders in concert with some of the merchant customers. New online advertising technologies could sharpen this focus. Cardlytics is developing an advertising network for financial institutions following these principles. It is developing technology for helping financial institutions display advertising and other marketing messages on online banking pages and on credit card portals for bill payment.

- It could be used as part of "location-based promotions," where the consumer is presented a message on their mobile phone when they are near a store. Such location-based methods promise to be the most transforming because they can truly drive incremental sales to merchants. Cellfire is a company that has pioneered many aspects of mobile couponing and location based promotions.[40] They are pushing ads to people's mobile phones based on where they are and what they have purchased in the past.

In all three cases, we may see payments business models and online advertising business models start to mash up, and the technologies developed for online advertising used to target marketing and advertising using transaction data. New businesses might be behind these combinations—some may act as intermediaries between the online advertising and payment industry. Existing businesses might extend themselves. For example, a financial institution might consider using payments data to provide advertising and marketing that helps their payments business and cross-sells other products, driving additional revenue. Businesses from these two ecosystems—Yahoo and MasterCard for example—might themselves be mashed up through a merger or acquisition. They are both, after all, businesses built on the manipulation of data over networks.

The mobile phone has the potential to play a central role in this integration of transaction data and advertising.

IV. THE MOBILE PHONE REVOLUTION

The mobile telephone has become the world's most ubiquitous technology. There are more than 3.5 billion mobile telephones in use today globally. That is nearly four times higher than the number of PCs and two times higher than the number of television sets.[41] Figure 4 shows mobile phone subscriber penetration as a fraction of total population for various countries. The growth of mobile phones in

Figure 4:
Mobile Phone Penetration* for Various Countries

Worldwide	***47%***				
Argentina	102%	Hungary	110%	Philippines	51%
Australia	102%	Iceland	115%	Poland	109%
Austria	117%	India	20%	Portugal	126%
Bolivia	34%	India	20%	Qatar	150%
Brazil	63%	Indonesia	35%	Romania	107%
Bulgaria	130%	Iran	42%	Russia	119%
Canada	58%	Ireland	115%	Saudi Arabia	115%
Chile	84%	Israel	123%	Singapore	78%
China	41%	Italy	135%	Singapore	127%
Colombia	74%	Japan	79%	Slovenia	96%
Costa Rica	33%	Jordan	81%	South Korea	90%
Croatia	111%	Kenya	31%	Spain	110%
Cuba	2%	Latvia	95%	Sweden	106%
Czech Republic	128%	Lebanon	31%	Switzerland	108%
Denmark	115%	Lithuania	145%	Taiwan	106%
Dominican Republic	57%	Luxembourg	130%	Thailand	80%
Ecuador	76%	Malaysia	88%	Turkey	83%
Egypt	40%	Mexico	64%	Ukraine	120%
Estonia	148%	Morocco	64%	United Arab Emirates	173%
Finland	115%	Netherlands	106%	United Kingdom	118%
France	90%	New Zealand	102%	United States	84%
Germany	118%	Nigeria	27%	Uruguay	90%
Greece	108%	Norway	111%	Venezuela	86%
Guatemala	76%	Pakistan	48%	Vietnam	27%
Hong Kong	146%	Peru	55%		

*Penetration reflects mobile subscribers as a percentage of total population
Source: International Telecommunication Union (ITU), "World Telecommunication Indicators Database," June 2008.

the emerging and lesser developed countries is an example of the path dependence observation we made previously. Countries that had made little investment in fixed-line telephone systems simply leapfrogged the old technology and went with the new. In many parts of the world there have already been mashups of mobile phones and payments. These mashups have responded to particular local circumstances. Only a portion of the potential synergies between the mobile handset, mobile communications, and payments have yet been realized.

A. The Development of Mobile Phone Technology

Mobile phone technology is evolving rapidly. Although the stock of mobile phones around the world consists of a large portion of "dumb" devices, people replace their mobile phones relatively frequently. Much of the stock of mobile phones in five years is likely to consist of devices that are powerful computers, run by sophisticated software platforms, with many applications available. Many of these phones are likely to be connected to the Internet and have browsers.[42]

There are three aspects of mobile phone technology that can prove important for mashups with payments.

1. Browser-based/Internet Connected. An increasing portion of mobile phones have browsers and can be linked to the Internet. As of May 2008, 95 million mobile subscribers (37% of all subscribers) in the United States paid for access to the mobile Internet. As more recent numbers are published, this penetration will likely increase due to the entry of devices which utilize the 3G network or can connect to WiFi.[43] Some analysts predict that by 2010, more than 50% of cellular subscribers in the United States and Western Europe will access the Internet on a mobile device at least once a week. The most successful example of such phones thus far is Apple's iPhone. More than 8 million people have these handsets, with analysts conservatively predicting that, worldwide, 25 million additional units will be sold in 2009 and optimistically predicting that this number will reach 40-45 million.[44] The phone's popularity has attracted many imitators and has placed

pressure on device manufacturers to meet newly defined consumer expectations.[45] The fact that phones will be browser-based means that any payment method that works online also works on mobile phones.

2. Powerful computing device. Mobile phones have become much more sophisticated computing devices over time. Around 10% percent of phones sold worldwide are "smart" phones that have computer chips for processing, rapid-access memory and storage, and worldwide sales of these devices are expected to maintain strong double-digit growth over the next five years. (Although these phones are very powerful computers the fact that computing is moving to the cloud, as we discuss below, means that the "client" can be thin.)

3. Software platforms and applications. Mobile phones that are based on sophisticated computer hardware have operating systems that control that hardware. Most of the phones have operating systems that are "software platforms" that include both code that runs the hardware on the phone as well as code that provides services to applications. There is extensive competition to provide software platforms for mobile phones. The leading players at the moment are Windows Mobile, Symbian, and Linux. In addition, Nokia has a software platform that works on top of the Symbian operating system on its mobile phones. Apple has a software platform that works with its mobile phones. Recently, Google has introduced its open-source Android platform.

The main importance of these software platforms is that they can encourage the development of the same sort of rich ecosystem of applications for mobile phones that developed for personal computers. The Apple iPhone points the way. In the two months after Apple opened its iPhone application store more than 3,000 applications have been made available there—90% of these are priced at less than $10 and 600 are free. Since its July 11, 2008 debut, iPhone and iPod touch users have downloaded over 100 million applications.[46]

4. Location-based technologies. An increasing number of mobile phones include GPS which enables the network to locate the phone within a meter so long as a satellite signal can reach the phone. In 2007, 200 million mobile phones were GPS-enabled and this number is projected to reach 700 million by 2009 and 950 million by 2013.[47] There are other methods for locating the phone. Triangulation methods based on using several cell towers can provide a rough idea of where the phone is—generally within a 20 to 40 meter range. In addition, mobile phones emit a unit signal which could be detected by local devices such as ones at stores.

B. The Mobile Phone Revolution in Payments

Without even using many of these capabilities, mobile phones are substituting for plastic cards as the form factor for making payments in several important geographic regions. When examining developed countries, the United States is not likely to see any level of near-term robust growth in the use of mobile phones to replace plastic cards. Despite the supply-side push for contactless and continual advances in mobile technology which work to enable various deployment possibilities, unresolved market restraints and consumer concerns remain at the forefront of any substantial activity.[48] Other developed countries, however, are seeing more encouraging growth. Japan and Korea are leading the market, with broad contactless use now converging with mobile devices. In Western Europe, efforts by companies such as Paybox in Austria and Payforit in the United Kingdom are providing platforms for enabling mobile payments.

In emerging countries that do not have mature payment networks, mobile payment schemes are unfolding to satisfy the needs of residents (many of whom are unbanked) rather than improving the convenience of an already established process.[49] The introduction of mobile phones has revolutionized communication in many emerging economies as land-line infrastructure is often undeveloped. The mobile phone is now the key access point in many of these markets.

Safaricom's M-Pesa technology was introduced to Kenya in March 2007. The service enables person-to-person money transfer and urban-to-rural remittances via SMS, with currency that can be collected from one of the many M-Pesa shops across the country. Users register for the service and after their identity is verified an electronic account is established which links to the customer's mobile phone number.

The customer can then deposit cash with the agent that is reflected as e-money, and thereby transactions can be carried out over the mobile phone. Cash is collected from one of the many M-Pesa shops dotting the country.[50] M-Pesa aimed to add 200,000 new customers in the first year but achieved this penetration within a month, reaching 2 million customers as of May 2008. Other schemes, such as GCASH in the Philippines and mChek in India are providing similar services.

Another interesting occurrence in the mobile payments arena in developing countries relates to using prepaid air minutes as a form of currency. Mobile operator Celtel in Africa is reports that the transfer of air minutes via SMS is the preferred means of payment for small-scale vendors, amounting to its own $2 billion industry. It has become particularly useful in Africa due to the fact that transferring small amounts of money through banks is costly.[51]

C. Potential Mashups between Mobile and Payments

Much of the discussion in the payments industry concerning mobile phones has surrounded using the mobile phone as the form factor for payments instead of using a mag-stripe, chip-based, or contactless card. There has been great interest in whether the Japanese model points the way. This development may happen in the United States, Europe and other parts of the world that are still card based. Mobile phones could become equipped with contactless chips, as many in Japan already are. If such phones became ubiquitous and if people liked waving their mobile phones at contactless terminals, this might be enough to sway merchants into investing in contactless point of sale terminals. Or, it may be that with the

opportunities that mobile phones provide for further profit, some players in the ecosystem subsidize the deployment of contactless technology at the point of sale. It is also possible, however, that some new technology for using the mobile phone for payment will displace the contactless-chip-enabled mobile phone.

We believe that the current focus on the mobile phone as a "form factor" is misplaced. It is by no means clear that it is better than the plastic card as a payment device. People may prefer to use PIN- or signature-based cards rather than contactless-chip-enabled mobile phones because of security concerns. Too little thought has been given in the industry to the consumer experience at the point of sale with the mobile phone. Customers that use multiple cards will need some way to select a card on the phone. They may find doing so time consuming and cumbersome, depending upon how the phone is designed. If the mobile phone were just "smarter" than a mag-stripe card, we would not be optimistic about the widespread adoption of mobile phones as physical methods of payment in countries that have an efficient card-based industry.

The mobile phone is likely to become a significant method of payment at the point of sale not just because it is smart, but because it enables the combination of a number of transaction-related services that add value to the consumer and to the merchant. The mobile phone can be easily integrated into the consumer's shopping experience and used by consumers to locate products and services at physical stores, to compare prices, and to locate or navigate their way to particular stores. Consumers could also receive advertising and marketing messages related to their precise shopping experience—tailored to the store and possibly even their location within the store in real time. The phone could also store coupons that the consumer could produce and use on demand. Using the location-based services on the mobile phone, it is possible to deliver coupons and advertising messages based on where the consumer is shopping at any moment.

Card issuers do many of these things now, but in a rudimentary way. Card issuers have loyalty programs with groups of merchants, provide rewards to

consumers who shop at those merchants, and even sometimes place advertising in their monthly statements. The mobile phone would enable all of these activities to be done in a more sophisticated way: to be more precisely targeted to the consumer, to her shopping patterns and her locations, and to be served in real time. These mashups are facilitated by the fact that smart mobile phones have a software platform on which application programs—which embody the ultimate technology for mashups—can operate.

V. CLOUD-BASED COMPUTING

The electronic payments industry today looks like the information-technology department of a conglomerate that has been kludged together from numerous mergers. The payment card system runs on two separate set of rails: the rails for signature-based cards sponsored by the four major card networks and the rails for PIN-based cards sponsored by the PIN-debit networks. Each of these is based on a patchwork of systems that rely on many proprietary networks, hardware, and software platforms that have been interconnected over the years. Other parts of the electronics payment industry have their own sets of rails including the ACH system and the electronic check clearing system. Businesses and financial institutions must enter into point-to-point transactions for each of these payment systems using each of these rails.

With today's technology, one would design a very different system based uniform standards and interoperable technology. As with many modern systems, much of the work would be performed in the cloud, with the Internet—subject to security issues—being used for connection to the various entities that comprise the electronic payments ecosystem. However, participants in the ecosystem have little incentive to abandon their past investments in hardware, software, and processes that work pretty well, paving the way for entrepreneurs to look for ways to improve the efficiency of the current system rather than replacing it entirely.

One can view PayPal as an early attempt to solve the problem of multiple payment rails in an online world. Buyers can plug several alternative payment methods into PayPal, including multiple signature debit and credit cards and their checking account number. Sellers then can select to receive a direct ACH transfer into their accounts from PayPal. This provides a many-to-one payment method. One can think of PayPal as operating a platform for buyers, sellers, and payment method providers. Of course PayPal is not neutral as to payment method providers: its business model is based on moving buyers to ACH-based transfer, which allows PayPal to avoid paying merchant fees on cards.

A much more sophisticated approach is being pursued by Denver-based IP Commerce. It has developed an "operating system" for the payments ecosystem that, in effect, provides a cloud-based software platform. Although they have difficult chicken and egg problems to conquer to get their platform established within the electronic payments industry, it is instructive to describe their approach because it shows how cloud-based computing—whether provided by them or someone else—could lead to a rapid increase in innovation throughout the payments ecosystem.

IP Commerce has developed a software platform which provides for many-to-many connections. In effect, a buyer or seller that obtains access to the platform's services can select among a menu of payment alternatives for sending or receiving payment without having to install the individual connections for each one. This is similar to a PC operating system such as Windows that enables the user to plug into many different peripheral devices without having to install software drivers for each one. As anyone who used personal computers 20 years ago knows, the incorporation of these drivers into the operating system has saved users a lot of work. Likewise, in the payments system, the ability to have a standard platform for accessing multiple rails has the potential to save a great deal of time and effort. The company has been working at getting its software platform incorporated into the major third-party processors that handle the bulk of electronic transactions.[52]

As a software platform, IP Commerce exposes APIs, which allows developers to use its code to provide services. One developer that has done so is PaySimple. It has developed an application which enables small businesses to accept any type of electronic payments easily and cost effectively. The business can use their software service to handle recurring bills and to generate invoices that embed electronic payment methods in them. This takes the small business only a few minutes to set up and can enable the acceptance of electronic payments online even in the absence of a merchant web site. So in this case, PaySimple has developed an application (hosted in the cloud) that provides services to small business owners, relying on the IP Commerce software platform (which also resides in the cloud) to power many of its underlying services. IP Commerce facilitates this sort of innovation by saving developers the cost and time of dealing with the complex plumbing of the payments ecosystem. It, therefore, operates in much the same way as Windows. An application developer does not having to worry about dealing with a multitude of device drivers for various kinds of hardware because Windows has done all that work.

To the extent that this, or other software platforms, become established in the electronics payment industry, it could promote a massive wave of innovation. It will become possible to develop applications that mash up various forms of payments with other technologies, including on-line advertising and mobile payments, without having to change much of the other parts of the payments industry.

VI. WHAT MASHUPS MEAN FOR CONSUMERS, MERCHANTS AND POLICYMAKERS

Consumers constantly look for goods and services that can satisfy their wants and desires at the least possible cost, while providers of those goods and services are constantly looking for consumers who will buy their wares. Value is generated when buyers and sellers find each other and engage in exchange. The

buyer usually pays less than his maximum willingness to pay and therefore gets some additional benefit—what economists call consumer surplus—as a result of the transaction. The seller often gets some profit that covers not only its costs but its investment and risk-taking. A diverse set of businesses and institutions in the economy facilitate the process of buyers and sellers finding and transacting with each other. These include retailers who act as intermediaries between producers and consumers, payments systems that provide methods for paying and sometimes borrowing, and advertising and marketing that helps consumers, producers, and retailers find each other. These businesses and institutions create tremendous value by reducing frictions and transactions costs in the marketplace. It is hard to imagine a modern economy functioning at all, let alone functioning well, without well-developed distribution, payment, and information provision systems.

We have tried to show here that the convergence of behavioral targeting, smart mobile devices, cloud-based computing technologies, and payments could transform the "shopping" experience: how consumers find what they want; how producers and retailers sell consumers what they want; how the parties exchange information in this process to facilitate this matching; and how buyers pay for goods and services and sellers receive payments for those goods and services. These mashups could change the day-to-day shopping experience in profound ways. In so doing, the integration of these new technologies could create substantial value—even a fraction of the value created by modern distribution, payment, and information provision activities in modern economies would be a huge number.

Consumers would benefit from targeted advertising that is closely tied to what they are looking for in the physical as well as virtual worlds. For example, using location-based services and behavioral targeting, it would be possible to provide consumers with advertising messages and coupons that are be used where they are shopping and that are based on knowledge of the consumer's preferences and past purchases. Most importantly, consumers could benefit significantly from more useful information and more intense competition for their purchases at the point of

sale. One can think of this as extending, to some degree, the easy comparison shopping that consumers can do online to the physical world.

Producers of goods and services would have more efficient mechanisms for reaching consumers during their shopping excursions, targeting relevant messages to them, and assessing whether their efforts have been successful. They currently have—or, soon will have, subject to privacy concerns—these abilities in the online environment. Offline, however, the delivery of advertising is removed in time and place from the consumer's purchasing decisions, and there are very limited methods for assessing how advertising messages actually influence purchasing behavior.

These technologies would also enable retailers, who act as intermediaries between producers and consumers, to be able to provide a more valuable shopping environment for both consumers and merchants through the methods discussed above. Indeed, some of these new technologies could be tightly integrated into the store location to deliver coupons and messages depending on where the shopper is situated within the store.

It is unclear how this convergence of technologies will affect the existing players in the payments ecosystem and who will take the lead in driving many of these innovations. A key consideration concerns the opportunities for consolidating the merchant and cardholder data for transactions. The banks that issue cards and handle DDA accounts sit on a treasure trove of data. However, those data would be far more valuable to advertisers (and to the online advertising industry) if they were pooled. That scale would increase the reach across the population and facilitate targeting or large enough groups of narrowly defined people.[53] Those data would be even more valuable if they could be combined with richer merchant data which is often held by merchant processors. MasterCard and Visa could possibly facilitate combining data. But as those entities have evolved into publicly owned companies, it remains uncertain how their relationships with the banks will evolve. That may

provide the opportunity for new players that do not pose competitive threats to financial institutions to provide value.

Another consideration involves the role of mobile operators. It is unclear at this point whether the mobile operators will seize some of the opportunities that are available for integrating mobile, online advertising, and payments, whether they will collaborate with other players on these technologies, or whether entrepreneurs will creatively bypass the operators who many see as obstacles to progress. Apple is a potentially powerful player in this business because it has shifted power from the mobile operators to itself as the handset maker. Google could be important as well, although its Android software platform for mobile phones has not yet attracted a significant following. Outside the U.S., mobile phone sales are often not controlled by network operators, and this may facilitate the kinds of innovation we have discussed. A variety of changes in the mobile regulatory environment in the U.S. could encourage or discourage payments-related innovation.

Policymakers will have much to consider as this transformation of the shopping experience moves forward. Credit and debit cards have attracted an enormous amount of attention from federal and state legislators over the years. Part of this is well deserved. Some credit card lenders in this intensely competitive industry have used deceptive practices to make money. Consumers have also suffered from the theft of large quantities of data on cards stored at retailers. Meanwhile, online advertising is also attracting increased scrutiny. As noted earlier, some online advertisers have been quite aggressive in tracking consumer behavior on personal computers without the consumer's knowledge or consent, and.

While policymakers should deal with these excesses, they should also recognize that the payments and online advertising industries bring tremendous value to the economy. Particularly in a period of potentially rapid and socially beneficial innovation, it is important to regulate with care, to avoid stifling that innovation – either unintentionally or in order to protect one or more entities threatened by it. Legitimate consumer protection concerns about deceptive lending

practices, for instance, should not be used to impose unnecessary and potentially regulation on the performance of the payments function.

In addition, there will be legitimate concerns going forward over the use of transaction data for online advertising and over location-based methods to find out where people are. Traditional concerns over the protection of personal financial information should be carefully considered. But these need to be weighed against the value that consumers, in particular, will obtain from the kinds of new services we have discussed. This is not a business-versus-consumer issue. To balance privacy concerns, policymakers must consider the extent to which consumer permission should be required in various settings: should we demand that consumers specifically opt in to location-based services or to having their transaction data used for delivering them advertisements and coupons? Or should consumers just have a clear and transparent method to opt out?[54] We believe that privacy advocates tend to over-state the risks involved with business use of consumer-specific data, but we do not deny that they raise legitimate concerns. We would only urge that policy-makers recognize the potential benefits we have discussed here and proceed with care and caution to deal with the attendant privacy concerns.

One interesting feature of the current payment system environment is the variety of legal regimes governing cash, checks, cards, and other new systems of various sorts. Some have argued that the legal playing field should be leveled, or at least made somewhat less hilly, at least in part so that any new entrants would have greater certainty that they would not be disadvantaged. While we certainly understand and appreciate the advantages of a transparent and neutral legal regime, we would once again counsel caution. The current regime, messy though it may be, has the signal merit of working well. We would suggest that specific problems with the legal regime under which payment systems operate be solved only when they have been clearly identified and alternative solutions carefully explored. We are unaware of any problems and solutions that meet this standard.

Finally, we must say something about price regulation. Though in most areas of the U.S. economy and of many other developed economies, price regulation is becoming a matter of only historical interest, price regulation of payment systems is emerging globally.[55] This mainly takes the form of merchant-generated pressure for reduction or elimination of the "interchange fees" that Visa and MasterCard have traditionally imposed on merchants and passed on to issuers. In the U.S. merchants have brought antitrust litigation to reduce or eliminate these fees, while administrative regulation of one sort or another has generally been used abroad.

With their transformation into for-profit entities, Visa and MasterCard ***may*** eliminate interchange fees at some time in the future. That is, like American Express, they can simply impose fees on merchants (or on the acquirers who deal with merchants on their behalf) and provide subsidies of various sorts to the banks that issue their cards. After all, in every successful payment system from Diners Club onward, merchants have contributed the bulk of system revenue, and they have been unhappy about it. The political forces that have put pressure on interchange fees will thus naturally turn to putting pressure on merchant fees directly. But if they succeed, regulation will naturally extend to merchant fees charged by *all* payment systems, including American Express, Discover, and any new entrants – and perhaps, to ensure that price regulation is not evaded, to other aspects of their operations.[56] If this were done, innovation would surely be substantially slowed, and the costs to consumers and businesses could be dramatic.

# # #

[1] The payments industry is going through a period of creative destruction that results from fundamental changes in institutional arrangements, business models, globalization n the last two years, MasterCard and Visa have transformed themselves from essentially non-profit bank cooperatives to for-profit publicly traded firms with market values of $29.68 billion and $55.83 billion, respectively, as of September 8, 2008. A new global player has emerged with China Union Pay—a state-owned bank cooperative in China— having more than1 billion cardholders with acceptance in 27 countries and regions, rapidly expanding its footprint throughout the world. Mobile phones and related communication technologies are being used instead of traditional magnetic stripe cards for making electronic payments in a number of countries. For more details, from the perspective of 2007, see "Capitalizing on the Industry's Inflection Points" by David S. Evans, 2008 TSYS prospectus, *Our Story,* pp. 45-61.

[2] The term "mashup" refers to a derivative work consisting of two pieces of (generally digital) media joined together, such as a digital map overlaid with user-supplied data.

[3] For further details see the web sites for the Smart Card Alliance (www.smartcardalliance.org) and the NFC Forum (www.nfc-forum.org).

[4] The electronic payments industry includes the credit and debit card systems, ACH-based transactions, online banking, electronic bill pay, and all other methods that providing for payment and settlement using digital money transmitted over communications networks. For much of this paper we focus on the credit and debit-card systems. Much of what we discuss, however, is relevant to the other aspects of the electronic payments industry.

[5] David S. Evans and Richard Schmalensee, *Paying with Plastic* (2nd ed.) (Cambridge, MA: MIT Press, 2005). For more information on payment card networks refer to Dee Hock, *One from Many* (San Francisco: Berrett-Koehler Publishers, 2005).

[6] In information technology, a "client" refers to a device that is used by an individual and that can be connected to a network. A "server" is a node on a computer network that provides software and hardware services to these clients. A "thin client" refers to one which does not have much computing power—either processing speed, memory, or storage—often because these features are made available remotely by the server.

[7] "POS Terminal Shipments Worldwide," *The Nilson Report,* Issue 866 (October, 2006).

[8] Testimony of Kim Stubna, Director of Public Policy, First Data Corporation, before the House Small Business Committee. Washington, D.C.: June 2008.

[9] David S. Evans and Richard Schmalensee, *Paying with Plastic* (2nd ed.) (Cambridge, MA: MIT Press, 2005).

[10] The survey was conducted online in August 2008 by Market Platform Dynamics. It was designed to get a general understanding of the consumer's interest in alternative form factors and transaction experiences including mobile, contactless and various cardless solutions.

[11] When asked "When paying at the point of sale, I wish I could pay by using…" 32 percent cited the mobile phone as important, 48 percent said a contactless card and 38 percent said by not having to pull out a plastic card.

[12] When asked "Please rank the following aspects of your payment experience," 93 percent of survey respondents cited "convenience as being important, 87 percent cited a non-confusing/easy to use process as being important and 91 percent cited the ability to use a variety of payment methods as important.

[13] This same survey asked consumers to rank their level of satisfaction with a variety of payment methods. When asked about contactless, 83 percent said that they had never tried it.

[14] For an historical discussion of merchant reactions to merchant discount fees, please see David S. Evans and Richard Schmalensee, *Paying with Plastic* (2nd ed.) (Cambridge, MA: MIT Press, 2005).

[15] It is also anonymous, which provides benefits to merchants and consumers for a variety of reasons including difficulty of detection by tax authorities.

[16] Market Platform Dynamics Survey of 750 small business customers in April 2008. For a complete discussion of survey results in a Market Platform Dynamics whitepaper see Karen L. Webster, "The Next Payments Frontier" (May 2008).

[17] R. Mitchell, "No Contact: Could Smart Phones Spur Contactless Payment Card Adoption?" *ComputerWorld,* June 11, 2007.

[18] Federal Reserve System, "The 2007 Federal Reserve Payments Study" (December 10, 2007).

[19] Karen Webster, "Tap and Grow? The Case for Contactless Payments in the U.S." PowerPoint presentation. Federal Reserve Bank of Boston, Boston, MA. May 21, 2007.

[20] For a general treatment see David S. Evans and Richard Schmalensee, *Catalyst Code* (Boston: Harvard Business School Press, 2007). For the piece that introduced the concept, see Jean-Charles Rochet and Jean Tirole, "Platform Competition in Two-Sided Markets," *Journal of the European Economic Association* 1 (4) (2003): 990-1029.

[21] There is considerable uncertainty over relative the costs of alternative forms of payment. See Daniel D. Garcia Swartz, Robert W. Hahn, and Anne Layne Farrar, "The Move Toward a Cashless Society: A Closer Look at Payment Instrument Economics," *Review of Network Economics* 5 (2) (2006).

[22] Daniel D. Garcia Swartz, Robert W. Hahn, and Anne Layne Farrar, "The Move Toward a Cashless Society: A Closer Look at Payment Instrument Economics," *Review of Network Economics* 5 (2) (2006).

[23] Sears Holdings Archives. Refer to their website at http://www.searsarchives.com for additional historical information.

[24] Pay By Touch Press Release, "Pay By Touch Helps the World Go Walletless with Finger Scanning Payment Systems," July 22, 2005. Business Wire.

[25] Matt Marshall, "Pay By Touch in Trouble, Founder Filing for Bankrputcy," *VentureBeat*, November 12, 2007.

[26] "Octopus Cards: Statistics," available at http://www.octopuscards.com/corporate/why/statistics/en/index.jsp.

[27] "Octopus Cards: Payments," available at http://www.octopuscards.com/corporate/application/payments/en/index.jsp#Link02.

[28] Evan Ramstad, "Electronic Money Card in Hong Kong is a Hit" *Wall Street Journal*, February 19, 2004.

[29] Analyst predictions support this point. In 2004, Jupiter Research predicted that by 2006 151 million contactless cards would be in consumers hand and by 2009 396 million. In 2006, the firm revised these predictions, publishing 2006 penetration at 19 million and 2009 penetration at 126 million. In 2007 PackagedFacts predicts 2009 penetration at 68 million contactless cards in consumers hands.

[30] Aite Group, "Contactless Payments and NFC in the United States: Beyond Science Fiction," (January 2008). Their reports also suggest that this number will increase to 217,000 by 2014, representing less than 3% of all merchant locations.

[31] According to a Jupiter Research survey of 25 – 34 year old cardholders presented at CTST in Orlando, Florida on May 14, 2008, 9.4% use contactless payment once a week or more.

[32] Refer to the BillMeLater corporate web site (http://www.billmelater.com).

[33] Tempo, however, has moved to providing a platform for "decoupled debit cards"—cards which various parties can issue which tap into the consumer's checking account via ACH and Revolution Money has started a P2P payment service online.

[34] SKU is a unique numeric identifier that is assigned to a product and that is used to track inventory.

[35] David S. Evans, "The Economics of the Online Advertising Industry," *Review of Network Economics* 7 (3) (September, 2008).

[36] Strategy Analytics reports that worldwide mobile ad spending will increase from $1 billion in 2008 to $2.4 billion in 2009. Other analysts are as bullish, citing the number of people worldwide with mobile phones, especially those in emerging countries, where the mobile phone is a proxy for a PC.

[37] That involves looking at past search histories, web visits, web email, and possibly correlating those data with other sources of data.

[38] The Senate Commerce Committee held hearings in Washington, D.C. on Online advertising and privacy. For a summary of that testimony, please refer to http://searchengineland.com/080710-090207.php. The European Parliament held similar hearings in January 2008.

[39] After a lot of public controversy and a campaign on Facebook mounted by Moveon.org, Facebook has since changed this system to be a strictly opt-in system.

[40] Refer to Cellfire's website (http://www.cellfire.com/).

[41] See Tom Eisenmann, "Inside the Google Money Machine," *Harvard Business School*, February 1, 2008.

[42] Gartner. "Important Mobile and Wireless Market Directions 2008 to 2012" (2008).

[43] Ibid.

[44] Piper Jaffray Companies prediction.

[45] Gartner, "Key Trends in Mobile Devices, 2008-2009" (2008).

[46] Jason Ankeny, "iPhone App Store tops 100 million downloads," *FierceMobileContent*, September 10, 2008.

[47] ABI Research, "GPS-Enabled Mobile Devices" (2008).

[48] It is worth noting that on September 25, 2008 Visa announced introducing mobile payment services via Google's Android platform and Nokia by year-end 2008. Visa has publicized that the service will include initiatives such as mobile applications for Android that will allow Chase Visa cardholders to receive mobile notifications following making a transaction, receive offers from merchants utilizing Android's LBS technology, as well as make contactless payments, remote payments, and money transfer. Ankeny, Jason, "Visa expands m-payment service via Android, Nokia," *FierceMobileContent,* September 25, 2008.

[49] Frost & Sullivan, "Social Impact of Mobile Telephony in Latin America" (2006).

[50] Olga Morawczynski, "Surviving in the 'dual system': How M-PESA is fostering urban-to-rural remittances in a Kenyan Slum." University of Edinburgh, 2008.

[51] Associated Press, "Cell phones reshaping Africa," *CNN.com,* October 17, 2005.

[52] The IP Commerce software is also included in Microsoft Office, so that small businesses that use Office for invoicing can incorporate payment functionality—such as sending or receiving money electronically—into their invoices.

[53] Since only a small fraction of consumers click on ads advertisers require large numbers of viewers to warrant the cost of launching an advertising campaign.

[54] Richard Thaler and Cass Sunstein, *Nudge* (New Haven: Yale University Press, 2008).

[55] Courts or competition authorities have determined that interchange fees as set by card schemes are unlawful in the European Community, Australia, Spain, and Poland. Investigations and lawsuits are proceeding in many other jurisdictions. The U.S. Congress is considering legislation to regulate interchange fees. U.S. merchants have filed a private antitrust lawsuit against MasterCard and Visa that seeks to eliminate the interchange fee.

[56] The late James W. McKie, Professor emeritus of economics at the University of Texas, Austin introduced the term "tar baby effect" to regulation" to explain what happens when an agency applies a regulation, perhaps a defensible one, to one aspect of business, only to have the result not be what it had hoped and then seeks to implement additional regulation to "correct" what did not occur with the initial regulation.