

The future of technology and payments

EDITION 2

MORE OF THE SAME

TECHNOLOGY EVOLVING
AT BREAKNECK SPEED

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WHO GOES THERE?

IDENTITY MANAGEMENT MODELS PLAY
A BIG ROLE IN DETERMINING THE WAY
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INFERENCES FROM DATA ABOUT YOU,
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A life
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It's all about
Ecosystems

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SET TO AUTOMATIC PAGE 28

Digital lifestyles accelerating the move from ownership to consumption.



CONTINUE THE CONVERSATION

Two years ago, we produced our first report on the future of payments and technology. Within it, we identified seven technology-related topics, and we discussed the likely impact on payments.

That report catalysed a lively dialogue - within Visa Europe itself, among our members, and across the wider payments ecosystem (encompassing the retailers who accept Visa and the technology and telecom players who enable Visa payments to take place).

This dialogue has been hugely valuable. It's enabled us to explore and understand the different ecosystem perspectives. And it's helped us to refine our thinking.

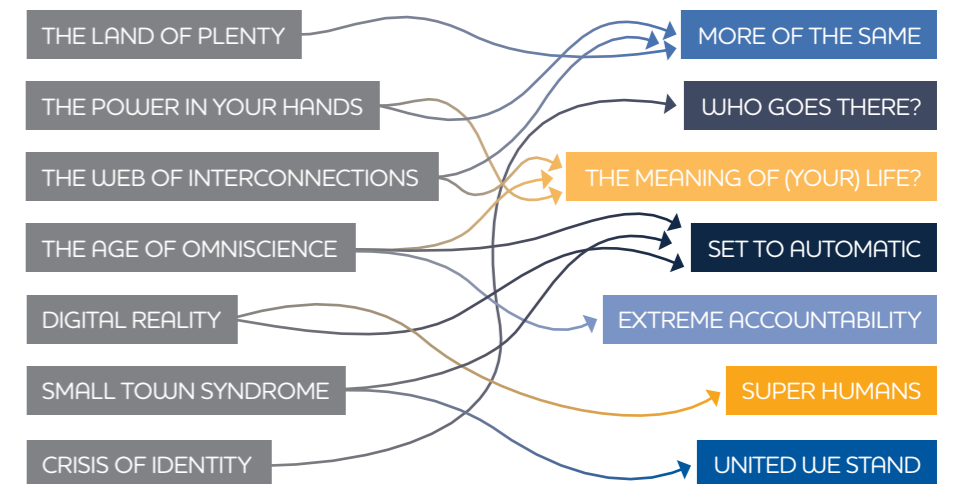
In the meantime, things have moved on.

COMPUTE POWER HAS BECOME EVER MORE ABUNDANT, AFFORDABLE AND ACCESSIBLE. BUSINESS MODELS HAVE EVOLVED. BEHAVIOURS HAVE SHIFTED. AND THE CHANGES WE HAVE SEEN ARE SET TO ESCALATE.

So, in this follow-up, we're looking out over the next three-to-five year time-scale. We've identified the next seven topics (an evolution of our original seven). And, in each case, we've asked the question: what does this mean for payment businesses?

1ST EDITION

2ND EDITION



This is not a Visa Europe manifesto. Nor is it a statement of intent. Instead we want to raise areas of mutual interest with our stakeholders - and to continue the conversation.

So, please, read through and tell us what you think.

Adam Banks
Chief Technology Officer & Head of IT
Visa Europe





PAYMENTS AND TECHNOLOGY

SOMETHING EXCITING IS HAPPENING IN THE WORLD OF PAYMENTS...

What was once regarded as a steady, stable business has become a magnet for investment and innovation.

It is estimated that, in the space of just 30 months (from the start of 2010 through to mid-2012), more than 300 companies attracted some US\$1.9 billion in venture capital funding for their mobile and online payment initiatives¹.

That's a big figure in its own right.

But it's entirely separate from the investments being made by big, established technology and telecom companies like Apple with its annual research & development fund of some US\$2.5 billion, or Google with US\$4.8 billion, or Samsung, with an eye-watering US\$8.2 billion².

WHY THE FLURRY OF ACTIVITY? OR THE ABUNDANCE OF SPENDING?

The analyst house, CB Insights, which tracks venture capital spending, suggests that: "the emergence of new technologies and some unusual suspects entering the space has made the payments landscape busier, more complicated and a great deal more uncertain."³

ANNUAL RESEARCH & DEVELOPMENT FUND ²	
Samsung	US\$8.2 billion
Google	US\$4.8 billion
Apple	US\$2.5 billion

At Visa Europe, we largely agree with this assessment. But we think it goes somewhat further.

As our businesses, our lives and our behaviours become more and more dependent upon and defined by technology, payment will have to evolve accordingly.

Fuelled by mobile and digital technologies, there is a requirement for payment to become easier and more convenient. It needs to take place using any device, across any channel in any location. It needs to help retailers and service providers to improve and enrich the customer experience. It has the potential to become a point of convergence between the online and offline worlds, a source of rich data, and a powerful new way to engender loyalty and influence behaviour.

VIEWED IN THIS CONTEXT, THE FUTURE OF TECHNOLOGY AND THE FUTURE OF PAYMENT ARE IRREVOCABLY BOUND TOGETHER.

Drawing on existing commentary and analysis, this report seeks to identify the main technology trends that are set to play out over the next three-to-five years. We then go on to consider the implications for payments.

In total, we have identified seven topics for discussion. The first of these is a pure technology topic. The next six concern social and behavioural trends which technology is facilitating, accelerating and, in some cases, exacerbating. For each of them, we discuss the consequences for the way that payment services are delivered, managed and processed.

OUR THOUGHTS SHOULD HAVE RELEVANCE FOR:

Our own members⁴ - in terms of the attendant opportunities and threats, how they service their existing business, and the type of payment services they develop.

Participants in the wider payments ecosystem⁵ - in terms of the solutions they deliver and the value they bring.

The customers (payers and payees alike) who we help our members to serve - in terms of the type of payment services they can anticipate for the future.

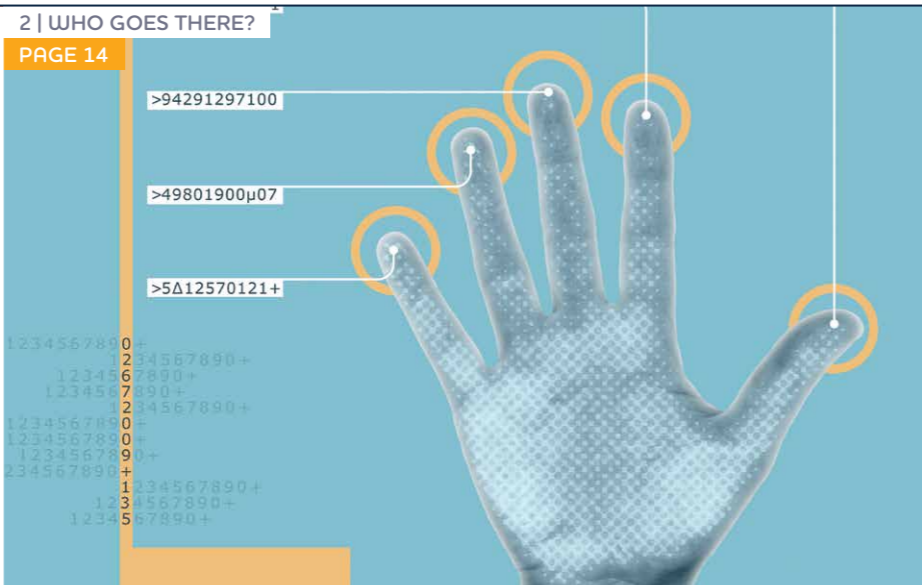
The governmental organisations which are responsible for regulating and overseeing the payments industry, and formulating the related public policy agenda.

Visa Europe itself - in terms of the evolution of our payments processing business, our risk and fraud management services, and the innovations we develop on behalf of our members.

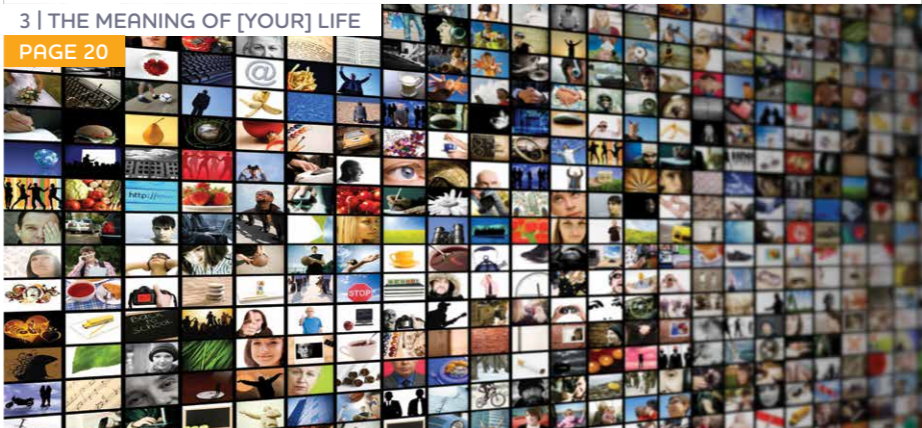




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TOPICS AND IMPLICATIONS

1 MORE OF THE SAME (MUCH, MUCH MORE)

Technology continues to evolve at an astonishing speed, liberating ever more compute power, in ever more places, ever more easily, and ever more affordably

- Implications**
- The fate of the POS network
 - The blurring of once-clear distinctions
 - Bring your own acceptance device
 - The agility imperative
 - The uptime imperative

2 WHO GOES THERE?

Identity management models play a big role in determining the way we transact and interact

- Implications**
- Scope for a collective industry solution
 - From authentication to profiling
 - Dynamic risk-sharing with retailers
 - Preserving and enabling anonymity

3 THE MEANING OF [YOUR] LIFE

Data about you, your location, and your past behaviours are increasingly used to anticipate and respond to your innermost needs and desires

- Implications**
- The crushing weight of customer expectation
 - Privacy no more?
 - Where do you want to play?

4 SET TO AUTOMATIC

We live in a world of "hands-off" and "light-touch" commerce - in which products and services are automatically served up

- Implications**
- Facilitating new consumption models
 - Anticipating new payment patterns
 - Opening up the closed loops
 - From bricks to clicks
 - Increased importance of software
 - Less friction please
 - Three dimensional considerations

5 EXTREME ACCOUNTABILITY

Because every single thing is becoming scrutable, many more things (including behaviours) are becoming much more closely scrutinised

- Implications**
- The value, and particular sensitivities, of payment data
 - Coming clean on data
 - The war for talent
 - The "oil" of the digital economy

6 SUPER HUMANS

Technology is fast-becoming part of "us" (both literally and figuratively) - extending and augmenting our human capability

- Implications**
- Augmented payments for augmented shopping
 - Biometrics
 - Payment solutions for the very young and the very old
 - Helping the augmented humans

7 UNITED WE STAND

The world is a far more open and collaborative place in which to operate - so much so that openness and collaboration are becoming a pre-requisite for any level of business success

- Implications**
- Many hands make light work
 - Enabling and encouraging safe innovation (instead of cleaning up after naive innovation)
 - Opening up to the developer community
 - Re-imagining the value model - who gets revenue for what?
 - Crowd funding new payment solutions

SO, WHAT DO YOU THINK?
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1
TECHNOLOGY CONTINUES TO

EVOLVE AT AN ASTONISHING SPEED,

LIBERATING EVER MORE COMPUTE POWER,

IN EVER MORE PLACES, EVER MORE EASILY,

AND EVER MORE AFFORDABLY... IT JUST KEEPS

MARCHING ON (AND ON, AND ON, AND ON).

MORE OF THE SAME

(MUCH, MUCH MORE)

This is about the ever increasing abundance, availability and affordability of compute power.

In our last report this was the central focus. It accounted for almost half of our content.

This time around, we were tempted to gloss over it. But it's the basis for everything that follows.

So we do need to spend some time emphasising the blistering pace of technological development. We also need to keep reminding ourselves that this change should continue to follow the same general trajectory - well into the future.

Perhaps the best and most obvious indication is in our own hands, in the form of our smartphone⁶:

- These personal compute devices are ludicrously capable, they are incredibly affordable, and they are evolving even more quickly than Moore's Law⁷ would allow us to believe. Indeed, the A6 processor in Apple's iPhone 5 is said to be twice as fast as the preceding model released less than a year earlier⁸.

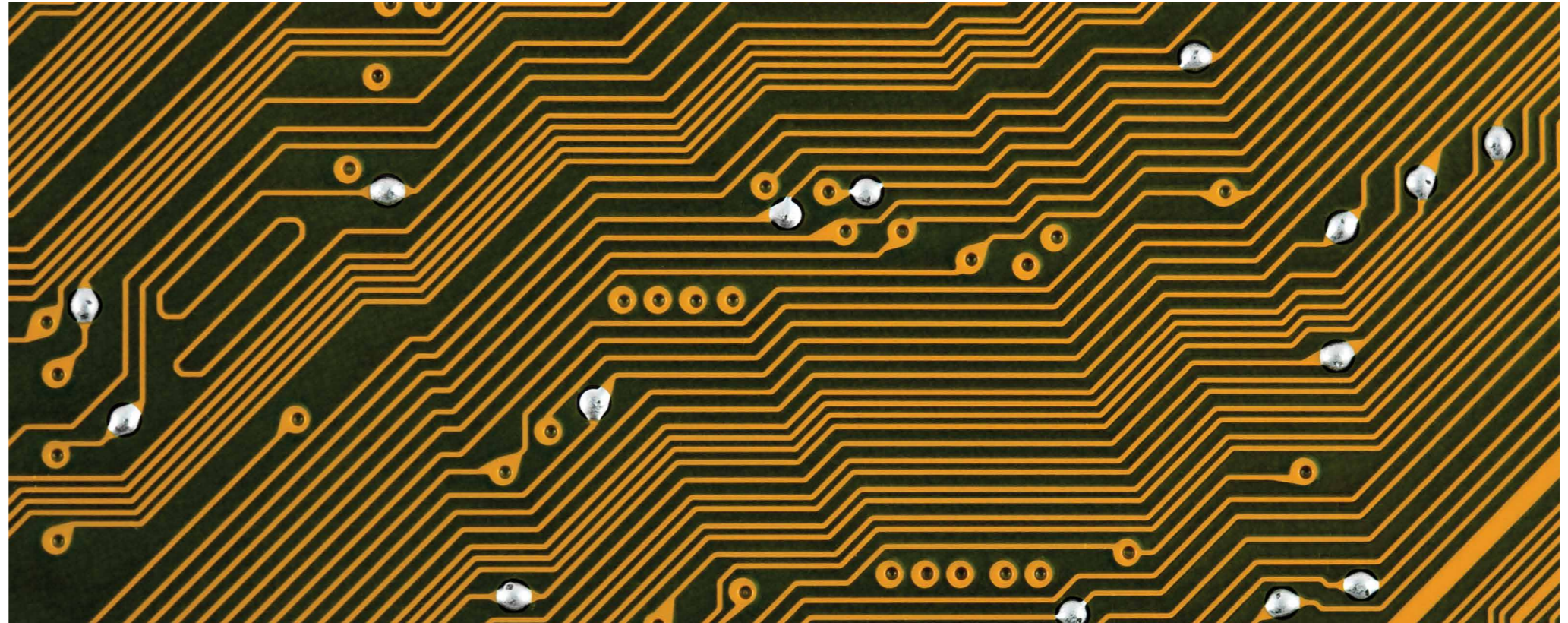
- Right now, smartphones are fast approaching ubiquity. Back in 2011, annual smartphone shipments overtook PC shipments (at 415 million), and are expected to exceed the billion mark by 2016⁹. And Euromonitor estimates that penetration already exceeds 70 per cent of the population in many developed countries¹⁰. Annual growth rates are predicted to continue at 40-to-50 per cent through to 2015 at least¹¹.

- At the same time, smartphones are becoming better connected. New 4G networks are now being rolled out across several European countries, offering far higher speeds than the fixed broadband services to which we are accustomed¹². The consumption of mobile data is ballooning (predicted to grow from 149 megabytes per month per smartphone in 2012 to 3,000 megabytes in 2015¹³). And, all the while, the price-per-megabyte is plummeting (from US\$0.46 in 2008 to an estimated US\$0.01 in 2015)¹⁴.



BACK IN 2011, ANNUAL SMARTPHONE SHIPMENTS OVERTOOK PC SHIPMENTS (AT 415 MILLION), AND ARE EXPECTED TO EXCEED THE BILLION MARK BY 2016⁹.

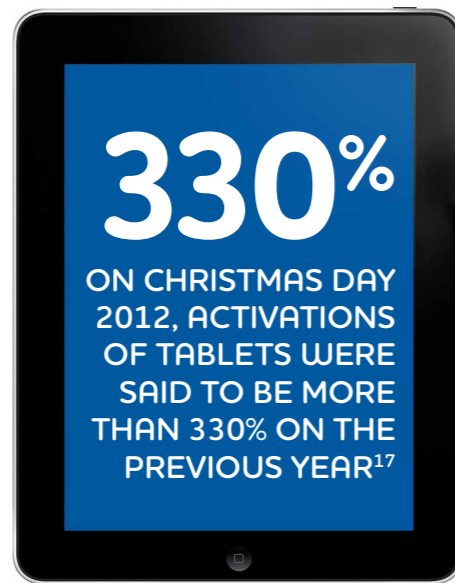
IT'S NOT JUST SMARTPHONES. LOOK ALMOST ANYWHERE IN THE WORLD OF TECHNOLOGY, AND YOU SEE SIMILAR DEGREES OF PROGRESS.



Tablet computers are another clear example. Growth far outstrips the initial estimates. In early 2010, Juniper bravely predicted that global shipments would reach 81 million devices by 2015¹⁵. In fact, this figure was exceeded in 2012¹⁶. And, on Christmas Day 2012, activations of tablets were said to be more than 330 per cent on the previous year¹⁷.

Consumer demand for cloud computing¹⁸ services (or, at least, cloud storage services) is also surging ahead. IT market-watcher, Gartner, reckons that consumers will store a third of their digital content in the cloud by 2016, adding up to a barely credible 4.1 zettabytes¹⁹.

At the enterprise level, the demand for cloud-based services is more muted. Gartner suggests that "most cloud computing technologies and concepts are more than two years from mainstream adoption."²⁰ At Visa Europe, we would be even more cautious. Aside from concerns over security, availability and performance (a hygiene factor in the payments business), the costs of commercial cloud services still appear to be prohibitively high. But the concept is compelling, and we do see a definite rationale for in-house cloud appliance models²¹.



OF COURSE, IT'S NOT ALL ABOUT POWERFUL CLOUD-BASED, MEGA-PLATFORMS. NOR IS IT JUST ABOUT TURBO-CHARGED PERSONAL DEVICES. MOORE'S LAW ALSO ALLOWS FOR THE EVOLUTION OF TINY DEVICES THAT COST PENNIES.

As of 2012, the price of electronics was estimated at one tenth of a millionth of a cent per transistor²². Moore's Law suggests that, by 2014, it will be half the price. So it's becoming possible to build intelligence and connectivity into anything from a heart pacemaker to a migrating cuckoo²³.

We therefore expect to see the progressive deployment of so-called Microelectromechanical systems (MEMs). These minute devices, generally smaller than a square-millimetre, typically comprise of a microprocessor plus a sensor or actuator. Already, they are common components within consumer devices acting, for example, as accelerometers or gyroscopes. Typically an airliner will contain "a hundred thousand sensors, covering everything from the speed of air over every part of the airframe through to the amount of carbon dioxide in each section of the cabin."²⁴

For the future, the use of MEMs seems destined to become more widespread. More exotic sensors will become available (capable, for example, of checking blood pressure or glucose levels). Their proliferation could therefore enable the so-called "internet of things"²⁵. And, in the coming years, IBM holds out the

prospect of a trillion connected devices²⁶ - that equates to one hundred smart objects for every person on our planet.

In the middle-ground, we have eminently capable compute devices that cost just a few euros. At the end of 2012, IT Pro magazine suggested that, irrespective of the array of new gadgets to hit the market, the roll-out of 4G, and the arrival of Windows 8, the biggest computing breakthrough of the year was the launch of the Raspberry Pi²⁷.

Retailing at just GB£35, and developed by a UK-based charity, the Raspberry Pi was originally designed as a low cost way to encourage students to learn about programming. Widely heralded as "a science sensation"²⁸, it now has its very own app store, and the first enterprise applications are now emerging (notably, the rasPBX phone system²⁹). As IT Pro puts it, "In a few years, if all goes well, Pis, or applications and devices developed and tested on Pis, could be in use in all walks of life."³⁰

IT'S NOT JUST THE HARDWARE. THE PRICE OF SOFTWARE IS ALSO PLUMMETING.

Most smartphone apps downloaded are free, and the average price for the top 100 iOS paid—for apps is just US\$1.47³¹. Strategy Analytics suggests that, by 2017, the average consumer spend per smartphone app will fall to \$0.08³².

Meanwhile, the open source community has become very much mainstream - think about names like Android, Drupal, OpenOffice or WordPress. And, with a little technical knowledge, individuals and start ups are able to conduct the type of sophisticated computing tasks that were once the sole preserve of governments and mighty corporates.



\$1.47

THE AVERAGE ESTIMATED PRICE FOR THE TOP 100 IOS PAID-FOR APPS³¹.

Given these developments, one can easily envisage a future in which (i) huge, central compute platforms emerge as utilities, (ii) our personal compute devices interact with them continuously and seamlessly, and (iii) a further layer of computing becomes embedded into everything else around us. In a remarkably prescient paper from way back in 1991, Mark Weiser, the influential chief scientist at the Xerox PARC laboratories said, "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it".

SO, THAT'S OUR BEDROCK. A FUTURE IN WHICH COMPUTE POWER IS ABUNDANT, AFFORDABLE, ACCESSIBLE, INTERCONNECTED AND EMBEDDED. AND BECOMING ALL THE MORE SO ALL OF THE TIME.

SO WHAT?



THE FATE OF THE PHYSICAL POINT OF SALE (POS) NETWORK

The extent of the physical POS network has traditionally been one of the payment card industry's strongest assets. But, in a connected world, is it still necessary?

We'd argue, yes, most definitely.

There may be a rationale for infrastructure-less cloud-based solutions in some situations, but the physical card will be with us for many years to come - it's small, it's reliable, it's never out of power, or out of coverage.

EQUIPPED WITH CONTACTLESS, IT'S GREAT FOR INSTANTANEOUS TRANSACTIONS AS THEY DON'T NEED TO BE BEAMED INTO SPACE AND BACK.

So, the physical POS network will continue to warrant attention and investment.

THE BLURRING OF ONCE-CLEAR DISTINCTIONS

Card Present versus Card Not Present. It's always been a fundamental distinction in the payment card industry. But we're set to see a seemingly limitless variety of transaction situations - for example, conducting a cloud-based or e-commerce transaction to pay for a burger and chips, which is then consumed within the physical fast food restaurant.

Or how about the showrooming phenomenon, in which the physical outlet is there as nothing but a showroom, and everything to do with the transaction is then pushed online?

ALL OF THIS WILL HAVE A DIRECT IMPACT ON PRICING, ON LIABILITY FRAMEWORKS AND ON FRAUD AND RISK MANAGEMENT.

BRING YOUR OWN ACCEPTANCE DEVICE (BYOAD)

This has been the runaway success of the shift to mobile payments - the use of standard consumer devices (smartphones and tablets) as card acceptance terminals.

And there's appetite to accelerate the trend - by doing away with the card altogether, and giving consumers the ability to conduct a cloud-based, e-commerce payment within a physical store, again using standard consumer-grade devices.

IT SOUNDS EASY AND APPEALING. BUT IT'S KEEPING THE FRAUD TEAMS AWAKE AT NIGHT.

Keeping PINs secure on made-for-purpose terminals has proved challenging enough. But entering full payment credentials into an unsecure "public" device? The security implications are profound, to say the least.



THE AGILITY IMPERATIVE (IN A FAMOUSLY UN-AGILE SECTOR)

The speed of technological change, and the affordability of compute power are pushing expectations ever upwards. The tech-savvy consumer considers every new tech-development to be an inalienable human right. And the "retailer", who can build a new business concept from their kitchen table, launch it to the entire world, expects to bolt-on a simple, flexible, turnkey payment solution.

The payments world has traditionally followed a more measured pace.

If the incumbent players don't match the agility of the new breed of businesses - or respond to the expectation of the customers - they leave clear white space into which others can step.

HAMSTRUNG BY HERITAGE?

This abundance of cheap compute power is all very well in theory. But, in practice, the beleaguered Chief Information Officer may find it very difficult to take advantage of it - particularly in a sector like payments, with the emphasis on security, integrity and availability.

They see the availability of endless compute power. They crave its speed and flexibility. They are beguiled by its affordability. But how, exactly, do they integrate it into their legacy systems? How do they liberate and analyse the data within their ageing warehouses? How do they give open access to customers? How do they mobilise functions which, by their very nature, demand airtight security?

THE UPTIME IMPERATIVE

Thanks largely to its abundance and affordability, technology has assumed a new criticality in peoples' lives. We assume that it will be always on, always there, always informed and always connected?

And if it's not? If there are outages? Or denials of service?

WE'RE LIVING IN AN AGE IN WHICH ANY FAILURE OF BANKING SYSTEMS BECOMES FRONT PAGE NEWS. WE'RE ALSO LIVING IN AN AGE WHERE CARD PAYMENTS ARE LUBRICATING THE ENTIRE CONSUMER ECONOMY.

Across Europe, for example, Visa Europe alone accounts for €1 in every €6.75 of consumer spending, rising to GB£1 in GB£3 in the UK. This puts yet more pressure on CIOs. When, as well as speed and agility and innovation and everything else, they also need to be the guarantors of availability.

Visa Europe consumer spending in Europe

€1 IN EVERY €6.75

MEETING YOUR "MAKERS"³³

The sequencing of DNA was once a formidable exercise. The global scientific community spent decades on the challenge. Well, now you can do it at home, on a €40 computer, using a free code from the open source community. That's the extent to which compute power has been democratised.

AND BIG BUSINESS IS INCREASINGLY TURNING TO THE SO-CALLED MAKER COMMUNITY TO SOLVE SOME OF ITS MOST PRESSING ISSUES.

So how can the payments industry support and engage with this community? What type of game-changing ideas could come out of it? What type of challenges could be solved?

As an industry, we have perhaps been guilty of waiting and seeing what comes out at the end of the development process. Isn't there an opportunity to move up stream? And exert more influence over the actual development agenda?

Visa Europe consumer spending in the UK

GP£1 IN EVERY GP£3

WHO ARE YOU, OR WHO ARE WE?



When we use the term “identity” we are referring to the abstract quality of a person that is constant throughout their lifetime – and which distinguishes them from everyone else³⁵.

IN SIMPLER TIMES, IT WAS RELATIVELY EASY TO ASSERT YOUR IDENTITY.

Having laboriously identified yourself to them, governments would provide you with a certificate (in the form of a birth certificate, a passport, a social security number or perhaps a driving license). Banks could also play a role in ascribing and conferring your identity, very often in the form of a payment card. And, these credentials could be wielded whenever it was necessary to assert your identity.

THESE DAYS, ALMOST ANY ENTITY WITH AN ONLINE PRESENCE ROUTINELY ISSUES US WITH ITS OWN IDENTITY CREDENTIALS, IN THE FORM OF USERNAMES AND PASSWORDS, COOKIES³⁶ AND SUCH LIKE, WHICH IDENTIFY YOU VIA YOUR DEVICE).

As a result, we get utter fragmentation.

It’s frustrating for us, as users, to manage. It’s woefully inefficient, with millions upon millions of entirely separate identity management and authentication solutions all doing the same thing. It’s inherently unsecure. And it prevents the smooth, integrated delivery of services from multiple providers.

THINGS WILL CHANGE. THEY HAVE TO. SO, WHAT TYPES OF MODEL CAN WE SEE EMERGING?

DEVICE VERIFICATION

In a world in which our use of technology is becoming part of “us” (see our Super Humans chapter), we can increasingly expect our mobile devices to become regarded as a surrogate for “us” – our digital doppelganger. The growing ranks of digital wallet providers therefore see opportunities to use a combination of mobile device IDs and location indicators to enrol a consumer to their service, and then authenticate the device during each interaction.

IDENTITY BROKERING

Banks and governments have traditionally ascribed and conferred identities – they have satisfied themselves of who I am, and issued me with the credentials to prove it. With identity brokering, this process is

effectively digitised. I still identify myself to them; but the credentials are digital; and they are offered up, on-demand, to the organisations with whom I want to interact. You can think of it as a more formalised, more robust version of Social Login – a widespread process whereby people use their social networking IDs to log on to other unrelated websites.

In Canada, for example, a company called SecureKey is turning the theory into reality by enabling Canadian citizens to use their online banking details to access Government services. But it has plans to go further. And several other such schemes are working hard to gain a foothold.

This is an area with real promise. It could provide us with a truly transformative systemic solution. But the barriers to wide-scale adoption are considerable.

BEHAVIOURAL MONITORING

The payment industry has long used scoring systems to spot suspicious or out-of-pattern transactions. In the era of big data, we can realistically expect these detection systems to evolve into true behavioural monitoring systems.

Your behaviours, interactions or transactions – in and of themselves – could become a means of confirming your identity (“we know it’s you because only you would behave in that way...”). And, if there were any doubt, additional levels of “step-up” authentication could be instigated.

BIOMETRICS

Various biometric techniques, such as iris scanning, DNA testing, facial recognition and fingerprinting, are already in use in several fields,

particularly in law enforcement and at border controls. But they tend to be complex and intrusive, they can be temperamental, and are yet to find their way into everyday life. At the time of writing, there is much more industry enthusiasm around the potential for voice authentication – which confirms your voice patterns, the words you use, and the order in which they are said.

Of these four approaches, the most exciting is identity brokering. It’s about identity and verification, rather than simple authentication. But it would be wise to anticipate that a whole range of different techniques will emerge – and that many of them will be used in combination, depending on the specifics (and the inherent risks) of each interaction.

SO WHAT?

SCOPE FOR A COLLECTIVE INDUSTRY SOLUTION

Banks have always been in the business of ascribing and conferring identities, so there's a logical rationale and an opportunity to extend this function into the digital space. Identity brokering also requires a trusted central provider, much like payments processing, so, again, there's a rationale and an opportunity. And our industry has been successful in instigating and implementing other global standards (like EMV).

As an industry, we do have the capability and the credibility to step in. But, with so much else going on, do we have the capacity? Or even the collective desire?

FROM AUTHENTICATION TO CUSTOMER PROFILING – WITH STEP-UP AUTHENTICATION

To date, our industry has primarily relied on a combination of two basic authentication methods - the Card Authentication Method and the Cardholder Verification Method.

THEY ALLOW THE ISSUER TO AUTHENTICATE THE DEVICE AND THE INDIVIDUAL. BUT THEY'RE NOT DIRECTLY LINKED TO IDENTITY.

Equipped with better, faster analytics, there's an opportunity to bring the two together. Lying at the very centre of an

authentication engine there could be a real-time scoring system, equipped with a complete profile of every customer.

This would deduce whether each transaction is in character or not. It would calculate the attendant risks. It could decide which checks are warranted for each transaction. And it would be able to call upon a host of step-up authentication techniques, like device fingerprinting, plus geo-location, plus voice biometrics.

If it's a routine, habitual payment, or if an individual merchant has agreed to assume all of the risk, why impose any checks at all? If it's a little more unusual, why not ask for that passcode? If it's high value, why not get the customer to verbally confirm it, and cross reference their instructions with your voice recognition systems?

RISK SHARING BETWEEN PAYMENT PROVIDERS AND RETAILERS

In the past, the focus of fraud management activity has been the authentication and authorisation processes and, by definition, the checks we carry out have always had an intrusive impact on a retailer's check out and check through processes, whether that be via chip and PIN at the physical point of sale or Verified by Visa at virtual checkout pages.

In the past, the industry has also tended to establish and enforce a fairly rigid, one-size-fits all set of requirements and liability frameworks. But shouldn't we be preparing for a more collaborative and flexible approach.

For example, wouldn't it make sense to accommodate a far more dynamic form of liability management? With up to

four factors of authentication available, shouldn't it be possible to take a risk-based approach to authentication, which takes full account of different retail environments? Under certain clearly-defined circumstances, couldn't it become feasible for retailers to determine the level authentication that they are willing to impose on their customers? And, based on the risk characteristics of their particular business, couldn't they choose to remove any friction from the point of sale?

THE IDEA HERE IS FOR INDIVIDUAL RETAILERS TO MAINTAIN CONTROL OF THEIR OWN CHECKOUT EXPERIENCE AND, WITH IT, THE LEVEL OF LIABILITY THEY ARE WILLING TO ASSUME.

As ever, the devil is in the detail. For example, a retailer with low marginal costs and high profit margins may not care too much about fraud. But, in tolerating direct fraud losses, they would also introduce certain costs and inefficiencies back into the payment system - which others among us would be unable to endure.

PRESERVING AND ENABLING ANONYMITY

For whatever reason, some people do like to retain and protect their anonymity.

Sometimes it might be a matter of personal or political conviction. Sometimes, and for some particular activities, people may just want to be furtive. So, yes, there will always be a demand for anonymity.

IS THIS A DEMAND THAT WE, AS AN INDUSTRY, SHOULD BE ACCOMMODATING? AND, IF NOT, WHY NOT?

We should also remember that electronic payment is not the same as digital cash³⁷. So should we be enabling cash-like digital payments? And, if we were to cede them to other players, what else and how much of it could we be sacrificing?

APPRECIATING THE FULL IMPLICATIONS OF IDENTITY MANAGEMENT

As an industry we do tend to have a somewhat schizophrenic attitude towards identity management. Often we choose to focus simply on the authentication dimension which, most emphatically, is not the same thing.

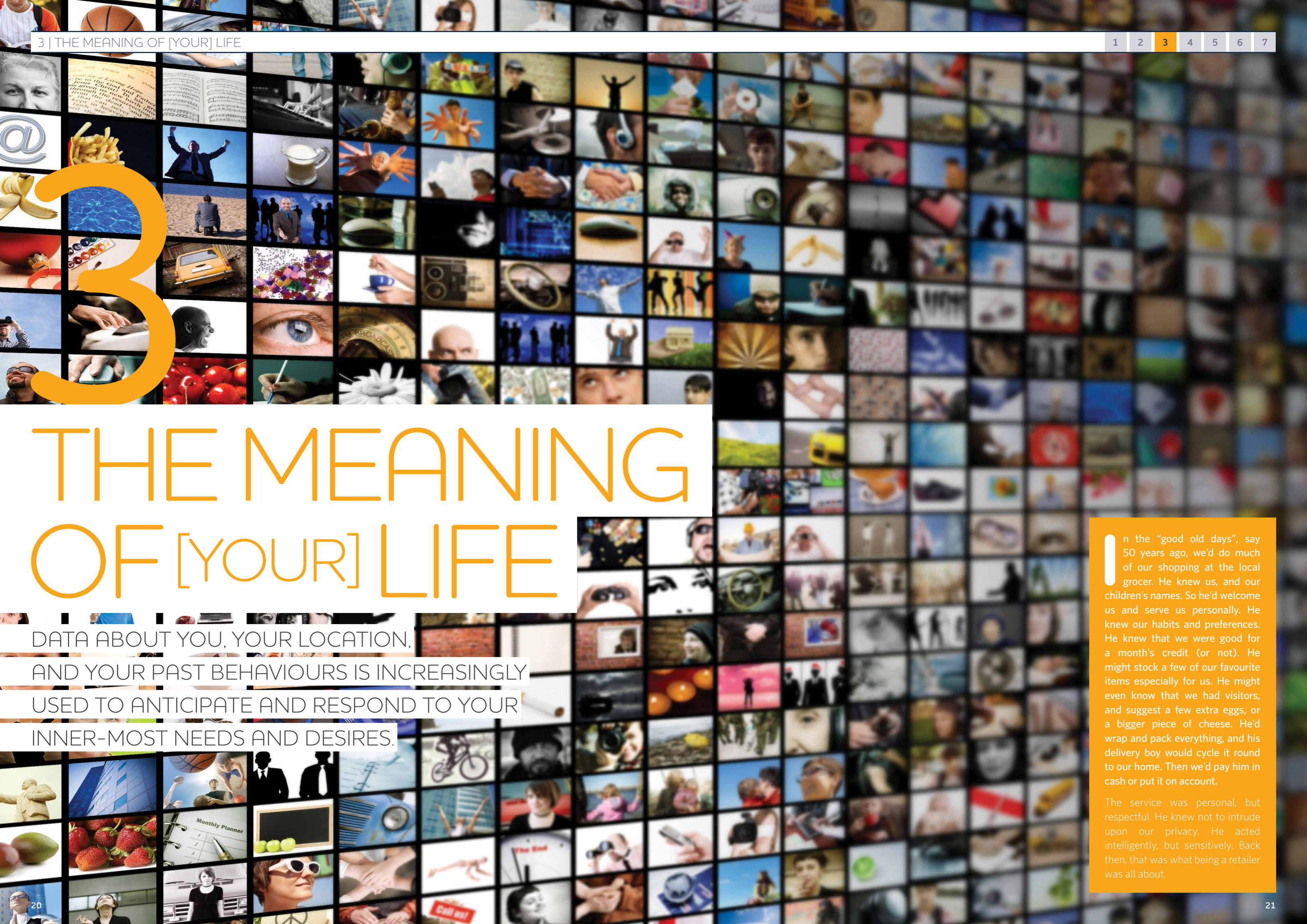
BUT, LET'S REMEMBER, TRUE IDENTITY MANAGEMENT AND RECOGNITION ARE KEY TO MANY OF THE FUTURE TRENDS WE ARE ENVISIONING.

In order to fully set the world to automatic, or to fully ascertain the meaning of [your] life, or to fully exert your super human powers, identity and context are key components.

Again, if we, as an industry, don't develop or accommodate new solutions, aren't we leaving clear white space for others to leap in?

SUPER HUMANS,
TECHNOLOGY IS FAST-
BECOMING PART OF "US"

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THE MEANING OF [YOUR] LIFE

DATA ABOUT YOU, YOUR LOCATION, AND YOUR PAST BEHAVIOURS IS INCREASINGLY USED TO ANTICIPATE AND RESPOND TO YOUR INNER-MOST NEEDS AND DESIRES.

In the "good old days", say 50 years ago, we'd do much of our shopping at the local grocer. He knew us, and our children's names. So he'd welcome us and serve us personally. He knew our habits and preferences. He knew that we were good for a month's credit (or not). He might stock a few of our favourite items especially for us. He might even know that we had visitors, and suggest a few extra eggs, or a bigger piece of cheese. He'd wrap and pack everything, and his delivery boy would cycle it round to our home. Then we'd pay him in cash or put it on account.

The service was personal, but respectful. He knew not to intrude upon our privacy. He acted intelligently, but sensitively. Back then, that was what being a retailer was all about.

TODAY WE LIVE IN A FABULOUSLY MORE COMPLEX WORLD.

Generally, neighbourhood shops have fallen from favour. We go to larger, more anonymous retailers. We consume products and services that would have been unimaginable 50 years ago (broadband, mobile, cable TV). We can even select our electricity supplier. And the choices available to us can be overwhelming (typically, a supermarket will stock more than 30,000 product lines, whilst one UK-based retailer famously stocks 38 separate varieties of milk³⁸).

But could we realistically bring back some personal care? Could we expect tailored services? Based on knowledge of who we really are? And our changing circumstances?



TO SHOW WHAT WE MEAN, WE'VE IMAGINED A "DAY IN A LIFE"
See Ana's story on page 24

All of the technologies that are needed to make Ana's day a reality are with us (or just around the corner). The challenge is to bring them all together. And many of the world's largest IT vendors (the likes of Adobe, Cisco, IBM, Microsoft, Oracle and SAP) are developing so-called user experience platforms (UXPs)³⁹ which could do just this.

WHAT'S THE CONTEXT?

The key concept here is context. And it has direct relevance to the emerging world of technology.

Gartner usefully defines context-aware computing as "a style of computing in which situational and environmental information about people, places and things is used to anticipate immediate needs and proactively offer enriched, situation-aware and usable content, functions and experiences... [it] is at the nexus of social, mobile, cloud and information. Market growth is driving richer user experiences, stronger customer loyalty and better business processes."⁴⁰

We are familiar with websites such as Amazon or Netflix making recommendations for purchases.

In the simplest sense, this can be done using our past purchasing records. Analysis of behaviour, using not only our history, but drawing on that of other people who might be similar to us provides much more powerful techniques for making recommendations or predictions. Using true contextual knowledge can further enhance these capabilities.

And, thanks to the abundance, accessibility, affordability and "embedded-ness" of compute power, we can expect to draw upon an ever-increasing selection of "contexts".

LOCATION, TIME, ACTIVITY AND IDENTITY VERIFICATION WERE EARLY POSSIBILITIES.

With newer technologies more exotic capabilities are becoming available - such as spatial (direction, or orientation and speed of travel), environmental (indoors, outdoors, weather, and so on), social (who or what is nearby, our Facebook status, etc), physiological (whether we're hungry or not, or our temperature), transactional information (recent purchases, social contacts) and all of the outputs of predictive or other analytics.



IT CUTS BOTH WAYS



AS CONSUMERS, WE ARE BECOMING WELL AWARE OF THE DATA WE ARE GENERATING AND THE COMMERCIAL VALUE IT REPRESENTS.

Often we have been willing to make a Faustian Pact with certain online providers "you give me a product or service for free, and I'll let you collect my data". But many commentators expect us to become more and more aware of the value of our own data.

A whole new field is emerging - Vendor Relationship Management - which is, if you like, the converse of Customer Relationship Management. In his book, *The Intention Economy: When Customers Take Charge*, Doc Searls suggests that: "Soon consumers will be able to: (1) Control the flow and use of personal data, (2) Build their own loyalty programmes, (3) Dictate their own terms of service, and (4) Tell whole markets what they want, how they want it, where and when they should be able to get it, and how much it should cost. And they will do all of this outside of any one vendor's silo."⁴¹

Similarly, the Economist recently reported on a new generation of start ups acting as data lockers - "secure online locations where people can gather information on themselves, including their consumption patterns - utility bills, loyalty-card statements, telephone records and so on."⁴²

Meanwhile, merchants are already bidding, in real-time, to present themselves on web and mobile displays, based on the perceived value of each consumer (or, at least, each consumer's "eyeballs").

AND, IN THE FUTURE, WE COULD EVEN FORESEE A SITUATION IN WHICH PAYMENT PROVIDERS VIE FOR THE OPPORTUNITY TO PROCESS A GIVEN TRANSACTION, BASED ON ITS CONTEXT.

ANA'S STORY

Just imagine that you are a stranger in town...



YOU WALK INTO A COFFEE SHOP. "HELLO ANA, HOW ARE YOU TODAY? HOW DO YOU FANCY A DOUBLE ESPRESSO AND APRICOT MUFFIN?" YOU SMILE AT THE FAMILIAR WELCOME, PICK UP YOUR BREAKFAST, AND WALK OUT WITH A FRIENDLY "BYE FOR NOW!" WITHOUT SEEMING TO PAY.



A FEW HOURS LATER, AFTER A GREAT MEETING, YOU'RE SITTING IN YOUR HIRE-CAR. YOUR PHONE TRILLS THE JINGLE OF YOUR FAVOURITE DRIVE-THRU AND SAYS, "IF YOU'RE HUNGRY, WHY NOT TAKE THE NEXT EXIT, AND WE'LL HAVE YOUR USUAL SALAD AND SANDWICH WAITING FOR YOU WITH A ONE-FIFTY DISCOUNT. JUST SAY YES TO PAY, AND WE'LL SEE YOU IN A FEW MINUTES!" YOU GESTURE TO LEAVE THE CONVOY.



YOU PARK BY THE RIVER TO ENJOY YOUR LUNCH, AND THE HEADS-UP DISPLAY AUTOMATICALLY CONJURES UP THE EPISODE OF THE SOAP YOU MISSED LAST NIGHT. AS YOU PREPARE TO GET BACK ON THE ROAD, YOU DECIDE TO RING YOUR BOYFRIEND AND, AS SOON AS HIS NAME IS OUT OF YOUR MOUTH, YOUR PHONE REMINDS YOU THAT IT'S YOUR ANNIVERSARY TOMORROW.

HOW WOULD YOU LIKE TO SEND HIM TICKETS TO THE FOOTBALL GAME? (NICE IDEA!). YOU SPEAK A LOVING GREETING. AND YOU KNOW THAT, AS HE LEAVES THE OFFICE THIS AFTERNOON (YOU WOULDN'T WANT TO INTRUDE ON HIS WORK!), IT'LL ARRIVE ON HIS PHONE ALONG WITH E-PASSES FOR THE STADIUM (SO THOUGHTFUL!).



JUST AS YOU ARRIVE AT YOUR NEXT MEETING, THE CLOUDS BURST. BUT, NOT TO WORRY. YOU GET OUT, UNDER-COVER AT THE OFFICE ENTRANCE. BEFORE YOUR CAR GOES TO PARK ITSELF, IT MAKES A SUGGESTION. IF YOU LET SOMEONE ELSE DRIVE IT FOR THE NEXT HOUR (JUST TO ESCAPE THE RAIN), YOU CAN EARN YOURSELF A GENEROUS DISCOUNT.



YOUR MEETING GOES VERY WELL. AND AS YOU LEAVE THE BUILDING YOUR CAR GLIDES UP. YOU GET IN AND THE HEADS-UP DISPLAY TELLS YOU YOUR FLIGHT IS DELAYED. BUT, IF IT'S ANY CONSOLATION, THE LOCAL DEPARTMENT STORE IS PROMOTING YOUR FAVOURITE LINE OF COSMETICS. YOU DECIDE TO MAKE THE BEST OF THE SITUATION. AT THE STORE YOU INDULGE IN A LITTLE RETAIL THERAPY, PICKING ITEMS (SOME SUGGESTED FOR YOU), SCANNING THEM WITH YOUR PHONE, AND POPPING THEM IN YOUR BAG. IN RETURN FOR REVEALING WHAT YOU JUST BOUGHT, AND COMPLETING A REALLY QUICK QUESTIONNAIRE, YOU ENJOY A FREE MAKEOVER AND GREEN TEA AT THE COSMETICS COUNTER.



BACK AT THE AIRPORT, YOU SAIL THROUGH SECURITY, WITH YOUR PHONE DISPLAYING YOUR UN-FORGEABLE ID AND BOARDING CARD. MEANWHILE, YOUR HOME AUTOMATION SYSTEM HAS BEEN TOLD OF THE DELAY. SO THE CAT'S BEEN FED AND THE HEATING'S BEEN ADJUSTED.



ON LANDING, YOUR TAXI DRIVER, HAS ALREADY PICKED UP SOME ONLINE SHOPPING FOR YOU, WHICH HAD AUTOMATICALLY BEEN RE-ROUTED TO THE AIRPORT DROP-POINT.

AS ANA MOVES THROUGH HER DAY, THE SERVICES, ALL OF THE SOLUTIONS AND OPPORTUNITIES THAT SHE IS OFFERED HAVE BEEN DETERMINED BY HER CONTEXT. HER PHONE HAS BEEN HER DIGITAL SURROGATE, KEEPING ALL OF HER PREFERRED BRANDS IN TOUCH WITH WHERE SHE IS, WHAT SHE IS DOING, AND WHAT SHE MIGHT NEED FROM THEM. IT'S A PERSONALISED, PRIVATE, NON-INTRUSIVE SERVICE, THE SPECIFICS OF WHICH HAVE BEEN DETERMINED BY ANA.

SO WHAT?

THE CRUSHING WEIGHT OF CUSTOMER EXPECTATION

You know the story... As consumers we are becoming ever more discerning and demanding. We are bombarded with too many irrelevant offers. Although businesses may talk about segmentation, many of them use a "scatter gun" approach. And we end up feeling overwhelmed by stimulus and choice.

ALL ORGANISATIONS ARE OPERATING UNDER A CRUSHING WEIGHT OF EXPECTATION. PAYMENT BUSINESSES ARE NO EXCEPTION. AND THE PRESSURE IS ONLY GOING TO INTENSIFY.

As an industry, we therefore need to plan for a scenario in which consumers want more-and-more for less-and-less. They want it created especially for them. They want it precisely when and exactly where they choose. They want everything to operate flawlessly (always). And they insist that you always take full responsibility - for anything that could possibly go wrong, whatever the circumstances.

The good news is that we have increasing access to the means and the mechanisms that enable this degree of personal service. And it goes far beyond the issues question of loyalty, rewards, and targeted marketing. Passive authentication and fraud monitoring are two areas where context is now being used to improve the overall customer experience.

PRIVACY NO MORE?

There's so much talk about the meaning of your life. But, even to the most enthusiastic among us, the data gathering techniques behind it can feel decidedly Orwellian.

And that's before we get into some of the darker economic implications - for example,

"A TIME MAY COME WHEN SHOPPERS WILL HAVE TO REVEAL ALL ABOUT THEMSELVES OR BE CHARGED TOP WHACK FOR EVERYTHING THEY BUY."⁴³

To our mind, these issues haven't yet been fully aired. And it's a subject we consider in more detail in a later chapter (Extreme Accountability).

WHERE DO YOU WANT TO PLAY?

Not all businesses will want to play in this space, nor will they all be capable of doing so.

Will we therefore see a polarisation in banking and also in payments? How many payment businesses will choose to focus on the engines and not the customer, because it becomes too hard to do both? And should we be contemplating the specialisation of banking into a consolidated back-end and highly segmented front-ends?



WHO GOES THERE?

IDENTITY MANAGEMENT IS A REAL MESS AND IT'S BECOMING MESSIER ALL OF THE TIME.

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SET TO AUTOMATIC

WITH THE ABUNDANCE, AFFORDABILITY AND ACCESSIBILITY OF COMPUTE POWER, WE ENVISAGE A WORLD OF “HANDS-OFF” AND “LIGHT-TOUCH” COMMERCE – IN WHICH PRODUCTS AND SERVICES ARE AUTOMATICALLY SERVED UP AND PAID FOR AS AND WHEN THEY’RE NEEDED.

“

So, when life is set to automatic, we can envisage a shift from ownership to consumption.

”

**ENGINE
START
STOP**

In a world that’s strewn with sensors, reality becomes digitised. Our real lives are reflected and replicated in a parallel, digital universe. And the same is true for the real lives of the inanimate objects around us – obviously our personal compute devices, but also our cars, our domestic appliances and even our consumables; from the food we eat, to the clothes we wear.

THIS NEW REALITY IS ALREADY SPAWNING SOME FASCINATING NEW BUSINESS MODELS – WHICH WILL DEMAND THEIR OWN PARTICULAR PAYMENT SOLUTIONS.

LET'S CONSIDER SOME SPECIFIC EXAMPLES...

A good place to start is the new generation of smart meters now being installed in tens of millions of homes across the world. Thanks to these networked devices, utility companies get a real-time understanding of actual energy consumption so timely, accurate bills can replace expensive, door-to-door meter readings. Meanwhile consumers get new insights and control, enabling them to save on energy use and cost.

There's also the option for dynamic pricing, where energy prices can be set according to the time of day, which spreads the load on generation capacity, making the whole system more efficient. And, of course, everything could be set or adjusted remotely, probably via an app on a smartphone.

The UK government (which estimates potential savings of several billion pounds a year), wants smart meters in every home by 2019⁴⁴. Meanwhile, in the US state of Oklahoma, nearly every household was due to have a smart meter by the end of 2012.⁴⁵

Ultimately, there's potential for intelligence and connectivity to be embedded within all types of machinery or appliances. The initial imaginings may have sometimes been a little fanciful (the apocryphal, self-replenishing, smart refrigerator, for example). But the realities are certainly emerging.

We see them in the automotive world. Our cars routinely tell us when they need servicing, or when a particular component is showing its age. It's also possible to buy



so called "black box" insurance policies that charge us according to our driving habits and can even impose night time curfews on young drivers⁴⁶.

In the same way, our compute devices are regularly diagnosed and automatically upgraded – often without our knowledge.

AS INTELLIGENCE AND CONNECTIVITY BECOME MORE WIDELY EMBEDDED, THERE ARE DEFINITE IMPLICATIONS FOR BUSINESS MODELS.

If a machine is in regular touch with its supplier, there can be an implicit shift in responsibility for its ongoing care, so a maintenance contract can be bundled in. Now think a step further... What if I don't own my central heating boiler any more, but pay for it under a single service contract with the supplier? Under this arrangement, preventative maintenance can be far more effective (based on actual use of the boiler and knowledge of its condition). I pay for what I actually use, and my risks of an expensive failure can be reduced.



It's not just machinery. When imbued with intelligence and connectivity, practically any goods can be sold as a service – even tyres.⁴⁷

So, when life is set to automatic, we can envisage a shift from ownership to consumption.

In the realm of digital goods, this shift is well established. We don't need to own CDs or MP3s, we can stream music. We don't need to buy DVDs we can rent them, or stream movies. We don't need to acquire books, we can download them to our e-reader. The old, rigid patterns of distribution (artist > publisher > retailer > consumer) are being exploded and reformed into dynamic eco-systems.

IN THE REALM OF PHYSICAL GOODS, WE ARE BEGINNING TO SEE SIMILAR DEVELOPMENTS.

Car clubs are a growing phenomenon in many urban centres. For example, the auto manufacturer, Smart, launched its Car2Go service in Germany in 2008, and now rents out some 6,000 vehicles in more than 20 cities worldwide⁴⁸. In the US, outfits like Lyft, Zimride and Uber provide an on demand car-sharing service. Through the website Parkopedia you can rent private parking spaces. And, in San Francisco you can even rent out your bathroom to a caught-short stranger through an app called CLOO.

AUGMENTED REALITY IS YET ANOTHER DIMENSION OF SET TO AUTOMATIC.

With the abundance and accessibility of compute power, a world of information can become available anytime, anywhere. And it can be "superimposed" on to our experience of the world. For example, on a visit to Barcelona's Basilica of the Sagrada Família, our smartphone can be our virtual guidebook, giving us historical and architectural information, or a virtual climb to the building's Passion and Nativity towers, or insights into Gaudí and his other masterpieces – or a guided walking route to the nearby street where, on his daily stroll to church, he was struck and fatally wounded by a passing tram.

For the less adventurous amongst us, the passive act of watching television is becoming augmented with a tablet or mobile device. "You only need to look at how busy Twitter feeds become when high-profile programming [is] broadcast to see that watching TV is becoming an ever more interactive experience these days,"⁴⁹ observes the Huffington Post. The article concludes that "the mobile has revolutionised the very act of watching television itself, opening up many possibilities for the future of television programming, advertising and fans alike."

In a life that's set to automatic, opportunities abound for new commercial models and, alongside them, new payment flows.

ON DEMAND LIVING



When our lives are set to automatic, products or services can be served up and paid for on demand – whenever and wherever we need them.

This is not just about digits.

Technological evolution is allowing us to "serve up" physical objects, on demand, through the rapidly evolving field of 3D printing. And basic 3D printers for home use are becoming available from a few hundred dollars⁵⁰.

The technology holds extraordinary promise in many fields from fashion – design and print perfectly – fitting shoes at home; to medicine – print human vascular components⁵¹ or even whole organs⁵² on demand! The 3D printer that can print copies of itself should soon become available from the open source community⁵³. The printing of prescription spectacles is also being commercialised and, if successful, could completely overturn the current industry model.

IN A WORLD OF "LIGHT TOUCH" COMMERCE PRACTICALLY ANYTHING COULD BE SUMMONED UP, ON DEMAND.



“**We don't need to own CDs or MP3s, we can stream music. We don't need to buy DVDs we can rent them, or stream movies.**”

CAN WE SEE A ROLE FOR PASSIVE BIOMETRICS SUCH AS FACIAL RECOGNITION OR GEO-LOCATION (VIA THE MOBILE DEVICE) TO FACILITATE AND PROTECT THESE AUTOMATED PAYMENTS – **AND WHAT ARE THE PRIVACY IMPLICATIONS OF DOING SO?**



SO WHAT?

FACILITATING THE EMERGING CONSUMPTION MODELS

In the card payment world, consumers tend to make “push” payments. They’ve finished their meal, or they’ve done their shopping. Then they “push”, and the infrastructure responds.

In a world that’s set to automatic, payments will also become automatic. They will be “pulled” through the infrastructure. And our systems will need to evolve accordingly.

Traditionally we’ve relied on a relatively blunt instrument – the so-called “continuous authority to pay”. Otherwise, our payments have always required some form of human intervention (logging in to our iTunes account, for example, or confirming our CVV security code, which is relatively easy but certainly not automatic).

The “continuous authority to pay” is what has been used for regular subscriptions (your ISP bill for example, or your Spotify subscription). But it’s sometimes been a source of tension for retailers and consumers alike. And it’s ill-suited to irregular payments of inconsistent values.

This is just one of very many such considerations. For example:

- What authorisation models (or trust models) should be deployed for machine-to-machine payments?
- With more payments being made more automatically, should we perhaps be bracing ourselves for a surge in first party fraud (“I didn’t ask for”/ “I didn’t authorise it”)? And should we be revising our dispute rules accordingly?
- If individual retailers or service providers want to facilitate automatic, pull payments, to what extent will they be willing to assume the consequent risks and liabilities?

- Should we anticipate a time when the payment functionality is integrated into the product or service and payments become completely invisible (I pick up the products, and walk out of the store with no check out)?
- Can we see a role for passive biometrics such as facial recognition or geo-location (via the mobile device) to facilitate and protect these automated payments – and what are the privacy implications of doing so?
- The nature of the payment, and all of its attendant risks, will be hugely determined by its context. So what should we be doing to equip our systems and our processes to become context-aware?
- In a world that’s set to automatic, doesn’t it become critical that all legitimate payments are automatically authorised and, from the consumer’s perspective, unthinkable that they could be inappropriately declined?
- How do we prepare for and accommodate the utter convergence of the “trusted” (physical) and untrusted “virtual” – not to mention the “secure” (terminals) and “unsecure” (smartphones)?

If, in the future, these frictionless pull payments account for a larger and larger share of total volumes, how do we ensure that they are pulled from our products? If we get it right substantial future flows will be virtually guaranteed. If not, we cede one of the biggest growth opportunities to our competitors.



ANTICIPATING NEW PAYMENT PATTERNS

If we see a progressive shift from ownership to consumption, what will that mean for our payment products, the linked accounts, and the underlying business models? Are we really set up to handle pay-per-use consumption models?

There would be less of those large, one-off payments (the washing machine, or the central heating boiler, or even the car). Instead, they'd be split out into an ongoing series of "pull" payments. And if the consumption were to become collaborative (that is, shared between individuals), we would need a much more consistent and convenient solution for person-to-person payments.

Are we, as an industry, positioned to benefit from these shifts? Or could we become a casualty?



INCREASED IMPORTANCE OF SOFTWARE

In the move from bricks to clicks, software takes on a much greater role than hardware. In most cases, physical hardware is being replaced by software to perform the same function - like POS.

The concept of virtual acceptance terminals is not new and many payment service providers provide these today. But do the established operating rules need revising in order to fully embrace this new world of digital hardware?



FROM BRICKS TO CLICKS

Smart retailers are realising the importance of an omnichannel approach. Consumers don't only think of shops as physical buildings anymore. Virtual stores, pop-up stores, showcases, posters, and bus shelters can all become opportunities to show off goods and make them available. So the means to pay, there and then, is vital.

This has implications on deliveries and distribution networks. Some big players are turning to different parts of their own organisation, or are forming partnerships with others. In the UK, for example, the John Lewis department stores are using the Waitrose network of grocery stores to fulfil "click and collect" orders.

Of course, while the customer is there, they may well buy a few groceries as well. That maybe explains why, also in the UK, the Co-operative grocery chains have struck a deal to offer Argos online shoppers the opportunity to collect items from their local Co-op store.

OPENING UP THE CLOSED LOOPS

Some payments have traditionally been set to semi-automatic (the Oyster cards or Octopus cards used for mass transit systems in London and Hong Kong respectively being good examples). But these first generation systems have tended to be closed loop solutions which, by definition, tend not to be that convenient for consumers, and carry a high cost burden for their operators.

SO WHAT SHOULD OUR INDUSTRY DO TO ENABLE THE CLOSED LOOPS TO BE OPENED?

In the UK, Transport for London, working with Visa Europe and the wider payments industry, has begun to accommodate contactless card payments. Across Europe, there is talk of a region-wide EMV transit standard. We have an opportunity to secure a massive new volume (but not necessarily value) of payments.

LESS FRICTION PLEASE

Generally speaking, the easier it is for someone to pay, the more satisfied they will be with the transaction and the more likely they will be to return.

The removal of any form of friction from the customer experience is a current concern across much of the retail community. The checkout and payment processes have been a particular target. And new solutions should perhaps be regarded as an inevitability.



THREE DIMENSIONAL CONSIDERATIONS

3D printing is on the radar of every trendwatcher. It's threatening to disrupt entire business sectors. It's promising to democratise and re-distribute the manufacturing process. But what does it mean for payments?

If, or when, a cardholder buys counterfeit blueprints for digital goods, what moral or legal liability should be assumed by the issuer? Should payment privileges be withdrawn for entire classes of suspect or illegal goods - firearms for example? What happens, when the blueprints have been bought, the goods have been "printed", and the consumer reaches the conclusion that they are "not as advertised"? And, once all of the principles have been agreed, how on earth will they be policed?

EXTREME ACCOUNTABILITY

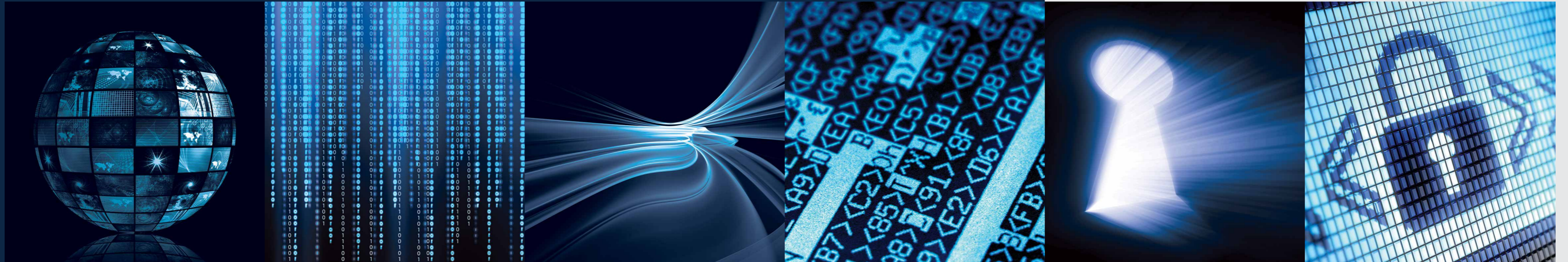
BIG DATA⁵⁴ IS GETTING MUCH, MUCH BIGGER AND BECAUSE EVERY SINGLE THING IS BECOMING SCRUTABLE, MANY MORE THINGS (INCLUDING BEHAVIOURS) ARE BECOMING MUCH MORE CLOSELY SCRUTINISED.

5

NATURE MAGAZINE PUT IT JUST PERFECTLY.

“The relentless march from kilo to mega to giga to tera to peta to exa to zetta to yotta. The mad inconceivable growth of computer performance and data storage is changing science, knowledge, surveillance, freedom, literacy the arts – everything that can be represented as data, or built on those representations.”⁵⁵

This is all about big data. Increasingly, it's seen as critical to business success⁵⁶. And, according to received wisdom, it has four dimensions⁵⁷:



Again, these four Vs are the received wisdom. But, we think it's useful to add two more:

VOLUME

The volume of data now being stored by humanity defies comprehension. For 2012, IDC put the figure at 2.7 zettabytes⁵⁸. How big is that? Well, if you were to print it all out on A4 pages, and laid it end-to-end, the paper trail would go six times further than Alpha Centauri, our second nearest star, some 4.3 light years (or 25.6 trillion miles) away. Of course, you could stack the papers up instead – in which case the pile would be thirteen times the distance to Pluto.

No human could ever look at this volume of data and make sense of it. The only way to cope with its gargantuan scale is to offload much of the thinking to machines.

VARIETY

Not so long ago computers used to handle very neat data fields. Not anymore. IBM suggests that 80 per cent of big data is non-conventional or unstructured data. As Nature magazine puts it, this is typically comprised of “images, videos, voicemails and files based on social media and web-enabled workloads – full of rich information, but challenging to understand and analyze.”

VELOCITY

This is the rate at which data is created, or moves, or arrives, or is processed. Again, the figures are startling. Walmart is said to generate 2.5 petabytes of customer data every hour⁵⁹. And the ability to handle velocity is often more important than the ability to handle volume. For example Visa Europe's processing systems can collect, route, analyse, authenticate and deliver an authorisation message in less than 20 milliseconds. It doesn't matter to the card issuer, the retailer or the consumer that we'll be doing this for up to 1,000 transactions per second. They only ever care about the speed of their own transaction.

VERACITY

This is where it starts to get really interesting. To what extent can you rely on the quality of your underlying data points? How good are the techniques you are using to analyse it all? How sound are your inferences? And how appropriate is the action you are taking as a result? The fact is that the statistical techniques of the past are woefully inadequate.

The skills that are required to make sense of this data are in short supply. As the Financial Times observes, a bidding war is being waged to attract candidates with “the unique mix of statistical, software engineering, and business analytics expertise required to find the predictive insights companies are all looking for.”⁶⁰

Yet, within our own industry and across many others, the weight of expectation can be crushing.

VALUE

Not all data contains value. The trick, from all of those petabytes, is to find those few digits that truly unlock new insights.

Here's an interesting example from the Economist. “Airline yield management improved because analytical techniques uncovered the best predictor that a passenger would actually catch a flight he had booked: that he had ordered a vegetarian meal.”⁶¹

Meanwhile, the Harvard Business Review explained how the online movie rental business, Netflix, offered a \$1 million dollar prize to anyone could beat (by ten per cent) its algorithm for making recommendations to individual members⁶². The challengers didn't look at the attributes of the actual movies. Instead they concentrated all of their attention on the way other people responded – that's where the value lay.

VULNERABILITY

We believe this to be one of the most profound dimensions of big data. And we are surprised that so many commentators have given it such scant attention.

Again, we are looking at a future in which everything can be scrutinised. With this scrutiny will come extreme accountability. And we feel it's inevitable that the custodians of big data will face a growing burden of responsibility.

In a 2012 speech, Joaquin Almunia, Vice President of the European Commission fired a warning shot. He said “A sensible treatment of personal data will allow us to benefit from better services targeted to our preferences and needs. But the line between the sensible use and the abuse of this kind of information is very thin. New problems will probably appear and become systemic.”⁶³

The complex issue of privacy is certainly a part of this. But our vulnerability dimension extends somewhat further. When every aspect of business activity can be monitored, we expect organisations and the people within them to be held to account more thoroughly than ever before. In the field of digital marketing, for example, techniques such as split and multivariate testing techniques are being used to over-rule gut instinct and aesthetic sensibilities. It will be truly fascinating to see how all of this all unfolds.

Again, everything can be measured. And what is measured can always be managed.

“
The unique mix of statistical, software engineering, and business analytics expertise required to find the predictive insights companies are all looking for.
”

SO WHAT?

THE VALUE (AND PARTICULAR SENSITIVITIES) OF PAYMENT DATA

Payment data is the richest there is. But, to unlock the value within it, trust has to be built and retained.

Most other industries have little idea of what is really happening outside of their own immediate domain. By contrast, a successful payment provider can deduce exactly where, when, how much and with whom money is being spent. And, as cash and cheques are progressively displaced, this data - and its value - escalates accordingly.

TRADITIONAL RETAIL BANKS ARE IN AN EVEN MORE DATA-PRIVILEGED POSITION.

They will see all types of payment in and out of a customer's account - mortgage, bills, salary, pension, loan re-payments, standing orders, direct debits, everything.

Looked at in this context, payment providers (and, more particularly, retail banks) are uniquely positioned to provide: (i) the market-wide, real-time and location-based data which is necessary for the effective delivery of targeted, timely offers, and (ii) the necessary mechanisms to automatically redeem these offers and track sales conversion rates.

Yet, as custodians of this data, our industry is under deep scrutiny from the media and the public.

So how will today's payment businesses make use of this truly priceless asset? Isn't this the most strategically significant decision facing many incumbent payment providers?

COMING CLEAN ON DATA

As consumers, what type of data are we really giving up and to whom? How will they use it? How will we benefit? And under what circumstances would we decide to withdraw our consent?

The picture is far from clear. And the debate has barely begun.

So, within the payments industry, wouldn't we be well advised to tread with extreme caution? Shouldn't we be assiduous in securing consent and informed opt-in? Might it be best for us to eliminate any ambiguities? And to what extent should we confine our analysis to aggregated, anonymised data?

THE WAR FOR TALENT

Let's face it. There simply aren't enough data science skills to go around.

The field is so new and the education cycle so slow, it will be several years before schools can graduate enough candidates with the right skills to meet demand⁶⁴.

AND TALENT IS ONLY ONE PART OF THE EQUATION.

Big data requires bigger everything (storage, processing, you name it). Typical industry data centres were never built with advanced analytics in mind. And, it will become increasingly necessary to invest in artificial intelligence (as more decisions will need to be delegated to self-learning machines).

Payment businesses will need to consider how they can build, buy and provision these services/capabilities. They may also want to consider whether to call on their collectively owned assets and capabilities.

THE "OIL" OF THE DIGITAL ECONOMY

Data is, without doubt, the most valuable currency of the digital economy.

Somehow there must be a way for payment businesses to monetise the value within their data, but the nature of the new revenue models is far from clear. How will the insights be bought, sold or traded, and with whom? How will the security concerns of the individuals be allayed? And how will this new ecosystem be defined when the beneficiaries of the data don't bear the costs or the risks of storing or processing it?

6

SUPER
HUMANS

COMPUTE POWER HAS ALWAYS BEEN USED TO EXTEND AND AUGMENT HUMAN CAPABILITY. BUT TECHNOLOGY IS FAST BECOMING PART OF “US” – BOTH LITERALLY (IN THE FORM OF PROSTHETICS⁶⁵ OR WEARABLE TECHNOLOGY) AND FIGURATIVELY (IN THE WAY THAT OUR COMPUTE DEVICES ARE BECOMING THE DIGITAL REPRESENTATIONS OR EXTENSIONS OF OUR PHYSICAL SELVES).



IT'S LONG BEEN THE STUFF OF SCIENCE FICTION. BUT THE SCIENCE FACTS ARE UPON US.



Ever since the TV series “The Six Million Dollar Man” in the late-1970s, human augmentation has been deeply embedded in the public imagination. With his bionic eye, legs and arm, the character Steve Austin became an icon for technology in support of human progress. These utopian and often dystopian themes have been a staple of Hollywood ever since, from Blade Runner to The Matrix. “If real is what you can feel, smell, taste and see, then ‘real’ is simply electrical signals interpreted by your brain.”⁶⁶

TODAY, WE ARE SEEING MANY TRULY LIFE-CHANGING TECHNOLOGIES EMERGE.

In the 2012 Paralympic Games, athletes like Jonnie Peacock and Alan Oliveira, aided by sophisticated prosthetic limbs, astonished us all with their sporting prowess. Cochlear implants, to assist in certain types of deafness, are now in widespread use⁶⁷. Eye lens replacement is now an affordable consumer reality⁶⁸. Meanwhile, human exo-skeletons, providing super-human strength and endurance, are now being tested in military applications⁶⁹.

Brain-computer interface technologies are also emerging and developing apace. One example among many is Brainsled, an initiative developed at London’s Imperial College, which allows disabled athletes to, “control a bobsleigh using special helmet device containing electrodes which enables users to steer by power of thought.”⁷⁰

IBM for one, clearly envisions the mass-commercialisation of these interfaces. As soon as 2017, the firm sees an everyday role for its “thought control” technologies - “perhaps embedded into a baseball cap, and with a finer range of thought patterns detected and connected directly to my mobile phone - allowing me to interact with the world just by thinking particular thoughts.”⁷¹

HANG ON JUST A MINUTE... THOUGHT CONTROL? IMPLANTS? SURELY NOT...

Well, these are just interfaces. Other interfaces may be seen as less invasive (like the touch screens on your tablet, or gesture control on your new Smart TV or games console, or Siri⁷² on the iPhone), but they are still indicative of the same trend. And, of course, we have the emergence of wearable technology⁷³ and Body Area Networking (BAN)⁷⁴.

WHICHEVER WAY YOU LOOK AT IT, TECHNOLOGY IS BECOMING PART OF “US”.

It’s also useful to consider the myriad of ways in which technology is automatically stepping in on our behalf - doing many of the cognitive things that we used to do for ourselves, except better and faster.

A good example is in automotive technology.

Cars that can parallel park themselves, stay in lane, cruise in heavy traffic, and brake automatically to avoid collisions in busy city streets are already available. We’re even moving towards the dream of self-driving cars - witness Google’s Driverless Car programme: “Our vehicles, of which about a dozen are on the road at any given time, have now completed more than 300,000 miles of testing. They’ve covered a wide range of traffic conditions, and there hasn’t been a single accident under computer control.”⁷⁵

AND IT’S TRULY FASCINATING TO CONSIDER THE WAYS IN WHICH THE SUPER HUMAN THEME PLAYS OUT ACROSS DIFFERENT AGE GROUPS.

Left to their own devices, the very young are masters at manipulating technology. In the UK, for example, Ofcom (the regulator and competition authority for the communications industries) reports that over a third (37 per cent) of 3 to 4-year-olds are going online with a PC or laptop, and almost one-in-ten (9 per cent) are using a tablet. And, of those with access to such devices, 80 per cent of 12 to 15-year-olds have a social networking profile.

Much further afield, American researchers from the organisation Global Advocacy, One Laptop Per Child mounted an experiment in two small, remote Ethiopian villages⁷⁷. They gave out tablets, programmed in English and without any instructions, to every child between four and eleven years old, then walked away. The results, they say, were astonishing, with children learning spontaneously how to use the devices, even beginning to read and type in English - and accessing 40,000 separate applications.

Of course, these younger age groups have been somewhat neglected by the payments industry. Much of what they buy is online, especially virtual goods such as phone top-ups, music, games and other content. Yet, other than masquerading as their parents, few payment solutions are available to them.

At the other end of the age spectrum, we do see digital disenfranchisement. But this is changing, particularly as the new interfaces make it easier to use the technology, through the multitude of new interfaces and as familiarity grows.

Ofcom also reports that “there is evidence that older age groups are catching up in the adoption of technology. For the first time, over half (55 per cent) of those aged 65-74 have access to the internet at home while over three quarters (77 per cent) now have a mobile.”⁷⁸

Overall, we’re seeing technology assume an unprecedented criticality in people’s everyday lives. Their personal compute devices are becoming extensions of their very being, acting as powerful gateways into a world of limitless information and expert assistance, as well as social networking.

And we can be sure that, one way or another, payments will follow life.



SO WHAT

AUGMENTED SHOPPING

Through concepts like virtual changing rooms, technology is increasingly being used to augment the shopping process. And, as the shopping experience evolves, there will surely be pressure for the payment process to follow suit.

Having been enthralled by the latest augmented retail concepts, wouldn't it seem a little arcane to then go and queue up at a "pay here" sign to complete your purchase?

BIOMETRICS (AGAIN)

As an industry we need to cater for multiple new ways to "conclude" the transaction (wave, blink, smile, thumbprint, say a word).

We also need to consider whether, at some point in the distant future, it may not be necessary to carry any form of payment token and the phone or card may become entirely redundant. If technology can recognise us, and verify our identity, without the need of any tokens, why bother with the risks or the inconvenience of carrying our payment credentials around with us in any form?

PAYMENT SOLUTIONS FOR THE VERY YOUNG (AND THE VERY OLD)

As an industry we could probably do a much better job of catering to different demographic groups. We are finally seeing some prepaid products that are specifically designed for younger age groups and intended to bring them up to speed on money management. But what more could we do? And what should we be doing at the other end of the age spectrum?

HELPING THE AUGMENTED HUMANS

New retail shopping experiences are taking advantage of the "augmented humans" that are walking around. We will see much more of this. But what sort of payment solutions will be required?

“

Through concepts like virtual changing rooms, technology is increasingly being used to augment the shopping process.

”



UNITED WE STAND

The world is a far more open and collaborative place in which to operate - so much so that openness and collaboration are becoming a pre-requisite for any level of business success

The obvious topic here is social media. You know all about it. So we won't go into detail. But, our final theme is about more than social media.

It's about the way that technology has made the world a far more connected place. People and business are getting used to connecting. And, increasingly, it is through connections (technological as well as social) that things get done.

— LET'S CONSIDER A FEW OF THE DIMENSIONS. —

ECOSYSTEMS

Self-contained, vertically-integrated businesses are a thing of the past. In industry-after-industry, old value chains are being un-wound and replaced by open ecosystems.

In his seminal book "The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems"⁷⁹, James F. Moore defined a "business ecosystem" as: "An economic community supported by a foundation of interacting organizations and individuals - the organisms of the business world. The economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they co-evolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. Those companies holding leadership roles may change over time, but the function of ecosystem leader is valued by the community because it enables members to move toward shared visions to align their investments, and to find mutually supportive roles."

VISA EUROPE IS A CLASSIC BUSINESS ECO-SYSTEM, NOW WELL INTO ITS SIXTH DECADE. ALTHOUGH OUR MEMBERS COMPETE WITH ONE ANOTHER, THEY ALSO COOPERATE TO SUSTAIN THE VISA PLATFORM THAT BENEFITS THEM ALL.

Membership does change over time, and now includes non-traditional players such as eligible retailers and mobile network operators⁸⁰. Technologies change too. But the eco-system model proves more resilient than traditional value chains.

New eco-systems are growing all around us, and almost everyone will be familiar with those that have developed around players such as Amazon, Apple, Facebook and Google. The critical factor seems to be the ability to connect.

To connect large communities of customers, suppliers, logistics, finance, content providers, services and so on in a single framework that creates value and choice.

THEY ABSORB INNOVATION AND ALMOST EVERYONE BENEFITS, FOR EXAMPLE AMAZON'S SUPPORT OF EBOOKS, WHICH HAS SEEN CUSTOMERS BUYING FOUR TIMES AS MANY BOOKS⁸¹.

It's difficult to think of a major industry sector which, today, does not sustain a broad ecosystem.



COLLABORATION

With so much networked resource available, human, computing and financial, many new ways to collaborate have emerged.

The online encyclopaedia Wikipedia, SETI@home (the search for extraterrestrial intelligence using spare home computing power) and Galaxy Zoo (the collaborative effort of more than 250,000 untrained volunteers to classify galaxies in photographs from large telescopes), are just three of the non-commercial examples.

But we're also seeing some new business models emerging - most notably microwork exchanges, such as Mechanical Turk, where people can be paid to do simple computing tasks like scraping company email addresses off the web, or tagging photographs.

AND, WHEREVER YOU LOOK IN THE WORLD OF BUSINESS, THE SAME COLLABORATIVE ETHOS IS TAKING HOLD. FOR EXAMPLE, LARGER ORGANISATIONS WILL INVARIABLY HARNESS THE DRIVE, THE SPECIALIST SKILLS AND THE PURE ENERGY OF ENTREPRENEURIAL START-UPS. AND, IN THE MOBILE ECOSYSTEM, IT IS THE DEVELOPER COMMUNITY THAT BREATHES LIFE INTO THE SMARTPHONE PROPOSITION.

As we discussed in our "set to automatic" chapter, we are also seeing a shift away from private ownership and towards collaborative consumption with technology bringing scale and connectivity to old marketplace behaviours like renting, lending, swapping, sharing and bartering.

WORKING THE CROWD

Finally we have crowdsourcing which enables you to engage the public (the whole world in fact) in your product and development programmes. A great example is Quirky, a New York based prototyping business that seeks to develop two new consumer products every week. The online community submits ideas. Quirky develops and retails them. And the inventor gets a 30 per cent share of revenues.

A close cousin is crowdfunding, in which members of the public donate small sums to projects they like the look of. Sometimes it's scientific projects, through sites like petridish. Sometimes it's a charity or an arts initiative, perhaps through indiegogo. Often it's an alternative to venture capital funding, most notably through kickstarter.

So far, speculative start-ups have been the main beneficiaries. But think how the model could be deployed in the world of bigger business.

WHY WOULDN'T A LARGE BUSINESS-TO-BUSINESS SERVICE PROVIDER ENGAGE ITS CUSTOMERS IN PRODUCT DEVELOPMENT INITIATIVES – AND GET THE NECESSARY FUNDING DIRECTLY FROM THEM IN THE FORM OF ADVANCE PLEDGES?

MANY HANDS MAKE LIGHT WORK

Sometimes it just makes sense to work together. You can benefit from scale, you can share expertise, you can rally around a particular technology standard or platform. And it's how our industry has traditionally faced many of its most daunting tasks – such as the creation and management of the EMV chip standards, or the Payment Card Industry Data Security Standards (PCI DSS).

Even though many collectively owned assets and bodies may be resorting to private ownership, the rationale for a collaborative ethos continues. And it's a route being taken by many of the non-traditional payment players, such as the ISIS initiative in the USA, or WeVe in the UK.

The rationale is compelling. But the governance can be a nightmare. Working closely with would-be competitors requires a particular skill set. And competition laws need to be understood and respected.

ENABLING AND ENCOURAGING SAFE INNOVATION (INSTEAD OF CLEANING UP AFTER NAÏVE INNOVATION)

As we noted at the outset, the payments sector has become a magnet for investment and innovation. Hundreds of entrepreneurs and start ups are bringing a real sense of energy and excitement to what has traditionally been a somewhat staid and stable sector.

But how many of them understand what it really takes to work in the real world of payments? What about the security and integrity? Can they operate at scale? Have they thought through all of the intricacies? Are they aware of the rules and requirements?

OFTEN WE SEE SOLUTIONS BEING RUSHED INTO THE MARKET THAT DON'T MEASURE UP.

We have to step in and stipulate. So doesn't it make sense for the industry to engage much more closely with the developer community? Shouldn't we be providing advice and encouragement at the initial stages? Rather than clearing up the issues when things go wrong?

OPENING UP TO THE DEVELOPER COMMUNITY

In theory it should be so simple... Visa Europe, along with all of the other payment systems, should open itself up to the developer community. We should democratise our platforms and establish common APIs. That way, we can open the flood gates to innovative new solutions.

IN REALITY, OUR SECTOR HAS TO RETAIN ITS DEEPLY INGRAINED SECURITY ETHOS.

SO WHAT?

In the serious world of processing systems and platforms, we have traditionally moved at a measured pace. By nature – and necessity – we tend to be control freaks. We're reluctant to establish new interfaces. We're innately suspicious of open platforms. We need to think through and guard against every eventuality.

At the same time, we do see the need to work more collaboratively. We need to work in the same ways and move at the same pace as others in the digital ecosystems. It's a real dilemma – and one that everyone in our industry confronts on a daily basis.

RE-IMAGINING THE VALUE MODEL – WHO GETS REVENUE FOR WHAT?

This is a tricky one... A really tricky one... Arguably it's been the biggest single barrier to the arrival of mass market m-payments propositions.

BY THEIR NATURE, THESE PROPOSITIONS ENTAIL THE INVOLVEMENT OF SEVERAL PARTIES.

The issuer, obviously. Also the mobile network operator. Probably the handset manufacturer. Generally a few trusted third parties for good measure.

But what value, precisely, does each party bring? And what, precisely, should they expect in return?

How should the specifics of the commercial model work? Where should the red lines be drawn? Who, if anyone, should retain ultimate control of the proposition? How about the respective consumer relationships? And how is trust apportioned in this expanded eco-system?

To date, uncertainty about the specifics has had a crippling impact. Let's hope for – and work towards – a more productive and pragmatic approach for the future.

CROWD FUNDING NEW PAYMENT SOLUTIONS

The crowd funding model has worked well enough in the consumer space. So how could it be deployed in a business-to-business context?

COULD WE AT VISA EUROPE RE-THINK OUR TRADITIONAL FUNDING AND DEVELOPMENT MODELS?

Could we perhaps take a proposition to a particular sub-set of our members and ask them to fund its development directly? Or, more controversially, the retail community?

In the past we have done it informally. But, drawing inspiration from the crowd-funding movement, what are the opportunities to take a more formal and explicit approach?



SO, WHAT DO YOU THINK?

I HOPE THIS REPORT WILL PROMPT CONSTRUCTIVE CONVERSATIONS BETWEEN US (VISA EUROPE) AND YOU (OUR MEMBERS AND OUR WIDER STAKEHOLDERS).

AS WE WERE PUTTING IT TOGETHER, I WAS STRUCK BY THREE PARTICULAR IMPLICATIONS:

1 First, I feel that the “Set to Automatic” topic is already upon us. People expect things to “just happen”. Payments will also have to “just happen” (no one ever wakes up with a desire to pay for something). And, to provide the necessary levels of automation and integration, we will need to work with a much wider array of partners. It is simply not realistic to expect our own network to reach out to every consumer in every way and situation. So we must allow others to bridge that gap, add some value of their own, and also take a proportionate share of the spoils - otherwise they will surely create solutions that exclude us.

2 Second, I was left reeling by the ramifications around the big data or extreme accountability angles. Big data won’t respect corporate boundaries, collaboration between enterprises is the distinguishing factor for big data. Many disparate players from many different sectors see data as their salvation. Personally, I take a more measured view. Aside from the privacy and permission issues, I am concerned that the necessary ecosystem is not evolving, and no big ecosystem players are emerging. I am also acutely conscious of the crippling shortage of necessary expertise - data science skills are one thing, but they are precious little use without the business wisdom to inform the insights and the operational prowess to act upon them.

3 Third, from a technology standpoint, I am looking for ways to bridge new cultural divides - not simply between technology and the business, but between new technology, old technology and the business. The skills and attitudes needed to run a bullet-proof, always-on, pan-European processing operation are very different from those needed to build mobile apps and dredge out new analysis. At Visa Europe, as we create our own next generation payment solutions, these are the type of skills and attitudes we are introducing - and integrating them into the more established business has been one of the toughest management challenges of my career.

Overall, I’m incredibly excited by the future and the opportunities presented. At the same time, I’m conscious of the pressures faced by so many incumbent providers. Traditional revenue streams are dwindling, regulation is encroaching, change is accelerating and expectation is escalating. I know the conditions are tough. But, at times like this, almost out of necessity, innovation does tend to flourish.

Adam Banks
Chief Technology Officer & Head of IT
Visa Europe

BUT WHAT DO YOU THINK?

If you have been interested, intrigued – or infuriated – by the content, we would love to talk in more detail.

To continue the conversation, you can contact the Visa Europe technology team directly at futurevision@visa.com

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- Mind Reading is no longer science fiction, IBM Research, December 2012 (<http://ibmresearchnews.blogspot.co.uk/2011/12/mind-reading-is-no-longer-science.html>)
- Siri is described as a built-in "intelligent assistant" that enables Apple iPhone 4S users to speak natural language voice commands in order to operate the smartphone and its apps (<http://www.apple.com/ios/siri/>)
- Wearable technology (also referred to as tech togs, or fashion electronics) relates clothing and accessories such as watches or earrings, incorporating computer and advanced electronic technologies. The designs often incorporate practical functions and features (see <http://www.foxbusiness.com/personal-finance/2013/02/22/whats-driving-wearable-technology/>)
- A Body Area Network is formally defined by the US Institute of Electrical and Electronics Engineers as, "a communication standard optimized for low power devices and operation on, in or around the human body (but not limited to humans) to serve a variety of applications including medical, consumer electronics/personal entertainment and other" [IEEE 802.15]. In more colloquial terms, it is a system of devices in close proximity to a person's body that cooperate for the benefit of the user.
- The self driving car logs more miles on new wheels, Googleblog, August 2012 (<http://googleblog.blogspot.hu/2012/08/the-self-driving-car-logs-more-miles-on.html>)
- Significant rise in children's texting and time spent online, Ofcom press release, October 2012 (<http://media.ofcom.gov.uk/2012/10/23/significant-rise-in-children%E2%80%99s-texting-and-time-spent-online/>)
- Ethiopia children 'master tablet PCs', BBC Today Programme, October 2012 (http://news.bbc.co.uk/today/hi/today/newsid_9765000/9765200.stm)
- Older age groups drive take-up of fixed broadband, The communications market 2011, Ofcom (<http://stakeholders.ofcom.gov.uk/market-data-research/market-data/communications-market-reports/cmr11/telecoms-networks/5.81>)
- The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems, James F Moore, 1996
- Under the terms of the European Union Payment Service Directive, six types of organisation can offer payment services: credit institutions, e-money institutions, payment institutions, post office giro, central banks, and various government organisations. Any company or organisation that falls within these six categories, and which is authorised and supervised as appropriate, can apply to become a member of Visa Europe. Such members can then issue Visa payment products, or offer a Visa acquiring service.
- Kindle ebook sales have overtaken Amazon print sales, says book seller, The Guardian, August 2012 (<http://www.guardian.co.uk/books/2012/aug/06/amazon-kindle-ebook-sales-overtake-print>)

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