

Last Call For

DATAUTOPIA

*... Boarding **Now!***

Four Future Scenarios On The Role of Information and Technology in
Society, Business and Personal Life, **2030**

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Letter from the Editor



Frank Buytendijk,
Research Vice President
Information Innovation
Gartner

What would the impact of "information" and "technology" on society, business and life look like in 2030? With that interesting question, we started the project that became "Datatopia." Why the year 2030? Because it is far away enough to be able to let go of today's reality, and close enough for it to not become like "Star Trek."

Not only is the question interesting, and it does spark creativity, it is also very relevant to business. Undeniably, we are in what you could call a "crisis," in a somewhat alternative definition. Being in a crisis is realizing that the old ways don't work anymore, but the path forward hasn't really unfolded yet. A crisis like this can have many faces: political, economic, social, technological, ecological.

This path forward is moving us to the second half of the Information Age. In the first half, IT was all about automating organizations and business processes. Now, IT is about digitization of a company's products and services. As consumer technologies are impacting business IT, so organizations are using technology to impact the lives of consumers.

These technologies are different from traditional IT topics, such as ERP systems, business intelligence (BI) tools, and application development environments. Gartner speaks of the Nexus of Forces, when we identify the four big technology trends: cloud, mobile, social and information. We talk about the "Nexus" of Forces rather than the "List" of Forces, because these trends don't come separately, they are inextricably linked. Because of the magnitude of their impact, many organizations struggle to imagine a future in which so many things are different. Moreover, CIOs realize that the nexus further affects technology investment cycles. Enterprise architectures and IT infrastructure cannot be written off every time something changes. They need to be ready for technologies that don't even exist today.

As the cliché goes, the future is uncertain. This is where scenario planning comes in. Although we can't predict the future, we can be ready for it. By imagining multiple futures, we can explore what we need to do to prepare for multiple outcomes; and, by understanding which futures we like and which we don't, we choose a course of action that helps create our own future and, who knows, influences the overall future a little as well.

One respondent observed sharply: "Thinking becomes more important than knowing." This is exactly what scenario planning teaches us to do.

But we didn't sit down with a small team, thinking until our heads exploded. Instead, we asked people worldwide to contribute. To write a short essay; no limitations. In other words, we used a crowdsourcing approach.

“Thinking becomes more important than knowing.”

The results have been amazing. An incredibly rich set of narratives, full of creative ideas, exciting storylines and interesting details that a small group of people would never have been able to assemble.

What is the bottom line? Will everything change? Many sketch a world that is pretty different from today. But one person wrote that in order to look into the future, we need to understand the past. "Looking back a similar period of time, we have seen several hypes in information management. What is today's penetration of the information factory, data federation, BI, EIM, SOA, etc.?"

Maybe change is fundamental, maybe not. We do know that drastic change is sometimes triggered by a single event, and things go fast then. The only thing we can do is be ready. What these changes mean for more resilient IT strategies, for new business models, and for competitive advantage is the subject of continued Gartner research, but the essays and a first round of analysis is a good start.

Discuss the scenarios with your colleagues. Stress test your own strategies with them. But most of all, enjoy reading.

The Results

From the analysis two dominant dimensions appeared that allow us to organize the four scenarios that are the outcome of the analysis; these are:

The "connected" versus the "conflicted" world

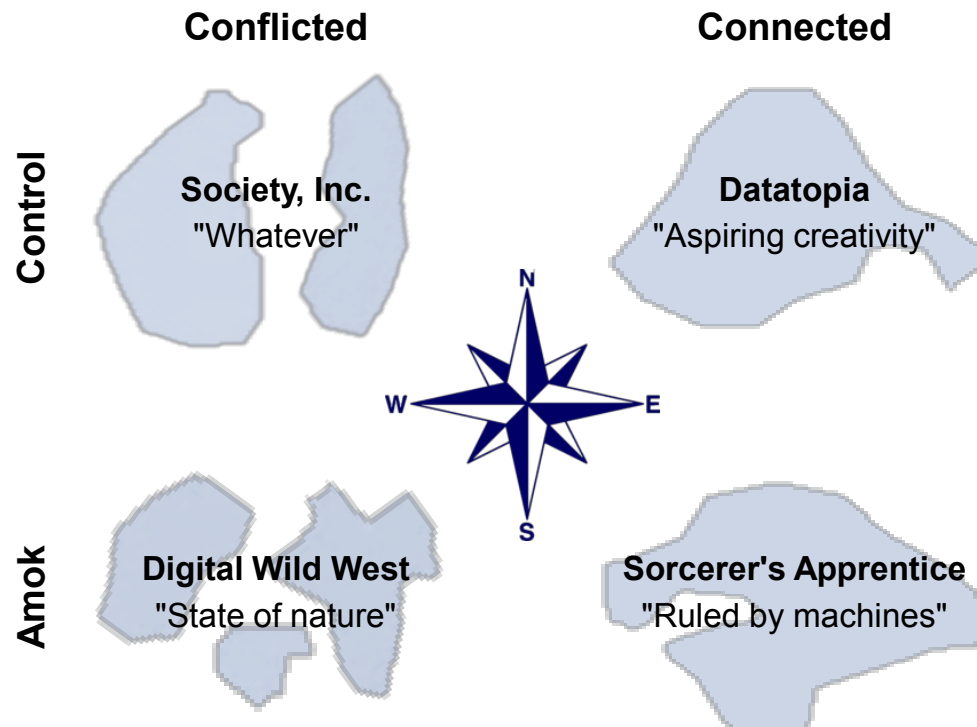
- In the connected world, all kinds of technologies interact with each other. Goals are aligned.
- In the conflicted world, technologies are often used to block other technologies. Goals are conflicting.

The "controlled" versus the "amok" world

- In the controlled world we know what we want technology to do, and make it so.
- When technology runs amok, society does nothing but respond.

This leads to a total of four scenarios (depicted in Figure 1 as islands). Let's consider them in more detail.

Figure 1. The Four Scenarios



Source: Gartner (January 2014)

Society, Inc. (A Controlled and Conflicted World)

In many ways, Society Inc., is an evolution of today's situation — information is power. Big corporations and governments store all the data that they can find and, unlike you, they don't forget. In the end, "big data" knows more about you than you know about yourself. The business model for these corporations is clear, the information is being sold to advertisers, to government agencies, and to all others who are willing to pay for detailed behavioral information.

Since power corrupts, there will be more examples of the abuse of data. In fact, one of our respondents came up with the great term "datator" — a data dictator. Unlike conventional dictatorship, they don't rule a country with certain geographical limits; they rule the worldwide community whose data they possess.

In this future, as has been explored in multiple science fiction novels, a lot of analytics are outsourced to the corporate world. Laws and regulations, imposed after continued scandals, don't allow governments to collect data as much as they would want and have done in the past. However, the need and the desire for information didn't go away; and through the Internet of Things and monitoring mechanisms, it becomes easier and more efficient to simply outsource this task to the commercial world.

“USB sticks and SD cards will be forbidden.”

It also becomes easier to build up targeted profiles. Today, dragnet analytics are needed — collecting as much information as possible to identify interesting customers or citizens. However, as in the real world, unique identification will also emerge online.

Whether this is utopian or dystopian is in the eye of the beholder, but people who are suffering from high cholesterol may find themselves denied certain foods in the supermarket or in restaurants. Analytics rule life. Will there be a moment when a boy and a girl planning to meet each other do more than just a quick Google? Will there be an analytic that suggests to what extent they fit together and how their DNA will produce babies with certain characteristics?

Privacy becomes an outdated concept. Everything is monitored. In one essay, it is suggested that storage mechanisms such as USB sticks and SD cards will be forbidden, because they can't be monitored that easily. All storage *has* to take place in the cloud. At the same time, most people will stop caring altogether for privacy, and will simply accept what is going on — enjoying the benefits while ignoring the downside.

All is not doom and gloom in this scenario. It is very business-oriented, and new ways of organizing a business will evolve: not centralized, not decentralized, but componentized. The "service-oriented organization" will emerge; this is only logical, after a service-oriented architecture and mass customization of products

and services. The next entity to be decomposed is the organization itself. A business becomes nothing but a collection, a configuration of business services. Most of them will be standard; some of them will be unique and exclusive; but it is the configuration of them that makes the difference. This scenario seems a logical continuation of the path we are on: it allows businesses to reconfigure without complex reorganization.

Sorcerer's Apprentice (Connected yet Amok)

Today's situation also resembles the "Sorcerer's Apprentice" scenario, although it is the opposite of Society, Inc. This scenario is called Sorcerer's Apprentice because it is similar to the Disney story, where Mickey Mouse knew the spell for how to bring the brooms to life, but not how to control them. This is the scenario that occurs when technology innovation isn't controlled, when society does nothing but react to what is happening. The Nexus of Forces is very much triggering that situation today.

Everything is connected, that is what makes this scenario so dangerous. As all technologies talk with each other, it is easy to identify people or, in the case of anonymized data, it will be easy to reidentify people. Sorcerer's Apprentice is not a bad world, it's just reactive. Continued scandals highlight what has gone wrong with technology, and then the hole gets plugged.

Sorcerer's Apprentice is also a very entrepreneurial world. It is not ruled by the big corporates, but by small and innovative companies that can easily make a difference. There will be an endless choice of devices, and each device will replace itself within a short time (as well by its next generation). Because all is connected, it is easy to switch or combine devices.

“Personal analytics will play an important role.”

There will be a particular focus here on personal analytics — all kinds of things you can measure about yourself: health, finances, productivity, social contribution, and so forth. Due to the lack of control, what does become more important is having an understanding of what all these devices actually prescribe or suggest. More than data quality, algorithmic quality becomes important.

Does the device have your best interest in mind, or is it pushing someone else's agenda? For instance, if you connect the device that tracks how much you move to a service that helps you diet, are the recommendations based on your health or on the supermarket's newest products? What about the stability of these algorithms — who can change them, and for what purpose?

Is this a futuristic perspective? Not according to one respondent, who wrote "Someone out there is already doing all this; they just haven't been caught yet."

Technology innovation really is the main driver of this scenario. In particular, open source technology and consumer technology. Sorcerer's Apprentice is a continuous possibility in a technology-driven world. Even when we are in control, like in Datatopia, if we let it slip, Sorcerer's Apprentice is the result.

Digital Wild West (Conflicted and Amok)

The Digital Wild West scenario is the result when there are too many scandals in Sorcerer's Apprentice and Society, Inc. There will be public backlash, and technology will start to play a different role — not to connect to everything, but to protect oneself. It is the situation that philosophers describe as the "state of nature," before society established what is called the "social contract." Life is short and brutal, and everyone is on his or her own. The Digital Wild West is the online variation on this theme.

In a way, today's privacy concerns are overcome. Technology will help people to protect themselves. Technology will help "obfuscate" — which means creating lots of noise (misinformation) so that the real signals (interactions, movements) are hard to find. Advanced encryption, currently used in some shady parts of the Internet, might become fashionable. We may be able to create advanced personas that have a digital footprint and a targeted profile instead of us.

"Technology will be a means to protect ourselves."

Surveillance, which is the norm in Society, Inc., and probably also in Sorcerer's Apprentice, is being countered by sousveillance (where activity is recorded by a participant). In one way this is much scarier, because everybody will be monitoring everybody and it's completely uncontrolled. However, another version may appear; that is, that sousveillance will be used to monitor the authorities (who are monitoring us). In this way, technology becomes a force of balance.

In the end (as they say), the more things change, the more they stay the same. In the Digital Wild West scenario it is only a matter of time before technology companies that have always been part of the problem start to offer new services that will help you protect yourself. For this they will charge a fee, nothing less than "protection money."

Business life is not very stable. As customers easily vote with their feet, the life span of companies can be short. One trend and its hype follows the next. New technologies are fashionable for a while and then immediately discarded again. Information, like in most scenarios, is an asset; not because of its value when

shared, but because it increases in value according to its exclusivity. Information is power, and it needs to be protected.

Datatopia (Connected and Controlled)

Most contributions describe a scenario that we call Datatopia. The privacy problems of today are solved and privacy is by design. Multiple respondents come up with the idea of universal identification (UID). Paradoxically almost — how can more identification lead to more privacy? Mostly, because no additional data gathering is needed. In fact, when architected well, identification does not even mean revealing identity; perhaps only, for instance, your coffee preferences. Some speak of identity cards and come up with names such as Taiko or P-Tag (persona tag), others mention biometric identification.

“Privacy will be a part of technology by design.”

Privacy can, furthermore, be achieved through randomly fragmented storage, separated into different parts, in different clouds (rather than centralized storage). Each fragment is meaningless without the others and private keys are used to reintegrate the data.

This scenario is closely connected to a change in the ownership of data. Currently, data is mostly owned by the party measuring it. In Datatopia, the data is owned by the person the data is about. The data is centrally stored, and data owners can decide who gets access and who does not. Every action, of anybody or anything, is seen as an information product and falls under copyright law.

Next to business analytics and personal analytics there will be more planet analytics — analogous to the "people, profit, planet" promise of corporate social responsibility (CSR). There will be smart buildings and smart homes next to smart meters and smart grids. There will be smart parking. Every activity is analytics assisted.

Information will be more broadly available, even more so than today. Facebook and Twitter are no longer the places to be, they are replaced by communities of interest in which information sharing is valued. Current social media have to re-evaluate their business models.

For businesses, the service-oriented organization is as prominent here as in Society, Inc.; though probably in a different form. New and cooperative business models will emerge, in which the borders between partners, suppliers and customers are blurry, if not nonexistent. Think of business to business (B2B) or peer to peer (P2P) lending services for a bank, for instance. Brands will be less dominant, because the value comes from the people that use the products and services — like a referral network.

However, all is not utopian in this scenario. One respondent, from Botswana, comments on how in today's situation social norms already change. In Botswanan culture, there is a set procedure for bringing important (and bad) news. News travels via the elderly family members, through the family hierarchy, to show respect and compassion to all affected. With all social media and mobile technology, this tradition is hard to sustain. Communication, and culture as a natural consequence, globalizes toward an egalitarian structure. If everyone has the same access to the same information, communication, understanding and relationships change.

Looking at what triggers Datatopia, it becomes clear that Datatopia is not an automatic result. More regulation isn't going to help; it will make corporations more careful and risk averse, and it leads to more Society, Inc. In fact, there are many opposing forces, such as power and consumer backlash after scandals. Technology innovation is, in itself, continuous, but that isn't a driving force to reach a world in which we have control over the technology we use.

Leadership might be a road to Datatopia — a few powerful people in Society, Inc., who decide they want the world in which they live to look different. But a bottom-up approach is more likely — people in Sorcerer's Apprentice who start to use technology to control technology. They communicate, correct where things are about to go wrong, and take a community approach to control. In this way, technology is becoming a social source; not based on rules, but based on behavior and transparency.

All Scenarios

A few topics were mentioned regularly in all the essays that work across all scenarios. No matter what, you can prepare for them.

Continued Technology Evolution

Whether it is in competing ecosystems or not, the Internet of Things will become a reality. Storage capacity, processing power and integration capabilities will all increase. Costs will continue to go down, but analytics will still be subject to huge investments. In the end, old technologies never die; data archiving will become "hot" again, developing new ways to access old media, for longitudinal analysis.

Cybercrime

Today, hackers are focused on getting passwords in order to gain access to systems. The next step is that hackers will try to gain access to datasets, and change them. This is much more dangerous than hacking systems, because it is not so obvious: you will get different recommendations; will not be contacted for a job, someone else will; will not get certain insurance; will be selected for "random

security checks" at the airport (or not), and so forth. There is certainly a market for it.

The step after that is also clear, the only question is "when." Once technology routinely gets integrated into the body, hackers will start hacking people — influencing your pacemaker, or your Quantified Self readings.

Smart Machines Will Emerge, and Data Gets an "Attitude"

Smart assistants will monitor what you see, and will keep you posted. The killer app, according to multiple contributors, is shopping lists. All human-machine interaction will become personalized, adaptive and intelligent in some way. Remember Microsoft's animated paper clip? Something like that, just much more connected and much smarter.

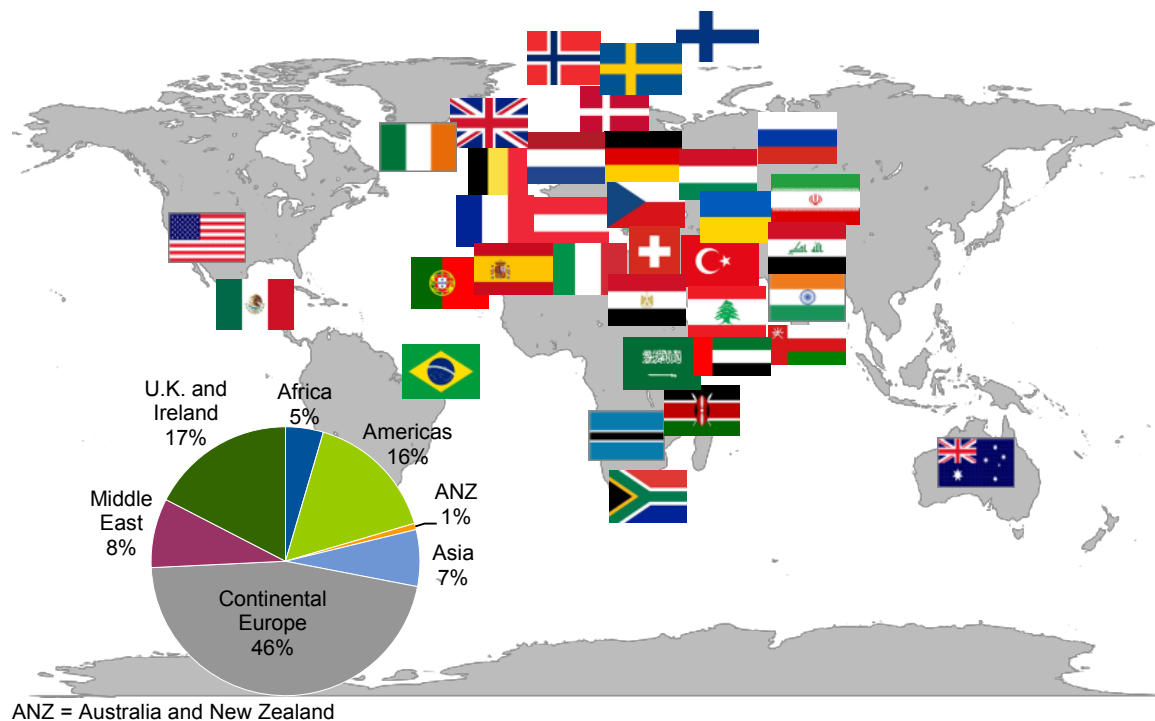
Data becomes active: it finds you, instead of sitting in a database waiting to be queried. Data will become self-aware (finds its own context and meaning), self-organizing, self-describing, and self-protecting. Data will behave autonomously, based on external triggers, and the more data is used, the more metadata is collected and the smarter the data becomes — about itself, and about other potential uses.

The question is, what goals will smart machines pursue? In Society, Inc., the technology services large enterprises, selling more products and services to customers. In Sorcerer's Apprentice, it does all kinds of things based on a million good ideas. In Digital Wild West the main purpose of smart machines is to protect us. And in Datatopia, smart assistants are there to take away routine work so that people can focus on the more creative tasks.

The Background

The project ended with a total of 132 respondents, of which about 60 gave significant input, some anonymously. The results came from all over the world (see Figure 2).

Figure 2. Geographical Distribution of Contributors



Source: Gartner (January 2014)

Unsurprisingly, many people concentrated on similar themes. Figure 3 provides a small word cloud of the most commonly used terms or concepts described.

From a societal point of view, "privacy" was one of the most mentioned themes. Most people suggested privacy issues would be solved, and came up with multiple solutions. Others, fewer, suggested that privacy would be a thing of the past.

On the business side, "information is an asset" was the most common theme. Information is the source of competitive advantage in most new business models, and leads to new revenue streams. It is also an asset for consumers; instead of giving away information, multiple respondents suggested that consumers will start charging for access to their information.

On the people side, it is no surprise that "healthcare" and the "quantified self" was a major theme, as was the emergence of smart machines. The biggest surprise,

though, was the universal agreement on the killer app for smart machines — creating and managing shopping lists!

Figure 3. The Word Cloud



Source: Gartner (January 2014)

From all the essays, we derived the underlying assumptions: What it was that the respondents were really suggesting. What would develop? What would change? What would stop? We grouped these as utopian or dystopian and generalized them. We also grouped all assumptions in different categories: economical, business, social and technological (as a variation on the well-known PEST analysis; that is, political, economical, social, technological), as shown in Table 1.

Table 1. Grouping of Assumptions

Category	Utopian	Dystopian
Economical	<ul style="list-style-type: none"> U1: Economy will bounce back 	<ul style="list-style-type: none"> D1: Recession is the new normal
Business	<ul style="list-style-type: none"> U2: Information is an asset U3: All information will be free and is open U4: The service-oriented organization will emerge U5: Data ownership moves from the business to the consumer or citizen U6: Everything is personalized U7: Successful projects with a clear top-down engagement 	<ul style="list-style-type: none"> D2: Information = Power

Category	Utopian	Dystopian
	<ul style="list-style-type: none"> U8: Analytics of external information will be, and remain, an outsourced activity 	
Social	<ul style="list-style-type: none"> U9: Privacy concerns will be overcome U10: Monitoring becomes the norm U11: Unified identification will be the norm U12: Next to business analytics, there will be personal analytics and planet analytics U13: People will focus on creativity, and not be ruled by machines 	<ul style="list-style-type: none"> D3: "Privacy" will become an outdated concept D4: Monitoring becomes the norm D5: Unified identification will be the norm D6: Analytics-based decisions rule life D7: Cybercrime changes; from hacking systems, to hacking data, to hacking people D8: Connected society will redefine social norms
Technological	<ul style="list-style-type: none"> U14: Data gets an "attitude," with semantic technology U15: Smart machines will emerge U16: Continued technology evolution 	

Categories are a variation on the well-known PEST analysis; that is, political, economical, social, technological.

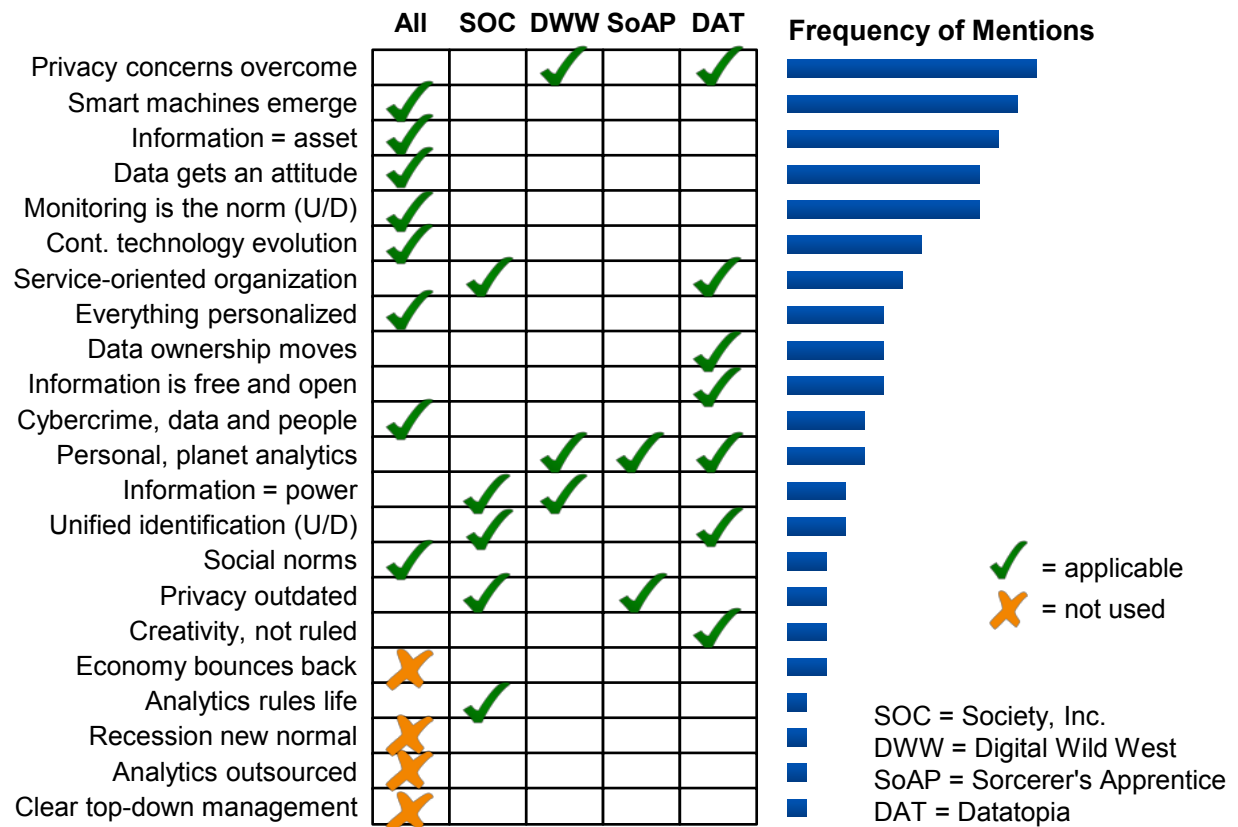
Source: Gartner (January 2014)

As mentioned before, two dominant dimensions emerged from all assumptions. This creates a two-by-two matrix that houses a total of four scenarios (see Figure 1):

- Society, Inc.
- Sorcerer's Apprentice
- Digital Wild West
- Datatopia

Figure 4 describes which scenarios the assumptions map to, whether they map to all scenarios, or whether we chose not to use them. The figure also contains the frequency with which each assumption was mentioned.

Figure 4. Mapping Assumptions to Scenarios



Source: Gartner (January 2014)

The Contributions

Each of the essays is tagged with the assumptions that apply. But the essays are listed in random order. To find all underlying information, use the search function to look for the code of the relevant assumption.

The following contributions do not represent Gartner research. They are the responsibility of the individual authors who contributed to the project. The contributions are unedited.

Mady Korada, U.K.

Assumptions:

- U2: Information is an asset

Information drives today's economy. The future will be led by information-driven companies. Titans of yesteryears will have to adapt and avoid an ostrich response to the growing importance of the information asset. So how do companies understand this new world order? Just as food is grown, data is created, managed, harvested and eventually delivered to the end user. This model works as much today as it will do in decades to come. Understanding where your strengths and weaknesses lie will help you plan for your future.

The data economy will classify all enterprises into these 4 categories(chain).

- Data Creator: People, Machines, Events
- Data Gatherer: Sensors, Interaction/Activities, Social Media
- Data Harvester: Banks, Telecoms, Super Markets
- Data Provider: Search Engines, Devices, Payments

Data creators include humans, machines and gadgets that capture interactions. Creators are able to monetise the little data they control and produce for the gatherers.

Cash-back companies, affiliate marketing and deal aggregators are already working directly with creators to gather valuable data.

Data gatherers are providing platforms for creators to store and share their interactions, usually free. The transactional information is used to sell services. Slick targeted marketing campaigns allow products and services to be sold at a very low customer acquisition cost.

Data harvesters are collecting vast amounts of valuable information from their customers. This helps them to continue selling efficiently to their customer base and acquire new ones. They are dependent on the search providers for directing customers to them, only a well-known brand amongst their customer base can escape this.

Information providers that have collected data, ensure its quality, content, structure and relevance, usually on a global scale. This makes the information attractive and everyone below the chain is dependent on them to drive customers and eyeballs.

Creators produce data that has lower value and transactions but is higher in transaction detail; unlike data providers who have higher value and transactions but are lower in detail. The tradeoff will be crucial to creating services and products that can be positioned to maximise the return on the data. Brokers, aggregators or collaborators

will add value and even bypass someone higher up the chain.

Agile companies will wise up to this threat and move into this space themselves or help fund collaborators for the common good. Products and services can be created at all levels by individuals and companies; some currently straddle multiple categories. The higher up the chain more value is created, which is reflected in their valuations. Every step of this chain can be monetised, the scale and penetration will be crucial to the success.

Every organization must move higher up this chain to grow or even just to protect its customers. Social media have gathered enough personal information about all of us and have started to offer searchable sets of potential customers to businesses. They are moving into the data provider space to secure their flow of paying customers.

Deal aggregators have pushed out the data gathering, only collecting customer information from the kind of services/products they purchase. Deal aggregator is operating with very little risk, getting the businesses to subsidise data gathering to which they will sell other such services.

Internet retailers are moving from being just a harvester to being a provider. They are providing a one stop shop for all such products, services and the opportunity for other harvesters to sell on their own platform. Providing competitor product information has enabled them to take a cut of such transactions, which they would have normally missed out on. They are trying to control the whole ecosystem with new cheap and subsidised devices to lead their customers straight to their inbuilt stores. They have just engaged will all the four types in a single model.

Today, a social media platform (gatherer) is allowing a car company (harvester) to provide a suitable product (car) based on their online interactions. The information provider (search engine) enables this product to be found and purchased by the customers. Every type is important for this data economy to work. Harvester and providers are the ones who can and need to employ the sexy data scientist!

The future belongs to the agile companies that understand data, its value and put it to the best use. Do you understand where you are in this new age data economy, do you possess the ability to understand your threats and opportunities before they come knocking on your door? Get a handle before they take you in their stride.

Lisbeth Gdalia Chapon, Switzerland

Assumptions:

- U2: Information is an asset

Business is finally realizing data is a company asset. Master Data has a seat at the board. Data value is included in the balance sheet as is any intangible asset. Master data roles and position are created and the master data organization is a new dimension as global processes and functions. Clean data is a competitive advantage and master data is part of due diligence in case of merger and acquisition. The fact that data has a value has a huge impact on the day-to-day Web life. Twitter, Facebook are no longer the way of free sharing of data and information as it has a value This is replaced by communities of interest willing to share an asset and to negotiate the market price of consumer information. Companies like Google have to review, create a new business model. In parallel initiatives, as Wikipedia is growing.

**Alex Brojba-Micu & Dennis Groot,
KPN Consulting, The Netherlands**

Assumptions:

- U14: Data gets an "attitude" with semantic technology
- U15: Smart machines will emerge

Information has always played a pivotal role within our society, culminating in the current Information Age (primarily enabled by the digital revolution of the past decades). Daily we are presented with new technological breakthroughs, which re-shape our paradigms regarding the distribution and usability of information. Technical limits are continuously challenged by new ideas, resulting in a rat-race between traditional content providers and technological solutions (and the positive added bonus of new content channels). For example, whereas in 2000 a mobile was primarily used for calling and messaging (and the subscription was focused on minutes and number of messages), in 2015 the smartphone provides a multitude of information sources (and subscriptions usually start with the data specifics).

If the current trends keep evolving, slowly but surely, we can start to distinguish two major concepts, with the focus around connectivity. On one side we have the progress of Internet (including such trends as cloud, Internet of Things, etc.), a medium which will keep evolving into an all surrounding logical distribution channel, governed by standards and translation layers.

The second concept revolves around devices, which at some point will evolve into complete and full sense stimulation machines. Starting with progression of the current sound and sight capabilities, soon

we will also be able to touch, smell and taste. 3D printing should also receive a special mention because of the endless consumer possibilities.

The implications are numerous; however, we will try to capture the most important one. Sense stimulation (e.g., traditional screens, Google Glass, paper computer screens, functional holographic projections, virtual reality masks, etc.) devices will be decoupled from computation. Technical specifications will revolve around the degree of stimulus, and not around storage space and number of processor cores. Computation will become abstract and be available on demand per required functionality (ubiquitous computing).

As the boundaries of computation and connectivity become limitless, data and information can start with the true revolution regarding our daily lives. Whereas currently we are primarily pulling information from various sources (select what to read in the news section, choose a radio station, read our calendar to determine where we should be next, scan our emails for importance, etc.), in the future most of our daily activities are pushed upon us based on complicated user models and artificial intelligence algorithms (primarily focused on user-centric content) and we are always connected. Your device will automatically close your current activity and prepare you for your next appointment; your TV will choose the appropriate channel when started; your car will make a stop for fuel; your rain jacket will be available on certain rainy days; multivitamin food is automatically ordered and available in the house because of a possible flu outbreak. You want to get some work done on your holiday? Too bad, it is not in your best interest. Data just got an "attitude."

And do we mind? That's up to us.

Ian James, England

Assumptions:

- U9: Privacy concerns will be overcome

I'm imagining the future where healthcare is beginning to be transformed from the disjointed present where a patient has to relay his story again and again to numerous professionals, to the holy grail of a full Electronic Health Record stored in the cloud, but accessed through the iris scanner or the fingerprint reader, or even the embedded chip or barcode on his neck.

When Mohammed the patient arrives at A&E, confused and weak from the heart attack he has just had, his record is immediately accessed by the waiting nurse. The nurse can see that he is allergic to penicillin, that he has had a bypass two years ago, that his GP is Mr Downs at the Sycamore Road Surgery, and that Sarah is his next of kin. Consent for this information has already been given during the opt-out process whereby the public were encouraged to allow their information to be accessed by any licensed health professional in the U.K.

The cardiac surgeon was not surprised to be treating Mohammed — the NHS organisation, that was beginning to extrapolate trends from the realms of data that had been collected from hospitals, had briefed his team on a growing trend for this condition in their area among this age-group, and had stationed a team at the hospital to combat it. In addition the exercise program and diet that the GP had uploaded to Mohammed's smart watch had also recorded some gaps in his efforts of late. The watch indicated a recent peaking of Mohammed's blood pressure, so perhaps the patient could have presented sooner.

Is this surrender of our personal information, medical history, habits and relations an abuse of human privacy? Perhaps. Does it support the professionals and agencies in their attempts to treat our illnesses and make us better? Definitely. Does the recording of our lifestyles and our habits educate us on how to live healthier lives, or is it an intrusive step too far? I think the former. If we take a big step back and look at the culture and values of the majority of the people in the world, then we should see that all these developments are for the best intentions. There will always be potential abuses but the use and interpretation of this data is primarily positive.

Rune Espelid, Norway

Assumptions:

- U2: Information is an asset
- U4: The service-oriented organization will emerge
- U9: Privacy concerns will be overcome

On the business side we will see two strong forces that in a certain manner will balance each other. Firstly, the primary objective of earning money will drive competition and increased utilization of all possible means of cost reduction, which drags process standardization and automation, and utilization of global market strongly into the strategies. On the other side, the companies need to protect themselves and their assets, and comply with authority requirements — which will kill many enthusiastic ideas and keep the development of the business model within some safe limits, slowing down the speed of change.

Ten to 15 years is not far ahead. Looking back a similar amount of time, we have

seen several hyped trends within information management, but what actually is the penetration of, for example, the Information Factory, information federation, business intelligence, enterprise information management, enterprise architecture, SOA, etc., etc.?

Anyhow, my opinion is that the development will take us to a situation where we see today's hurdles and inconveniences, related to computer based information handling, overcome. The relevant information will be properly received, categorized, secured, found, shared, utilized, and eventually disposed of. These nice terms and policies of today will become the track on which the future company operates.

Having this in place we see the following business model dominating the scene. A company (a business) is seen as a complex service, built up by a set of sub-services. Services are designed to execute business processes at all levels. The global marketplace will offer all standard services required to run a business, capable of delivering anywhere at any time, and our company will utilize it and pay per use. A few services have to be built and maintained internally, those giving the company its uniqueness and competitive advantage. In the company's balance sheet the value of the company-owned information asset is appearing with significant figures. All information management processes are governed from top management dedicated to increase the asset value. The basis for this situation is that all information coming into the company, or being created internally, is properly categorized, tagged and adequately secured.

The availability of information is almost unlimited internally and externally. The key issue is to take advantage of it, by identifying/creating the valuable information

and making it operational. The company thus has clear categories of information according to their function. We identify the following categories with increased importance:

- The business configuration data — This is the complete set of master data, reference data and configuration parameters that in total defines the company itself: who they are, what assets they own, what services they deliver, products, equipment, customers, employees, etc, etc. This data defines the complete context of the company, into which all information is classified. If the information is not defined in this context, it is of no value, it actually does not exist. This context defines the interface between the company and the outside world, configures execution of processes/services and all types of production and reporting.
- Then the categories of transactional data, which documents all service execution, and the monitoring information, which documents both business status and the status of the environment around the company's service execution. This data is providing necessary evidence to protect the company in occasions that might occur, and demonstrating compliance to regulations.
- A category of information that will soon achieve a high value in the information asset are the models, the computer models describing real world assets or phenomenon, or processes/services/etc. These models can deliver descriptions of real world situations, simulate and forecast and, on the virtual side, a

model can be the complete computer specification of executing an HR process according to authority and company requirements. If you own a model, you can execute a service, and you have a business.

The business model described above with a high degree of global standardization and automation forces people to climb on the competence ladder to get jobs, and fewer people will be needed to run traditional businesses. Corporate dependencies on local resources strongly reduced. This will draw in the direction of a society divided into classes with big differences. However, the formation of society depends not only on the business trends, but also on the political and ethical forces. The latter must take responsibility in leading into a better world for everybody.

Richard Corbridge, National Institute for Health Research CRN, U.K.

Assumptions:

- U3: All information will be for free and is open
- U10: Monitoring becomes the norm

"Data in clinical research? You mean information and insight don't you?" yelled the latest participant in the clinical trial we have established to consider the impact of a new drug on hearing problems brought about by the loud music available to the teenagers of the 2020s.

Information gathering is now so much easier than 17 years ago. Here in 2030, the trials of 2013 are just delivering the drugs they were considering into man, whereas now, with the access to real-time data and the mobilisation of patient access to information

and the enablement of the clinical trial participant through the implementation of truly mobile data systems, new drugs are available to man in less than half that time. Information is no longer the longest pole in the tent!

Let me explain. We now have a global standard recognised across all government and life-sciences industries for the sharing of information and the collaborative recruitment of patients. If a scientist in Boston, U.S. needs a participant with a rare disease and a set of criteria that are complex, the scientist is able to place that call for participants within the information system, asking for a patient globally to come forward to take part in the clinical trial. The scientist in Boston, U.S. can easily recruit a patient from Barnsley, England. The additional difference is that now all clinical trial information is now truly open and participants are far more willing to put themselves forward, not just for the good of mankind but often, due to the reduction in the time drugs take from bench to man, for the good of themselves.

So that's information systems aiding recruitment and opening up the data. The actual collection of data is now also resolved, not always on a global scale but far more opportunities are in place. With the advent of the truly electronic healthcare records across care settings came the ability to access real-time data about a patient in a clinical trial. With the new anonymisation capabilities within these systems, the life-sciences companies and academic researchers are able to track any patient episode through the clinical system, knowing exactly the impact of illness on trials and understanding efficacy of drugs in a trial.

Gone are the days of drug recall or long replayed clinical trials. The volumes of participants can also be much higher as the

information systems to gather critical information are automated directly from the clinical system of each country taking part. It is therefore easier to have large numbers of participants utilising access to real world data and then, through the open agreements between companies, there is far less running of the same trial with a different colour label on the drug, as companies are able and willing and public opinion has 'facilitated' them in the sharing their information.

For the participant, the most exciting information-enabled change though has to be the collection of information itself. When they first became available, solutions to monitor the health of the person were marketed to the worried well: systems to enable a person to track their own sleep patterns, heart rate and insulin levels. These systems have been significantly developed over the last 17 years and they are now part of modern day life. The ability to monitor key health indicators from the clothes we wear is common practice. To have the ability to update simple patient logs through items that the participant wears or uses all the time has had two key impacts, the number of willing participants for clinical trials has increased as taking part in a trial is no longer intrusive on the daily life and taking part in a trial can often provide access to the latest "toys" for communicating health scenarios and clinical outcomes.

All in all the impact of the modern information system on the ability to make new discoveries that make people well and keep them fit and healthy has been staggering. The life-science system now recruits patients in the volumes they require at the speed they need to. The transparency and openness of the information they gather has increased the public perception of clinical trials and the drug companies and

has reduced the repetition of clinical trials significantly. Empowering patients through access to systems that enable them to monitor and evaluate their status in a clinical trial has further enabled opportunities for real-time data and the ability to trace the efficacy of new drugs beyond the older phase trial approach.

Nino Lancette, Cinafidès Consulting & Technology, U.S.

Assumptions:

- U5: Data ownership moves from the business to the consumer or citizen
- U9: Privacy concerns will be overcome

It's October 9th, 2028, 8.10 a.m. You walk into your local coffee bar for a cup of espresso. You order at the door with a swipe of your watch against a small glass display. You walk straight to the collection counter and with another casual flick of the wrist you pay for your double-shot organic soy latte. You walk without having spoken a single word to anyone. You start to wonder "oh, how things have changed since 2013..."

Back in 2013, people still led two lives. There was a 'real' life and a not-so-real online life. Back then people kept separate personalities for their virtual life. The Great Convergence was already under way but, in 2013, most people were still reluctant to give up the perks afforded by online anonymity. Eventually, the desire for a better quality of life prevailed and today, no one talks of online profiles. There is only one life and one identity merged into a single persona that exists in rich, complex and ubiquitous digital environments.

The unified persona flourished on the back of an explosion in data technologies that started early this century. Back then, companies, governments and people grappled to understand the power of 'Big Data' analytics. But large-scale data harvesting had already started capturing every aspect of people's lives, from how they spent money to what movies they watched and where they worked. Now, data harvesting is pervasive: persona data is collected from dozens of touchpoints every day, 24 hours a day. Today, the recorded history of someone's habits, movements and decisions is what makes up their unique persona.

The Great Convergence towards the single persona gave rise to massive Persona Companies (PCs) whose primary role was to collect, safeguard and process persona data. Today, these companies are the guardians of this data: they collect and store everything from banking transactions to medical records. People encourage these companies to collect intimate data about how they live. The more data that is harvested the better the quality of life people can enjoy. Persona data determines one's access to a range of personalised products and services, from personal computing to banking to healthcare services.

These developments have made PCs very powerful in today's society. People buy a latte or a new car with a swipe of a Persona Tag (p-Tag), a single digital key linked to an individual's official persona. Swiping a p-Tag doesn't share your private data with the terminal. Instead, a query is sent to your PC about a level of personalisation. Like at the coffee shop this morning: swiping your p-Tag resulted in the PC telling the barista to make a double-shot organic soy latte with one sugar. At no point did the query reveal

to the barista who you are; your privacy was respected at all times.

Absolute privacy in 2028 comes at a high price: the loss of personalisation. Citizens who withhold their p-Tag become marginalised consumers who are denied access to certain products or services, even essentials like healthcare. In the era of the unified persona, banks refuse to open accounts for individuals without valid p-Tags. Insurance companies, schools and even hospitals decline service on the basis of one's unified persona. Telecommunication companies don't sign up customers without p-Tags because their devices simply cannot be sold 'as is', uncustomised.

In 2028, nothing comes as standard anymore. Businesses access PCs' APIs to deliver fully personalised products. However, such customisation is most powerful and controversial in sectors that still rely on human interactions for positive outcomes. Healthcare, education and law enforcement are arenas where data technologies are making the most significant impact. In hospitals and schools, PCs optimise human relationships. In hospitals, they match surgeons, doctors and nurses to patients in order to maximise positive health outcomes. Matching is made based on Persona Interaction and Compatibility Algorithms (PICAs). PICAs are complex formulas that predict an outcome based on people's experiences, preferences, history, habits, skills and connections with other personas. In schools, PCs process admissions, schedule classes and even optimise class composition to create the best possible learning outcome for students and the school. In law enforcement, tactical response teams are rostered based on each member's persona data. Officers are

partnered and assigned cases based on the PICA coefficient computed in real time.

The positive outcomes earned PICA the approval of the masses but several groups are worried about dangerous side-effects: engineered bias and systemic social engineering. The civil rights movement has become wary of built-in biases against certain groups. In the era of the unified persona, banks systematically refuse service to certain groups deemed 'high risk-low profitability' based on non-financial considerations. PCs inadvertently limit university seats for students on the basis of their reading, sporting and entertainment habits. Hospitals develop 'ghetto-wards' where patients receive sub-standard treatment because of the calculated high chance of relapse. Unfortunately, in a world where data is the new currency, optimisation of outcome leads to systematic marginalisation. This is the price to pay for a better standard of living.

Jonathan Nicholas, Switzerland

Assumptions:

- D4: Monitoring becomes the norm

An essay about 2034 — 50 years after 1984. In respect and homage to George Orwell who wrote the classic, nightmare view of the future. His did not come true. I hope this does not.

Winston Smith stepped out of his front door. As he walked down the street he looked over his shoulder to make sure he was being watched. The CCTV camera blinked reassuringly. He was on his way to the school where he worked as a teacher. You couldn't hide in secret these days; that would invite the knock on the door from the Police. You had to hide in the open.

He used to be a publisher back in the good old days of the New Millennium, when information technology was new but still not obligatory. You could read a book in public then. Now books and newspapers were banned, of course for "environmental" reasons; to save the trees. In the 2000s you could use a phone, but you could always turn it off. Now you had to carry your Raspberry with you at all times. And it was tracking him as he walked the few blocks to school.

He arrived in the classroom; some children were already there. One slight advantage of these times, he thought rather bitterly, was that the children did arrive on time. If they were late the system sent messages to their parents, and if they were late repeatedly the parents lost credits. And they would never forget their Raspberries.

The Raspberry was your constant companion. It was a phone, a tablet and a writing and reading machine although the voice recognition was so good that no-one actually wrote any more they just spoke into it. The latest ones could lip read which was a great improvement as you did not have to listen to everyone talking. It was also an electronic book; you could read and comment on every book ever written. The only price to pay was that the government knew what you were reading, and your comments.

Winston Smith left his behind once and as soon as he got back home a policeman knocked on his door. Luckily he had witnesses to say that he had done nothing but buy cigarettes. Cigarettes were still legal, as most drugs. As there was hardly any black market, the government had the monopoly on all sources of pleasure.

In the first years of his working life people had a lot of freedom, even if they did not appreciate it. The intelligence services

gathered information about criminals and innocent people, but they were not very good at it. They were so inefficient that eventually all that they did became public, leaked by one of the thousand "system administrators." There was so much of a public reaction that in 2014 the government intelligence services were shut down completely.

This was the time that Raspberry was founded. It came from the merger of the biggest software company, search engine, telecoms provider and biggest phone manufacturer. They bought the government data centres and soon became "big data" itself. They were contracted by the government to provide intelligence services. So everything you did, wrote or said went into their data centres, as well as everywhere you went.

Winston Smith knew he just had to live a normal life. He had to spend just what he earned, as since cash was finally abolished in 2030 the government could follow every financial transaction that anyone made, except for Bitcoin which somehow survived.

When he arrived home, he put on the television, placed his Raspberry near it and got out his most treasured possession, an old laptop. He loved the feel of his fingers tapping on the keyboard, but most of all he loved the fact that it was connected to nothing. No-one knew he was using it, and no-one could read what he did. The results of his work, a book he was editing, could be stored on an SD card, an illegal storage medium from 20 years ago. This was the only way you could communicate in private. You could not send an encrypted mail, that would get a knock on the door as soon as you hit the send button.

Winston Smith finished his work, and copied the results to the card. Shortly he would walk to a nearby bar where he could give it

to a friend, who ran a clandestine printing press selling books for Bitcoins. He stroked the logo on the laptop — HP — who were they? Some poor company that did not get involved in Raspberry and just disappeared. He closed the laptop and then heard a loud knocking at the door.

Karla Viglasky, eLogic Group, U.S.

Assumptions:

- U14: Data gets an "attitude" with semantic technology
- U15: Smart machines will emerge
- D7: Cybercrime changes; from hacking systems, to hacking data, to hacking people

Information at the speed of thought! In the future — 10 to 15 years out — I think the information architecture and capabilities we know today will evolve and eventually merge with the ultimate computer, the human brain. There is a delay from when we think of something, to when we write it down or type it in email. Think about what it would be like if we no longer needed devices. Merging outside information with that already in our heads will increase speed and efficiency of both our personal and business lives.

Scenario 1: Grocery Shopping! Something everybody does — some use lists, some use an iPhone app, some just have a great memory — but what about things you don't know you need? I could see a smart technology that tracks your purchases, your consumption patterns, and your memory/observations and translates all of that into a smart grocery store where as you walk through the store the different foods highlight based on what you need or what you might be out of due to past

consumption. If you saw an almost empty milk carton in the fridge this morning, no need to write it down, the computer will remember this and will highlight milk when you get close to it. If you have been looking up information on a certain diet like gluten-free, the computer will highlight foods that are gluten free as you walk around. If you try them, this will be logged as an observation, if you don't this will also be logged.

All of this information is your own personal big data in your head. No need to log what you buy and consume, no need to make lists, no more forgetting that you needed milk! As many of us "shop hungry" from time to time (at least I do) — this will also allow you to browse around and if you see something interesting, you can ask for suggestions on other types of food like it and it will direct you to that place in the store. And here's the best part — no more multiple devices!

Everything is in your head now — merging the human brain with a sensor of some sort to combine the two so you become your own infrastructure. To be able to see answers to your questions, or to see what you might have missed, all you need to do is look at a clear piece of glass — probably charged so it will connect to you/recognize you when you look at it — that will then project what is in your brain. There can be many multiple sizes, but no more different operating systems — you are your own OS, your own app, your own computer! We can ask questions and the combination of our experience, personal knowledge, and world data combine to bring us the answer.

Scenario 2: The workplace! Efficiency will be significantly increased with this capability, folks at work will be able to access data and the computer will suggest data based on personal observations. If you have a question during a presentation, you

can ask the presenter or "Google" it and get an answer without even sneaking your smartphone under the table.

This will also make competing for talent fierce — the ability to do this will be a combination of technology and the employee's knowledge, IQ, and experience — so employees will be able to use their full intelligence to gain understanding. And those typically random thoughts we have throughout the day can be logged and that potential can now be tapped. So it could also trigger a new dawn of unconstrained innovation! Think of all the random ideas out there that never get tapped or pursued — marrying big data with human creativity could significantly improve our ability to innovate.

The potential downfalls to these scenarios could be privacy related — hacking a person could be extremely damaging both emotionally and physically. It could also be complete data overload, so it might not be for the faint of heart to use this capability. And then there is the creepy factor to consider — could this turn us into more cyborg than human? Where is the line? Do we run the risk of losing our humanity by retreating into a world of data without emotion? That's an ethical question to be pondered in depth! I personally believe that with the right governance/policies, security, and guidelines in place, this could be life changing. The downside is always that people would use this capability for evil instead of good, so the restrictions and rules would have to be really thought out ahead of time. But just like how parents balance video game time with outside play for their kids — we would have to find our own balance to keep the human side, but I believe our lives would be significantly better with the added knowledge and efficiency!

Jan Willem Ebbinge, The Netherlands

Assumptions:

- U4: The service-oriented organization will emerge
- U5: Data ownership moves from the business to the consumer or citizen

The Purpose Era 10-15 years from now, many of the brands we currently know will no longer exist. They will have been replaced with completely new brands, not yet known today. We are on the brink of an exciting decade, in which a complete shift in power will take place from supply to demand.

Ten to 15 years from now, we will look back at our current times pityingly. How organizations stubbornly adhered to their outdated business models, how consumers and citizens allowed themselves to be patronized by institutions while they were holding all the trump cards. And how we persisted in the irrelevant distinction between consumers and citizens. Boy, those must have been frustrating days! Analysts will disagree passionately about what triggered the power shift, thus fueling a multitude of interesting Gartner conventions (yes, Gartner will remain ;-)). The technocrats will credit it to social media and big data, others will declare the people's boost in self-consciousness as the prime driver for what happened. But what everyone will agree upon, is that it started with a complete innovation of the journalistic principle.

Trust had fallen to an all-time low in every corner of society around the world. Financial organizations had brought the world economy to near collapse, governments had outsourced practically all their knowledge and had fallen victim to populism, damaging their prime assignment

to provide the moral guardrails for development and the infrastructures for advancement.

Frustrated with journalism which, hampered by commercial objectives, had failed to timely debunk institutional propaganda, people had started asking questions to companies and public organizations themselves, through social media. Many of the answers they got were half true at best, and the awareness among the people had grown that they were not taken seriously. Some of them realized, however, that the people had quite a powerful position: they had the money to buy products and the vote to elect their political leaders. In other words: they had an interesting offer to the commercial and political markets.

So they united. Not to bargain for low prices on the basis of volume, but to aggregate common needs and values, and to advertise their value-enhanced purchasing power to the markets. One of the first issues that was addressed in this way was education. A group of people had aggregated their collective wish for better education and had invited commercial and political parties to meet their wish.

At first, organizations had not responded, there had even been bewildered reactions that this was irresponsible and dangerous. But it didn't take long for, I think it was, a shoe brand to state that it would invest a fixed percentage of its turnover in new inventories for primary schools. The people had responded immediately and the shoe brand had quickly outperformed its competitors gloriously. This success had triggered a boost in dialogue between traditional organizations and a fast growing number of consumer collectives with illustrious names like 'We The People', 'World Peace' and 'Purpose before Profit'. A court sentence initiated by 'Purpose before Profit,' which ruled that any information

would be the property of the producer of that information, had empowered the consumer collectives even more.

Any action of anything or anybody was now regarded as an information product and hence protected by copyright law. If you wanted to use such information, you would have to ask permission for it or buy it. The consumer collectives were all about information and knowledge, so they had invested in knowledge aggregation heavily from the beginning. Traditional organizations had not seen the necessity to do so for too long, and they were about to pay the price.

First, banks and insurance companies started to disappear. In no time, the collectives had developed their own insurance and credit facilities, and they had completely taken over the payments infrastructure, which they also used for financing: a small amount of every payment their members made was donated to the collective to finance their operations. Soon after that, the collectives had proven to be such relevant and people-centric brands, that most of the traditional brands were degraded to white-label suppliers. Around 2025, economies had become completely purpose driven, instead of growth or profit driven. Healthcare, education, public welfare and international trade had profited from crowdsourced efficiency solutions, aggregated through the knowledge of millions of people. If only we had known back in 2013.

Michael van Wetering, Kennisnet Foundation, The Netherlands

Assumptions:

- U2: Information is an asset

- U9: Privacy concerns will be overcome

Today's education spends many hours on testing, administration and reporting on student progress and school efficiency. We are 'teaching to the test' and learning, creativity, developing cooperative skills come second at best.

Quantified Learning will reduce the amount of energy wasted in measuring everything, we build on data generated in the learning process without requiring measuring or testing. Adaptive digital learning materials offer students a personalized learning experience that engages and challenges them like good games do. The high frequency data that these materials generate give detailed insight into how a student is doing and what next action is needed to optimize his/her learning experience. A personal learning environment helps students plan and track their individual program. It consist of a collection of tools and resources chosen by the student, some may be offered by an educational institution mostly for administrative purposes. An app-store-like matching function advises on the best learning materials suited for the task the student selected. All components in this eco-system learn about their own effectiveness and can report this to each other. The eco-system learns about effective learning strategies given specific student profiles, rating the quality of materials based on 'hard' data. The quality of commercial and open educational resources becomes transparent, students can make a conscious decision to pay for higher quality materials when they need them.

This "edutopia" partly exists and is developing rapidly. Adaptive digital learning materials are now available, the first experimental adaptive learning platforms

are being built. Students are already assembling their personal learning environments, mostly ignoring formal school systems when and where they can. This digital learning eco-system will have an enormous impact on teaching and the role of teachers, who will have to learn to use these tools and reinvent themselves as humans always do when paradigm shifts happen. Likewise this new edutopia will challenge the physical classroom and the school organization. Questions include: what's the value of face-to-face time at school, between students and teachers? What is the core of education? What value does it have when all knowledge is available at our fingertips, when the most brilliant teachers speak to us on YouTube? We badly need to have this discussion about education!

Martin Schatton, Germany

Assumptions:

- U9: Privacy concerns will be overcome
- U15: Smart machines will emerge

Having my electronic passport with me I thought this would be enough to get through the day. But it began with a visit at the doctor. I forgot my e-health card. Normally no problem, as I could login into the insurance companies' network and confirm the visit. But due to the heavy transmission interferences (all devices at the practice are wireless and communicating with each other and a central insurance server) I was not able to get a connection. Trying to get a better connection I went on the street when suddenly my Smart-Device starts to ring at maximum volume and vibrates extremely.

Seconds after a car, probably not under control anymore, crosses the pavement. I

only just jumped aside, thanks to the pre-warning system of my device which got an alert from the approaching car. As the car left the street at high speed also the Police were informed, even before the car crashed into a tree. Two minutes later an ambulance arrived as the car had sent an emergency call. Lucky guy, his personal diagnostic device told the ambulance where he is injured.

After the doctor's visit I got in my car and logged automatically into the companies' network, while my car was driving autonomously and communicating with other cars, traffic lights and junction controls. The car's display was, as nearly every display is, only a displaying and controlling unit for every device that wants to use it. In order to get a better view of the document I switched it to the windscreen. Nearly all companies switched to private clouds, self-administrated or secured third-party environment. Huge amounts of data and secure sharing of industrial documents like 3D CAD documents need more secured transferring as hacking and giving details to other countries brought some companies to insolvency.

On the private instance of my personal central device I parallel-checked my personal social groups for updates in a central social cloud. No one is depending on Facebook anymore, as a social media standard has been adopted. My favorite and secure social community application is communicating via a scramble provider.

Back again at home I checked letters from some companies which I have contracts with, as written and signed letters are still the most secure way of confirmation. There is no central organization where I have all my data and this organization is sharing it with demanding companies, subject to the condition that I have approved each communication. Now, due to huge data

privacy problems in the past I have a decentralised, anonymised network for my personal data, where no connections between information sources can be tracked. Every information output has to be approved by myself.

Actual problem is hacking "on the air" as hardware is able to sometimes decrypt on the fly for mobile connections. The devices themselves are very secure, but being connected via cable (even if this is unusual) is still more safe than wireless.

Also the device-to-device communication has risen. Public information at a point of interest is shared to near devices dynamically (thanks to big device storage) in order to react more flexibly to requests from users. Bandwidth, speed and storage are the key indicators for the people. But direct communication (speech and face-to-face) is more preferred than status updates on social network. This was an outcome of some case studies where more single people have problems with personal relationships ("Everyone got a dog, but nobody to talk"). Therefore places of face-to-face communication are preferred.

Sarvesh Kumar, U.K.

- U2: Information is an asset
- U5: Data ownership moves from the business to the consumer or citizen
- U12: Next to business analytics, there will be personal analytics and planet analytics

I see significant changes happening to Business and Society — Cities and Rural Economy, Consumer Centric and Industrial Sector, and IT Industry in the next 10 years due to an analytics-led transformation complimented by forces of digital disruption.

One of the biggest transformations that I see happening is how cities adopt analytics, digital and information, leading to a completely new way in which we will see travel, transportation, healthcare, education, care and other citizen-centric services being seamlessly provided in a proactive, integrated, real-time manner leading to great improvement in the people and planet aspects of the business and social world. So far businesses have used analytics to get better profits. Analytics will significantly impact the other 2 Ps — People and Planet metrics. Such changes will also align business strategy towards new dimensions: making businesses more linked to social and community dimensions, making them more sustainable and competitive in the long term. Analytics and information will significantly reduce traffic congestion; environment issues, significantly improve effectiveness of healthcare and education; Employment, social enterprises, social programs in developing countries, emergence management, etc.

Technologies that will help cities transform would also help change a large part of world living in rural areas with farming economies on one side and issues of poverty, health, education and employment on the other side. Transformation of farming can happen with use of big data to get better yield and prices for the produce, enriching the farming community. This will also prevent significant food waste that we see in the world today — all this helping better exploitation of natural resources and sustainability.

Business model innovation led by information will help create a number of new offerings and products using information as an asset and using innovation enabled by information. Current innovation in business models seen in consumer-centric industries on the basis of customer information as an asset, will evolve further to include other

information classes and combinations in the times to come — leading to interesting diversified conglomerates whose competitive advantage is actually data-vantage.

We will see the banks, retailers, telcos and media companies of the future seamlessly integrated to provide end-to-end customer service in a real-time and personalised manner at the convenience and choice of the customer.

In the industrial sector, like energy companies, utility companies, the oil and gas sector will significantly adopt analytics and digital technologies to sustainably exploit the digital oil field of future and alternative energy sources. On the other hand, intelligent buildings and appliances will choose the energy sources (both conventional and alternative) and modes to optimise on cost, availability and environmental impact .

The industry that serves end users with analytics and information systems products and services will also transform significantly. A very important and disruptive challenge to current business model of IT services companies comes from emergence and adoption of new technologies like cloud, advanced analytics, and mobile computing. This has the potential to completely change the manner in which IT and business services are built and consumed by customers.

Imagine a business world where the Global 1000 change their procurement processes to be able to source best-in-class services on cloud ,so that the only contract that exists is between the customer and service brokers who themselves do not own the service but have back-to-back SLA agreements with multiple SMEs who build services like apps and host it on cloud! This model is especially possible in consumption

of data intelligence and insight. Increasing adoption of innovations like "data as a service/analytics as a service" lead to the possibility that new business models can be built that threaten large IT services companies very existence, as they will never be able to compete in terms of innovation, business value, agility and cost.

Zehra Can, Turkcell, Turkey

Assumptions:

- U11: Unified identification will be the norm
- U12: Next to business analytics, there will be personal analytics and planet analytics

What if people would be able to learn their next near future step from their smartphone application? It would absolutely end the fortune teller's job. The next generation for business intelligence (BI) would be the personal business intelligence. Every person would like to analyze their next eating behavior, their next decision for their spending behavior or their next health status. Wouldn't it be great for an individual to plan their life easily and monitor their future actions?

Every day, when a person wakes up, he does not rub his eyes, the first thing he does is to check his friends' status and then say "good morning" to them from his Facebook profile. So the first action is logged in with the information date and time. One does a lot of things during the day. Have meal, paying with credit card by creating a transaction. Or buy something that he needs. Go to restaurant or a doctor, a hospital. All of them create a transaction. Even, he shares his thoughts on Twitter. The transactions will also include what he has in his mind. So from the BI side, all the

materials that will be processed to "fortune tell" to the person will be available.

Nowadays people usually complain of logging into different Internet sites and mobile applications with different usernames and passwords. It would be simpler for one to have a single username/password or even not to have them; instead, to log into anywhere simply with his fingerprint touch, or with his voice, etc., so it could be any biometric identification for a person to reach the transactions of his life path on the Internet, on the government database, or on any insurance company and bank account database. Furthermore, people like to keep their photos, movies, songs for their future access on external hard disks but they rarely go back and access their past data. It only stays there keeping in mind that he can access it any time he needs. Why would not it be accessible at any time from his fingertips — to see his own past actions and to analyze his future actions? All personal data can be collected to an Internet data cloud, and personal data warehouses can be created upon them. The data already exists there. The technology already exists there. The only thing is to bring them together to open the way to the new BI world, the "Fortune Teller BI."

What can people expect from the new BI personally? They can expect guidance for their career path planning and their personal development; their daily routines to be arranged; to be reminded of their periodic or non-periodic health check-ups. Analyzing the past actions of the person and giving some advice about them. Everyone needs some direction in some part of their life. Sometimes it could be choosing a school, sometimes choosing a job or the need for changing a job. Everyone has some confusing period in their life and try to find someone to ask, someone to direct them.

Why could not it be a smartphone application just one finger away?

Maybe someone can schedule a reminder that wakes him up after five years for his career planning; while indulging in the daily routines, putting the career planning in to the second place in his life. Sometimes he needs someone to ask him what he is planning, what is the position he wants to be in?

During our daily routines, everyone sometimes forgets their priorities. Would it not be nice if there is something that reminds us of our priorities and directs us again in the right way? This new "B-eye" will be a new eye on us — like our parents' eye that stays on us during our daily activities. It could have more control over our lives than our parents because it will know much more detail than our parents. It sounds strange, but it would be very possible. The stored data anywhere and anytime that we create is more than data. It has the footprints of our lives that compose our personal journey. So, next-generation BI can make value out of this personal journey that is of value to an individual, and which will certainly help to improve a person's personal branding. Instead of keeping the personal data in external hard disks, or keeping them in our personal accessible Internet sites, or keeping them on any corporate system (i.e., online banking, insurance systems), let BI discover it.

René Lykkeskov, Affecto, Denmark and Finland

Assumptions:

- U3: All information will be free and is open

In a not so distant future, all publicly-owned data will, in an anonymous form, be

accessible to other public organizations and private companies. The trend is that more and more data is being made available each day by governments all over the world. In Denmark, the Open Data Innovation Strategy initiative (ODIS) was created to enable easier and more uniform access to public data as a raw material for the private sector, for development of innovative digital products and services.

On 9 May 2013, U.S. President Barack Obama signed an executive order stating that all data created or collected by America's federal government must be made available free to the public, unless this would violate privacy, confidentiality or security. The president said that open and machine-readable is the new default for government information.

"The Obama Administration today took groundbreaking new steps to make information generated and stored by the Federal Government more open and accessible to innovators and the public, to fuel entrepreneurship and economic growth while increasing government transparency and efficiency. Today's actions — including an Executive Order signed by the president and an Open Data Policy released by the Office of Management and Budget and the Office of Science and Technology Policy— declare that information is a valuable national asset whose value is multiplied when it is made easily accessible to the public. The Executive Order requires that, going forward, data generated by the government be made available in open, machine-readable formats, while appropriately safeguarding privacy, confidentiality, and security.

The move will make troves of previously inaccessible or unmanageable data easily available to entrepreneurs, researchers, and others who can use those files to generate

new products and services, build businesses, and create jobs."

In addition to the executive order, an Open Data Policy was released and the Administration announced a series of complementary actions.

The first key driver for this vision is that privately held companies, public organizations and individual people should be equal partners in this data- and information-driven revolution. I believe that through partnering and co-innovation, data as a service (DaaS) and information as a service (IaaS) will be the next wave in the IT revolution. The focus will move from "technology" to "value delivered as a result of technology."

The Collaboration Model

The second key driver for this vision will be that the creators and owners of data will push for a collaboration with technology companies, application developers, system integrators and IT infrastructure owners where the data will create the real value — not technology, not application and not systems! The real heroes in all organizations and companies will be the people who understand how to create value and insight from data and information. These new heroes will be essential employees that will lead the collaboration towards creating value independent of, and across all kinds of, technologies.

The Business Model

All organizations, companies and individual people can access the common infrastructure, use the publically available data and develop and post applications for all kind of purposes. When someone then uses the application/app the pricing model will be based on a "pay per use" fee or a "fixed fee" per time slot (i.e., monthly). A part of the payment for using the

application/apps will be assigned to the owner of the infrastructure.

The Infrastructure

The total infrastructure to support the vision of "information as a value driver" will be owned by society and operated by the individual countries and paid by taxes, but co-funded by the above business model. Just as many roads, train tracks and likewise today are owned by the society and the local governments.

The Applications/Apps

Within areas like transport, waste, energy consumption, healthcare, education etc., there will be developed a variety of small apps for specific purposes — all supporting the aim of using our common natural resources in the most efficient way and secure that future generations will get an even better life than we do have today.

My Standpoint

Public owned data — mostly indirectly paid by the tax payers — does have an enormous potential in being a future value creator for societies. This potential can only be utilized to the benefit of us all if the collaboration between all involved parties is supported by common "laws" and that we in the collaboration model understand and agree on a business model where private companies and individual people will receive a fair price/award and payment for their investment. The future value will be in the data and information — not in technologies and infrastructure.

Smirt Collins, GraspInsights, U.K.

Assumptions:

- U14: Data gets an "attitude" with semantic technology

- U15: Smart machines will emerge

A day of my life in a truly digital world — Living in an expanding universe of information, connected people and devices. It is 2030, information, connectivity and technology innovation have caused a tremendous effect on how people, societies, cultures, organizations and objects interact and so it has transformed my personal life.

Taiko is my personal connected device, which comes with a special wearable device. Taiko is continuously interacting (24/7) with many connected services, applications and other devices around me and it has a huge influence on what I do, how and when.

I live in an intelligent home, as I get up in the morning and start getting ready, coffee is being made in the kitchen and all the heating systems and electric systems (e.g., lighting and entertainment systems) are being automatically activated by applications and sensing devices which I set up in Taiko. While I eat breakfast I can see how my day looks like, in my kitchen-screen connected to Taiko. I authorize some pending food shopping, order some extra clothes I need, send a couple of messages to my family and friends, and by the time I leave home all electronics and devices turn off and the security systems self-activate.

I ride my bike to work following the suggested ecological route of the day, with less traffic and pollution levels. I use a voice/gesture-activated sensing device linked to Taiko that allows me to check mails, calendar, banking, listen to my favorite radio program and any other applications. By the time I get to the office I have checked mails, planned my agenda for the day, talked to my mum and checked what my friends are doing tonight. My fitness app is telling me I have consumed 200 calories in this ride and tells me about

some alternative routes to go back home. I don't have fixed working hours; there is a seamless flow between my work and my personal life throughout the day. I am a strategist and work is fun; I belong to a cluster of professionals, located around the world, who "virtually" collaborate in multiple projects. I connect Taiko to my company social network to interact, share and discuss ideas with colleagues on the go, providing a dynamic flow of innovation. I have continuous access to our intelligent IS (that I can access with a simple voice command from Taiko), which provides me real-time actionable insights — customized, analyzed and categorized data, designed to help me visualize complex situations and make fast and informed decisions anytime/everywhere. At lunchtime, Taiko recommends me to try the new organic Chinese restaurant near my office because it knows I like Asian food!

It has been a fun day, when I get home I have my dinner ready and spend some time with my son doing his homework on his Taiko. By the time I am ready to relax, Taiko is providing me with some suggestions based on a seamless analysis of my previous watching habits and dims the lights to set a relaxing environment.

Taiko is a timesaving device. It makes my life easier, unwraps access to a universe of information and helps me to be aware of what is happening with my friends, family and colleagues. It keeps me up to date with relevant events around me and helps me make quick choices in my day-to-day life. I use a cool visualization application to tailor the information I want to have access to, with the option to pay for more relevant personalized information services when I need them. Taiko has become an extension of myself that provides a seamless online and offline presence, enriching my lifestyle

and enabling a better real world life experience.

Taher Borsadwala, India

Assumptions:

- U9: Privacy concerns will be overcome
- U11: Unified identification will be the norm
- D5: Unified identification will be the norm

A utopian, equal opportunity and honest world enabled by clean and quality data!

Datatopia, the future wherein, though the physical world remains divided by boundaries, the overlaying e-world will be truly unified in real-time with efficiently and thoroughly managed data. Data management disciplines will be an integral part of all processes thereby ensuring a state of crystal clear knowledge. Every individual across the globe will be assigned a universally unique identifier (UUID). Such UUID assignment will be at the time of birth and will be associated to a unique human biometric trait, a finger print for instance. Country-specific unique IDs will be mapped to this UUID, thereby allowing the country-specific data to be easily leveraged.

At the time of birth, UUID assignment will happen along with the linkage to the unique biometric human trait. And thanks to the biometric trait, there will be no need to carry any physical form of identification. All personal and medical history will now be associated to this UUID. As the kid grows, his/her educational details will also be linked to the UUID — school, grade, teachers, progress, extra-curricular activities, etc. School transfers will be smooth owing to all educational history being available on the

UUID itself. This will cut down on fraudulent mark-sheets and certificates. Additional forms of government identification such as driver's permit will now be tagged to the UUID. Automobiles will be smart enough to interpret the driver and their eligibility to drive. If the automobile comes across an underage driver then, besides not starting, it will file an alert with the authorities.

Besides underage driving, there is this huge problem of underage drinking. Smart containers will ensure that only age-appropriate people are able to consume such contents. Post education, once that individual enters the professional world, no background verification documentation will be needed. UUID along with the finger print will suffice for companies. Based on the available educational and extra-curricular activities, companies will be able to easily zero in on the best possible candidates for the available positions.

Good diet will be ensured automatically as the food outlets will only allow people who have a good health record to indulge in certain types of food. For instance, people who are suffering from cholesterol issues will be denied greasy and cheesy food. Travel, whether domestic or international, will also benefit. Documents such as passport and visas won't need to be carried along and the concept of "travelling light" will ring true. The biometric scan along with the UUID will be sufficient for travel officials to validate a proper travel ticket along with the necessary paperwork. Finance management will be easy as everything will be tied to that individual's UUID directly — all the accounts, investments, etc. No need to carry cards as the biometric scan will prove sufficient for any and all transactions.

The UUID, while identifying an individual will also be automatically tied to a household and master data management will provide easy analysis of such hierarchies. This will

tremendously benefit financial institutions such as banks in determining a person's creditworthiness or, in other words, assessing the associated credit risk. Financial bubbles will be avoided as the financial worth of a person, family or organization will be available in the most transparent of manners, thereby omitting speculation and crashes. Supply chain management will be optimized as retail chains will know their optimum economic order quantity (EOQ) at any given time. In fact, since this will be happening in real time, the EOQ will be revised automatically on any and every given day. Big data will have become mammoth and will allow businesses to target the customers based on their preferences, their economic standing, their health and all such factors in totality; thereby leading to highly ethical corporate practices.

Monopolies will be circumvented and all information will be made available to everyone. Each and every individual from any part of the globe will have available to them equality of opportunity as they will not be limited by geographical boundaries and status anymore. Since an individual will (himself or herself) be carrying on them their metadata at all times, hard copies will become redundant and eventually obsolete. The future will see a true green data initiative.

Effective data management will herald a utopian society that will allow people, nature, machines, businesses to not only grow individually but rather to co-exist in true harmony to bring a tear of joy to Mother Earth's eye!

Claudette Kints, The Binding Force Company, The Netherlands

Assumptions:

- U2: Information is an asset
- U5: Data ownership moves from the business to the consumer or citizen

I own my own data in my personal data warehouse created on the day I was born.

I exist, so I produce data and whose data is that anyway? Is it mine? Maybe there is a need for a personal data warehouse that stores all my produced data in my own private data warehouse cloud; when someone needs access for an information question, I can give it. The cost depends on the question or problem that needs to be solved, or it is free — but that is my own decision. I can sell my own data. At the extreme, a personal annual report can be created from all the data that I produce in a year. It is like a multidimensional diary. When I produce data in a store — for example the Albert Heijn (AH), I buy products and I pay for the products so the data which I produce is mine. The influence on the stock, that there is a product sold, is AH data. The combined information can be used to answer the question, Who bought the product? It was Claudette. When they need to store that data as a result of the question, do they need to have an aim for that; also, they will need my permission to save my personal information. So, data is confusing when it goes to next level of information. The next level is knowledge in this mind-oriented world, and knowledge is power. But what do we do with data that is on other frequencies or levels? Can we store this, and use it to answer questions, and collect it to create information? Data is confusing as it is coloured with our own projections. Objectivity is, therefore, the answer, but what is that? I think a new research `;)

Ron Dimon, U.S.

Assumptions:

- U10: Monitoring becomes the norm
- D4: Monitoring becomes the norm

Video, text, voice, and other kinds of surveillance by the state and by corporations is on the rise around the world. (Reference example: "The Watchers: The Rise of America's Surveillance State" by Shane Harris, 2010). In 10 to 15 years out, the amount of data collected about us by others will be unfathomable by today's standards. Privacy law will take a while to catch up with technology and pervasiveness, so that in the meantime we are exposed as to who captures what information about us. This is surveillance from the top down.

However, at the same time, the rise of social network adoption and volume of information collection and dissemination is rising exponentially. More people, armed with more cameras (in their phones), are taking more pictures than ever before. When these pictures are shared on "open" platforms (not controlled by one government or one entity), like information in its natural state, they "want to be free" This is the possibility of surveillance from the bottom up.

Dr. Steve Mann of the University of Toronto has coined a new term to describe this surveillance borne by everyday people as "sousveillance." Witnesses to crimes and other events quickly share evidence of what is happening with the world so that the truth comes out. (Recent example: <http://www.cbc.ca/news/canada/toronto/stre-etcar-shooting-toronto-police-officer-suspended-1.1362193>.) Sousveillance has also been used to expose nefarious use of surveillance data, for example where police

have planted false evidence to try and incarcerate an innocent citizen (<http://wnyt.com/article/stories/s3107069.shtml>).

In 10 to 15 years, information will be used from the top, down to protect and incriminate; and from the bottom up, to defend and exonerate.

Anonymous

Assumptions:

- U16: Continued technology evolution

Everyone and everything will be connected to the Internet. Available resources, land, water and petrol will be less and less. We'll have more data than we can manage, than we need and than we care of. The euro will fail, the European Community will fall.

There will be no breakthrough discovery or invention in the next five years. Innovation will come from the combination and convergence of existing technology and knowledge; a little bit like smartphones combine multiple "legacy" devices. Data will be the new oil. Business intelligence will be vital to companies' survival — companies will make profit only if they base business decisions on data analytics. Grocers, insurance companies, banks, manufacturers — they'll all stay in business only by analyzing customer data. Work will be smarter, automated, mobile, virtual. Individual productivity will keep growing, and manual work will be less and less. It will be impossible to find a plumber or an electrician when you need one; but you'll download patches to fix pipes and your domestic equipment from the Internet. Most shops will close and be replaced by e-commerce. You'll be able to buy milk on Amazon. Physical goods' prices will keep dropping. Consumers will be more and

more aware of their rights, and form coalitions to purchase smarter.

Joeri Beerts, Aveve, Belgium

Assumptions:

- U10: Monitoring becomes the norm
- U14: Data gets an "attitude" with semantic technology
- U15: Smart machines will emerge
- U16: Continued technology evolution

Today, everything comes together. Data leads to information, information brings insights, and insight gives you power. We have known this for decades and have invested in systems ever since; but only in the last 20 years, a whole series of parallel evolutions have led us to a momentum we experience today.

- More and more data is gathered. Sensors everywhere, video camera (public and private owned)
- We have the technology to store huge amounts of data where the price/GB continues to decrease.
- The Internet gave us the possibility to find more data, to generate more data and to connect data sources scattered around the world.
- Mobile devices bring instant and always-on connectivity to information and to create content on the go.
- Computer power keeps going up with the possibility to combine computer power in computing grids and massive parallel computing.

- Advanced analytic applications have been developed and this is still subject to huge investments.

This all brings us to a momentum where we can finally say that:

- We have the data
- We have the power and tools to crawl data and transform it to information
- We have the connectivity to combine data sources and to access information wherever we are.
- The possibilities are available for everyone

For the first time, we can say we live in an always-on, always-connected information society. It's out there, but not everyone sees and uses it yet. It will first have to stabilise and get a bigger footprint in business, government and society.

What's Next

The leading group is already one step further on and defining the shapes of the future; the future of information and what can be achieved with information. My personal feeling is that the next 10-15 years will be around how we can have real-time, accurate and usable information based on a continuous stream of data that comes from anywhere (the Internet of Things) so that we can integrate this real-time information in our day-to-day personal and professional business processes. Example: I'm going to the supermarket and what I will buy will be based upon the logic I use today to create my shopping list.

- What are my food preferences?
- What is in my fridge?

- What season is it: which vegetables are market fresh?
- What's the weather?
- How many people do I have to cook for, based on day of week — Are my children at home; is my wife having dinner at work? Or based on my agenda — Did I invite other people?

The real-time analysis of all this data, accessible directly from my smartphone, will give me a pretty accurate shopping list I can base my shopping upon. This shopping list will be automatically generated the moment I enter the supermarket. So I think that we can say that today all the elements are out there. This ecosystem will not grow that much, but will be further developed. More data-generating devices, more data, faster connections, more computing power, and more. The evolution will be in the applications built upon this ecosystem, and the integration of these applications in our daily life — both personal and business.

What's the Impact?

This information-driven society will have a huge impact on our lives. What we do, and when we do things will be told to us by devices that are connected to each other and to the Internet, where they can find the information to push us in a certain direction. A human being's main task will move from thinking about what to do, to checking/controlling the outcome of what all these devices are telling us to do.

How to Cope

A big shift lies in the educational systems. We come from a school system where they taught us how to assimilate loads of data so we were able to reproduce it months and years later. This era is gone. Schools have to teach us life in a world that never stops

evolving, nor does the learning. The focus will go from assimilating data towards knowing how to find data, how to analyse it and how to combine data streams into information. Personally, we need to learn to filter information and to focus on what's relevant.

Vinayakumarrajulakkamraju, India

Assumptions:

- U12: Next to business analytics, there will be personal analytics and planet analytics

Being a farm-based country, India should be able to take advantage of the vast data that is generated over the years, and across the country, which should be able to help the farming sector — from the start to taking their products to the market. What we lack is proper analysis of the data. Although the government collects large volumes of data across the country, it is unable to analyze the data which will help the farming sector. Most Indian farmers are small farmers with one to three acres of land and they completely depend on the old methods for farming and taking their products to the market. We should be able to use the mobile intelligence (the mobile reach is very high among the farmers in India) to share the analyzed data with the farmers and should be able to revolutionize the sector. It should be a combination of both private and public sectors.

Gary Cokins, Analytics-Based Performance Management LLC, U.S.

Assumption:

- U6: Everything is personalized

- U9: Privacy concerns will be overcome
- U10: Monitoring becomes the norm
- U15: Smart machines will emerge

Whenever someone pulls out their crystal ball to see what may be in the future for the role of information in society, in business, and in our personal lives, it is relatively easy to reference the "usual suspects." These include more mobile device applications and an electronic wallet (like a highway toll EZPass).

My belief is that a good way to view what the future holds is to see it from the position of the individual. People will increasingly want personalization. They will want what they choose to want and not necessarily what someone thinks they want. That is, they will want to customize their relationship with information to their personal preferences. With that in mind, here are my predictions:

- Sports television statistics — Avid sports fans love statistics. Increasingly, sports telecasts are raising the bar for viewers. For example, televised golf tournaments will display for each hole the distribution of the golfers' number of eagles, birdies, pars, single bogies, and multiple bogies. The display will go beyond a table to a histogram for quicker visualization. The viewer can control capabilities to further drill down on each golfer's performance.
- DNA testing — Individuals will be able to have their DNA tested to detect potential diseases or disorders they may have in the future. Advances in medicine will prevent their ailments and suffering.

- Home utilities monitoring — As the awareness of environmental sustainability and conservation increases, water and power utilities will offer real-time and summarized "smart" sensor metering of usage. The user can flexibly segment their monitoring to the appliance and device ranging from a clothes washer and dryer to a toaster oven. They can measure water consumed taking a shower compared with a load in their dishwasher to better understand where their opportunities are to conserve. The utilities companies will provide benchmarked feedback, normalized by the size of the household and number of residents, so that households can assess how effective their conversation is to compared with similar households.
- Preventive asset maintenance — Equipment and devices inevitably experience malfunctions; in the worst case they break down. Scheduled preventive maintenance, like lubricating a machine, mitigates equipment failures. In the future, sensors will detect an imminent problem.
- Smart street parking — Cities with extreme automobile traffic create frustrations for drivers seeking street parking. With sensors and a mobile app, drivers can locate where an available parking space exists. The city can variably adjust the parking meter prices throughout the day, from peak to less peak time periods, to assure there will be constant parking spaces available.
- Freight and inventory movement and storage — With sensors,

individuals and businesses can manage the distribution and storage of individual items (ranging from freight packages to individual items in a retail store). Households will have alerts when food is nearing spoilage in the refrigerator.

- Government social services — Public sector agencies will provide their employees with substantially better information to serve citizens. For example, case workers for children at risk of abuse can monitor the relationships in social networks, such as moves to foster homes or potentially unreliable or risky relatives. They can drill down to see possible criminal records of the caregivers for the purpose of mitigating risk or harm to a child.
- Traffic light throughput flow — With sensors in automobiles and along streets, traffic lights will change from red to green in real time, based on the density and speed of the autos, to speed the flow of traffic and reduce the wait time for drivers.

Some of these uses of information are already in pilot stages. Eventually, they will be commonplace. With the acceleration of analytics and big data, if you can imagine a use now it will likely become a reality. What are the consequences? My examples are generally desirable, but some cross the line of invading one's privacy. Let us hope we are governed by global leaders who know where and how to draw that line. We are moving from possibilities to probabilities, to the existence of a solution or an aid to living a less stressful life.

Barbara Leoni, Italy

- D3: "Privacy" will become an outdated concept
- U13: People will focus on creativity, and not be ruled by machines

On privacy, we will stop caring altogether. Creativity should not be affected by rules.

Gavan Horton, The Netherlands

Assumptions:

- U9: Privacy concerns will be overcome
- U16: Continued technology evolution

Few can question that the volume of stored data will grow exponentially over the next 10 to 15 years. Every day billions of people are leaving an indelible record of their private lives and everyday a myriad of organisations are trying to use that record to their advantage. When examining the use of this data one factor that is often overlooked is the fact that the correct use of information by any entity causes a positive feedback loop.

When a company uses analytics over big data to achieve an economic benefit, this will drive the company to seek even more insightful data to achieve an even greater economic benefit. In the past, personal data may have represented a simple list of email addresses that allowed us to mass-mail our customers. As this process generated more business we sought more information and greater insight. Which of our customers responded to our mass mails? Which countries did they respond from? Which browsers did they use?

As our knowledge grows, so does our understanding of our ignorance. The more

we know the more we want to know. Each successful exercise in the use of big data and analytics enables an entity to invest in increased capture and usage of data. Success breeds success, it is Darwinian evolution in its purest form.

How long can a positive feedback loop go on for? What is out there that will break the loop? There is a high probability that the loop will be interrupted in the coming 10 years by the next big scandal. We don't know exactly what it is, we don't know who will be caught, but sooner or later an organisation will be exposed for using personal data in a way that is immoral, illegal and, more importantly, abhorrent to the general public. The likelihood is that this is already happening. Someone out there is already doing this; they just haven't been caught yet. It is difficult to predict the full ramifications of the next big scandal, but one inevitable response will be the kneejerk reaction of governments in the major consumer societies. The legislation that then ensues will make it difficult for companies to fully exploit their data assets. However, the potential gains inherent in the use of big data can only increase and companies will continue to search for ways to exploit this opportunity.

Evolution is unforgiving; adapt or die. The increasingly fragmented and complex regulations governing the storage and use of big data may benefit countries that have less stringent laws in place. If Panama and Liberia can raise revenues by issuing flags of convenience to shipping companies, then why can other countries not do the same for organisations with vast amounts of our personal data? In the same way that flags of convenience and open registries provide a cloak of anonymity to shipping companies, we may face the prospect of anonymous shell companies manipulating our data in

safe havens without any effective legislation.

We cannot trust organisations to police themselves in the use of our data. Some companies will be responsible while others will not; there is simply too much money to be made. We cannot entrust the safety of our data to our legislators; if we cannot achieve agreement on something as basic as nuclear non-proliferation we will surely not be able to set global standards and agreements for the use of personal data. Organisations in the heavily legislated countries will be able to achieve insight from data which is stored and manipulated in less stringent regions.

The use of data will remain one of the key deciding factors in the evolution of our markets. In the past the companies that could exploit and use data were successful; in the future, the companies that can most successfully work around legislation will succeed. The only effective policing that will be possible on the use of personal data will be via the consumers themselves. Mass movements and unstructured consumer groups may be the only hope left for the responsible use of data.

The revolution in social media has given us the tools to manage one of the problems that it has, itself, created. As Nestle, Fruit of the Loom and many other companies have discovered, the consumer has power and is awakening to that fact. The future of analytics comes with a warning, use our data with caution, for if we catch you crossing the line we will make you suffer!

Job Jansen, The Netherlands

Assumptions:

- U13: People will focus on creativity, and not be ruled by machines

The digital world is overwhelming; but our world is far more than that. Humans have the creative mind that is necessary to survive in the ever changing world. In the following years we have to control the digital power, we have to cope with this binary world, before our mind can think only like a computer. The people who shall foresee this will behold the creativeness to survive. They shall learn to use digital information instead of letting the digital world control their lives. They will make it easy to find the information they want, without being distracted by all the information they can't handle.

When we control the power we can use the media to access all the creative powers in the world, because we can reach them through the digital world. We will still learn everything through human interaction and physical experience, but because all the information is accessible we will learn from all the experiences of people all over the world. Because all information is accessible, the only actions humans have to perform are creative actions. All computer actions that were performed before can be automatically be performed again. So, computers can fix themselves if the error has been fixed before — anywhere in the world. All information can be checked and corrected automatically when it refers to old information. We will spend far more time being creative and enjoying real experiences, because we never have to search for information that can be found automatically by a computer.

The people who will try to learn from the computer will become like it. They will only be able to reproduce by means of the computer, they don't get any real experience and become a dependent of the digital media. They won't survive when the power of the creative people will change the world.

Ludo Kenosi, Botswana

Assumptions:

- D8: Connected society will redefine social norms

As per the definition provided on Google search; Information (in•for•ma•tion) is "facts provided or learned about something or someone." Depending on how and what these facts are used for, information can have positive and/or negative consequences in our day-to-day lives. My focus will mainly be around how information has affected the life of an ordinary Motswana (that is, the singular form of "Batswana" — a citizen of Botswana of any ethnic background) — Wikipedia; whose life is basically governed by a set of cultural norms and beliefs. Recently there has been a series of occurrences where individuals will rush to an accident scene, start taking pictures and posting them on social media platforms like Facebook and Twitter (again because of an evolution of camera phones for capturing the facts — information).

The issue is that in our Botswana culture, whenever a relative or immediate family member has been involved in a bad incident, there is a followed procedure whereby the elder family members are informed and then the rest of the family members learn through the family communication channel (family hierarchy). For an ordinary Motswana, this is to show respect and most of all compassion to the affected; nowadays, this principle has gone through the window and it has gotten so much worse that somebody learnt about their father's passing on Facebook — worse still, a picture of their dead father's body was posted as he lay crushed in an accident. Loss of cultural norms and a lack of compassion and respect has become an

issue for me with regards to information. This is as bad as somebody standing on the street and announcing the passing of one's relative, which could probably happen in the next 10 to 15 years if it continues.

On the flip side, for the same ordinary Motswana, sometimes being informed on certain issues adds a new dimension on how they view things. A lot of Batswana are now becoming aware of what's happening around them, socially and politically, therefore they are able to ask relevant questions and contribute positively to issues affecting their personal lives and the future of their country. The standard of running businesses is improving quite significantly. Every well-informed business succeeds in execution of their strategies as having information encourages fact-based decision making, and therefore enhances the quality of decisions. Information plays a vital role in this aspect of life.

Rui Serapicos, Portugal

- U14: Data gets an "attitude" with semantic technology
- U15: Smart machines will emerge

If the population is analyzed from the point of view of three age groups — people under 15, those 15 to 59 years, and those older than 60 years — it appears that those segments of extreme ages are the ones that show the most significant changes, because while the proportion of children under 15 in the total population may decrease slightly, the older segment will gradually increase. If the working-age segment keeps stability and the elderly segment increases extremely then a massive generation gap should occur. Technology and human-computer interaction (HCI) present

opportunities; not to reduce this gap, but to circumvent it altogether.

In the early 2020s, policy makers should address the social image of aging and discrimination, social support networks, transport, urban space and aging at home. Health targets with this level of policies will be the beginning of certain services promoting healthy lifestyles and monitoring the health situation of the elderly. However, this will not be sufficient to cope with solitude and the need for autonomy and "intelligent" interaction.

As the generation gap increases, the rise of the cybernetic servant should occur after 2020, with a manifold of pattern recognition functionalities as well as a need to have incorporated "holistic experiences," ready to simulate companionship. Recording, packing and developing "holistic experiences" may become a sub-segment of the HCI industry.

Initially the experiences will be extracted from human storytelling as well as conversion of existing scripts from the movie and the entertainment industry. And, as technology evolves, automatic content capture and generation becomes a reality — new systems will be able to develop stories from past experiences as well from client fantasies. Machines will be able not only to develop better stories, but also to depict and tell these according to the listener's past experiences. Sentiment analysis will demand a whole new set of hardware and software capabilities in "holistic experiences." Capabilities like integration of facial and voice sentiment, multisource pattern recognition and processing. Additionally, multiple forms of script generation based on multiple aspects of the respondents' behavior (mood, tone, length of speech, linguistics, etc.).

The consequence of the development and implementation of such technologies, if not well managed, is the increase of the generation gap and the experience, knowledge and value transfer that past generations have benefited from. Alternatively, this generation divide can be reduced as younger and elder generations share their stories and experiences through these platforms.

Freddy Holwerda, The Netherlands

Assumptions:

- U2: Information is an asset
- U3: All information will be free and is open
- U4: The service-oriented organization will emerge
- U9: Privacy concerns will be overcome
- U14: Data gets an "attitude" with semantic technology

Investigating the role of information in society, in business and in our personal lives in 10 to 15 years from now is not a trivial task. We know the reality of today. On the one, positive, hand we see an increase of information democracy, "caring is sharing," and machine learning. However, it is certainly not without costs. On the other hand, it shows information overload, information obfuscation, increasing privacy concerns and increasing vulnerability for cyber-attacks. Will the shore block the waves? Or has something been set in motion that cannot be stopped anymore; did we start something that we are not able to stop?

In this essay, I will picture a scenario based on the latter. This essay exists of three

parts. First, some key concepts will be introduced to describe the future state of data capture, processing and use.

Secondly, the major implications of this technology push on our society will be described, in businesses and in our personal lives. Of course, I cannot conclude without taking a stand on the consequences of the future depicted, and whether I feel this is a desirable future or not.

Let me be very clear on this point: Datatopia will arrive in its full glory. Data has come alive and it will not tolerate being underestimated. Data does establish itself; the more data we use, the more we come to realize there is nothing that cannot be called data. And, the more data we use, the more we realize all data is worth capturing. Every interaction, every event, every signal can be given meaning, can be made valuable in its broader context.

In 10 to 15 years from now, this development will have resulted in a Data Lake of Things. The contents of the data lake stream in and out to fill and refresh the lake, and various users of the lake can come to examine, dive in, or take samples. The main body of this Data Lake of Things will be streaming, but extended of course with more stable pieces of data. For this Data Lake of Things to function properly, data will be self-describing, self-organizing and self-protecting. Ten to 15 years from now, data will be completely autonomous. It will not be a mere by-product or a necessary means, but the primary and key construct and it will have surpassed money as the most valuable asset. Data will evolve according to the principles of "Context Accumulation" and "Data Finds Data," as described and referred to by Jeff Jonas. To be able to interact, application programming interfaces will evolve in data programming interfaces, and apps (applications) will be replaced by ents (entities). Applications as

we know them now, will be nothing more than combinations of data according to individual needs, characteristics and specifications.

As a consequence, reality as we conceive it becomes more-and-more fact-based, and is constructed as the data itself finds its context and meaning. These principles will completely change the way we use data. In fact, we will no longer determine the relevance and meaning of data ourselves, but the data will find us and present itself to us as it finds suitable. Augmented reality becomes reality, and reality as we know it will disappear.

Of course, these developments will have a huge impact on our society, in businesses and in our personal lives. Being promoted as producing a smarter and connected planet, the developments turn out to produce a planet that is much more loosely connected, and through that maybe smart and efficient, but certainly not happier or more effective. And, as humanity, we will both love and hate the developments. We will love the ease, efficiency and transparency that the developments bring. It will certainly bring a sense of richness when all systematic knowledge is immediately computable and accessible to everyone, as is the goal of Wolfram Alpha. Yet, as the volume, velocity and variety of data increases, life will be experienced as being less certain and predictable. Humanity as a whole will doubt reality as it is being defined, and will keep looking for a reality that reckons with who people are, instead of reckoning with how they behave. Until even our identity and personality are being as thoroughly captured as all the signals we produce, this search will continue and intensify. Data will be uncovered as only guiding us into the known, without being able to lead us into the unknown.

Lars Gröndahl, Tax Administration, Finland

Assumptions:

- U2: Information is an asset
- U4: The service-oriented organization will emerge

The number of scientists is increasing all the time, faster and faster. That means that the number of ICT scientists is also increasing about the same rate. The more ICT scientists exist the more they will develop scientific new ideas, which can further be developed to innovative solutions to support the development of societies, commerce and business. The information society or societies will be more and more complicated. That means that it will be increasingly difficult to manage society, politics, commerce and business as a whole.

To support possibilities to manage different kind of wholes, stakeholders must develop generic models so that they can understand the whole. How the whole depends on the outside world and how the whole depends on its parts, which form the whole.

To survive in the evolution and sometimes in the revolution of innovations, organizations and people must concentrate on where to focus their knowledge. Some must have broad knowledge to be able to compound the system and some must have knowledge deep enough to find suitable parts or subsystems to the whole, which forms some kind of system. That means that everyone must carefully plan where to target their efforts and what knowledge they need.

To properly manage developing systems and developed systems, there must be at least three things separated from each other: governance (that is, management of

management), management, and operative doing. They must not overlap.

In some cases governance can be done by governments and in some cases by the board of directors in businesses.

Governments can further form bigger organizations for governance, for example the EU, and businesses can form, for example, trade organizations.

Management of a system (e.g., organization) should actively support operative work. They should not do operative work instead of specialists. They should lead the system or processes mainly with metrics and with leadership skills.

Global competition will increase heavily. Different industry sectors try to get more markets from other sectors. Their businesses may heavily overlap with each other. For example, the telecommunication sector wants to be a big player in cloud computing, so competing with traditional IT houses. Another example is Amazon, which also sells IT services although it started as an Internet shop. In many cases, the winner is the one that reaches the mass markets first, until new innovative solutions will come to markets.

One most important thing to survive is to manage information or data. Societies and organizations, which are capable of surviving or developing services fast, are good in information management. At the global level, a good information infrastructure is a must for a faster raise of global living standards. Those blocs who are not successful with their information infrastructure will suffer in the global competition, some organizations will disappear and societies' living standards will decrease. Information security and trust play a more and more important role in competition and developing services. Nearly every security system can be broken,

especially if governments want security systems that are breakable. So, information security must be designed so that security can't be totally broken if part of the data is stolen. That is, in many cases, possible by separating information into different parts, so that different parts by themselves don't have a clear meaning. The meaning can be found out only by combining the parts of the information. Trust can be improved by political means and possibly developing methods and tools by which trustful operations can be guaranteed sufficiently. In future there will be different blocs, who build trust networks with each other but don't necessarily trust this to other blocs.

Modeling, building and combining processes and iteratively developing them, according the needs of customers, is one key thing when trying to survive in competition. Processes must be developed horizontally (business to business) and vertically (that is, support processes; they may also be business-to-business processes). Processes must include value chains, which must be measurable and combined services, when two or more processes or services are combined into a new service.

Competing parties are, for example, governments, cultures, political groups, geographical areas, business sectors, separate businesses, organizations and individuals. Some of them collapse with each other and some cooperate, at least to a certain extent. The soup is mixed up with breakthrough solutions and with global big money. Breakthroughs can happen in sustainable technology or in military solutions. They can both be used as positive or negative solutions. The future shows how we have mastered our global system, the whole.

Muffadal, TechProf, U.K.

- D3: "Privacy" will become an outdated concept
- U5: Data ownership moves from the business to the consumer or citizen

Through scandals, consumers will become more aware of privacy issues, or will stop caring altogether. People are worried about their privacy and identity being exploited in today's exposed and user-data-eating industries. I would be happy if there's any regulatory body that keeps an eye on these exploitations of data (users should be provided with where personal information is stored and used), and if I were given power to control the flow of my data.

Yves de Montcheuil, Talend, France

Assumptions:

- U10: Monitoring becomes the norm
- U15: Smart machines will emerge

It is 5:23. The alarm just went off. It has been a short night — the season 16 finale of "Downton Abbey" was on TV last night and I went to bed late. But I have a train to catch this morning, and I'd better not miss it — I am starting a new job and I am due for orientation and training at headquarters.

Of course, Carson knows all this. He also knows precisely my sleep patterns, how long I need to shower and get dressed, real-time traffic conditions to the train station and how the weather will affect them, and so he has adjusted my wake-up time to optimize my rest — and to make sure I don't miss my train. And, having duly reminded me to fill the coffee machine last night, he has started a fresh pot that I will be able to sip while I browse the news clippings he selected for me.

The taxi shows up at my door exactly one minute after Carson intimated to me to leave the house (and to not forget my raincoat!). Carson was — of course — tracking its arrival in real-time. I get to the train station mumbling about these seven minutes I have to spare, but Carson is notifying me that my train is departing from platform J — the farthest one, which takes six minutes to reach. So, typical of state-operated monopolies, the railway company is not really connected. I therefore need to dutifully order breakfast from the steward. At least, airlines know what I want to eat before I board; but thankfully, Carson is able to scan the QR codes on the menu and knows my calorie intake. I would hate to have to enter this manually or, even worse, to not have the treadmill in the hotel gym tonight adjust automatically to what I need to burn! Of course when I am home it's so much easier, the fridge and the pantry have all these sensors that measure which items are consumed. Not only does it enable Carson to restock in real time, I also get suggestions for meals based both on what I like and what's available.

Did I already mention I was starting a new job today? I need to let my network know! This is something I handle myself, Carson doesn't help me there. It's fairly complicated: I have my professional network to think about, my friends, my family. I also need to make sure my profile remains up to date. Fifteen years ago, that would have meant updating at least five profiles, post statuses or updates to as many networks. Thankfully, they have all merged over the years, and the network knows that my parents do not need the same type of information as my former colleagues, or as that Gartner analyst I have been arguing with over a Magic Quadrant (some things never change!). In the past, starting a new job would have entailed spending hours with HR and admin, filling

out a stack of paperwork for payroll, healthcare, traveler profile, and more. Thankfully, all I need to do today is authorize them to request this information (and only this information!) from Carson. Not only is this faster, it also ensures that the information is always up to date for whoever needs it (and is authorized to get it — guess what, my insurance company does not get access).

Carson is my personal data manager, my PDM. Unlike Carson, the trusted butler of "Downton Abbey," it does not bring me coffee in the morning, nor does it iron my shirts. But it turns on the coffee machine at the exact right time, and makes sure I am home when laundry is delivered.

Carson manages all my personal data, and all the services that are connected. What used to be called the "quantified self" has dramatically expanded with the rise of connected objects. Today, everything in my home, in my office, in public spaces, has an IP address, carries either a RFID tag or a QR code, or is wirelessly connected to the Internet. Everywhere I go, everything I do, every food I eat, every person I meet, Carson knows about it. Carson makes decisions based on my historical patterns, expected behavior, and external factors. It books my train ticket when I need to go to headquarters, orders the taxi and makes sure I wake up. It orders groceries for that dinner I am hosting next week, taking into account the food allergies and preferences of my guests.

Is Carson software, device, app, service? It does not matter. Carson is in the cloud. It's always there when I need it. And it knows everything about me. Well, not quite everything... I still have this bottle of 25-year-old Cognac from my great-uncle, that is not connected. Carson doesn't know when I have a sip from it, and it probably goes bananas when it does not understand

why my sleep pattern changes, or why I have gained a pound... but that's my personal space!

Cristene Gonzalez-Wertz, IBM, U.S.

Assumptions:

- D7: Cybercrime changes; from hacking systems, to hacking data, to hacking people

It's 2025; Ali and some of his colleagues were what is now referred to as "The Breach." It doesn't need a year, everyone knows it, no matter what language you speak. While hackers were continuously assaulting the financial systems, the digitization of money, communications and medicine was what led to an unprecedented "identity" theft.

The thieves didn't make demands. They had no intention of having a bidding war on the DNA and full lives of people. They were going to "engineer out illness, program for smart and healthy, prevent obesity, diabetes and cancer." They were going to create a race of super-smart people — reconstructing at the cellular level the identities of the smartest people on the planet. Then, slowly, they would release them back into society. They would be part cyborg, sure, but then who wasn't these days? We'd added intelligence to knees, hips, shoulders, hearts, ears, and finally the pancreas, once the guys at Duke Med started 3D printing body parts for real. And at one time we tried to outlaw performance-enhancing steroids in sports. It seems quaint now when any player could be rehabbed and put back out with exoskeletal or endoskeletal jewelry in the space of weeks not months. Once we had the means to enhance our bodies, were our minds to take long to follow? So it was that right outside of Cambridge (Mass), Oxford,

Rotterdam, Taipei and San Jose that the Borg (it was funny in a trite sort of way, and played well in the infinite news stories told) set up shop. Their real base of operations was a satellite which was seemingly taken offline from a solar storm, and directed from Romania. After combing through billions of records and samples, and hacking every major government, they started stealing people's complete identities — down to the healthiest, smartest individuals. They stole Stephen Hawking's, but he was the exception, not the rule. He took it with more good humor than most.

Being able to assemble a human being from its component parts isn't all that hard. The data needed to be reassembled after decrypting it from ecdh-84 and a host of other new standards. Then they wormholed into Council Bluffs and started stealing capacity in wee increments. When Brin declared it was impossible, he misspoke. Yet, a culture and a set of governments so intent on spying on their citizenry absolutely made it easy.

Now, Ali faced the bigger problem. Finding himself in the new world — literally. The thieves weren't shy about letting you know when they released the new you, but they wouldn't tell you where. (Pride is still the biggest sin.) He kissed his wife goodbye, activated the black market trackers in the roof of his mouth and between two of his toes and left, not knowing if he would come back.

He met with Aya and Martin at their own hub. Fifty-two affected MIT students and alumni set up their own secret center. With resources from DARPA, the Israeli government and Anonymous (who had fractured as parts of the group were also parts of the Borg). Using the patterns he had established all his life — what kind of company he'd work for and what role he'd take, how far he was willing to live from

work, what he bought at the market, what he looked for in a vehicle, how he picked a place to live — the team started to reconstruct Ali's life through digital records; his entire health history (including his carpal tunnel disorder — did they fix in the new him?).

The doctors introduced a slight new mutation into his DNA. It wouldn't affect his 150-year lifespan, but at 77 he wasn't sure how much he should care — he was in his prime. Within 63 days the team had located 15 potential versions of him, including one eating curry three miles away.

He walked out — ran out — really. There, near in the shadow buildings reflecting their green status on meters and guided electric bikes displaying calories burned, he searched for the location using his Google glasses, synched to his own original DNA. The onslaught of other noisy data was tuned out by focus.

"He" was dialing a call on his hand when Ali walked up. Ali gripped the 3D-printed gun in his pocket. He released it, sat down, and asked, "Why"? Only in humanity can we continue to find answers.

Anonymous

Assumptions:

- U14: Data gets an "attitude" with semantic technology

"I'll will not know anything, but I can access all knowledge"

- Cognitive capability of human brain will be the key competency; it will be more useful to think than knowing to trade off a decision.
- Multidisciplinary reasoning will give the ability to infer underlying links

between the all and will give to human beings the capability to observe the world in another perspective than that of human nature. Information communication will no longer be linear, but will be presented more as a thesaurus. Readers will determine the sequence of information to read at the time of reading. Book support can survive, but will no longer represent the right support to share knowledge (forms and speed access).

- Flat 2D screens are too close to the book page paradigm to resist over the time. Interfaces that take the temporal and structural aspect of the information will be invented to definitively replace the book paradigm.

Mark van Rijmenam, BigData-Startups, The Netherlands

Assumptions:

- U14: Data gets an "attitude" with semantic technology
- U15: Smart machines will emerge
- U16: Continued technology evolution

How will the future of big data impact the way we work and live?

The semantic Web, or Web 3.0, is often quoted as the next phase of the Internet. The semantic Web will enable all humans as well as all Internet-connected devices to communicate with each other as well as share and reuse data in different forms across different applications and organizations in real time. The future of big data takes full advantage of the semantic

Web and it will have a vast impact on organisations and society.

Artificial intelligence that will match human intelligence will allow us to ask questions and find answers more easily by simply asking natural questions to computers. Already, Japanese scientists have built a supercomputer that mimics the brain cell network and has reached 1% of brain capacity. To achieve this, that simulated a network consisting of 1.73 billion nerve cells connected by 10.4 trillion synapses. The process took 40 minutes to complete the simulation of one second of neuronal network activity in real, biological, time. In the coming years, these supercomputers will become the standard. At the moment, users still need to know what you want to know, but in a future with such supercomputers it is all about the things that you don't know.

The real benefits will be when organizations do not have to ask questions anymore to obtain answers, but simply find the answer to a question they never could have thought of. Advanced pattern discovery and categorization of patterns will enable algorithms to perform the decision making for organizations. Extensive and beautiful visualizations will become more important and help organizations understand the brontobytes of data.

Big data scientists will be in very high demand in the coming decades, as McKinsey already predicted in 2011. The real winners in the big data startup field, however, will be those companies that can make big data so easy to understand, implement and use that big data scientists are not necessary anymore. Large corporations will always employ big data scientists, but the much larger market of small and midsize enterprises (SMEs) do not have the money to hire expensive big data scientists or analysts. Those big data

startups that enable big data for SMEs without the need to hire big data experts, will have a huge competitive advantage.

The algorithms developed by those big data startups will become ever smarter, smartphones will become better and in the future everyone will have a supercomputer in their pocket that can perform daunting computing tasks in real time and visualize it on the small screen in your hand. And, with the Internet of Things and trillions of sensors, the amount of data that needs to be processed by these devices will grow exponentially.

Big data will only become bigger, and brontobytes will become common language in the boardroom. Fortunately, data storage will also become more widely available as well as cheaper in order to cope with the vast amount of data. Brontobytes of data will become so common in boardrooms, that eventually the term big data will disappear again and big data will become just data again. However, before we have reached that stage, the growing amount of data that is processed by companies and governments will create a privacy concern. Those organizations that stick to the ethical guidelines will survive, other organizations that take privacy lightly will disappear; privacy will be self-regulating. The problem will be, however, with the governments because citizens cannot simply move away from their government. Large public debates about the effects of big data on consumer privacy will be inevitable and together we have to ensure that we do not end-up in Minority Report 2.0 or in a "1984-like" setting.

The future of big data is still unsure, because the big data era is still unfolding, but it is clear that the changes ahead of us will transform organizations and societies. Big data is here to stay and organizations will have to adapt to the new paradigm.

Søren Laursen, BusinessMinds, Denmark

Assumptions:

- U9: Privacy concerns will be overcome

Do you remember those days? In the heyday of big data people took in the magic of social media but also felt unease in the post-private world they created. The providers displayed lengthy terms and conditions you had to accept and updated these on a regular basis. Of course nobody but a few ever read the legal gibberish, and by populating all of those small check boxes we gave away the better part of our privacy.

Tools began to evolve for the user to control privacy, but this was more like getting yourself a helper in the haze of terms and conditions. The emergence of information scepticism was evident. Then, however, the International Standard Privacy Model surfaced. With its lucid framework, a concise way of communicating the privacy options and restrictions for any service was created. It lent itself to graphical representation and it became easy, at a glance, to comprehend the character of the privacy handover the service required from you.

The visuals had a major didactic impact and soon entered even into the primary school curriculum. No surprise. We teach our kids how to take care in the traffic, of course we want them to stay in one piece in the online world too. Frankly, I think an important role of the model was to enable the parents to understand the privacy exposure and control of the ever-changing social media of the youth. In general most kids managed their privacy relatively well, but nowadays they actually learn how to tame the beast. In

school these visuals enabled teaching of identity management and cloud ethics to the masses. The requirement to communicate in the framework of the International Standard Privacy Model met with some resistance from the providers. Soon, however, the user acceptance would be strongly correlated with the openness of the providers; thus, they had to communicate according with the model (also) because it was the preferred navigation tool of the users. Trust lift and identity care became highly valuable business areas, and privacy transparency a critical branding parameter.

Also, in the sphere of fundamental rights the model was successful at facilitating the definition and discussion of operational privacy measures, and thus the evolution of legal instruments to safeguard our civil rights.

I am an old man now. I have lived in the shanty towns of the socioinfo rush of the big data era. Don't get me wrong, I made a living there and I think we prospered from it as society as well as individuals. But only when privacy management became a household skill did a new responsibility emerge, resulting in comprehensible, enforceable, pervading policies in the amazing world of information professionals and business developers.

Anonymous

Assumptions:

- U7: Successful projects with a clear top-down engagement

Information is power. Therefore to create valid information will stay crucial for business and the organisation. I will organize projects to get better at processes, get quick transparency, and support decision taking. I want to have successful

projects with a clear top-down engagement of the overall organisation.

Sergey, Russia

- U6: Everything is personalized
- U9: Privacy concerns will be overcome
- U16: Continued technology evolution

The information will play an even more essential role in the life of society over next 10 to 15 years. The reason is that the services and products will become more personalized and companies will require more data to bring such services onto the market. For sure, we will see more efforts from the state institutions to protect data privacy and to regulate this area. We can even assume that the new market will appear with a new business model, where it will be possible to exchange and/or expand personal data on behalf of the customer. New laws will regulate this market.

I personally believe that the environment will become smarter in the sense that the concept of the Internet of Things will really come to reality. More and more infrastructure elements will have IP addresses and more new scenarios will appear, allowing us to bring these clever infrastructure elements into the consumer services. Also, more new companies will try to build new businesses benefiting from these new opportunities of smart infrastructure — implementing both B2C and B2B models.

At least a couple of new disruptive technologies will become usual for us even though they don't exist at the moment. This disruptive development can happen for sure in such fields as TV and cars, using social networking as the communication delivery

technology for new and existing services with their freemium business models.

For sure in 10 to 15 years we will live in the smartphone era. There will no more difference between smartphone and PC/laptop. The only differentiator will be the consumer's required size of device. New OSs will be suitable for PCs and smartphones at the same time, and the applications will be no longer differ for PCs and smartphones. This will bring new opportunities for sure and we will become consumers with multiple communications channels available — computer devices, smart homes, connected cars, smart cities.

Thus, the world will become more technological. We can even become witnesses of the emerging new Chinese International Giant Corporation — operating in new business yet to exist. We can even stop using Apple iPhones, as they will be outdated, and will walk with essentially new multipurpose personal devices.

Paul Milne, eircom, Ireland

Assumptions:

- U8: Analytics of external information will be and remain an outsourced activity
- U10: Monitoring becomes the norm
- U16: Continued technology evolution
- D4: Monitoring becomes the norm

I would like to give a perspective of the world of data in about 15 years' time (2030) by looking at two different areas in our personal world and in the world of business. Let's look at the business world, and in particular at how the explosion of data will create business opportunities at two ends of the data spectrum.

The first is the world of data archiving. Ever since the advent of commercial computing in the 1970s the need to archive data, both critical and non-critical data, has been a key part of IT practice, with many man-hours and investment dollars spent in technology, codifying processes and storing the large volumes of data ever since. In part, due to the unexpected reliability of IT systems, and in part due to the increasing irrelevance of the archived data, business has had little need to access and restore this data. I believe that this will change sometime in the early 2020s, as data scientists, social scientists, researchers, and even historians will realise the wealth of data that has been lying locked up since the 1970s in various media — ranging from punch cards to tape drives to disk drives — and which will now be virtually unobtainable due to the absence of the technology to retrieve this data and to convert it to modern format and media. This will drive a fresh initiative among hardware and infrastructure specialists to develop contemporary methods to retrieve and convert this data. Rather than refurbish old equipment, I believe that new technologies will be applied to develop new multiread systems that will be fast, accurate and use yet to be developed data processing techniques to read and convert this data for consumption by the emerging big data processing tools.

The second business area relates to how non-structured big data will be mined for the useful information that it contains. Although some may do so, most companies will not wish to scale up their organisation to process large volumes of unstructured data, most of which will be generated externally in the cloud. The task of mining this information and serving it up in real time will be devolved to niche companies with a specific skillset in technology, data science or a vertical industry. I believe this will create a new industry somewhat similar to

the social networking industry today, with some large data processing companies and many more niche players, boutique data processors and start-ups creating a very vibrant ecosystem of innovation. I would call these new businesses Data Bureaux. The data bureaux will employ the technologists, data scientists, statisticians, human behaviour specialists and quantitative analysts that will mine the data for useful patterns of human and machine behaviour. The challenge for the customers of these data bureaux will be to locate and to work with the right player; understanding their capability, articulating the requirement and building the right partnership to work together. Of course, there will also be a huge community of data consultants who will act as the matchmakers between the data bureaux and their customers.

I now want to turn to our personal lives. I think the revolution in machine-to-machine, geolocation and telecommunications network data will provide a wealth of information about individual's lives in real time. This will enable new value propositions for consumers that will be contextually-aware (i.e., the value proposition will vary depending on the time, location, motion and behavioural disposition of the consumer). Moreover, this context awareness will not be limited to individual consumers but will also envelop their family, friends and work colleagues. For most consumers in 2030, this will be a routine aspect of life and they will take this pervasive context awareness in their stride. I do think that a significant minority will be antipathetic to this perceived intrusion into their privacy and will choose to go "offline". This may become a significant demographic shift with a whole support system built around their lifestyle. For example, I believe that the concept of creating an avatar of oneself will be rejuvenated after having become somewhat dated. The user avatar

will participate in the social networks, for example, but will retain anonymity for its creator and will have many implications for online gaming, social networking, ecommerce and online fraud.

The second aspect of our personal lives that will undergo a step change is in the use of video as a medium for personal use, which will be driven by improvements in the upload speeds of personal Internet connectivity. We are all familiar with the use of Skype as a kind of "special occasion" use of video chat and we are still reasonably tolerant of the poor quality of the connection. This will improve dramatically with the advent of faster and better-quality data links to such an extent that video calls will be the default method of contacting someone. This has implications for service providers, call centre operators and any service that formerly had the anonymity of voice only but will now be exposed through video. Authentication systems will be able to use facial and voice recognition techniques to obviate the need for passwords and other factors. Customer services, emergency services, and medical diagnoses will all benefit from this shift in engagement, but business-to-consumer retailers, in particular, will need to use this medium in order to differentiate from their peers.

Hermann Trimmel, Austria

Assumptions:

- U3: All information will be free and is open
- U6: Everything is personalized
- U11: Unified identification will be the norm

Whether we like it or not, I see big changes in society coming; all information about what

we are doing, when we are doing it, and with whom, is stored somewhere and available. Politics should guarantee misuse of this data, but I do not think politicians even understand what's going on (which makes me nervous ...). Biometric authentication will be widely accepted, as it will be convenient. So our lives will be different, whatever device or means for authentication and authorisation we are using; we will enter the car/start the engine, unlock mobile phones, pay for public transport, enter our office, log into our accounts etc., all with the same method. No need for money, everything will be done electronically. No need for buying CDs/DVDs, we listen/watch online when we want to. Do we need our own car? We just take the next one, authenticate ourselves, drive and get charged on usage. It will be a hard time for traditional banks like where I am working — electronic payments are the main driver for all financial matters, and here the "PayPals" (or whoever is it in 15 years time) will win. Still, banks do have a lot of data about customers and could give them best support by combining all information — internal and external — given via social media or other means. Using this information wisely may be the key for the banks to stay in business. Wisely means, for me: internally, to predict customer behaviour, be able to offer the right product or anticipate financial issues; externally, by giving the customer control not only over his finances, but also enabling him to utilize his funds much better. Tight integration with external parties, for example retailers, will be a key. Thinking of this further, questions arise, like will there be "classical" newspapers, will there be radio? Online media will take over, TV will be more interactive and individualised, which might also mean that information will be in the hands of a few people or organisations (well that's rather negative). But that's already

happening, information gets distributed online in seconds over the world, be it correct or not. Some anonymous journalists at a press agency can influence the world, some small misuse of an online trader puts exchanges all over the world into a shock. As said earlier, I am afraid politicians and regulatory bodies don't understand all this, but they should set the boundaries. As said initially, whether all this is positive, from a personal point of view — this total "online presence," I doubt; however, as it will be convenient it will come. One of the challenges will be how third world countries develop in these areas, and if the gap between developed and developing countries is getting smaller or bigger; the latter would likely lead to potentially dramatic different developments.

Ian Cahill, Ireland

Assumptions:

- D2: Information = Power

Once again, the IT industry outdoes itself with over-promise and hyperbole, and a whole generation of believers — the IT buyers of tomorrow — file, lemming-like, towards the cliff, dulled by the incessant assault on their breathing and thinking apparatuses of this new watery message that is "Data is good, data is power, here lieth the path to greatness and riches and assets ... Get the Data!." This is a great message because, of course, nobody has ever thought of this before; or have they? More of that later.

What is certainly fair to say is that there is more of this stuff — data, that is — floating freely round the place and accessible by more people. Data fishermen, if you like, sifting through the flotsam and jetsam of liberated data (maybe my data?), throwing back the small fry (maybe my data?), going

for the big, juicy one (maybe my data?)..."You shoulda seen it...it was thiiiiis big, wait 'til I tell the boys, get a picture." And it's going to increase as every device gets extra data capabilities whether it needs them or not.

Fair enough, a bit of future proofing seems reasonable. The Internet of Things will surely contribute to the oceans of data swirling around. What harm could it do? Consider this: when something...an industry, a country, a society, whatever...disaggregates and deregulates, what do we need to control the chaos? That's right, a strong man, a regulator. A modern-day Poseidon, trident-in-hand, ruling on what is right and what is wrong in a fluid, fluvial world that is inundated with data — "inundataed" (reminder to claim copyright if not yet grabbed), if you will.

The floods are coming. Individual data rivers, swelled by the incessant rain from the IT industry "cloud" (oh yes) look like they will burst their banks and join up with the oceans. It will be exciting for a while. Then the industry will apply the bait and sell the data rods — not all the rods will have compatible hooks of course and you may need the consultative help of an expert fisherman, or at least a guy who was amongst a group of fishermen once. A guy who knows all the angles. You might even need to buy a (bigger) boat. You'll know it's the right thing to do because you've been hearing about it for 10 to 15 years now. Around the time of that "cloud" thing (now known by the quaint title of "a finance deal"). Yeah, a couple of sales cycles after the "cloud" was when you started hearing about all this data stuff in earnest. The message has been constant, almost suffocating, but you have accepted it now.

What harm could it do? But wait. There's too much. All of this data is flowing around — my data? How come all of these

corporations have my data, know everything about me? How come my neighbour knows all about me? Did we ever face such a challenge before? Did nobody in the past think that control of the information, the power...the assets, was so vital? I know, we need a strong man at the centre. Someone to keep us from the depths of our worst excesses. A father-figure perhaps, to keep our little nymph-heads above water. You know who I mean. A benign, modern-day Poseidon. Like in the days of republican Rome, when great peril was at the (water?)gates. That's right ... a "Datator" (a "Data Dictator" doesn't scan, despite the alliteration, sorry). Just for a while, you see. Just until the peril ebbs away. Sulla fulfilled the role and relinquished it, as had others before him. So did Caesar, didn't he? Didn't he ...?

Richard Gray, Australia

Assumptions:

- Information = Power

I believe that over the next 15 years there will be a shocking change to the way we collect ideas and how we communicate. As newspapers and TV stations come under extreme pressure it maybe that news organisations are very dependent on customer support and/or the support of a number of larger corporate organisations as subscription-based funding becomes harder to attain. If newspapers aren't printed anymore, then the ease of launching an opinion-based news delivery will become easier. Therefore, groups with a vested interest other than the sheer profit from good news that attracts a subscription payment, will become more apparent. Governments may find that they need to become more active in this space to protect balanced reporting. Public service media

collection will become, therefore, more important in every aspect of news collection.

Anonymous

Assumptions:

- D6: Analytics-based decisions rule life

In the future, probably, data will act a major role in our life — now we are studying each and every pattern of data in order for us to take the best decisions and, sometimes, an algorithm takes our place and takes the decision. So maybe in the future we will keep digging for more data; maybe it will become an addiction caused by the fear of not facing a crisis, like we did in 2008, without expecting it. Maybe we will try to understand why today I was not in a good mood and link this to:

- 1 What I ate in the morning.
- 2 Who woke me up — is it my wife, my girl, my boy or maybe the maid — and many other factors or habits we have.

Could we arrive in a moment when a girl meets a guy, she will dig up the public data on him and see what he likes and why some of his relationships did not work and then try to avoid such reasons in order to stay with him, and after a while she will discover that they are living a lie. Shouldn't we respect the choice of taking decisions not based on concrete evidence but based on guts or a will to try new things and see what will happen? As a conclusion, I think open data will take from us the "rush" from awaiting the result or the consequences of an action; and, if we base everything on data, by the time we arrive to business as usual we will be more and more emotionless.

Luc Byhet, France

Assumptions:

- U9: Privacy concerns will be overcome
- D7: Cybercrime changes; from hacking systems, to hacking data, to hacking people

Olivier is your classic case of a startup entrepreneur. It's 2025 in Paris and he's launching a new food-centric mobile community, something that isn't new at all. Early effort in this area started as far back as the mid-2000s, but in the mid-2000s things were relatively straightforward: build your website or mobile app; let people take pictures and discuss; grow the community; and sell the data to whoever wants to buy it, without informing the user, and without helping them too much, actually, beyond connecting with friends over food. That was a bit like the wild west.

2018-2020 saw several cases of online services and communities taking advantage of information and human augmentations to get people to almost automatically buy new products and services. We went from tools and services that were supposed to help people, to tools and services that made them do things that were trickier before (when marketing was a mixture of art and data, with results that were sometimes difficult to anticipate). You get the scripts, you will get results. Public outcry followed, with more and more people using context shields, or re-programming personal augmentations.

Now, in 2025, it is all about compliance. The new service Olivier is launching clearly displays what is going on. Fifty percent of the information displayed at the start of his application relates to how data is used: "This service is provided to you free, but we

make money out of the data you provide to us. Data is shared with health- and transportation-related government bodies, and third parties — including your device manufacturer and carrier. We do not share your data with food manufacturers and restaurants. We renounce ownership and revenues on any recipe or food-related product discussed in this community. We will not re-reprogram your personal augmentation to make you buy other products."

This kind of disclaimer is now mandatory, and this one is setup to make users more comfortable, but that is just the tip of the iceberg when it comes to compliance; his company had to go through multiple gateways to get his service started: government and regulation bodies, carriers, device manufacturers, and so on. Cost of software development didn't really increase, but launching costs are much higher than before. As a consequence, innovation is slower than before, but consumer trust increased.

Consequences of this situation — of increased overhead when launching and running a new service — are:

- Larger corporations, which are used to compliance issues, got better at launching new innovative services.
- Startups have to find ways to bypass regulations and gateways, renouncing control and ownership over data — leading to a situation where their valuation can't depend on data anymore.
- Emergence of a new class of brokers helping companies comply and work with regulations; that is, "gateway brokers:" helping new services go through all the gateways, and making sure they

avoid a public outcry in case of problems and the possibility of being shut down from one day to another.

Lars Lin Villebæk, Lanwei Group, Denmark

Assumptions:

- U14: Data gets an "attitude" with semantic technology

What we thought was "The New Normal" continued to change. Both from a macroeconomic perspective as well as from any other angle. Businesses intensify the hunt for personal data that can be converted into digital channels directly to us, the consumers.

My personal study of context-aware computing and models, that can help to protect me from the wrong information at the wrong time (spam) and chase exactly the information I need at the right time (before I need it), at the right place (before I get there probably), and at the right channel (maybe even before I switch away from the channel I am in right now). I personally feel that will be the greatest relief, and a way to free up time that I can spend with my sons on quality activities. It will help to relieve the stress pain haunting me when I know I need to make fact-based decisions and do not yet possess the information I require. It will help people like myself, who live around our global world, to achieve the exact same benefits. I will build this service and give it away for free. It is a matter of improving everybody's life quality, and harvesting the benefits of IT while protecting us from the threats ... of IT. Lars, a father.

Anthony, Harrington, U.K.

Assumptions:

- U6: Everything is personalized
- U15: Smart machines will emerge

A look ahead to information in 2028. There is the potential for a complete, disruptive step change, in the way technology affects and shapes communication, to have taken hold in advanced economies by 2028. Moreover, to a large extent, via wireless networks, the same technology is likely to have appeared by then in emerging/recently developed economies.

Let's begin with some simple progressive steps from where we are right now. Today's advertisers are able to do deals with players such as major search engine providers, media content providers such as Reuters and the Financial Times, and ISP platform providers, which allows targeted video to be displayed on windows alongside content directed at end users, or requested by end users. These video windows invite the viewer to pause their current task and explore the content being pushed to them. Give it a decade or thereabouts, with advances in interactive voice systems and Web animation, and we will be looking at personalised "assistants," avatars, appearing on screen drawing attention to related content and then developing that content in dialogue with the user. Microsoft famously tried this with the animated paper clip and puppy in early versions of Windows, but the results were feeble and pre-scripted. The big difference will be "intelligent" interaction, driven by massive centralised artificial intelligence servers using neural net technology to improve the system's recognition of a huge range of potential patterns and behaviours, instantly reacting to feedback cues from the user's

expression, tone of voice, body posture and so on.

Thinking about this for a moment, you find yourself in a completely different world across a wide range of activities, from care of the elderly and the sick, to pre-school education/entertainment and play. Mainstream education will be transformed. Work will be transformed (not least because of the interaction between robotics and communication, but this lies outside the scope of this brief essay). First a quick warning. Intelligent avatars will create some serious issues with "capture," a term familiar in psychoanalysis where analysts have discovered that patients are prone to falling into a master/disciple relationship with their analyst and where analysts are schooled to actively disrupt "capture" activity by prompting more self-awareness and personal control on the part of the patient. My point here is that a deeper reach by systems technology into people's lives can easily be a double-edged sword.

Technology can also be used to reach out and shape young minds in undesirable ways, toward the wrong goals. Again, we will have some growing up to do, as an intelligent species, to reap the rewards without being impaled on the thorns of this developing interactivity with the "machine."

Search engine technology will be a mainstream driver of developments in avatar interaction. Most interactions that are not simple commands are implied searches of one sort or another, and a technology that can draw on the implied reasoning behind a search request can expand the usefulness of the search and prune/prioritise the results much more effectively. Again this can be double-edged, depending on the degree of interaction allowed. You are on a dating site and the avatar asks, "How many dates with different partners have you been on lately?" "Six"

"Oh, are you having difficulty finding someone you can form a stable relationship with?" As this little scenario shows, interaction can be disconcerting and any search can lead off to more profound areas of searching.

Clearly it matters little what devices "host" this interaction. Everything from Google-type glasses, to a smartphone, to a projected image on a wall or building frontal can be host to the delivery system. There is also the opportunity, when we have this technology, for layered approaches. For example, a sales analysis system could sit on top of a rep's video or voice conversation with a client and provide private feedback to the rep on the client and on the rep's own performance through the conversation. Opportunities for add on sales, or for relationship building that are missed by the rep could be flagged by the system and the rep nudged in the right direction. Expert systems to improve productivity and performance will be a normal part of business. Staff evaluations will probably be continuous on a rolling basis, instead of half yearly or yearly. There is scope in the developmental direction I have sketched out here for half a dozen new Googles and Microsofts to emerge. Behind the scenes, big data sets will become enormous — fuelling the need for ever faster retrieval and prompting quantum storage techniques.

Is this a step forward for the human race? The answer is "it all depends," mainly on the extent to which people develop, or are allowed to develop, inquiring minds. In a sense, we are already using the "hive mind" when we use Google and Wiki and we don't feel any less free. Information is what you make of it (the optimistic view) or what it makes of you (the pessimistic view).

Brad Monterio, Colcomgroup, U.S.

Assumptions:

- U6: Everything is personalized
- U14: Data gets an "attitude" with semantic technology

Technology is increasingly allowing democratized access to information. Users of information seek greater capabilities to mash data, analyze bigger data sets, and mix up all types of data formats and structures easily to make decisions. They want to do this on mobile and wireless platforms, and they want to do this for free or very cost-effective access.

Big data is causing the need for little data that is personalized/customized to ourselves (for example, I want to know what makes me tick, what products I don't know that I will be wanting in the near future, etc.). In order for this to happen, we need tools to access these data sets across all formats and structures. We need to be able to query those data sets in plain language very quickly and reliably. We won't necessarily need handheld devices to view this data (and so be limited by things like memory space or storage or processing capabilities) — advancements like Google Glass point to future technologies that can bring data into our physical personal space (not just our fingertips on a device), whereby the data is projected holographically around us for manipulation and analysis.

Data will be available in an ongoing, ever present and organic invisible stream that allows us to dip into the data streams and gather what we need as a snapshot in time. Data will be self-aware — allowing it to predict its own future and guide us with predictive intelligence for business and personal decisions. Data will not need to be manually entered into databases by humans

(thereby introducing risk for error) — data will be gathered, captured and analyzed by smart systems, regardless of format or structure (and including numeric and alpha/narrative information).

Anonymous

Assumptions:

- U1: Economy will bounce back
- D1: Recession is the new normal
- U3: All information will be free and is open

The economy will bounce back, or the crisis will deepen.

Knowledge is something that can't be claimed to be owned by somebody, it is for anybody.

Shahnawaz Aziz, Maersk Line, U.K.

Assumptions:

- U1: Economy will bounce back
- U15: Smart machines will emerge
- U16: Continued technology evolution

The economy will bounce back. In a future scenario I see big data playing a major role as more and more devices get connected in the Internet of Everything. I see that cloud is here to stay as the need for data analytics will grow exponentially.

Leen Blom, Centric, The Netherlands

Assumptions:

- U12: Next to business analytics, there will be personal analytics and planet analytics
- U15: Smart machines will emerge

7 a.m. and Jayden rolls out of his bed. He jumps on his KidsEnergyTrainer (KET) to keep his muscles supple. This is something he normally doesn't care about, but his sister Zoey entered a "personal carbon footprint reduction contest." And, as she reached the fifth position from the top, he is happy to transfer his generated energy to her. By the way, their mom considers it a sport to have a climate-neutral breakfast. While Jayden drives the trainer, the energy is converted to electricity which is fed back to the power grid via the so-called PlanetSaver. This registers all in-house-generated energy and Jayden generously donated his production to Zoey. "Hey, Zoey, wake up! And jump on your KET, I am not your slave!" Sighing, Zoey walks groggily to her MuscleTrainer which is also connected to the PlanetSaver. The other day she started playing tennis and has to train certain muscles. "How much did you generate, Jayden?" "13 points" "13 points? We need 120 today!" "Just train yourself! By the way, ask Luke, he is consuming points instead of generating..."

True story. Brother Luke just thinks it's nonsense. And, at age 16, he will buy a motorcycle. Only thinking about this makes Zoey shiver. Last month she worked on a project at school. She and her teacher estimated a 21 energy point drop each day Luke would use his motorcycle. Luke didn't care. "But then I am gonna loose!" "So what? Riding a motorcycle is fun. That carbon footprint thing is for kids" "Tsss, you are still a kid..." To prevent being slapped by her brother she flees to the living room to check the HomeControl to see if the wind did its job; 25 points, not bad, definitely

because of the breeze. Nice thing, gaining points while sleeping, Zoey thought.

Dad was making tea in the kitchen. "Breakfast is ready!" Boiling water is fun nowadays. They replaced their kettle with a WaterManny. This device has a handle to generate electricity. It also has an emergency-switch, for using normal power. Mom caught Dad several times using this switch. She told him she wants to make an energy-friendly start in the morning. "But I had to go" "Just get up earlier! You are always late, you stay up too long. by the way, room-lighting costs a lot of energy. "If we listen to you we all have to go to bed before dark. " At 8.15 a.m. they went out after a leaf-check of the solar cells. Their neighbor's tree is a burden: it filters 5% of light, but also fallen leaves sometimes cover 50% of the cells. They used to say, "Trees solve carbon issues, don't they?" Good point, discussion closed.

Nice thing is that trolleybuses stop nearby. Last year's public transport pass information is shared with their CarbonFootPrintSystem. Collected points are added to their children's accounts. They think children should be carbon footprint aware. They also benefit from this system due to a tax reduction policy — they didn't dare to tell their children. Mom steps into her electric car, not every school is easy to reach by public transport. She is allowed to use certain charging stations with a discount, in which case she collect points that will be added to the CarbonFootPrintSystem. No more filling in forms like five years ago. The user friendliness of the system convinced many people of the added value of carbon footprint reduction. That way, the government's goal of 30% reduction seems feasible.

"Hi Rose, how are you?" "I'm fine Frank, thank you! How are you? World Wide Fund for Nature people arrived already?" "No, but

they will be here in 13 minutes." The school donates 50% of energy savings to the World Wide Fund for Nature (WWF). Children start school days with thirty minutes sports to generate energy for the morning classes, as the supplier of fitness machines added connectors for the PlanetSaverSchool. Last week, children built a refrigerator-solar-mirror. The sunnier it is, the more cooling needed; even a child can understand that, and they did.

Dad came home early afternoon so he prepared diner. They used to cook everyday but they changed this into once in three days. That is more energy efficient even if you take freezing into account. Now they use special dishes that fit into the sun boiler. The microwave is still in use as message center, by putting post-its on it... "Dad, we are third!" Zoey shouts when she returned. "How's that, you were fifth?" "Luke and his friends were at the gym and they donated it all to us" "Weird guy, always joking about carbon footprint and then this."

Philip Indlekofer, Switzerland

Assumptions:

- D4: Monitoring becomes the norm

A child is born and this event and every subsequent event associated with its physical and mental existence become data points that can also be manipulated to affect its future state.

Fakhrudin Jivanjee, Kenya

Assumptions:

- U4: The service-oriented organization will emerge

Standards on data modelling will be sought. Metadata will move into the international space, customer data globally will eventually have similar structures to give way to perfect B2B technology.

If data structures are standardized globally to fit into master data based on the business object globally, instead of the organization/industry needs, then there would be a perfect fit for global services standardization to allow for B2B and automated technology without boundaries. For example, a customer data model should have at least all the standard structure required such that any system could be easily reached and data exchanged/integrated at a global level without need for migration, transformation or legal arrangement processes.

Anonymous

Assumptions:

- U2: Information is an asset

Data as an asset will be replaced by combining data to create information. Information is the new asset. By shifting from data to information, the focus on protecting data will be reduced and shifted to protect information gathering and analysis techniques. More secure approaches than today to have access to processes, services and data will be developed and used (e.g., people using their own body, like a fingerprint, as a signature).

Mady Korada, U.K.

Assumptions:

- U2: Information is an asset

- U4: The service-oriented organization will emerge
- U9: Privacy concerns will be overcome
- U10: Monitoring becomes the norm

Guess what's the sexiest job of the 21st century, data scientists — the geeks of the 20th century. And what's their medium of choice — data!

Data is cheap, information is invaluable. Anyone who can mine, distribute and maintain its quality will rule the next century. Apple and Google, today's biggest companies, are the finest examples of the information economy. Information is the oil of the 21st century.

Google now wants to control the way people access this valuable commodity via smartphones and the apps market ecosystem. They have successfully bypassed the telco carriers out of the gravy train. They are threatening to do the same for payment providers. Watch out for TransferWise and azimo to make payments simpler, faster, cheaper and more secure.

Banks have already sunk huge amounts of money into designing leaner banks that are customer focused, agile and innovative. Their current lethargic legacy systems are expensive to change and maintain, making them too slow to offer new products without considerable cost. A seven-day bank account transfer in the U.K. was only just made possible recently, this is too slow for this day and age. They are just gearing up to react more quickly, but they will probably have to just buy out smaller innovators at expensive valuations for their lack of agility and long-term strategic thinking. Banks have too much historical baggage dragging them down.

Banks and insurance will have to create data services. Some have already started doing this, which only opens them up to competition from brokers or collaborators who can procure customers and leave the transaction processing to the traditional banks. Mint-style personal finance services will keep the margins as they start to control the customer relationships. Financial services have resisted competition due to regulatory compliance requirements, but new business models will threaten their dominance. Peer-to-peer and business-to-business lending will rival the biggest of the lending institutions.

Currently, healthcare is expensive; partly because it takes so long to measure vital statistics and the equipment used is bulky and expensive. The tests have to be scheduled and performed by authorised individuals. We will see digestible microensors and smartphone apps that can capture measurements within an acceptable margin of error. These will become legitimate tests upon which doctors can base their decisions. Smartphones will capture these statistics for numerous metrics, creating a real-time health check alerting you to potential issues long before your body even shows symptoms. Done right, they could ease the burden on the healthcare system — so it could concentrate on treatments rather than time-consuming diagnosis.

A hospital in Canada has already used big data to analyse and monitor the vital statistics of a premature baby continuously, to predict complications and give doctors valuable time to treat them. Continuous monitoring of vital statistics is not available today, a microingestible sensor in your body will achieve this non-intrusively.

People will move to living their lives entirely online, using the cloud to share and store their memories, conversations and

interactions. In spite of the pervasive American Prism programme, information will become more difficult to track and trace. Alternative currencies, like bitcoin, silk route and TOR networks, will gain in popularity. New-age payment systems will break down geopolitical barriers. With virtual currencies operating in secure, nearly untraceable, networks these payment systems can easily operate under the radar of governments and across borders. This will push online innovation as much as sophisticated fraud. It will be a fine balance between the two as a generation who lived their entire lives on the Internet are less fearful in return for better and speedier services. High-tech skills will be the norm and specialists will be in even greater demand.

A great opportunity for the current players to innovate and keep up with. Governance of financial services will struggle to keep pace with innovation, as always; and creativity and governance don't make great bed fellows.

All of this sensory overload impacts us as human beings too. We are starting to see Attention Deficit Trait (ADT) not as an illness or defect, but as how our brains react to this deluge of data. Data will be ignored, only information is consumed. We owe it to ourselves to not let it overpower our faculties. For one, we will be doing less driving on the congested roads by leaving that to the cars themselves. Information can give us time back, only for us to do more things that create more data points to analyse. The circle of data (life) goes on!

Karla Carter, Bellevue University, U.S.

Assumptions:

- D2: Information = Power

- D7: Cybercrime changes; from hacking systems, to hacking data, to hacking people

The election of 2028 marked a departure in American politics: the partisan rancor that overshadowed the first two decades of the 21stst century gave way to candidates who believed in the value of compromise; of course, it helped that campaign contributions were banned in 2022, freeing the country from what had become an effective plutocracy, aided and abetted by lobbyists. Candidates were given free social media accounts and 100 college interns (funded through the new fees drivers, paid for the right to drive themselves instead of using the driverless mode of their cars) to run them — although "college" is an old-fashioned word for describing what post-secondary education had become, as it implied a static physical location and only a few traditionalist students chose that route anymore. Young adults assembled their own educations, drawing from a multitude of classes sponsored by institutions worldwide, and taken online, as it were, projected onto whatever surface could serve as an interactive display (even sand, which, admittedly, was tricky to implement, although it never lacked for a large pool of testers). Competency and proficiency were what mattered, not a lockstep major; flexibility was a core principle. Real-world experience was mandated, so to be selected as an intern for an election was a high honor. Interns — easily identifiable by their thought-to-screen headgear (funded by the Rare Earth Metal Reclamation Tax that everyone who owned any device paid) — were sworn to non-partisanship and acted only as technical vehicles for the candidates' communications. Fact-checking capabilities integrated into the Internet had advanced to the point where inconsistencies and errors were spotted on the fly, as the intern was thinking the content, and what

ultimately appeared on the display was free from...accidental inaccuracies and unwitting plagiarism.

Following a campaign noted for its logical and measured discussion of issues that affected all Americans, Emerson Smith, the Gulf War veteran whose open smile smoothed over her indomitable personality, won the presidency easily, relying on the reassuring combination of 55 years of living to the fullest and a forward-thinking mindset — she was both mature and youthful at once. Her running mate, Parker Lotr (who played up the relationship between his last name and the Tolkien series whenever possible — and, yes, people absorbed even classic 20th century works from their pillowreaders that whispered knowledge to them as they slept), was the youngest vice presidential candidate on record — he turned 35 the day before the inauguration.

If Emerson represented tradition looking ahead, Parker was everything that was new. Born in 1994, he had never known a world without a World Wide Web. One of the early adopters of Google's Glass project, Parker was fascinated with the idea of infinite archiving. He founded a startup — Huginn-Muninn, quickly shortened to "HM" — that integrated with Glass 2020 and recorded not only every sound and every image, but every thought and every imagination. The HM technology was shrouded in secrecy, but the users adapted well to the implant — after all, implants were popular among the tech-savvy by that point; none of them carried keys or cards or money — why would they when a swipe of the hand, Jedi-style (the classic mid-20th century *Star Wars* saga remained a perennial favorite) would open a door or pay for an item?

After becoming the wealthiest person under the age of 30, Parker switched his focus to public policy, which — given his interest in infinite archiving — was a perfect fit, given

the ubiquitous role surveillance had come to play in everyday life; in all ways, but, especially, the government's interactions with its citizens. By the start of the second decade of the century, the government was already capturing as much data as it could, on everything and everyone. The data center set up in the Utah desert eventually quadrupled in size — basically forcing the widespread adoption of solar and wind power on its own, if only by sheer example. The federal government, in fact, was an avid supporter of Parker's HM recording device, requiring its use for military personnel, federal agents, park rangers, and civilian intelligence operatives, to name a few. Local law enforcement employed the device as well — it proved to be a beneficial accompaniment to the UAVs that roamed the skies, recording everything and everyone with their powerful high definition lenses. All data collected was streamed into Utah, where the latest and greatest in data mining techniques sifted and analyzed: looking for patterns, and following lead after lead — because eventually the data always leads somewhere. It was rumored that the automatic fact-checker on the Internet was integrated into the Utah system — and that the system would know half-way through a communication snippet whether the author needed extra watching.

Emerson was privately uncomfortable with the depth and breadth of the government surveillance machine — she remembered a time when forgetting was a good thing — and publically campaigned on a platform of evaluation of the system. Many thought it odd at first when she announced Parker as her running mate, given his stake in the machine and his overall philosophy of infinite archiving, but they appeared in perfect sync in public and seemed to perfectly complement each other. And, who better to reform a system than someone who is fully one with the system?

It wasn't that Emerson was anti-technology, either — a hereditary cardio-vascular ailment had afflicted her shortly after she turned 50, and her state-of-the-art pacemaker device made sure her life was unaffected by her rogue genes. The pacemaker communicated regularly with her physician, who, in turn, could send proper instructions to Emerson's portable 3D food printer, making sure that Emerson's "Twinkie" (you could print the nutritionally balanced food in any shape and format and Emerson had a fondness for the Twinkies of old) had the right balance of nutrients and calories for her physical condition. The 3D food printer itself was a marvel; unbeknownst to anyone but her doctor, Emerson had a severe peanut allergy and being able to print her own food made life less worrisome — the Twinkie output was merely a bonus.

In May of 2029, Congress passed legislation that would increase, yet again, the size of the data center in Utah. Emerson knew the legislation was coming, but as it crossed her desk for her to sign (she forwent the autopen in favor of an early 21st century retractable fountain pen, filled with bottled ink), she paused...and then paused longer. Her private doubts rose to the top. She couldn't sign it. The surveillance state needed reining in. She called Parker in and expressed her thoughts to him. He listened and said he'd have a proposal to her by the next morning that she could present to Congress and the NSA (who was in charge of the Utah center).

The next morning America was stunned to hear their new president was in the intensive care unit at Bethesda, hanging onto life by a thread, because of a severe allergic reaction. Something had gone wrong with her 3D food printer and it had printed a Twinkie with peanut butter filling. Only the nearly magical operation of her

pacemaker had kept her alive through the anaphylaxis. An investigation revealed quickly that an error in the instructions sent to the food printer from the doctor's office had substituted the pattern for peanut butter into Emerson's food. Even in 2029 technology glitches happen, apparently.

With the perfect customized recovery therapy, coordinated by all machines communicating with each other, Emerson seemed to get better little by little as the week went on. She was sitting up in her bed when Parker came to visit. He wanted to show her the latest gadget he'd gotten. (Parker always had the latest gadget.) As his fingers slid in patterns across the small display, Emerson started to feel dizzy and short of breath, almost like an anaconda was wrapped around her chest — as though her anaphylaxis were coming back. She tried to speak, to ask for help, but to no avail.

By the time Parker walked out of the room to call a nurse, Emerson's heart had stopped. The autopsy indicated her pacemaker seemed to have misfired and caused the heart attack it was designed to prevent. The nation mourned, newly sworn in President Parker Lotr chief among them. When the country returned to business as usual, his first act was to sign the Utah data center expansion legislation.

Nestled in that very Utah data center, unnoticed after the fact because no one demanded a correlation, were all of Emerson's medical records, including her peanut allergy, the food pattern for her Twinkie, and the moment by moment feed from her pacemaker, including its last moment, when Vice President Parker Lotr, in order to preserve his beloved surveillance state, hacked into President Emerson Smith's pacemaker and turned it against her, after hacking into her food printer and

making it print peanut butter...assassination by data.

We learned in 2029 that while technology changes, humans don't. The Romans routinely conspired against each other when it was convenient or expedient to do so — "et tu, Brute?" — why would 21st century humans be any different? Data is power. Beware of those who seek to take power over your data — especially when your data defines you, as it does more and more every day. Once we reduce our lives to mere data, we become, at worst, hackable by those with malintent. They may seek to end our physical lives, our economic lives, or our emotional lives; assassination by data can take on many forms.

William Clapp, Market Harborough, U.K.

Assumptions:

- U2: Information is an asset
- D8: Connected society will redefine social norms

Information — there's a lot of it about. And there's going to be a lot, lot more. The more there is, the less each bit is worth. Aggregated information is worth something. At the margin though one more bit of information about me is without value. Books used to be luxury items, owned only by the elite. Now they're digitised and you can get one for less than the cost of a cup of coffee (and coffee isn't a luxury item anymore either, come to think of it).

Paradoxically, as the value of information is going down awareness of its value is increasing — global corporations worth billions of dollars are built on the idea that they own so much data that they can mine it for money. Big data, bigger bank balance.

My global reach is immense, but what's it worth? How might individuals respond to this realisation about the value of information? Well they might just get all protective about it, "If you want my information you're going to have to pay for it." This flips around the current commercial relationship where "it's free and always will be." Free, shmee. Customers start thinking "hang on a minute — you're getting lots of information about me for free. Well it won't always be." All-you-can-eat data — what if I'm not that hungry anymore? Our reluctant love for Facebook, Google and co., will continue because they'll keep giving us things that excite us. Does an addict love his dealer? What's love got to do with it? We'll keep providing information in return for functionality. I don't value the functionality enough to be prepared to pay for it, and Google-Facebook don't value my information enough to be prepared to pay me. Question is: will the functionality continue to excite us or will we become jaded? What was exciting yesterday bores me tomorrow.

We're involved in a spiral — the Googles and Facebooks improving their offer to entice us to keep sharing more and more information so they can bundle and sell it. The better the online experience the more time we'll all spend there and the more we'll give away about ourselves, bigging up their data and their profits and enabling them to invest in further enticements. They've got us hooked, we can't give up, but we want more. In fact, they might just have reached a point of being like roads — such an integral part of our lives that we can't really imagine what it would be like without them.

What of the firms that are actually paying for the big data? Will they keep buying? Well, probably. They have to keep believing that competitive advantage will come from ever more intricate analysis of their customers'

and potential customers' preferences. Everyone's at it, no-one can afford to stop: keep running or you'll fall over. So my Facebook-Google addiction drives their paying customers' addictions — it's neat now, and it carries on being neat.

We do and we don't want to stand out from the crowd — leading to everyone protecting their reputation and personal brand like they're famous. "No pictures, please" — unless I authorise the photo shoot. If everyone knows everything, your behaviour has either got to be buttoned-down so that you expose no career-limiting weaknesses or so entertaining that you don't need that kind of career anyway. Over-reaching ourselves to get noticed — ever more extreme behaviour to stand out from the crowd. I'm no-one in the real world of my village, but globally I can be a virtual freak show. Sharing — just because I can, doesn't mean I should, but hell, let me entertain you. Dreams of being a YouTube sensation, a few weeks basking in the global adoration of millions of hits.

If I live in a village my chances of finding someone else who shares my particular interests might be small. The wider I cast my net the more likely I am to find someone

who does. Where does this lead us? To a world where people egg each other on from the other side of the world — "it's ok to think as you think — you're not alone." So the tyranny of the small group is overcome...at what cost socially? Deviance from local norms becomes more common, leading us where? To ever more globalised norms of behaviour, hastening the trend of everywhere becoming more like everywhere else. For westerners, used to this globalisation being essentially Americanisation and therefore Europeanisation, we tend to conceive it as basically benign — if people are becoming more like us it makes life easier for us. But realistically, won't Americanisation be overtaken by Sinicisation as the economic balance of power continues to shift? Less comfortable, less familiar.

So the future looks: increasingly Chinese; increasingly polarised between the risk-taking global self-exposers and the cautious career-managers; and increasingly technologically sophisticated as the big online providers lure us into providing more and more commercially useful information about ourselves.

Further Reading

Recommended Gartner Research:

- "How the CIO Can Influence Enterprise Strategy," Richard Hunter (G00255692)
- "Maverick* Research: Surviving the Rise of 'Smart Machines,' the Loss of 'Dream Jobs' and '90% Unemployment'," Kenneth Brant, Anurag Gupta and Dan Sommer (G00253498)
- "Security and Risk Management Scenario Planning, 2020," Paul Proctor, and others (G00250811)
- "Use Scenario Planning to Make Business and IT Strategies More Resilient in an Increasingly Volatile World," Ansgar Schulte, Mary Mesaglio (G00237486)
- "Scenario-Based Planning: Toolkit," Mary Mesaglio, Dave Aron (G00155342)

Other Recommendations:

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