Risk and Privacy Implications of Consumer Payment Innovation in the Connected Age

Ross Anderson

I. Introduction—Sofort or Surcharge?

One might think that innovation in consumer payment systems is hard because payment networks tend to be slow-moving cartels with high barriers to entry, thanks to two-sided market effects and other externalities. And if innovation is hard, then surely new security and privacy risks should be moderate?

Then consider the case of Sofortüberweisung, a controversial entrant to the payment market in Germany. Its name means "instant payment," and its service has taken off rapidly in the past 2-3 years. Branded as Sofort (Instant), this service provides merchants with a low-cost payment service for online shopping. It is promoted by some large sites (such as airlines) by exempting users from the surcharges normally made for credit card payments. So far so good. What might be of interest to regulators is how Sofort managed to break the payment-card cartel. When a German bank customer clicks to pay at a website, Sofort asks for her bank account number, then goes to her bank's website and impersonates her. The bank asks for a PIN and a TAN (a one-time code, typically mailed to the customer); Sofort in turn questions the customer. If her responses lead to a successful logon, Sofort checks her available funds and uses her funds transfer facility to pay for the purchase directly from her account. In effect, Sofort is doing a middleman attack on her bank account in order to deprive the bank of card transaction fees. The merchant typically pays 75 basis points plus 10 cents per transaction rather than 250 or more for online credit card payment. Analysts estimate that Sofort had 1.2 billion euros of the 20-billion euro market for online payments in 2009.

One might think that Germany's 300 banks would object to this, and indeed they did. There was a technical arms race; the banks tried one security measure after another, from CAPTCHAs to IP address blocking. Sofort generally won that race. The banks' payment cooperative sued Sofort for unfair competition and for inciting customers to breach bank terms of service by entering their credentials at

Sofort's website. The case was suspended after the intervention of the German Federal Antitrust Office, which argued that the banks' harmonized terms of service hindered competition and were designed to exclude new business models like Sofort's.

The banks do make clear via their public relations machinery that any customer who gives their PIN and TAN to any third party breaches their terms and conditions and is on their own. Yet while geeks denounce Sofort in blog posts, the consumer-protection issue is far from salient to Sofort's many happy users. The company's own information on system security is reassuring: "Shopping-glück oder Geld Zurück" (Happy shopping or your money back); your banking is protected by your PIN and TAN (not pointing out that it's the PIN and TAN issued by your bank and used against its wishes); and their data protection is approved by the local standards body (whatever that means).

What lessons might be drawn from this? First, while a geek would consider it imprudent to enter bank credentials into the website of a low-cost airline, banks worldwide have trained their users to do just this through the Verified by Visa/MasterCard SecureCode (VbV/MSC) program. In (Anderson, Murdoch 2010) we discussed how VbV/MSC has become perhaps the most successful authentication protocol ever despite poor technical design, because of strong adoption incentives on merchants (who get cardholder-present fees and liability rules). In practice this means that in many countries, transaction disputes are being charged to the cardholder rather than to the merchant. The explanation: "Your password was used so you must have been negligent." So banks trained their cardholders to enter bank credentials into merchant sites, and trained merchants to adopt insecure systems in return for low fees. They sowed the wind with VbV/MSC, and reaped the whirlwind with Sofort.

Second, German banks had already introduced a Giropay system, which they had planned to extend to SEPA e-mandates (Anderson, Murdoch 2010). Such payments have much the same look and feel as Sofort: a customer making a payment at a website is redirected to their bank's logon page to authenticate it. By sending the customer to the bank directly, this mechanism does not have the same potential single point of failure provided by an active middleman such as Sofort, but is still vulnerable to many of the problems with VbV/MSC such as phishing.

Third, the payment-system innovation provided by Sofort may facilitate innovation elsewhere in the economy. The main alternative in Germany, which historically has had low credit-card usage, is direct debit. Tech-savvy Germans may have direct debits set up with large online businesses such as Amazon, but may be reluctant to trust small startups, who as a result might have to operate through Amazon or other portals that charge much higher fees than the card payment system.

Fourth, it is quite normal for firms competing in two-sided markets to offer insecure products in the race for market share and then lock things down later (Anderson 2002). This pattern has been seen in operating systems, mobile phones and social networking systems; there is no reason for payment systems to be any different.

Fifth, if Sofort becomes the dominant player in its market then there will be systemic consequences. It will be a natural destination of an investigator with a

warrant; some will consider this a privacy risk (but then so is Visa). Others may see it as a control point where governments could interfere with trade (as Visa blocked WikiLeaks). A compromise of its systems could be expensive, leading to large-scale credential reissue (but the same can be said of Visa, and of firms like Cyota that provide VbV service).

II. Might Mobile Compete on Cost?

The Sofort model is spreading. Not only is Sofort Bank expanding its operations to Austria, Switzerland and Belgium. We now see the beginnings of payment service competition along similar lines in the U.K. This time, it comes from an insider. Barclays Bank has recently piloted a service called Pingit for small payments on mobile phones. In the initial phase, the bank's own customers can make payments up to £300 via a mobile phone app to other individuals and to businesses; the innovation is that the mobile phone numbers of the payer and the payee act as names in the system, as more familiar proxies for bank code and account number. Now that the usability issues have been debugged, the second phase will enable anyone with a U.K. bank account to make payments. The payer will make a single authorization for direct debits to be made to her account; thereafter whenever she presses the "pay" button, Barclays will direct-debit her and send money to the payee directly. This service has the potential, like Sofort, of breaking the payment card cartel (of which Barclays is a prominent member). In the short term, consumers and merchants will win as costs fall. There are already calls for regulation: industry people complain that Pingit will break money-laundering traceability (which is nonsense; if we end up with one interbank payment service provider the police can just subpoena them for everything). But in the medium term, consumer advocates may worry that pressure on margins may erode fraud protection still further.

So can mobile and online payments challenge the existing payment-card cartel? This is a fascinating question. Handling cash costs merchants 2.5 percent to 3 percent of turnover, and credit-card merchant discounts are set to be just competitive with this at 2.5 percent. The case for using cards rather than cash rests on factors such as convenience, credit and marketing rather than cost (Garcia-Schwartz and others 2006). In their history of the credit card industry, Evans and Schmalensee describe the vigorous competition between both issuers and acquirers within the framework set by Visa/MasterCard, which they describe as "co-opetition"; they recount how it drove merchant discounts down from the higher levels in the days of go-it-alone operators such as Diners and American Express. But the industry has largely resisted attempts to make electronic payments substantially cheaper than cash. PIN debit does cost about 1.5 percent but U.S. banks have been resisting attempts by retailers to move their customers to this—for example, MasterCard prevents the U.S. version of EMV (and mobile-wallet versions of PayPass) from supporting PIN debit.

Could a U.S. bank or an "outsider" like Barclays, break the U.S. payment-card cartel by offering a mobile payment service such as Pingit? An instant peer-to-peer

payment service, delivered over a mobile channel, could be transformational. If consumers could pay for purchases not just online but also in-store, and merchants benefit from a discount of under 1 percent, then it could give the payment card cartel a real challenge. Merchants might offer triple air miles to entice customers, and even install femtocells at checkouts so that mobile phones would work there. Alternatively, a scheme operator could offer a contactless Pingit card for use in wireless dead zones. Competition of this kind could be economically significant; an efficiency gain of about 1 percent of retail sales would bring real benefits. And the incentives are certainly right for retailers: Wal-Mart processes $200 billion in credit-card transactions in the United States alone.

What might be the lessons for U.S. regulators? If the payment-card cartel is to be seriously challenged then a mobile system backed by ACH might be the way to do it. At present ACH-based consumer payment services are mostly niche players, with the largest being probably PayPal (we suspect most people top up their PayPal account from their credit card rather than using the ACH option, though we're not aware of any data). Mobile platforms might just possibly provide the opportunity to shake up the industry.

Three words of warning though. First, many people have predicted a mobile payment revolution; since about 2002 we've repeatedly been told that within five years m-payment will be big time with a billion users and a trillion a year in turnover, yet it hasn't happened. It is instructive to read and compare the Innopay market analyses for 2010 and 2012 to see how expectations are subsiding (Innopay 2010, 2012). Mobile has taken off in less developed countries that have no alternatives, rather than in developed ones with mature payment ecosystems: they account for 3.3 percent of GDP in Kenya but only 0.05 percent in Japan, the developed country with the highest uptake (IFC 2011). The U.S. market has multiple mobile offerings, some well-established (Obopay was founded in 2005) and some backed by large players (Obopay by Nokia, PayPal X by PayPal, Google Wallet by Google). Yet these remain niche players. The Innopay view is that to prevail they will have to offer speed and security of functionality. To these we might add cost; if mobile payments become cheaper than debit cards, we might see real change.

Second, there will be continuing pressures to reduce, undermine or circumvent the relatively strong consumer protection that U.S. account holders enjoy, and this will be especially the case if mobile succeeds as a low-cost payment channel. We will return to this later. Meantime, it makes sense to regulate Sofort or Barclays in the same way as Visa or MasterCard. In fact, Sofort now has a company in its group with a full banking license, so if the German government had acted against it on security grounds, rather than backing it on antitrust grounds, that would probably have led to a suboptimal outcome. There are outstanding issues around liability, dispute resolution and truth in advertising, but the same can be said for the banking industry as a whole.

Third, a large-scale move to mobile payment platforms will introduce new privacy and security tussles. Customer tracking via cookies is well-established online but has still led to an EU Directive whose implementation is controversial with both businesses and privacy advocates. The tracking of mobile platforms is even more likely to lead to conflict. A consumer's cell site location history is sensitive data, as is her address book; both are collected surreptitiously by mobile companies, which has led to a class action against path.com and congressional investigations into the privacy policies of Apple and of mobile apps generally. Even the late Steve Jobs publicly criticized mobile analytics in 2010 after he found that flurry.com's apps were monitoring devices on the Apple campus (Tofel 2010). There are also issues of security as malware writers turn their attention from the desktop to the handset, now that there's money to be stolen. (I'll discuss malware in more detail below.)

III. Regulation and Risk—130 Years on the Treadmill

The social objectives of payment system regulation may be some combination of efficiency, access (the absence of unlawful discrimination), consumer protection against fraud, rip-offs and liability dumping), privacy protection, and finally the avoidance or management of systemic risk. It is natural for supervisors to pay most attention to whatever aspects currently generate the most controversy, such as the interchange fee issue in recent years (Rochet, Tirole 2006; Chakravorti 2010). But neglected issues can move rapidly up the agenda—so we might perhaps pay more attention to operational risks, consumer protection, privacy and systemic risk.

There is a long history of payment system supervisors acting to protect consumers, only to find that the protection was only partial, and that eventually technological changes allow service providers to wriggle out. An early consumer-protection measure was the Bills of Exchange Act 1882. This responded to fraud as checks became widely used by ordinary citizens as well as by sophisticated merchants. The Act made a forged signature "wholly inoperative," so that a bank in the British Empire could not make its customers liable for a forged check by means of its terms and conditions (unlike in Switzerland where banks did just that). The responsibility for signature verification now fell on the relying party, as it should. But nothing was done about stolen checks. If a thief could open a bank account in the payee's name and cash the check, the drawer had no recourse. This shifted the tussle to the conditions under which a check could be negotiated by endorsement. When the thief of a check payable to "J. Bloggs" found it hard to open an account in that name, he could try to negotiate it by endorsing it with a forged signature and passing it through an account in a different name. Banks responded by overprinting check stock "not negotiable," and the arms race continued when courts in some countries found circumstances in which checks crossed in this way were in fact negotiable after all, leading to more fussy local detail about prudent check crossings.

The pace picked up in the 20th century. The introduction of payment cards into elite markets in the 1960s, followed by their spread into mass markets in the 1980s, made available a new payment instrument in the form of the credit card, with generally good consumer protection worldwide. From the late 1960s banks also started to deploy ATMs, leading to debit cards, which have had a more mixed history and were driven initially by a desire to save staff costs rather than to provide elite service (Batiz-Lazo 2010).

The treatment of specific payment instruments can vary across jurisdictions. In the United States, the signal ATM case was Judd vs Citibank. Dorothy Judd claimed $800 from Citi in disputed ATM transactions; Citi said that as its systems were secure, she must be responsible. The judge ruled that he was "not prepared to go so far as to rule that where a credible witness is faced with the adverse 'testimony' of a machine, he is as a matter of law faced also with an unmeetable burden of proof" and found in her favor (Judd 1980). Regs E and Z now entrench that view in the U.S. regulatory system. In the U.K., the first serious case was McConville and others v Barclays and others, where 2,000 plaintiffs sued 13 financial institutions for £2 million in disputed transactions. The banks' lawyers persuaded the court to split it up into separate small-claims cases, arguing that they would all be too different for a class action to make sense. Two years later, it turned out that the judge had got it wrong: Andrew Stone was sent to prison for 6.5 years for leading this crime wave. (The McConvilles, however, never got their money back.)

The banks introduced a Banking Code under which customers are supposedly only blamed for fraud if they were grossly negligent; but once the media fuss had died down, banks started claiming that cardholders whose card details and PINs were used in fraud were grossly negligent. Online banking was the scene of the next tussle as the dotcom boom in the late 1990s saw banks rush to offer services via the Web. The effects were documented by Bohm, Brown and Gladman: after some vacillation, banks harmonized their terms and conditions to the effect that a customer who accepted a password for Internet banking would be held liable for any transaction that the bank claimed had been authorized using it (Bohm, Brown, Gladman 2000). So as passwords replaced signatures, the protection introduced by Gladstone was quietly sidelined. People who complain of fraud are routinely told, "Your password was used, so you're liable."

The *danse macabre* of banks and regulators in the U.K. continued with the Financial Services Act 2000, which established the Financial Ombudsman Service, an arbitration system for dispute resolution between banks and customers, but which appears to have been largely captured by the banks (Anderson, Bohm 2008). The European Union's Payment Services Directive of 2007 brought in various provisions for consumer protection. This was advertised as stopping banks dumping fraud liability on customers, yet seems to have had little effect on national practices.

The situation across Europe is variable, but generally better than in Britain. The 2010 Eurostat crime survey ranks all 27 EU countries by online users'

concerns and finds that the U.K. is second worst after Latvia for fear of online payment card fraud, fear of phishing attacks on online bank accounts, and fear of privacy violations; it's also fourth for spam and sixth for virus infections (Eurostat 2012). In a report to ENISA in 2008 we recommended that comparable bank fraud statistics be recorded for all EU member states (Anderson and others 2008); such figures will be collected from 2012 for all seven eurozone countries. There will also be a further Eurostat survey of citizens' experiences of cybercrime in 2014. We will be interested to see whether fraud is higher in countries with good consumer protection, such as Finland and the Netherlands, or in countries with weak protection such as Britain, Latvia and Spain. It is noteworthy that the United States does not have central fraud reporting, a topic we'll revisit later.

Another variable that may bear watching is finality of settlement. In a previous study, we observed that fraudsters preferred to attack payment mechanisms with rapid final settlement, and to avoid those that permitted stolen funds to be clawed back for an extended time period (Anderson 2007). The Payment Services Directive imposed a uniform 48-hour settlement deadline for electronic transactions in the Single European Payment Area. Yet there are still variations. The U.K. government, for example, prodded banks to introduce a Faster Payments Service, which reduces the delay in electronic payments from one customer account to another from three days (under the old BACS system) to near real time. It will be interesting to see what this does for fraud; anecdotally, industry insiders suggest losses are on the uptick. We're not aware of any published data, but Faster Payments limits vary so widely from one bank to another (from £5,000 to £100,000) that we expect some interesting data in due course.

IV. Cybercrime Patterns

In order to put the likely risk evolution in context, it may be useful to consider the overall cybercrime picture. A recent study for the U.K. Ministry of Defense (Anderson and others 2012) classifies cybercrime into four categories:

1. Traditional offenses such as tax fraud and welfare fraud that are now classed as "cyber" by virtue of the fact that tax returns and welfare claims are filed online, but where the substance is much the same as a generation ago (in the case of tax and welfare fraud, misrepresentation of income/capital/relationships);

2. Offenses such as card fraud that have been around for a generation, but where both the modus operandi and the main countermeasures are changing rapidly with technology. The report calls these "transitional" offenses;

3. "Pure" cybercrimes against individual victims of a kind that did not exist offline, such as extortion using fake antivirus software;

4. "Platform" cybercrimes that provide illegal services to criminals committing offenses of types 2 and 3, such as the provision of botnets and cashout services.

The big picture is that in traditional frauds, the direct losses are much greater than either the costs in anticipation (such as security measures) and the costs in consequence (such as law enforcement); in pure cybercrimes, the reverse holds, with cybercriminals imposing billions of dollars of costs on the world economy while managing to steal only a few hundred million. Payment systems are a microcosm: the direct costs of card fraud ($9.2 billion) exceed the indirect ones ($2.4 billion) while for online bank fraud, the indirect costs are greater ($1 billion versus $690 million). In short, the more "modern" or "cyber" a payment system is, the harder it seems to be to defend it efficiently. This may be partly a learning effect, but externalities surely play a role, too.[1]

There is a further rider: if we include in the indirect costs an estimate of the opportunity costs—the value of business foregone, by both customers and merchants, because of the fear of fraud—then these numbers may be several times higher. The actual amounts are uncertain, but we can perhaps get defensible order-of-magnitude estimates from survey data. One Visa merchant survey, for example, suggested that merchants turn away $4 in business for every $1 they suffer in fraud (Khan, Hunt 2012). Yet it is not clear that all these $4 were lost to the economy; people who fail to shop at one website may shop at another or at a physical store. As a reasonable guess, we might end up with global indirect costs on the order of $10 billion for users and $20 billion for firms. (For a more detailed discussion, see Anderson et al. 2012.)

The takeaway message is that payment fraud is a large business. It's worth on the order of $10 billion a year to the bad guys—bigger than Facebook's turnover, but not as big as Google's. Specific defenses against fraud, and generic defenses against cybercrime, are worth maybe $3 billion each, while the indirect costs of cleanup and of lost business and confidence might be in the low tens of billions each. So if we include the indirect costs too, payment fraud might lie somewhere between Google and Microsoft in turnover. As for the growth prospects, fraud accounts for about 5 basis points of cardholder-present transactions but 30 basis points for cardholder-not-present. So if a further 10 percent of world GDP moves online over the next 10 years, we might see fraud increase by 0.025 percent of world GDP, which is $15.7 billion (though we'd hope we'd get better at fraud prevention and perhaps limit the rise to half that). It's important to realize that the move online is associated with real improvements in social welfare because of efficiency gains, and the same will almost certainly be true of mobile. Becker pointed out in the 1960s that the socially-optimal level of crime is not zero (Becker 1968), and that certainly holds for payments.

What's more, this isn't just a macro effect, of decreases in transaction costs improving welfare despite higher fraud; there are micro effects, too. The United States, for example, accounts for 47 percent of all card fraud despite generating only 27 percent of the transaction volume. This is partly because of much greater competition between issuers; they are reluctant to decline transactions as customers will just start using a different card (Business Wire2011). Yet no sane lawgiver

would want the United States issuing market to be as concentrated as the typical European one is. And if reasonably open mobile wallets take off, then there should be the same issuer competition as with cards; combined with the technological novelty and the strong externalities, this should lead us to expect a significant increase in fraud.[2]

V. Trends in Mobile Payment Systems

Mobile payment systems have been around for about a decade and are now widely used in less developed countries. A typical system, such as Kenya's M-PESA, lets a user access a bank account from a mobile phone, authenticating herself using a PIN that is encrypted in the SIM card and verified using standard banking technology. Payments can be made from one account to another by encrypted SMS messages. Such phone payment systems are expanding from phone-to-phone to phone-to-agent and even agent-to-agent; M-PESA does this, and Easypaisa is doing it in Pakistan. A phone payment system can thus grow into a physical network that looks somewhat like a bank branch system or a network of Western Union franchisees. The establishment of such systems in countries with poor banking systems leads to significant social gains; philanthropists such as the Gates Foundation have invested in supporting them (The Economist 2011).

A different technology, near-field communication (NFC) payment, was pioneered in Japan and introduced to the U.S. market in 2011. NFC is a radio communications standard designed to communicate with RFID (radio frequency identifier) tags, contactless smart cards and similar low-cost devices over a range of an inch or so. Contactless cards are already used in ticketing applications such as London's "Oyster" card for public transport. NFC technology allows a suitably equipped mobile phone or tablet to act as either the payment card, or the terminal, or both. Contactless payment used to involve dedicated tickets or cards talking to dedicated terminals; now it can become a software platform at one end or both, and this can support innovation in all sorts of new ways not just for payment but for apps such as transport and event ticketing, marketing coupons and loyalty programs.

An interesting general example is the Google Wallet.[3] This is a software app for the new NFC Android phones that supports NFC payments and enables other phone apps to interface to the payment system. Such phones contain a Secure Element (SE), a smart card chip mounted in a tamper-resistant package with an NFC chip and antenna. A bank can load a payment card into the SE chip in the form of a signed Java card applet; the user can then select it using the phone's screen and use it to pay, whether by tapping it against a payment terminal in a physical store, or by an online transaction. The wallet and its associated infrastructure deal with the tedious problems such as provisioning the phone with the right cards, revoking them should the phone be lost or stolen, and logging transactions to resolve disputes. (This is a simplified description; see Anderson 2011 for more detail.)

Mobile wallets will in future mediate access to the payment mechanism by other apps, which are assumed to be untrusted. Without this, an evil app could phish the user by saying "please enter your PIN to pay $2.50 to play this online game" while actually kicking off a large transaction elsewhere. By providing a trustworthy user interface and logging, the wallet can create a payment platform that supports innovation by other businesses. As Google is an advertising firm, their wallet is designed to support coupons and offers; platforms offered by other firms might have a different flavor. For example, Isis is a venture backed by Verizon, AT&T and others, working on standards for phone banking, prepaid cards and charge cards.[4] This will no doubt reflect the mobile operators' view of the world, as tends to be the case with the SIM-based payment platforms offered by operators in many less developed countries. And then there are the disruptive small entrants, such as Square, a company started by the founder of Twitter; its product line is aimed at challenging not just Google on wallets but VeriFone on terminals.

Darin Contini and others report a 2010 Federal Reserve meeting whose participants advocated an open platform for NFC payments, envisaging collaboration between financial regulators, the FCC, the FTC and bodies such as NACHA (Contini et al. 2011). They envisaged a single platform supporting multiple payment channels, from ACH to carrier billing, and common technical standards including dynamic data authentication (DDA) and for certification. They held out the hope that with the mobile phone used as a security tool for authentication at the point of sale and over the Internet, as well as in new NFC and peer-to-peer payment channels, there is a prospect of significant fraud reduction. Furthermore, eliminating physical cards would cut issuer costs, while removing magstripe data from merchant systems would cut the cost of PCI compliance. This vision helped guide industry players in the development of mobile wallets.

There are certainly cost savings to be aimed at, and the early experience of Google, Isis and others should help quantify them. But DDA is no panacea, and certification is hard, too. Europe rolled out EMV first, and has had many failures of hardware, software, protocol design and certification. Once the PIN entry devices (PEDs) used in EMV (chip and PIN) transactions were fielded at scale, terminal-tampering attacks turned out to be trivial, despite a much-trumpeted evaluation scheme (Drimer, Murdoch, Anderson 2008). We then discovered that a thief can use a stolen card (for which he does not know the PIN) by using an electronic device to manipulate communications between the card and the PED. The card believes it's doing a signature transaction while the PED believes that the card accepted an entered PIN; and this works regardless of whether DDA is used (Murdoch et al. 2010). The flaws in the DDA payment protocol design are simple enough but fixing them appears to be intractable because of the incentives facing different actors. Governance is hard in a payment system involving hundreds of vendors, tens of thousands of banks and millions of merchants. Everyone wants to cut costs and customize systems, both of which undermine security; and when a systemic vulnerability emerges, no one will step up to the plate. More complex value chains involving more diverse stakeholders will make governance even harder.

The killer is Wilkes' law. Imagine there's a sudden problem with relay attacks. At present, it's possible to connect a false EMV terminal remotely to a false card, so that when the victim buys coffee from a vending machine on which the false terminal has been fixed, a crook can take money from an ATM hundreds of miles away using the false card. With conventional EMV this requires specialist equipment, so it's not been industrialized at any scale (suspected losses are only in the hundreds of thousands). But once mobile phones do NFC, a crook can program one phone to act as a false terminal, and another to act as a false card. An attack that used to require serious engineering is now just a software app. This is Wilkes' law: "everything becomes software in the end." It applies to crime, too; while pick pocketing used to take long and arduous training, a pervasive mobile platform can reduce it to a piece of software that might take real skill to write, but can then be copied infinitely. Crimes can be pirated just as easily as music. Once a card cloning scam gets into widespread use, who's going to stop it, and how?

There are problems with carrier billing, whose viability is threatened by fraud according to some industry sources. First, there's a problem with malicious smartphone apps: most bad apps being removed from the Android app store in 2011 were dialers that called premium-rate numbers. Second, there's sharp growth in PBX fraud, where bad guys acquire accounts on corporate switchboards (often by exploiting default passwords) and use them to call premium-rate numbers. Third, enforcement against premium-rate fraud is poor; while victims are too dispersed to shout loudly, the telcos share the proceeds and so have no real incentive to crack down. Finally, no one really knows how much is being stolen, with estimates ranging from the low billions per annum globally right up into the tens of billions. If payments migrate to carrier billing on a large scale, this might become a big deal for financial regulators. But the fees for carrier billing are so high (typically 30 percent) that this channel competes mostly for virtual goods that sustain large markups, for poor customers and for tied services. And with chargebacks in some countries now over 20 percent, even these markets may become unviable. As phone malware spreads from China to the United States, we may see some interesting times.

The payment services associated with cybercrime also bear watching. At present the payment system of choice for scamsters is Western Union, as it enables scam victims to make irrevocable payments that can be collected immediately overseas in cash. Other payment systems are favored for internal use by the online criminal underworld—the people who herd botnets, operate pay-per-install services and trade financial credentials. For them, both irrevocability and untraceability are at a premium (Anderson 2007). A popular service was eGold, but after it was raided by the FBI the action appears to have moved to services based in Russia such as WebMoney. Other payment systems feed "High Yield Investment Programs," also known as postmodern Ponzi schemes. There's an ecosystem of such schemes which pay very high yields to early investors and then stop paying, supported by ratings agencies which track on a daily basis which schemes are paying and which aren't. Many "investors" seem aware they're Ponzi schemes, and hope to get in and out of a scheme quickly before it stops paying (Moore et al. 2012). We know little about

this ecosystem—we don't even know how many real principals lie behind it, let alone who they are. Perhaps the combination of phone payment networks with new international remittance services will open up new channels for laundering the proceeds of crime. The cautious regulator may prefer to tread carefully because of the net social gains from a more competitive remittance system; but those payment systems which serve only Ponzi schemes appear to break laws and merit investigation.

Pornography is big business online too, but rating firms such as FICO and Google are reluctant to try to tell the good from the bad and the ugly. Google, for example, will serve porn to those who ask for it, but won't optimize its search services for porn as it does in other sectors. There have been firms offering payment gateway services for pay sites but, as anyone familiar with the literature on adverse selection and moral hazard might expect, they have a bad history (Campbell 2005). The alternative to paid-for porn is free porn, but most pay-per-install services—villains who will install your choice of malware on thousands of machines in return for a modest payment—are linked to porn sites. The cost of free porn is often getting your machine infected (Wondracek et al. 2010). These problems will no doubt migrate to mobile platforms too as they become more pervasive.

The strategic risk with mobile payments generally is of an attack that makes fraud so easy that a platform or channel becomes unviable. The nightmare scenario of the wallet engineer is that malware on the mobile phone might take it over so comprehensively that a remote software attack becomes possible. If I can infect your phone, go into a shop, buy diamonds and bill the transaction to your phone while it sits quietly in your pocket, then its viability as a platform is at stake. Hardware security devices such as the Secure Element are designed to reduce such risks, but it's always possible that design error or governance failure could lead to catastrophe.

An optimist will take the view that disasters have been localized in the past. It's always been easy for a smart crook to loot a few accounts with a few million in them, but that doesn't threaten the system; and if someone invents a mass-pillage attack that can book a large volume of low-value debits, the problem is finding somewhere to send them without being caught. So far no one's managed to do that. Even the no-PIN attack has not been industrialized at any scale, and if the carrier billing mechanism breaks down because of fraud from mobile malware, it won't be the end of the world.

A pessimist will take the view that once all the authentication tokens we use in our lives—our credit cards, passports and car keys—become NFC apps on our mobile phones, we are creating a huge target and at the same time a serious governance problem. He will also argue that a constant low level of fraud can undermine confidence, dumping large opportunity costs elsewhere. (But then, that's already happened in countries with poor consumer protection like the U.K. and Latvia, and the world continues to turn; and phone vendors may be more motivated to fight malware than Microsoft used to be.)

VI. Where Else Might Competition Come From?

A large niche that may drive payment innovation is retail marketing. In the past, store loyalty cards have mutated into credit cards; the U.K. retailer Tesco launched a bank as a branding operation for the Royal Bank of Scotland (RBS) which handled its card issuance and ATM operations, then bought RBS out and set up a proper bank when RBS ran out of money in 2008. We already mentioned Facebook Payments; there is currently an explosion of interest in social marketing, with Groupon creating some excitement in the run-up to its IPO. There have also been rumblings from large retailers in some countries about setting up their own captive acquirers in order to cut card-processing fees. There are enough incentives here; the question is whether anyone capable will make a go of it.

Another possible source of new competition is managing merchants' risk. At present the heavyweight fraud-risk management is done by card issuers, as acquirers tend to be concentrated. Yet as more and more business goes online, merchants face an increasing share of the risk. The leading U.S. acquirer, First Data, is starting to offer risk management, but the industry perception is that the acquirer-side services are not yet as competitive as the issuer side.

Peer-to-peer payments are another source of competition. Some countries, like Germany, have almost abolished checks. U.K. banks said they would like to, but were stopped by the government, which worried about what might happen if the 9 million adults who do not currently bank online were suddenly forced to. But if I can no longer send my mum a check for the wool when she knits me a jersey, what am I to do? A number of startups have begun offering peer-to-peer payments, such as ZashPay and Popmoney. So far, they have tended to be bought by established players; these two firms were bought by Fiserv, whose model appears to be to buy payment service providers in many different niches, then industrialize them by improving the fraud detection and marketing.

Another class of financial-industry mold breaker is the low-cost remittance service. An example is oanda.com, a Canadian company that competes with high-street banks, Western Union and Hawala operators to help send money internationally at low cost. Oanda is a member of SWIFT; unlike traditional operators whose Forex rates include a bid-offer spread of 3 perecent to 10 percent, they offer interbank rates and a fixed fee of $25. According to Western Union's 2010 financial report, the main competitive factors in consumer remittances are brand, trust and distribution; building a direct competitor to their many thousands of franchisees in shops worldwide would be expensive. But with phone payment operators emerging in most LDC markets, a modern global payments business only has to link up to local or regional networks. The main problem now facing new payment market entrants, according to an executive of one of them, is the overenthusiastic interpretation of anti-money-laundering regulations, especially in the United States, which can lead to payments being blocked for days with no explanation or recourse.

A novel and controversial payment service is Bitcoin. This is a currency invented by "Satoshi Nakamoto," the pseudonym of an unknown cryptographer. People mine bitcoins by solving cryptographic puzzles and can then trade them; they are converted to and from U.S. dollars on a market run by several small firms. Bitcoins, being digital, have a number of features attractive to techies; there is a scripting language that enables you to make payments subject to time locks or other computational conditions. But their price depends entirely on demand in a small and not very efficient market; it peaked in June 2011 at almost $30, fell to under $3 by October 2011, and currently trades just over $5. It might be more accurate to think of them as bearer securities rather than currency: they are a store of value (of sorts) but not a medium of exchange except in that they can be traceless transferred from one holder to another. There is a concern that criminals with large botnets have been using their computational resources to mint bitcoin, and that they are used in Silk Road, an anonymous black market. This has led to U.S. senators calling for Bitcoin to be investigated by the U.S. Attorney General, and to bitcoin exchanges calling for the currency to be regulated (Bitcoin 2012).

The world of credit can also give us some pointers to possible future innovations in payments. Social credit has been established for some years, with the Grameen Bank earning its founder a Nobel Prize; there are now numerous online social lending systems such as zopa.com, prosper.com, lendingclub.com and smaba.de. These have a number of operational models; the "social" aspect can involve using social pressure to ensure payment or having individual lenders decide whether to offer loans. There may be privacy issues here as credit data can be disclosed to many potential lenders, and poorer borrowers are pushed to expose the private data of relatives (Böhme, Pötzsch 2010).

A recent development, from firms like Telrock, is to use a consumer's transaction stream for credit risk management. Cardholders who miss payments are encouraged to opt in to surveillance in order to escape aggressive calls, but get constant nagging and nudging instead: "How come you just spent $372 at Macy's when you need to make a card payment of $590?" This might conceivably be welfare-enhancing for people with poor self-control but also raises the question whether more "efficient" debt-collection mechanisms will be used to help the poor manage their finances better, or to get them deeper into debt, keep them there for longer and charge them even more. There is growing controversy in both the United States and the U.K. about payday lenders, with a new generation of online firms like wonga.com grabbing market share from old-fashioned pawnbrokers and check cashers despite interest and fees which can amount to thousands of percent per annum. Without regulation, we may see the emergence of a new underclass of digital sharecroppers, held in debt bondage by ever more sophisticated online and social tools. (In the United States, the concerns raised here may be more within the remit of the CFPB than the Fed but should still not be ignored.)

So far, we have not seen social mechanisms extending much into payment products. There are payments in social networks such as Facebook Credits, but

Facebook Credits is a centralized system used to levy a tax on user payments to game operators and other merchants operating within the Facebook ecosystem. (As Facebook takes 30 percent of all money spent via Facebook Credits, it's unlikely their system will spread beyond their tied services, digital goods and other niches unless the business model changes.)

We do know that more information sharing between banks helps cut risk of defaults (Jappelli, Pagano 2002) and could cut exposure to cybercrime (Moore, Clayton 2008). The FS-ISAC has existed for over a decade, and some banks are starting to get keen (Kapner 2012). But the most likely near-term future large-scale use of social data is by fraud analytics firms such as FICO that use dynamic profiles of cardholders to screen transactions on behalf of issuers; such firms do indeed see this as a hot opportunity (Zoldi 2012). Their systems cut fraud in cardholder-present transactions from 18 basis points in 1992 to 5 basis points now; if social data can be used to cut cardholder-not-present fraud from its current level of about 30 basis points, this could be a real benefit. Mobile data might also help: transaction location is already an input to some fraud engines. But the use of social and mobile data in fraud profiling might bring real problems of privacy and access.

VII. What Way Forward for Regulators?

The modern world demands ever more (and more complex) public goods—from a clean environment, through dependable critical infrastructure, to financial sustainability. Humanity's struggles to meet this challenge might be the defining story of the 21st century (Wolf 2012). The costs raise questions about the sustainable borders of the state, especially in post-industrial and post-credit-boom states with falling populations (Helm 2012). The upshot is that policymakers have to prioritize. But prioritize what?

Culture matters. In a recent review of the nuclear industry, *The Economist* wrote, "safety requires more than good engineering. It takes independent regulation and a meticulous, self-critical safety culture that endlessly searches for risks it might have missed" (*The Economist* 2012). Regulators can help shape culture over time. But which organizational cultures should be targeted, and with what interventions?

In the absence of a clear and present danger, the strategic priority of a smart regulator should be better information, so that when events suddenly demand action it has some hope of being effective. So let's summarize what we know about payment systems innovation. First, as the world moves online, fraud is likely to increase, as online card fraud is typically six times the level seen in face-to-face transactions. The net social welfare gains could still be considerable though. The same is happening with mobile payments, which are bringing huge social gains to countries like Kenya, Pakistan and South Africa, and will benefit the developed world too (though the revolution promised 10 years ago hasn't materialized yet).

Second, innovation in developed markets is likely to be driven by the high

costs of the existing core cartel. Competition can come from either insiders who break ranks, or external challengers—whether new platforms like mobile or social, niche services such as global remittances or consumer credit, or maybe even off-the-wall ideas like Bitcoin.

Third, cost pressures will push innovators to circumvent consumer protection if they can. This may cause governance failures and erode the incentives on industry players to fight fraud, leading not just to higher costs for consumers but overall. There may be real tensions between competition and security; monopolies may be better at managing the costs of crime in the short run but impose large social costs in the long run. Fourth, there is a small risk of a large-scale technical failure, whether a sudden catastrophic compromise, or a rolling governance failure of a payment ecology where no single player has the incentive to step into the breach.

Fifth, there is a risk of a confidence failure if ever more people experience fraud losses against which they could not have taken effective precautions. The uptake of e-commerce is already slower than it should be, and worse in countries with poor consumer protection (though opportunity costs are hard to measure with any precision).

Sixth, given that both technology and business models are changing rapidly, it makes little sense to regulate technical details such as whether consumer logons to electronic payment systems should use cryptographic challenge-response mechanisms rather than passwords. The important thing is to regulate desired outcomes, which boil down to an optimal combination of innovation, competition and traditional consumer protection (against fraud and privacy compromise). In fact one can see the regulator's job as the protection of consumers, defined slightly more broadly: it's about preventing not just the fraud and embarrassment of operational security failures, but also the high costs and lost innovation that follow failures of competition, and the asset losses that flow from institutional collapse.

Under the circumstances, the immediate priority for payment system regulators must be to get better information about what's happening. Some countries are taking steps towards this; Singapore tightened regulation post-Leeson, bringing technical experts into its discussions with bankers, while the Banque de France has set up an Observatory to measure fraud.[5] In work done for ENISA in 2008, we recommended that the EU collect comparable statistics on fraud across member states; from this year this will happen within the eurozone.

What I suggest for discussion is that the Federal Reserve set up a fraud analysis center, whose mission will be to collect fraud statistics not just for cards but for mobile and all other payment channels. There are several possible models to consider.

One option would be a pure public-sector body, centrally funded (as is the Banque de France's Observatory) and given the power by Congress to demand reports from all payment service providers. Another might use as a model the

National Cyber-Forensics & Training Alliance (NCFTA), the hub of America's cybercrime effort, which has a substantial public-sector input in the form of agents seconded from the FBI and the Secret Service, but which also works with the big service firms and with academics to turn data into both actionable intelligence and a strategic picture. A third model could be the private-sector firms that accumulate information for the benefit of subscribers; they include both for-profit firms like FICO and Nilson, and nonprofits such as the U.K. Card Association, which collects fraud statistics in Britain and shares them with member banks. It may be simplest to try voluntary pooling of information to begin with.

A good start might perhaps be made by collecting what's available publicly and asking both banks and other system operators politely for the data, giving overall estimates to the public and sharing better data with providers who cooperate and bona fide researchers. Links to academic researchers and to cybercrime bodies like NCFTA could add real value. Finally, no regulator should neglect payment system architecture, as this can define the platform for innovation and set the parameters within which consumer protection and competition are traded.

VIII. Conclusions

The world of payments is getting more complex, fast. Fraud is quite likely to rise as more and more transactions go online, and consumer protection is likely to be eroded as new payment systems fall outside the traditional frameworks. This could give rise to problems of access, consumer protection and privacy protection; if new monopolies emerge, or old governance structures fail, it might increase systemic risk. Regulators will face new challenges, and it's hard to predict what they will be.

Technical security is getting harder. Each new technology evolution starts up the arms race of attack and defense once more, and mobile is no exception. It also expands the circle of stakeholders in the payments system. The nonbank players used to be specialist service firms like First Data and FICO; now they include Microsoft, Google, Apple, hundreds of mobile network operators and thousands of app developers. The governance issues of dealing with compromises are going to be seriously difficult. (Privacy may be harder still, but is likely to be driven by European data protection law more than by U.S. regulatory action.)

Yet America needs better data on fraud, as do we all. Defensible statistics for card payments will not be enough. Analysts need to be able to watch what's happening with mobile, with other new competitors, with telcos, with Facebook and with niche channels too. Financial supervisors have a vital role here. Eventually the Fed may decide to ask Congress for the regulatory power to collect data from all payment service providers; meanwhile a start can be made by building links, sharing data on a voluntary basis and growing the capability organically. Others, such as NCFTA and NACHA, may look for actionable intelligence; someone should be analyzing data for the strategic picture, and that might well be a role for the Fed.

Finally, although sharing information helps, compelling sharing could be difficult. The stakeholders are many and diverse, and mobile payments touch the turf of many government agencies. An appeal to providers' enlightened self-interest may be quicker than legislation, and a multistakeholder approach may work better anyway.

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Endnotes

[1]These figures give no more than order-of-magnitude indications; Nilson puts global card fraud at $7.6 billion (Business Wire 2011). There is also an open question about the proportion of general "cyber" defense costs to apportion to the prevention of online payment fraud (these costs include $3.4 billion expenditure on antivirus software and similar measures, and a whopping $20 billion for the costs to users and firms of cleaning up infected machines).

[2]The mobile value chain is also more complex. The processor designer may invent a new access control mechanism, but has to sell it to the chip designer, get it supported by the operating system vendor and then promote it to wallet designers. An operating system upgrade is only rolled out if both the handset vendor and the mobile network operator agree. As a result, most smartphone handsets have exploitable vulnerabilities.

[3]Full disclosure: I worked on the design of the Google Wallet in January-February 2011 while on sabbatical as a visiting scientist at Google.

[4]See *http://www.paywithisis.com.*

[5]See *http://www.banque-france.fr/observatoire/home.htm.* The Observatory was set up by a specific law with representatives from issuers, merchants, consumers and experts.

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Risk and Privacy Implications of Consumer Payment Innovation in the Connected Age
Commentary

Alessandro Acquisti

It is always a pleasure to read a new paper by Professor Anderson. There is always something new to learn. Especially in this case. Mobile payments are not my research focus. My research focus is the economics and behavior economics of privacy. When you have a hammer, everything looks like a nail. So, I will focus my remarks on the privacy angle in Professor Anderson's arguments. First, however, I will briefly summarize what I thought were the main key points in the paper.

There exist dominant players in the payments industry—no doubt. But there are many challengers, too. Therefore, complexity is growing and governance is becoming more difficult. Innovation in this area may increase fraud—but that may be a price worth paying, considering the welfare benefits that more mobile technologies can bring.

Therefore, Professor Anderson's recommendation is: "Do not be afraid of innovation. In fact, foster innovation. Try indeed to create some formal central reporting of fraud, as has been happening in other countries."

Among these points, perhaps the conclusions which I found most interesting were the predictions Professor Anderson makes—and I find them reasonable predictions: with mobile payments, we probably will see an uptick in fraud and an uptick in complexity. I found that reasonable to expect; I am in fact going to push the envelope here, and consider other cases where fraud may become more common and other reasons why complexity could cause more fraud. But then, I will also try to invert the cards, and discuss an alternative scenario where, in fact, these technologies are going to bring less fraud and less complexity. Then, I will twist the cards once more, to suggest that less fraud and less complexity are not necessarily always a good thing.

Bear with me. Hopefully, I will get there, and hopefully I will be clear.

So, let me start with more fraud. There is a stream of academic research which combines computer science, psychology, cognitive research and usability studies, and which focuses on the security and the usability of security systems—for instance, how people respond to security warnings. It is a fairly recent literature—the first paper in this area was from 1999. Alma Whitten, at the time at Carnegie Mellon University (she now is director of privacy at Google), wrote a paper with a very catchy title, "Why Johnny Can't Encrypt." She ran some experiments with smart students—of course, they were CMU students—giving them encryption technologies to protect their data, only to find out that the students believed they had protected their data, but in fact they had not. This is the worst-case scenario—people believing they are protecting themselves and therefore acting under that belief—when in fact they are not protecting themselves.

This stream of research is recent, only 10 years or so old. There is an even more recent stream of research, which focuses on usability of security and privacy on mobile devices. Security and privacy on mobile devices represent a worst-case scenario, in the sense it is already hard to properly display security information on desktops (many security signals are hard to comprehend unless you have a computer science background. Figure 1 is a typical message telling the consumer or the Internet user: "Aw, there is something not so good about the website where you are about to go." It then proposes a number of choices the average Internet user may not be equipped to choose among. Well, when you translate these signals into the mobile world, you have a seemingly different problem. You now have messages which succeed in being simultaneously very terse and ominous.

Figure 2 is an example of another—PhotoSpy, which wants to access your photos. You do not know exactly what PhotoSpy will do with your photos. But you are there, using your device, probably doing something else under a state of cognitive load (because maybe you are driving, maybe you are in a store, and you are not paying much attention). The "OK" button, which is the one highlighted, is big. So you click on it—maybe even when the messages are even more ominous. I would say that, in this sense, the more we will be using mobile payments, the more we will face these kinds of challenges.

The good thing about mobile payments is that they should be really easy to use—seamless to use. Otherwise, why not use credit cards? But the more seamless and invisible they become, the less attention they require from the user. That also means, however, that the more vulnerable they leave us to social engineering attacks (which tend in fact, to focus on user inattention).

A second problem Professor Anderson was referring to is the fragmented payment ecosystem. There are up to 300 different electronic payments systems listed on Wikipedia. The ecosystem is very fragmented—and the problem is that, as economic historians know very well, the best technology does not always win. For instance, consider a very significant problem—the fact that many payment systems still use passwords confusing together identification and authentication. Identification is a

Figure 1

Figure 2

process through which you tell a system who you are. Authentication is a process through which you prove you are who you claim to be. When you are using credit cards, you are providing to the entity which receives your credit card number the information needed for impersonating you. If another party just has your credit card number and the three digits on the back of your card, they can impersonate you (authenticate themselves as if they were you).

Well, we have had much better authentication (and payment) technologies than that for many, many years. Let me give you an example. Figure 3 depicts a very well-known protocol to those of you who have a CS background. It may be less known among economists: It is a blind signature. The blind signature was a protocol developed in the 1980s by David Chaum. It then was transformed by Stefan Brands into anonymous credentials, which can be used for anonymous payments, in which you have at the same time authentication separated from identification. The idea is analogous to making a carbon copy. Do you remember carbon copy paper, through which you can write something on the first sheet, and that something transfers down as you press onto the second sheet? Imagine that you put a piece of paper together with carbon paper inside an envelope and you give the envelope to the bank together with a payment for $1. The bank receives the $1 from you, knows who you are, puts a stamp signature on the outside of the envelope and gives you back the envelope. The signature, because there is a carbon copy, has now been copied onto the sheet of paper inside the envelope, which the bank has never seen. So, now you can open the envelope and you have a document, signed by the bank, worth $1. While the bank can recognize the document as a valid $1 bill, it cannot recognize it as your bill, so you can spend it at any merchant—achieving full authentication (complete payment) but no identification (anonymity). Arguably, this is a more secure method than just passing a password. But do we have an existing payment system using this technology? Not really. In the United States only one bank was providing this payment—it was called eCash—only for a few years, because this technology did not go anywhere.

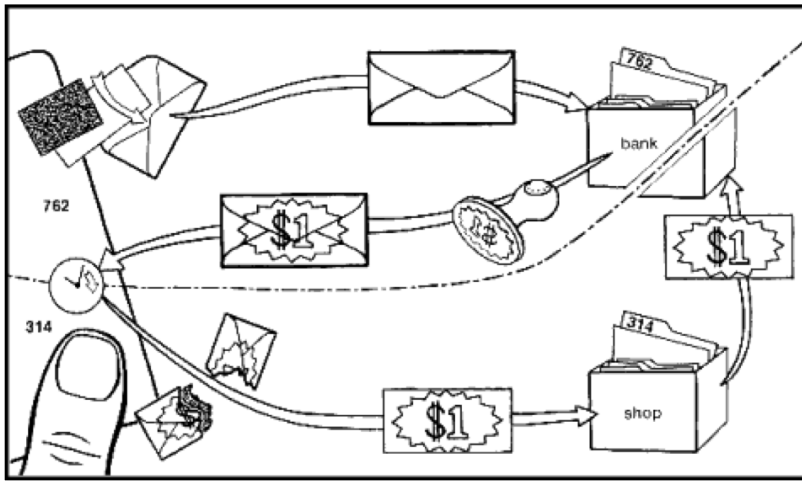
So, yes, I agree that we can have more fraud and more complexity with mobile payments. However, I also wanted to propose a different angle—the angle from which we have less fraud and less complexity. And then I will also mention, why I do not think this would necessarily always be a good thing.

In order to explain that, I would like to invoke two buzz words—one of them "social" has already appeared many times today. The other appears at any conference on privacy nowadays—so I guess I will be guilty of being the first to bring it up today: "big data." So we have "social" and "big data"—the two buzz words.

Of course, companies involved in mobile technologies have an interest in going social, in entering social networks (either coordinating with existing ones like Google+, Facebook, or creating their own). The two buzzwords (big data and social), reinforce each other, in the sense that the larger the social network you have,

Figure 3

Blind Signature and Electronic Cash



the more social data you can create. The more data you can create, the better your social network becomes. The better your social network becomes, the better you are able to target marketing information, products, and so forth.

This is good. In fact, it can create less complexity, in the sense that, as you can imagine, social networks and big data are inherently about network externalities—economies of scale and economies of scope. Facebook and Google+ are the prototypical network goods: You do not want to be in a network where no one else is! However, these networks may also suffer from negative network externalities: The moment when your grandmother is on Facebook, may become the moment you start moving your profile elsewhere (in reality, Facebook has succeeded in passing this threshold somehow unscathed). The success of the network also creates economies of scope, in that once you have so much data about people, you can start creating lots of new products. No longer only the social network itself; you can start innovating in mobile payments, too.

It is possible however, that in the future this virtuous cycle between social and big data—big data and social, social and big data—will also lead to concentration and standardization in the mobile payment industry.

This, in turn, can decrease the risk of fraud in mobile payments—because it allows providers to switch from authentication of individuals to authentication of transactions. Once you have so much data about people, you can recognize their behavior. Each behavior is a signature, and you can calculate instantly what the probability is that this person making a purchase from this type of store at this time of day from this location is really Alessandro Acquisti.

Credit card companies are already doing it, of course. Now, imagine expanding what credit card companies are doing based purely on transactional data, to what they can do when social network data is also combined.

These are the good things. But there is also, let us call it, a "dark side" to concentration and standardization and network externalities. One of the dark sides is, potentially, a decrease in competition. As you have more data, more network externalities, and the ability to combine big data and social, you start facing the temptation also to expand your business into different areas. Indeed, many of the large players in the Internet industry in recent months—in fact in recent weeks—have been accused of doing exactly that.

As a little exercise, a couple nights ago, I simply went to Google and I typed a name of a large Internet or Silicon Valley player, and then added to that the word "forces," and then I looked at what responses I received, using Google's auto-complete. It turns out that, nowadays, everyone is being accused of forcing someone else to do something. Apple is being accused of forcing a PC maker to stop making Acer ultrabooks because they compete with Apple MacBook Air or the iPad. Microsoft is being accused of blocking computer hardware from booting competing operating systems. Google is being accused of pushing Android developers to only use Google Wallet. I have not forgotten about Facebook, by the way. I am getting there in a second.

In terms of privacy externalities, the second potential danger here is the fact that, if you believe the network externality story, you also must conclude, that for those who want to protect their privacy, the costs of doing so is becoming larger and larger. Let me give you an example. There are more and more newspapers in this country that use Facebook Connect for their own commenting systems. Before, if you wanted to comment anonymously on the *Los Angeles Times*, you could do so. Now you cannot, unless you deliberately violate Facebook terms of services (because to comment on *The Times* you must be member of Facebook, and under Facebook terms of services, you are supposed to join with a profile that uses your real first and last name. Not everybody does that, but now you are in violation of the terms of services if you do not).

You can export this challenge to the mobile payments story, and see how—as more and more people start using, for instance, Facebook Credits for payments—then, more and more merchants will start using that too. But then, people who do not want to use Facebook may not be able to buy from these merchants.

Another story. Privacy as control over personal information, or privacy as protection from the control others have over you, once they have information about you? Once again, it is about the power of networks: once they become larger, their ability to influence your behavior in other parts of your life increases.

Take, as an example, Facebook's recent change in policies. If you sign up now, you are agreeing not only not to use the term "Facebook" as a trademark, but also

not even the term "book" or the term "face." So, in this instance, a company tries to expand its claims over the right of its users, once it has reached a certain size and power.

So, bringing this all back to where we started: my point is that mobile payments are both the products and the drivers of acceleration in economic and social changes. We cannot fully predict where they will bring us. You can imagine science fiction scenarios (which are not that much science fiction any longer). You can imagine how—and we are already starting to see this—years ago we went on the Internet to search for information, but now we go there looking for suggestions (there are more and more tools, like Yelp, that provide you with suggestions about where you can go). And then from suggestions, we get into decisions. I was browsing the Internet just a few minutes ago, and I was checking out an application which can choose automatically the perfect seat on your next flight for you. You choose your settings once, and then this app checks with the airlines every four hours, to see whether a seat better matching your needs has popped up. It is good, because automatically it takes the pain of searching for better seats away from you. And then, the next, step, is that you can also get into automatic payments: eBay did something along those lines a few years ago, allowing users to structure bids so that a certain item could be automatically bid upon.

So, finally, you can imagine now a complete sequence in which the future of payment technology is its own disappearance, in that you no longer even need a mobile phone or a smart card. The system knows exactly what you want, before even you know it, and buys it for you. Is it science fiction, or are we just 10 years away from that?

And this can be good, too. It can increase welfare. But…welfare for which party exactly, and at what cost? The now obligatory mosquito bite analogy (to paraphrase Professor Farrell) is the following: in the case of privacy, privacy costs are the mosquito bite. They are very small. You may not even notice them. But over a large number of people, over a long enough period of time, the bites amount to a very, very large transfer of wealth. Thanks.

Risk and Privacy Implications of Consumer Payment Innovation in the Connected Age
Commentary

Sarah Jane Hughes

Mobile payments present both new—and very traditional—challenges. In this paper, I address these challenges through a series of questions that, if I were designing a new payment method or if I were choosing among several to use, I would want to consider. Before I present these questions, however, I would like to offer three general observations.

The first is that payments providers' innovations are removing them, in whole or part, from traditional regulatory regimes. Finding new "spaces" in which to create new products and services to make payments faster, easier and possibly less costly, is a good thing. Leaving established regulatory regimes, however, carries a cost to providers and their partners: to the extent that consumers and perhaps merchants who take payments are uncertain of the rights and responsibilities they will have under new payment products, adoption of new products may be slower than it otherwise might be.

The second is, to the extent that one of these new providers experiences a major incident—whether a cyber-attack or merely a criminal intrusion into their system—and the public learns about it or individual consumers or merchants suffer losses as a result, concerns about what happens to consumers using the same or similar products are likely to arise. If we were to experience multiple incidents across multiple providers, as the cyber-events of 2010 and 2011 with payments processors and cloud computing services evidence may happen, consumers may race back toward the regulated forms of payments they already know, such as debit and credit cards swiped physically at merchants and ATMs, or checks.

My third observation is linked to the first. Despite the fact that the providers and the technology undergirding mobile payments are moving away from established regulatory regimes, a system in which only contracts govern payments (or in which significant issues are not governed even by contract provisions) imposes new costs on the participants in payments—the consumer or other end users, the

merchants or middlemen, the providers of payments bridges such as credit and debit interchanges or nonbank mobile payments providers, and the holders of funds being transferred, whether depositary institutions or not. Thus, in considering how to frame a new payment product from a business perspective, we must anticipate the types of problems the payment product and the participants in the overall progress of a payment transaction may have and deal with them—or decide not to do so and figure it out later if something goes wrong. The wait-until-later approach is more likely to impose unexpected costs than not. Someone in the payment transaction will absorb these external costs. It is highly desirable, in terms of encouraging adoption, for the risks of errors, fraud, and criminal events to be allocated in advance of the events. This is what payments law and payments contracts do.[1] In addition, the change-in-terms model currently operating in Internet-based transactions—in which the provider unilaterally makes changes and the changes go into effect the nanosecond they are posted on the provider's website—won't work in mobile payments. Payors and payees need to know precisely what will happen to the payment instruction and payment receipt they are about to engage in. Any uncertainty of how a particular payment will operate will cause a delay in adoption or an abandonment of one mobile payment provider's products for another provider's product that operates on a more stable contract platform.

My analysis starts with the premise that every payment system—in the United States, at least—presents similar challenges that need to be addressed. Some of these challenges depend on the channel being used for the payment, whether checks, debit, credit, wire transfers, ACH, or mobile. Some of these do not. The fact that the payment system arises outside an established regulatory system is significant because it means that users, applying their experiences from other payments systems they have used, are likely to be surprised. These challenges need to be addressed in the system design and contracts and to be expressed clearly upfront: they cannot be left behind for later consideration. As noted above, an important side observation here is that the model for changes in terms on the Internet —where the provider makes occasional unilateral changes and the changes go into immediate effect following their posting—will not work in the mobile payments arena because users need to know in advance what rules govern the payments they are about to make.

For this presentation, I focused on three clusters of basic issues, which I have presented as a series of questions without much additional exposition.

Issues Relating to Payment Execution and Consumer Protection

As at the advent of e-commerce when proponents argued it should not be "regulated" for fear of stifling innovation,[2] we are hearing the same calls now with new payments products. I would argue that payments are payments and that certain basic issues require attention in contracts between provider and user, among providers and other participants facilitating the payment, and, as appropriate, between providers and government—but, in the latter case, for somewhat different reasons I describe in

greater detail below. But, more importantly, I would argue that most of the issues in fact are closely related to issues in traditional payments law.[3]

The basic questions I recommend that designers of mobile payment products and prospective users consider pertain to most types of payments being executed in the United States without regard to the "channel"—depositary or nondepositary—being used as the provider of the payment services involved. As most of these questions will be familiar to professionals in the broader payments industry, I do not offer detailed explanations of them or the differences that may exist between or among payment systems in this paper.[4]

1. If funds are deposited with the payment system, are those funds protected—by deposit insurance, state money-transmitter bonds, or not at all—so that the depositor is guaranteed completion of a payment instruction or redemption of the credits reflecting the deposit?

2. Are there limits—as there were with traditional savings accounts—on how and when the depositor may redeem the credits they have with the payment system provider?

3. Are sufficient authentication methods in place to deter unauthorized or altered payments? Or the redirection of validly issued payment instructions to someone other than the beneficiary originally specified?

4. How quickly does the specified beneficiary receive the payment?[5] Are likely delays in sending or crediting disclosed at the time the consumer "sends" the payment instruction?

5. Does the consumer receive a confirmation or other usable record of the payment for later purposes? How quickly does the consumer receive this confirmation or record?[6]

6. When does the discharge of the payment obligation occur? What rules govern if the payment instruction is not executed? Whether by dishonor or system failure or outage?

7. Are damages available for misdirection, failure to complete the payment on a timely basis, or for the lack of proper authentication? Are incidental damages allowed? Are consequential damages—such as late payment charges for delayed payments or as loss-of-bargain damages—available without an express agreement allowing them?

8. What charge(s), if any, will the consumer pay to make a mobile payment? Will charges be per transaction or a periodic fee? How and when will charges be collected? By the provider? By the merchant? Otherwise?

9. What rules govern the ability of the provider to change terms in any contract the provider has with the consumer? How frequently and with what length

and type of notice may providers change the terms of service? What options exist for consumers to opt out of any changes?

10. What rules govern substantive error resolution? Are these rules readily available to the consumer? Are they easy to understand and follow? Do federal or state laws also govern error resolution? What recourse will the consumer have in the event that the error resolution provisions of their contract with the provider or other procedure available does not satisfy the consumer? Access to litigation? Access to arbitration?

11. How long will the consumer have to report errors of amount, authorization, duplication, or misdirection? To whom will the consumer report any suspected error?

12. What contractual or regulatory liability limits protect the consumer in the event of unauthorized payments? What does the consumer have to do to invoke those limits? Is the consumer's opportunity to invoke liability limits time-limited?

13. Beyond immediate confirmation messages or copies of receipts, what type of periodic statement will the consumer receive to allow a review of all payments made via the provider's services during a particular period of time? How much information will the periodic statement, confirmation or copy contain?

14. What are the consequences for the consumer sender of a payment instruction if the payment provider files for bankruptcy protection or is closed by government authorities? What happens if a payments intermediary files for bankruptcy protection?

Consumer Issues that Depend on the Payment Channel Being Used

Different *sources of law* currently govern mobile payments made through direct bank account access and relevant applications (payments that should be referred to as "mobile banking") and payments made through nondepositary providers including, but not limited to, telecommunications companies (payments that should be referred to as "mobile payments").[7] For payments that are made via mobile devices and associated software as the "access devices" for payments from demand deposit accounts,[8] I recommend we use the term "mobile payments" so that the taxonomy of payments in these spheres stays as uniform as possible.

Mobile banking transactions are governed by the federal Electronic Fund Transfer Act[9] as well as by contracts between the bank and its customer. Mobile payment transactions currently are governed by a mix of state laws, including laws governing "money transmission" and "money services,"[10] and by whatever contract provisions govern the telecom-customer relationship. As of May 1, 2012, as I was recreating this paper from the original PowerPoint presentation, the FCC had not adopted any regulations that affect the pure payments portion of the relationship—even though it has other spectrum regulations and the like in effect.[11]

The types of questions that affect the telecom-customer relationship and the nontelecom provider-customer relationship may offer different avenues or needs for regulation. For example, one can imagine that near-field mobile payments may present issues different from more remote payments that function with special "apps."

The disparity between the regulation of mobile payments made via access devices directly between the sender's demand account to a merchant, and those that use processing intermediaries including telecom and other nondepositary providers to handle such payments is likely to remain until Congress acts.

Issues Pertaining to Privacy, Data Security, and Government Access

Mobile payments are likely to involve no fewer participants or individual data streams—and probably more of each. This much seems likely: the greater the number of hands through which a mobile payment instruction must pass, the greater the risks to privacy, data security, and, frankly, to government access.

I recommend that providers, users and potential regulators consider the following questions:

1. How does the payment provider protect the integrity of the payment information in transit and in storage, of the consumer's identity and the transaction data?
2. Is the provider's channel subject to federal or state privacy laws, or both?
3. Is the provider's channel subject to federal data safeguards and disposal laws and regulations, or to state data security laws?[12]
4. How may the channel affect government access to the payment and consumer information embedded in the payment instruction/message?
5. Will the consumer sender be able to recover damages (actual, consequential, or incidental) suffered? Will damages related to identity theft, if any, be recoverable? On what standard? Even in an arbitral forum?
6. Will providers recognize a duty to notify consumers in the event of an interruption the timely execution of a payment or in the event of a cyber-event affecting the data about consumer payment transactions executed by or through this provider or processor that is in addition to any statutory duty to notify the provider may have?

Data Storage and Retrieval Issues

This subset of issues covers very important questions. The duration and location of storage will affect significantly access to payments instructions in litigation and otherwise.

1. How long and where (physically or in the cloud) will records of transmitted payment instructions be stored? Which government agencies, federal or state,

regulate record retention for payment instructions and the accompanying deposit, sender and beneficiary information?[13]

2. How long may the consumer sender have access to these records? (Certain online banking records are available only for 72 days.)

3. How much does/will the provider charge the consumer sender for "copies" of records the consumer sender may need later to prove that the consumer made the payment?

Some Concluding Observations

In this presentation I outlined the types of issues that arise in payments generally and identified those that have particular pertinence to mobile payments. I do not intend to call for a particular form of regulation of nondepositary provided mobile payments. Rather, the purpose of this presentation is to inform those preparing to offer mobile payments products, consumers interested in using them, and governments that regulate payments for a range of purposes about the types of payments issues that mobile payments present with particular emphasis on new risks and new types of exposure of payments instructions to risks relating to data security, government access, and transaction execution.

My greatest concerns have little to do with reliable providers, depositary-based or not. Rather, they relate to the functional equivalents of the "wildcat" banks that were sprinkled over the Midwest in the 19th century and whose obligations were based on so little capital that holders of their notes and script often were unable to access the funds that the instruments evidenced.[14] To the extent that rogue providers enter this space and cause losses to consumers, merchants, and others in the payments processing systems, or that cyber-criminals infiltrate and siphon off funds intended for others, consumer and merchant adoption of mobile payments may slow. Whether slower adoption is a collective good or not, is a question for another day.

Endnotes

[1]System rules may lessen this risk, but they do not entirely resolve it for two reasons. First, consumers tend to be ill-informed about system rules so they may not realize that the rules can help them resolve issues. Second, system rules often only apply to entities that subscribe to the system, such as with ECCHO, even if they often benefit consumers indirectly. In the absence of a provision such as Uniform Commercial Code §4-103, which incorporates Federal Reserve regulations and operating circulars and local clearing house rules as if all participants had expressly agreed to be bound by them, in payments transactions to which the UCC's Article 4 does not apply, this provision is only available by analogy.

[2]For a recent example of this type of argument and the concerns it engenders in other providers, I note that brick-and-mortar business owners in Indiana, including the Simon Mall Group, forced a deal under which the warehouse operations in the state will pay sales taxes by arguing that leaving Amazon.com free of the tax created an unlevel playing field between e-commerce and brick-and-mortar operations. "Indiana reaches online sales tax deal with Amazon.com," *Indianapolis Business Journal*, Jan. 9, 2012, *http://www.ibj.com/indiana-reaches-online-sales-tax-deal-with-amazoncom/PARAMS/article/31851 (reporting that Amazon.com will start paying Internet sales tax in 2014).*

[3]In this connection I urge readers to read the invaluable article by the ABA Task Force on Stored-Value Cards titled "A Commercial Lawyer's Take on the Electronic Purse: An Analysis of Commercial Law Issues Associated with Stored-Value Cards and Electronic Money," 52 *The Business Lawyer*, 653 (1997).

[4]I intend to consider these issues more fully in another paper in the near future.

[5]The paper presented by Bruce J. Summers, Ph.D., on March 30, 2012, at this conference titled "Facilitating Consumer Payment Innovation through Changes in Clearing and Settlement," which introduces fascinating (and possibly also fraught) prospects of real-time settlement of payments made on mobile devices, a paper that everyone interested in mobile payments should read. I would observe for the purposes of my paper that, although a boon to merchants and other direct counterparties of the person issuing the payment instruction, real-time settlement has the prospect to attract criminals to the mobile payments arena, those interested in taking the money and running.

[6]One of the best authentication and verification features of many mobile payments products is the sender's receipt of a prompt confirmation of the transaction. Arguably, confirmation received on the mobile device will provide more lasting, and far more secure, records for the sender. Their only deficit relates to issues about how the confirmations will be used later to prove payments when the sender and payee are not in the same locations at the time questions about the payment may arise.

[7]For this crisp distinction between "mobile banking" and "mobile payments," I am indebted to Philip Keitel of the Federal Reserve Bank of Philadelphia whose

essay titled "Contactless Consumer Payments: A Review of Rules, Laws, and Regulations That Apply to Over-the-Air Communication of Consumers' Payment Information" will appear in the forthcoming anthology of essays about Radio Frequency Devices and Other Near-Field Communications that I am co-editing for the American Bar Association.

[8]The Electronic Fund Transfer Act defines the term "accepted card or other means of access" as "a card, code, or other means of access to a consumer's account for the purpose of initiating electronic fund transfers when the person to whom such card or other means of access was issued has requested and received or has signed or has used, or authorized another to use, such card or other means of access for the purpose of transferring money between accounts or obtaining money, property, labor, or services" 15 U.S.C. §1693a(1) (2010). The term "account" is defined as "a demand deposit, savings deposit, or other asset account (other than an occasional or incidental credit balance in an open end credit plan as defined in section 103(i) of this Act), as described in regulations of the Board, established primarily for personal, family, or household purposes, but such term does not include an account held by a financial institution pursuant to a bona fide trust agreement" 15 U.S.C. §1963a(2). I also note that the term "electronic fund transfer" includes electronic payments initiated through "telephonic instruments" or "computer or magnetic tape" so long as the transaction orders, instructs or otherwise authorizes a financial institution to debit or credit an account 15 U.S.C. 1693a(6).

[9]15 U.S.C. §§1693-1693r (2010), Pub. L.90-321,92 Stat. 3728 (Nov. 10, 1978).

[10]A few states, such as Montana and South Carolina, have no laws or regulations governing money transmission or money services. For a complete listing of state statutes governing money transmission and money services, see *www.ncsl.org*.

[11]For a discussion of spectrum regulations affecting near-field communications, see Gregg P. Skall's essay titled "RFID Frequency Issues" in the forthcoming anthology of essays from the American Bar Association. Mr. Skall is a partner in the firm of Womble Carlyle Sandridge & Rice PLLC in Washington, D.C. He can be reached at 202-857-4441 or gskall@wcsr.com.

[12]At the federal level, only "financial institutions" as defined in the Right to Financial Privacy Act of 1978, 12 U.S.C. §3402 (2010), Pub. L. 95-630, 92 Stat. 3697 (Nov. 10, 1978) are covered by the Act and only when the government agency making the request is an agency of the federal government. The definition of "financial institution" was last amended by the Intelligence Authorization Act for Fiscal Year 2004, Pub. L. 108-177 (Dec. 13, 2003), incorporating every provider designated as a "financial entity" for purposes of the Bank Secrecy Act, 31 U.S.C. §5312(a)(2) (2010). Telecommunications providers are not "financial institutions" or "financial entities" for these purposes at this point.

[13]Depositary institutions are required to maintain records of payment and deposit transactions for a period of seven years. Telecomm providers are not yet

subject to similar requirements, and mobile payments providers who fall into neither category seem to have no record maintenance requirements except as the providers themselves may decide to have.

[14]For a history of wildcat banking, see Gerald P. Dwyer Jr., "Wildcat Banking, Banking Panics, and Free Banking in the United States," Federal Reserve Bank of Atlanta, *Economic Review* 1 (December 1996), available at *http://www.frbatlanta.org/filelegacydocs/acfce.pdf*.

General Discussion

Session 3

Mr. Anderson: Thank you. I will only speak briefly. We have heard some interesting points here, especially about the extra things people want to be able do, such as proving they have discharged their obligation or perhaps even having privacy of some kind against some types of government access issues.

Perhaps a good top-level way of looking at this is that systems engineering is all about managing complexity. Perhaps a third of big IT projects in industry fail and this is the same as it was in 1970.

Have we learned anything from 40 years' worth of studying software engineering and building ever more complex tools to manage complexity? No, we just build bigger, better disasters. You keep on rolling the stone up the complexity mountain, and a certain proportion of them fall off. So how you manage complexity is important. The evolutionary environment of your system also matters.

Now there are a couple of extremes here. One extreme is Odlyzko's Law, which says any system you can program eventually becomes so complex that it is unusable and you want to throw it at the wall in frustration. This happens and it does not matter whether it is a PC or a laptop or a phone or a computer game or whatever. And why? It is simple micro-economics, because whenever anybody suggests a new feature be added, the people who want the new feature are a concentrated and vocal interest, whereas the costs of this—the slightly increased probability of a blue screen of death—fall on everybody. So you end up getting complex and buggy machines for exactly the same reason we end up getting agricultural subsidies.

At the other end, Hal mentioned the Downton Abbey thing. This is actually very appropriate, because the goal of technology is often to enable the ordinary middle-class guy to live the way the upper class did a generation ago. When you think about it, we have laptops to do the jobs that were formerly done by secretaries and we have cars to do the work formerly done by coachmen. In an ideal world,

we want things like payments to be completely painless: we want to be recognized, and we want to be sent the bill—like a 19th century nobleman going in to a tradesman on High Street.

This enormous gap between the heaven of Downton Abbey and the hell of featuritis is what the designer has to somehow navigate. Now the problem is that, for most of the world, you are not in a position of having your own machine made by a company like Apple that was run by somebody who is a maniac for design. Systems come out of a long process of evolution, whereby there are various incentives facing the various players.

When you start talking about the trade-offs, such as fraud versus privacy or speed versus resilience to abuse, then I think the key question is this: What is the evolutionary environment of the mobile payment system? Which are the more concentrated and the more effective stakeholders? Will the environment be entirely molded by the Barclays Banks, the Wal-Marts, and the Googles? Will there be regulatory pressure as well? Will there be pressure coming from the civil court system through tort claims and contract cases and so on? How do we arrange things? How do we do the mechanism design so you end up with a payments system which has a reasonable equilibrium we can live with?

Mr. Fish: I will open up Q&A with a question of my own and then we will take questions from the floor.

I know from my work there is the big BYOD (bring your own device) movement, where consumers want to use their personal devices at work. And organizations are being forced into this, because they need to support that for their employees, but they feel this represents their No. 1 security risk.

You had discussed how payment applications tend to be insecure and, unlike a credit card, this now puts the enterprise at risk. Do you see a situation where an enterprise can now hold a payment provider liable for a breach that occurred because of their software?

Mr. Anderson: A big problem, of course, facing a medium-sized company, like I suppose Cambridge University with a few thousand employees and a few hundred million a year of turnover, is what happens if your finance department gets spear-phished. That is the big threat nowadays, because as a corporate body, you do not have the protections offered to a consumer. You are supposed to be a grown-up. And yet, when we look at the types of compromise that happen nowadays, very often the bad guy manages to get, say, 30 of the 50 guys in your finance division.

Old-fashioned accounting rules do not necessarily help there, because double-entry bookkeeping rules were invented to deal with one dishonest person, or alternatively one compromised machine. Once you have three or four, all bets are off. So there may be a case to be made for diversity of platforms.

Alternatively, you may want to make a case saying now consumer electronics have made devices so cheap—this is something I have actually recommended to organizations—you should see to it that your serious money bank account payments are made on a machine that is never used for any other purpose at all. Have an iPad that is kept in a safe and it runs your bank's app and is never allowed to run a mail client or a browser and certainly not a game. So the falling costs of consumer electronics can be a benefit as well as a problem.

Mr. Acquisti: Something I am seeing happening in this area (and also in the educational sector), is organizations outsourcing some of their services, precisely to avoid those liabilities. But that does not necessarily solve the privacy/security problem. It simply switches it to another party. The outsourced party, because of its specific knowledge and expertise, may be better equipped. But precisely due to its being large, and having lots of data from many different entities, it represents also a bigger target for the attackers. So, by increasing security in some sense, you are also increasing the incentives for the attackers to go after that type of entity.

Ms. Hughes: It would seem to me the kinds of experiences we have had, perhaps as individuals with data security risks, normally do not affect us very much except in the hassle factor. It takes us awhile, unless we have actually had identity theft.

Someone, not so long ago, tried to get a $250,000 mortgage in my name for a location I had never been and somehow had managed to get a hold of my Social Security number. Now somebody had the good sense not to give them the $250,000, but I would have had a terrible hassle. So I am not the university and I am not being drained of $300 million or $300 billion, but nevertheless to unscramble that would be a terrible problem for an individual if in fact the transaction had gone through.

That suggests to me Ross's advice is very shrewd. Certain things really need to be firewalled off, so that you can control some of your risks. And then you are going to have to figure out which other risks you are going to have. The university I work for has just announced that, unless those of us who also have computers at home that can link to the university's systems follow certain protocols, it will simply cut us off and no longer allow us to do that. There will be no telecommuting into the university's main email server, for example, unless we follow certain protocols and on a regular basis.

Getting everybody to do that with their mobile phone, getting your teenager to do that with the mobile phone is really going to be interesting. If you took the PayPal example and you are giving $80 to that teenager, but their phone may not be linked to your phone unless it is in one account, then that causes all sorts of other planning and employee behavior monitoring problems for us. It also will impose on the persons who suffer the attacks, as Ross has suggested, a duty to report fast and loud, so we can keep it from happening to others if there is something catastrophic in the works.

Mr. Fish: We will now take questions from the floor.

Mr. Burns: Dr. Anderson, I have a question for you, if I could. I was very delighted to hear you call for some form of registry of fraud data, payment data, and front-end payment data in this country, because we obviously need it. I am somewhat aware, but not totally aware, of an arrangement in the United Kingdom, where these data are reported on a regular basis and managed.

I have two questions. One, Do you have any sense about why we do not do it in this country? And, two, Is this system or the collection mechanism in the U.K. as comprehensive as you were arguing in terms of the different kinds of fraud, because obviously counting is a problem in many areas?

Mr. Anderson: I cannot really comment on why such an organization has never been set up here. I hear various things anecdotally, but certainly it is a good thing—it is de rigueur and it is being done elsewhere.

Britain was one of the first two countries to start doing systematic fraud reporting; the other was France. We have somewhat fallen behind the French, who have been enthusiastic in leading the European effort.

In the U.K., as you may know, there is the U.K. Cards Association, which gets information from the banks and provides relatively aggregated figures to the outside world. So we know, for example, how much was lost from the post, from card-not-present and so forth. But we do not have it broken down by individual bank, because that would be beyond the comfort zone of the participants.

What the U.K. Cards Association doesn't do is to talk to nonbank payment channels. So it would be great if a U.S. system being consciously designed could do more than either the British or the French systems do now. I am acutely aware of the fact that, if you try to legislate for such a thing to be set up, it would take years and years and years. And we do not have years and years and years.

So rather than doing something by compulsion, it may be better to do something simply by asking people nicely. I favor putting together a multistakeholder agreement, in which hopefully most of the serious players will collaborate and those who do not can over time be nudged and shamed and gently bullied along until they start to join in.

Ms. Hughes: The other thing happening in the United States, which has not been getting a great deal of attention, is the October 2011 SEC Corporate Finance Staff Guidance on Cyber Security Risk Disclosures and Events and what the remediation efforts are, etc. If you are not familiar with it, it is terribly hard to find unless you go to the Corporate Finance Division's own website, because there was no press release and it was not a commissioned statement of policy. It is just staff guidelines for the purpose.

But they go through six or seven different aspects of cyber security, event disclosures, including management and analysis—things that would be classic possible material changes. If the attack were large enough and you were a publicly traded company to affect your bottom line in a material way, the number and disclosures that theoretically could be made or have to be made are quite considerable.

We think they may make people very cautious about disclosing things. They want to know what you did to remedy the problem and they want you to describe the problem you had.

I venture that very few people in the room who are in payments are going to want to explain to the world in their SEC filings how it was they happened to get hacked. I just cannot imagine that is going to happen. My hunch is this is something anyone who is a publicly traded company should take very seriously, but they really need to talk with the person who handles their SEC materiality questions to determine precisely what they have to say. Otherwise—and a colleague and I wrote a very short paper about this about three months ago—there is a risk it will help the hackers more than it will help investors and businesses. The delicate balance is between not helping the hacker too much and helping yourself and keeping the SEC and your investors from suing you. Also in our paper is an argument that you may be road-mapping the shareholder derivative suit when you make these disclosures, which I think also no one in the room will wish to do.

Mr. Sullivan: I have a quick, two-part question. The privacy concerns of all these data being out there are tied, to some extent, to the potential damage that can happen when they get stolen. A large channel for that damage is payment fraud. I am proposing, if we can find a way of approving payments without having to rely on all the information about my background and my location that would be a good thing. I am curious about your reaction to that.

Secondly, there is always hope that maybe there is a hardware solution, like an EMV card. I am familiar with Ross's work, and his important work at showing how EMV has some security holes. A lot of that is simply because of sloppy implementation. If the implementation is right, the hardware could work very well at primarily getting appropriate payments into the system.

It is a two-part question and the parts are interrelated. Can we get a way of separating information from payment approval? Is there any hope for a hardware solution?

Mr. Anderson: Well, Rick, yes, I would agree with you that many of the problems with EMV are down to poor implementation, but not just poor implementation. There has also been a lot of sloppy design work. But the EMV documents are thousands of pages long; they are many shelf feet. When we get a new student onstream, we almost invariably discover a new vulnerability and almost invariably now you have to look in six different places and four different books in order to track it down.

You need to have mechanisms, not only to design systems better, but also to maintain the design of the systems as they evolve. This appears to be a problem with EMV. Back in the 1990s, when it was all new and fresh and bright and interesting and sexy, you could get bright engineers and academics to go to work on this. Now that is all really old and boring and tiring and complex and "crufty," and you have hundreds of different vendors fighting each other and thousands of banks complaining about this, it becomes that much more difficult.

How do you solve this core governance problem? If you can get the technology right, then yes, there are things you can do to make privacy a little bit harder to compromise. What we do, for example, is use the hardware tamper-resistant EMV chips in order to authenticate gazillions of payments. Then, again, there are economics issues of how you go about motivating people to accept a privacy payments option, if it means they do not get any air miles.

Mr. Acquisti: Thank you for the reference, because this is closely related to some experiments we did recently. Your question, Rick, is seminal to a debate every privacy conference ends up talking about—trade-offs or ostensible trade-offs between privacy and security. To have secure transactions, you can go one way, which is gathering more and more data about the individual (where they are, who they are, what time it is, which clothing they are wearing).

Or, you can go the completely opposite route. One example I gave was e-cash, based on blind signatures. I have no vested interest in e-cash whatsoever. In fact, the patent for blind signatures-based payments even expired a few years ago, so there's no money to make there. However e-cash was arguably a pretty secure system with complete authentication, without identification.

To clarify: I refer to an identifier as something like your telephone number. You can make it public. People use the number to connect with you. The authenticator is, instead, the four-digit code number you use when you access your voice mail. No mentally sane person would rationally want to use the same number as an identifier and as an authenticator. In fact, this is the way in which most financial systems use passwords. For instance, Social Security numbers in the United States are used as identifiers and authenticators. Similarly, when you reveal your credit card, you are providing information that can be used later to impersonate you. Not so when using blind signature. Now, of course, cryptologists know you can take a provably secure system and then, when you actually deploy it, you start adding vulnerabilities in the way you deployed it. Fair enough.

But at least in theoretical terms we have alternatives. So, the answer to your question is a resounding "yes."

The next point I would like to make is that we can offer economic incentives for the different stakeholders to use it. Professor Anderson was pointing out research about whether and how much people will want to pay to protect their data.

It turns out that, yes, there is a significant group of people who will pay a little bit more, but it is not a majority of the people.

Mr. DeCicco: Professor Anderson, I want to go back to the comments you made about the U.K. Faster Payments service. You talked about it being a target for phishing gangs to potentially get money out of the market there. The clarity I am looking for is, Is there already evidence that this is occurring or is that an issue or concern the market has and it is something they need to manage against?

Secondly, the U.S. market is currently considering our own version of Faster Payments. It would be a proposal out for same-day settlement in the ACH system. As we continue to debate that in this marketplace from a safety, soundness, and fraud mitigation perspective, are there issues or advice you can give us and points we should consider to stand it up in a correct way?

Mr. Anderson: Well, the Faster Payments issue is an industry concern, which I have heard from a number of firms that are involved in this. We do not have statistics yet, because where there are phishing losses, banks typically eat those. Statistics should feed through via the U.K. Cards Association and so on in a time scale of approximately a year. Given the different implementations by different banks, industry insiders at least should be able to take some view on how bad the problem is, perhaps within a year or two.

Generically, if you look at the paper I brought to this conference four years ago, we found there was a strong correlation between the speed and the energy with which banks go about stopping, revoking, and recalling stolen money, and inversely with their vulnerabilities to phishing. And it was those banks that were not very vigorous at stopping suspicious transactions and clawing them back that ended up taking most of the losses.

As far as the implications for same-day settlements in ACH are concerned, I would be most concerned if same-day payments could be used from accounts likely to be compromised and, in particular, to send money out of the country or to places where it could be effectively laundered.

The working assumption to make an engineering list is that you should assume something like 5 percent of all consumer PCs are compromised with malware. Before people do work to take Zeus down, you must always assume perhaps 1 percent of your clients' PCs will actually be running evil software on them. So you have to take a view on what sort of scams are likely and whether it is worth taking the risk of allowing people to move money out of the country on a same-day basis. Then again, what business benefit do you get from it? Normal consumers do not need to do that perhaps.

Mr. Fish: That was our last question. Thank you, panel. I thought that was a great conversation.