MAKING SENSE OF MEGATRENDS: VIRTUAL CONNECTIVITY

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August 2018

Orange Compass and Australian Futures Project

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CITATION

McKenzie, F. and Han, A., 2018. *Making sense of megatrends: Virtual connectivity.*
Orange Compass and Australian Futures Project, Sydney.

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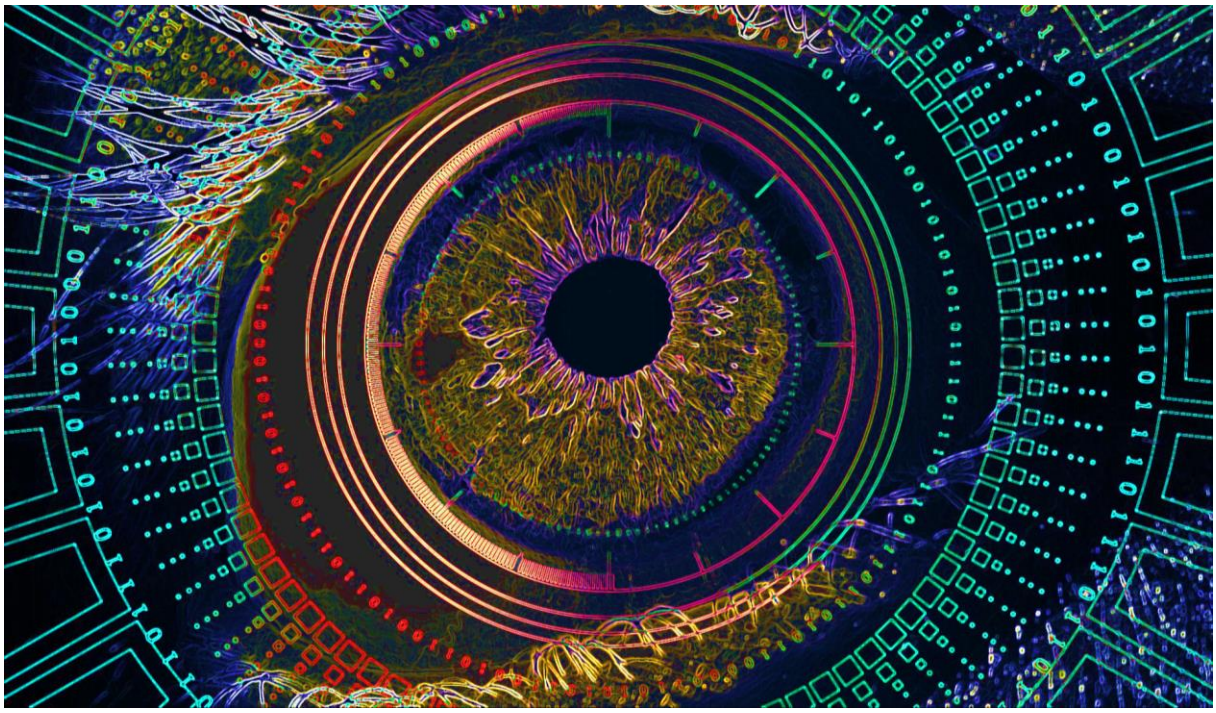
INTRODUCTION



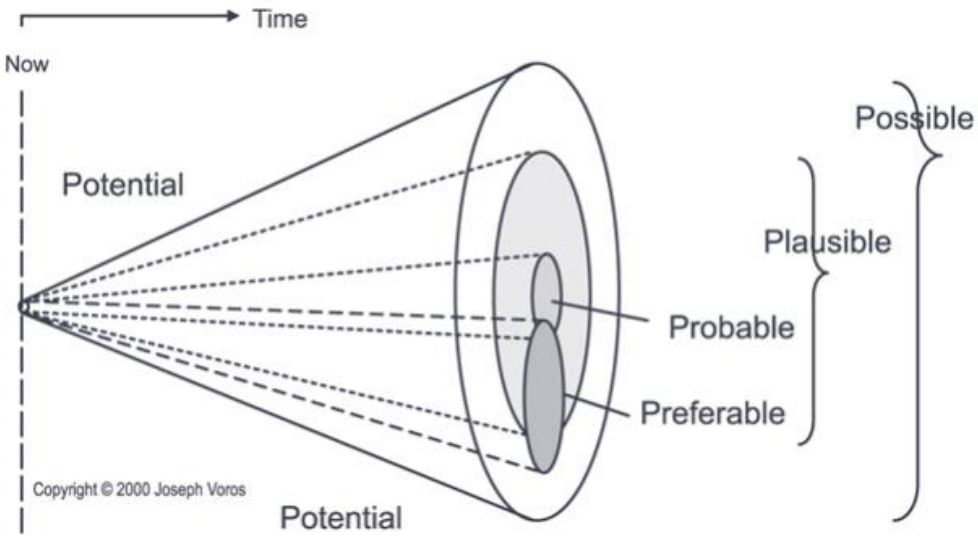
It's almost impossible to scan a twitter or news feed and not see a prediction about the end of days brought on by artificial intelligence or alternatively great wealth promised with the next bitcoin or technology boom. Humans try to predict the future. It's what we do. And we get it wrong and try again. That's also what we do. But we can think creatively and constructively about the future without needing to predict it. We can consider the evidence and understand how current trends may make certain futures possible. We can accept that there are a range of plausible scenarios that could unfold.

When conceptualising the future, it can be helpful to consider Voros' (2003) five types of futures:

1. **Potential futures:** alternative futures in general, including those we cannot even begin to imagine;
2. **Possible futures:** all the kinds of futures we can possibly imagine;
3. **Plausible futures:** futures which could happen according to our current knowledge;
4. **Probable futures**: futures which are considered likely to happen ('business-as-usual);
5. **Preferable futures:** what we want to happen based on subjective value judgments.

These five types of futures are further illustrated in Figure 1.

Figure 1: Types of futures (Voros, 2003)



The Futures field emerged during the mid-Twentieth Century as it became apparent that there was no single destination for humanity, but rather that there were many possible futures, some more desirable than others (Slaughter, 2008). The field is broad, with varied terminology and even more numerous methods, techniques and frameworks. What unites the field is a common purpose, not to predict the future but to highlight the many possible alternative futures (hence the use of the plural 'futures'). Judgment of what is possible, plausible, probable or even preferable will differ between people and over time, which means that opinions may change as the future unfolds (Voros, 2001).

What we do know is that the world is more interconnected than ever before. Complex and often non-linear linkages are driving rapid changes across sectors and systems globally. Events happening in one part of the world can have fast and far reaching consequences a long way from ground zero. Figuring out what factors are driving these changes is not easy, nor is predicting where the next change will occur. This is the value of strategic foresight. It isn't about prediction. It is about anticipating possible futures, learning how best to respond to uncertainty, and even shedding new light on present day situations.

There are a range of strategic foresight methods that allow for the consideration of multiple plausible futures. This is different from visioning exercises which often focus on a single preferable or desirable future. Megatrend analysis is one of these methods. Megatrends are deep-set trajectories of change in environmental, social and economic conditions, often unfolding over decades. They occur at the intersection of multiple trends. Megatrends analysis is not just about identifying pattern shifts but also considering the implications of these shifts (Wilkinson, 2017).

Many authors and organisations around the world have undertaken studies to identify megatrends. Some of the most commonly observed megatrends are:

- **Economics:** the major transformation currently taking place in the global economy as the centre of gravity shifts towards emerging-market economies.
- **Geopolitics:** the diffusion of power occurring globally that is resulting in a shift to coalitions in a multipolar world and to 'hybrid threats' or non-state-based threats, where nations no longer having the monopoly on advanced weaponry.
- **Demographics:** the population growth occurring in developing countries, population ageing in many developed and emerging market economies, and the ongoing shift to highly urbanised societies the world over.
- **Resource security and climate change:** the growing challenge of meeting increasing demand for natural resources such as food, water and energy, whilst maintaining ecosystem health – with the added challenges and effects of climate change thrown in.
- **Technology:** the many new developments in technology such as big data, the quantified self (personal data devices), blockchain, automation of vehicles and tasks, virtual and augmented reality, artificial intelligence, 3D printing, genomics & DNA editing. This also includes the applications of these developments for example in medicine, manufacturing, security, defence and emergency services.

Rather than replicate the plethora of good reports available on each of these topics, this report focused another trend – **virtual connectivity**. In this report, virtual connectivity refers to social, economic, cultural and political interactions that have been facilitated by the internet. In other words, it relates to online activities that influence or shape connections between humans.

In particular, this report focuses on the implications of virtual connectivity for social connection, governance, jobs, education and health. It is a synthesis of the observations of numerous authors and includes major developments as well as the big questions still being explored.

Before we jump into these big questions, it is important to acknowledge that the 21st century merging of virtual and physical realities is not a global phenomenon. Around two thirds of humankind have no access to the Internet. In terms of sheer numbers, almost half of the users currently accessing the Internet come from Asia (48.4%), followed by those coming from America (21.8%), Europe (19%), Africa (9.8%), and Australia (1%). Proportionally though, most of the countries with more than three quarters of their population accessing the Internet are developed ones - Canada, South Korea, USA, Japan, France, Netherlands, Australia, UK, Germany (Guilló, 2015, Bas, 2015). The topic of changing societies is therefore highly contextual (Heinonen, 2015).

We hope you enjoy this overview. For any feedback, or suggestions of the next megatrends topic you'd like to see covered, please email the authors at fiona@orangecompass.com.au.

VIRTUAL CONNECTIVITY AND SOCIAL CONNECTION

CHANGING CONNECTIONS

The online or virtual world is a growing part of our everyday reality. Virtual connection facilitated by the internet has already influenced human interactions in many socioeconomic, political, and cultural contexts (Guilló, 2015).

While the next section of this report concentrates on political implications, this section delves into the potential long-term impacts of the internet on social connection. There is a lot of interest in this topic. It is partly driven by the awareness that, at least to some degree, social connectedness, including to family or community, is good for us. Studies have even found that people subject to social isolation have a 29% higher risk of premature death - potentially greater than the risk posed by obesity (Cosmos, 2017).

Social connection is nothing new. It was human's ability to connect and cooperate in large numbers such as armies, schools and governments that led to the rise of homo sapiens. Aiding this connection has been our shared belief in constructs such as the value of money or the rule of law (Harari, 2015). The million-dollar question is how will this change as we live more and more of our lives online?

A NEW REALITY

An important implication of virtual connectivity is that the way we

perceive the 'real world' is changing. While many people still perceive online and virtual activity as somehow less real than events that happen in the physical world, this dualism no longer makes sense. It is like saying that a conversation had by phone is less real than one had in person. Social networks, collaborative work platforms, and even online political lobbying have already served to expose this myth. Our online world is deeply entwined with our physical reality.

Cyberspace and what happens online is not separate to but rather an extension of what happens offline (Ramos, 2015, Guilló, 2015). The way that social media is used is inherently tied to the local and cultural context of the user. This is because social interaction is both mediated by and influences sociocultural understanding. An interaction doesn't magically become free of all context because it occurs online. For example, studies have shown that the way someone in an English village uses Facebook will be distinctly English (Miller, 2016). The internet isn't something that is passively taken up. Individual's actively engage with and appropriate it to suit their purposes.

This distinction between online and offline will probably barely rate a mention in a few decades from now. Assuming we haven't become immortal, there will be no one alive with lived experience of a time before the internet. The internet won't be a technology that requires justification, it will simply be another place in the world where life happens (Bas, 2015).

In this new reality, content is increasingly visual as people seek to show how they live, not just describe it (Miller, 2016). The growing role of videos and visualisation on the Internet is visible in the popularity of channels such as YouTube and Instagram (Heinonen, 2015). The next steps in visualisation might even be 3D, 4D, and holograms. Immersion in virtual space will become more intense and beyond our normal visual capacity (Heinonen, 2015). Content is also becoming increasingly temporary with an growing appetite for interactions to be deleted after a specified time, thus enhancing user privacy (Eggers and Macmillan, 2015a).

LIQUID SELF

A curious aspect of the virtual world is that a user can constantly curate their identity or even reinvent themselves. Sometimes referred to as the "liquid self", this is an era where the user can introduce themselves to different people in different ways and at different times on different online platforms (Bas, 2015). The concept of "net reputation" has also become a widely discussed phenomenon, given that so much of our identity shaping now happens online (Heinonen, 2015). For many, the ability to continuously curate and rebuild their own reality is a positive. To an extent, anyone who has embellished their LinkedIn profile or tailored their Instagram feed to reflect only certain highlights of their life is engaging in identity manipulation. The degree to which a user manages and commodifies their personal brand in order to suit their desired audience varies - just as it does in the 'physical world'.

There are obvious downsides including the creation of fake personas and multiple identities to deceive other

users and the destruction of net reputation through identity theft or severe cyberbullying (Heinonen, 2015). When it comes to identity construction, it is worth noting that, as individuals, we engage with 'social fields' and 'sites of the self' and these contexts in turn influence our social identity (Ting, 2008). In simple terms, our identities have always been somewhat plural, with our behaviour fashioned to suit a social context. Our identity also morphs over time as a result of social interactions. These human characteristics predate the internet. However, the potential to generate significantly different and conflicting identities online is much greater, with potential complications not just for the deceived but for the deceiver's sense of self.

Another consequence of online identity shaping is the increasing peer pressure to have a suitable online presence in order to fit in. This pressure to conform is a surprising consequence of an online world. When most of our life is public, we tend to weed out the parts that might spark disapproval or trolling. In addition to conformity there is likely to be an increasingly mandatory aspect to our online presence. Virtual profiles could become compulsory – an idea that it is not so farfetched given that in some companies it is already required that employees have a public LinkedIn profile (Guilló, 2015). And we are already quick to judge a person without proper access to the Internet, email or a smart phone as strange, if not an outcast (Heinonen, 2015).

NOT SO SOCIAL

If our online lives are real, then the online world shouldn't necessarily reduce social connection and capital, it should just change the nature of it (Bas, 2015). And, to some degree, there is evidence to suggest that this is true. For example, the online networking revolution is allowing the internet to support face-to-face interactions (Guilló, 2015). The majority of people who use online social media deploy it in some way to manage offline social relationships (Dalsgaard, 2016).

Users are discerning as well. They will deploy different channels for different purposes: a text message to arrange a time to skype; a Facebook message to arrange a time to meet; an email with the meeting details. And as with any social interaction, the user is judged for their discretion in choosing the right platform at the right time for the right purpose.

Also of interest is the fact that users appear to have little emotional attachment to a single platform. It is something the big technology companies have already realised and why they are acquiring a suite of platforms for users to mix and match to suit their needs (Miller, 2016).

While social connections haven't withered with the introduction of the internet, they also haven't necessarily flourished in the ways we might have expected. For example, the degree of 'social', particularly in social networks, isn't high. In many cases, there is little interaction at all. For example, twitter accounts with thousands of followers may tweet every day and never get any replies from their network

members. Instead, the number of followers has become more important than the actual activity performed. Social networks have become so large they are unwieldy and no longer allowing the genuine exchange of information and the creation of meaningful connections. Instead the development of the network of followers has become an end in itself (Guilló, 2015).

This is not to say that all aspects of the internet have these characteristics. However, more widespread discussion is needed on how the internet is shaping the social contexts and constructs that govern social connections.

ALGORITHM OF LIFE

Our worldviews are increasingly being shaped by automated functions such as computer algorithms. Insights are being generated by machines whose job it is to filter and process the overabundance of shared information on massive virtual networks and platforms.

There are several fears related to this trend. The first is that there will be little time and less appetite for critical analysis, as the users' main aim will be to access information rather than process it (Guilló, 2015). Pessimists fear a future society with huge virtual networks, where interactivity has been reduced to the simplest expression where it is more important to follow (passive attitude) than to participate (active attitude). Connections become about affinity (like/unlike) instead of empathy (Guilló, 2015). Bas (2015) goes so far as to suggest that, instead of stimulating innovative synergies and connections among users, the Internet risks becoming a reproductive tool, basically oriented towards social control, surveillance, and market research (Bas, 2015).

The second fear is that our tailor-made information diet is fuelling disunity. The US National Intelligence Council's most recent Global Trends report suggests that a more interconnected world will continue to increase - rather than reduce - differences over ideas and identities. The report also foresees a world where an increasingly segregated information and media environment will harden identities - both through algorithms that provide customised searches and personally styled social media, as well as through deliberate shaping efforts by organisations, governments, and thought leaders. They suggest that some of these identities will have a transnational character, with groups learning from one another and individuals able to seek inspiration from like-minds a world away. A decrease in tolerance is likely to threaten Western ideals (National Intelligence Council, 2017).

The power of transnational identity groups is linked to a third fear – that political and ideological elements are building pressure for more exclusive virtual spaces and closed platforms (Heinonen, 2015). Growing access to information and communication tools will enable them to better organise and mobilise around political issues, religion, values, economic interests, ethnicity, gender, and lifestyle (National Intelligence Council, 2017). Quite strikingly, studies have found that information counter to an individual's opinion or prior understanding will not

change or challenge views but instead will reinforce the belief that the information is from a biased or hostile source, further polarizing groups (National Intelligence Council, 2017).

Even when platforms are open, we have already seen the growth in organised efforts to undermine facts and create "fake news". A 2018 report by the Oxford Internet Institute found that organised manipulation of public opinion over social media platforms has increased. This includes the activities of a range of government agencies and political parties who are using social media account automation and online commentary teams to spread junk news and disinformation, exercise censorship and control, and undermine trust in the media, public institutions, and science. It also includes paid advertisements and search engine optimization on a widening array of Internet platforms.

The Oxford Internet Institute found that the number of countries impacted by formally organised social media manipulation campaigns grew from 28 in 2017 to 48 countries in 2018. In each country there was at least one political party or government agency using social media to manipulate public opinion domestically. The authors go as far as to suggest that, "*at a time when news consumption is increasingly digital, artificial intelligence, big data analytics, and "black-box" algorithms are being leveraged to challenge truth and trust: the cornerstones of our democratic society*" (Bradshaw and Howard, 2018). Sweeney (2015) extrapolates further and questions whether social media could become weaponised, with the ability of online experience designers to foster infectible emotions and feelings. In this scenario, panic, phobias and even psychological conditions could potentially be spread with social media as the vector - something referred to as infectious connectivity (Sweeney, 2015).

Despite such reservations, it is likely that online platforms will keep proliferating. It would be fair to summarise this trend by saying that, while we will live in an increasingly networked world, it will not necessarily be an increasingly unified one.

VIRTUAL CONNECTIVITY AND GOVERNANCE

THE END OF DEMOCRACY?

As mentioned in the previous section, the information environment is fragmenting public perception and understandings of world events. When combined with a growing distrust of formal institutions and commercialisation of traditional and social media outlets, it has the potential to undermine democratic ideals like free speech and the "market place of ideas" (National Intelligence Council, 2017). This is one view. Others suggest that news of democracy's demise has been greatly exaggerated (Bedock et al., 2018). They claim that it is not democracy that is under threat, but rather the mechanisms for achieving democracy that need review.

To date, even as technology and communication mean more ways for citizens to make their voices heard, democratic participation remains largely limited to casting a vote between parties once every few years (Nuwer, 2018).

What is changing is what we hold to be true. Assumptions, values and ideologies we took for granted in the post-World War II era aren't guaranteed to withstand challenges in coming decades (Harari, 2015). Troubling economic, social and political trends (erosion of middle classes, growing inequality, and policy paralysis) threaten the stability of

contemporary liberal democracies and could dethrone democratic ideology – at least as it is now understood (Fukuyama, 2012).

What is also changing is that fewer citizens share a unified, uncritical and enthusiastic vision of democracy. A substantial share actually show little commitment to democratic ideals. For example, in Australia The Lowy Institute has found over the last seven years of polling that Australians, particularly young Australians, have a surprising ambivalence about democracy as a system of government (The Lowy Institute, 2018). To some extent, this is perhaps because citizens feel worse off and feel as if the democratic system is not working for them. Government systems seem slow and cumbersome in the face of rapid change and complex problems (Hilton, 2015). Party politics reduces voting to a binary option which is nowhere near the level of complexity of choice needed (Brock, 2017). Election-based political systems produce short-term mentalities and superficial patchwork fixes (Nuwer, 2018). At the same time, problems that governments must address – including climate change, terrorism, and increasing migration flows – are also becoming increasingly complex, costly and outside any single government's control.

DIGITAL GOVERNMENT

Where digital technology has been used in democratic process it has largely been focused on the use of online voting – or the replacement of voting all together. Harari (2015) predicts that democratic elections will become obsolete because data analytical software will be able to represent one's political opinions better than they themselves can. Already, psychographic analysis can already predict who are swing voters and who can be swung. Aside from the voting question, the discussion has also shifted toward an expanded role for technology in the democratic process (Soulas, 2017).

There are many ways that government can use digital tools such as to improve government services and processes, improve decision-making using big data and analytics and data sharing across governmental agencies and to the public (Corydon et al., 2016). One of the main trends we see in this regard is the tendency towards open government. Also known know as e-democracy, e-governance or government 2.0, open government holds that citizens have the right to access the documents and proceedings of the government to allow for effective public oversight (Longo, 2013). This can include posting government information and data such as key budget and planning documents online, allowing for greater transparency and civic participation (Bapna, 2016).

With technology, citizens can (in theory) evaluate policy in real time and co-design policy through the choices they make (Nye, 2014). Technology also makes it possible to distribute tasks to citizens (Eggers and Macmillan, 2015b). Not enabling citizen's involvement will likely bring into question the legitimacy of existing political institutions even further (Ryan, 2013). If efforts to improve government processes continue, it will likely become more 'distributed', where

government functions will be co-designed and co-created with citizens (Eggers and Macmillan, 2015b). Big data is also likely to play a role in influencing policy. The assumption here is that evidence informs policy, which is not always the case. Assuming a government did rely on evidence, the role of the public service will no doubt evolve in the future, especially if big data is perceived as being able to make better decisions.

PASSIVE PARTICIPATION

Despite technology potentially enabling activism and civic engagement, the evidence to date isn't encouraging. A lot of online civic engagement can be described as micro-participation, particularly the sharing of information about different social causes and initiatives. This is typically passive participation and requires a very low level of commitment. It is currently the most common kind of participation amongst social network users (Guilló, 2015). The trend extends to the internet of things, where the provision of physical and emotional data through personal sensors and other devices is another form of passive participation, as discussed in the following section on health.

This is not to deny the presence of powerful civic engagement facilitated by social media, including where it has played an important role in organising demonstrations. This has been the exception rather than the rule. The viral outrage that we see arise online quickly lurches from one topic to the next, the mob always looking for its next target.

While society has so far been unable to take full advantage of all the technological possibilities available to boost civic engagement levels, it doesn't mean it isn't possible. There have been an increasing number of efforts to engage citizens in more active discussions online through purpose-built platforms and careful curation of the 'user journey'. The goal is to counter the trend of passivity and a lack of interactions among social network users. There are early signs that there is both appetite and ability for greater engagement and thoughtful debate.

NOTIONS OF NATIONS

We can't talk about digital government and decision making without at least mentioning power, influence and access. The most extreme example is perhaps the ability of the President of the United States to be able to circumvent all the advisors and processes surrounding them to speak directly to their voters through twitter. Likewise, voters are able to access (at least theoretically) the President directly through twitter. This is nothing short of a huge disruption in political process, the implications of which have barely begun to be imagined.

While digital tools increase the ability for citizens to engage with and monitor governments, it also allows governments to watch citizens. The use of technology by governments has the potential to go either one way (improve democracy) or another (authoritarianism).

When it comes to social networks, to what extent national governments

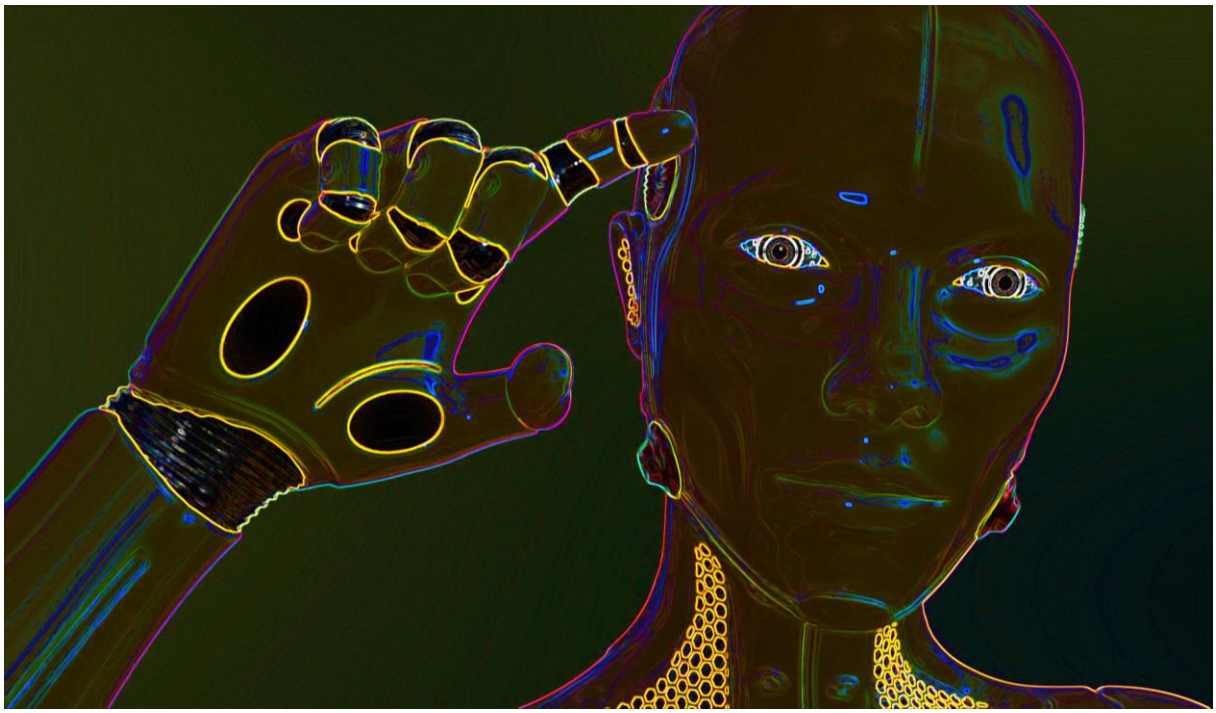
respond to the challenges they pose remains to be seen. Governments may eventually seek to control these networks - even if such control is illusory (Shell International BV, 2013).

The hidden assumption here is that the role of the state will remain important in to the future and that we will even have nations as we currently understand them. Benedict Anderson famously defined nations as "*imagined political communities - and imagined as both inherently limited and sovereign. It is imagined because the members of even the smallest nation will never know most of their fellow-members, meet them, or even hear of them, yet in the minds of each lives the image of their communion*" (Anderson, 1983).

It is very human to be able to not only imagine and connect spaces in the physical word, but to be also able to imagine the virtual world and give it meaning. It is another imagined place, just as a nation is collectively imagined. If virtual connectivity is changing our identities as well as our sense of belonging, then our imagining of modern nationhood may also be changing.

Technology and political change have long gone hand in hand and only time will tell how this will play out. Digital platforms might help voters to feel that democratic mechanisms still empower them, or it pave the way for the next new ideology.

VIRTUAL CONNECTIVITY AND JOBS



WILL A ROBOT TAKE MY JOB?

One of the most common questions related to the future of work is whether or not robots are coming to take our jobs. And the answer is yes. For some of us. But it won't be robots so much as computers and algorithms.

This is all part of the "Fourth Industrial Revolution" – characterised by the fusing of the physical, digital and biological worlds (Schwab, 2016). Again, technology and change have gone hand in hand. Two key parts of this process have been digitisation and digitalisation. Digitisation is the process of converting information into a digital format. The digitisation of photos, music, documents, data, social networks - and just about everything else. It is one of the most important phenomena of the past two decades. It has led the way to massive developments in digital technologies such as blockchain, the internet of things, and wearable sensors (just to name a few). This in turn has paved the way for digitalisation – where digital technologies are leveraged to improve or change a business model, provide new revenue and create value. The digitalisation of many sectors as well as the growth in digital flows of money, information, services and trade is changing the nature of labour markets around the world (McKenzie, 2017).

On top of this, through artificial intelligence and algorithms, we are

seeing digital technology expand into learning machines – dynamic entities that consume and translate data and perform tasks that were once the realm of human brains. This is big news and there has been a lot of speculation about what automation and 'computerisation' might mean for jobs.

Estimates on the actual numbers of jobs at risk vary depending on method used. They range from high estimates like a famous 2013 study that found 47% of total US employment had a "high risk of computerisation" by the early 2030s (Frey and Osborne, 2013). This was based on assessing entire job categories. Lower estimates usually arise when examining tasks within a job rather than the whole. For example, McKinsey Global Institute examined 18 capabilities which every job combines to some degree (things like sensory perception, cognitive, social and emotional capabilities and natural language processing). They found that less than 5% of occupations are candidates for full automation. However, almost every occupation has partial automation potential. And they estimate that about 50% of all the activities people are currently paid to do in the world's workforce could be automated by 2055 just by adapting technologies that already exist (Manyika et al., 2017).

That being said, none of these estimates consider job creation. They are just about possible job destruction. And in reality, we are more likely to see an advanced algorithm that acts as our boss, rather than a humanoid robot that competes with our business. The results will probably be a significant disruption rather than a computer driven Armageddon. While short-term effects may have been overestimated, it will still hit some people harder than others, potentially increasing inequality and reducing social cohesion. It may fuel the ongoing erosion of the middle class in developed economies and provide yet another threat to democracy itself.

ONLINE LABOUR

As described above, a lot of attention has also been paid to artificial intelligence and automation. Another area of interest has been the (re)emergence of gig work - where an online platform assigns a person a physical task such as food delivery or driving for a set price. However, what has received less attention is gig work that is carried out in cyberspace and requires no physical proximity to the buyer of the service.

Digital technology means jobs can now be subdivided into separate parts and then be outsourced via online labour platforms. These platforms specialise in purely digital tasks that require no physical delivery or proximity between workers and their clients (as distinct from car driving). There are literally hundreds of these platforms and task unbundling is common. Average task duration can range from several minutes to several hours (Gomez-Herrera et al., 2017).

Virtual connectivity means that skilled occupations have become more accessible on a global scale as well as more temporary and compartmentalised in nature. Yet there is so much we still don't know about this trend in terms of flows of labour. This work is in essence a type of

digital trade – one that is an increasingly important but hard to measure component of global and cross-border trade. There is no agreed way to measure value of the 'internet' or even how to track digital goods. And unfortunately, conventional labour market statistics are ill-suited to this task. What we do know is that virtual flows of online labour are small but growing rapidly.

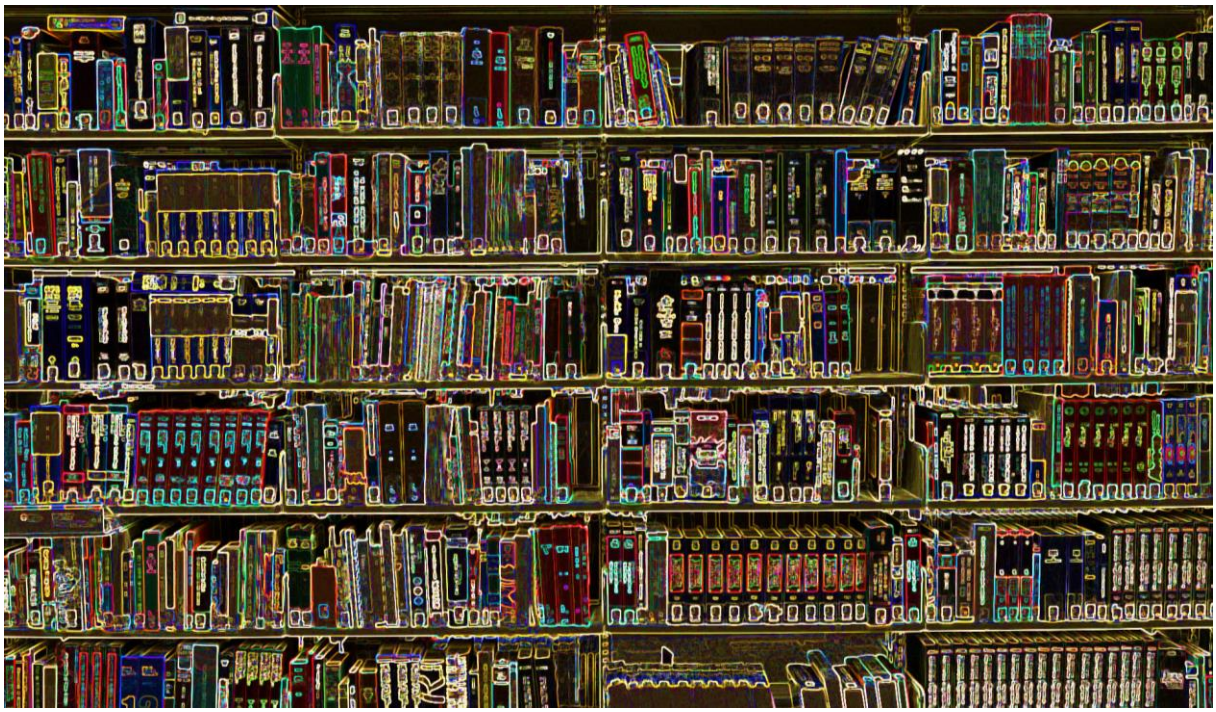
The Online Labour Index (created by the iLabour project at Oxford University) is one of the first economic indicators for online work. According to the Index, the total number of projects sourced using such platforms increased 26% (over 12 months from 2016-2017). This is quite significant when compared to growth rates for physical labour markets. In terms of the jobs going online, the index showed that the most in demand occupations were software development and technology; followed by creative and multimedia tasks. The Index authors suggest that this entire digital transformation of labour markets has remained largely unnoticed (Ojanpera, 2016).

A lot of questions remain about the online labour market. For example, we already know that many online platforms do not class themselves as employers of those who are employed via their platforms. If online labour markets continue to grow, questions arise such as:

- will protecting workers' rights only be possible with international cooperation?
- what are the impacts on worker wellbeing of constantly competing for one-off pieces of work?
- how is power and control allocated across workers, clients, and the firm?
- what biases exist in the algorithms that organise the information and the job exchange?
- how do worker reputation ratings and scores affect the distribution of work online?
- what will the impact be on minimum wages and inflation in the 'real world'?

As with everything online, there are linkages to what happens in the 'real world'. Physical labour markets will not be immune to the impacts.

VIRTUAL CONNECTIVITY AND EDUCATION



OLD SCHOOL

Classrooms have remained remarkably static in their form and function for many decades. However, predictions are that the classroom of the future will look nothing like the present. Some suggest that they will be completely digitised and transformed into creative spaces where teachers will use interactive whiteboards while students engage with their desk-sized screens. New technologies like augmented and virtual reality could create sensory-rich, interactive and immersive learning experiences (Eggers and Macmillan, 2015b). Others suggest classrooms will be 'flipped', whereby students learn new content (usually online) at home and class time will be devoted for teachers to provide personalised guidance and interaction, cultivating practical skills instead of theory (Evans-Greenwood et al., 2015).

When it comes to curricula, it is foreseen that content will be 'unbundled', meaning standard subjects like mathematics or even engineering degrees will be broken up and modularised into smaller parts to provide more customisation and personalisation to students based on their capabilities, interests and eventually, career pathways (Bradt, 2014). This is also known as micro-credentialing where smaller modules are awarded with badges which could be validated by blockchain technology and recognised by employers (Parker, 2017). With the

unprecedented access to a diverse and massive range of online learning and resources from all around the globe, students could have ample opportunities to learn at a speed and style that is comfortable, giving them the choice of alternative learning journeys, with little concern for barriers such as time, location and institution. The responsibility of constructing a credential or learning pathway would however likely lie with the student, who will have the ownership and responsibility of self-directing and assembling their own learner e-profiles. Today, some schools are already experimenting with Self-Organised Learning Environments, where students are given control over what and how they learn by finding the answers to questions themselves.

While these predictions may not all eventuate, it is inevitable that the role of teachers and educators will change. While some see artificial intelligence and robot teaching assistants rendering teaching positions obsolete (Eggers and Macmillan, 2015b, Bernard, 2017), it is more likely that the role of teachers will change from 'sage on stage' – who is the locus of knowledge and mandates what is to be learnt – to 'guide on the side' – who facilitates and navigates students on their learning journeys, equipping them with the skills to seek information for themselves and instilling in them the importance of continually updating and expanding their knowledge stocks (Evans-Greenwood et al., 2015). In a world of big data and advanced educational analytics, teachers will still play an important role in providing personalised feedback, adjusting teaching styles in real time in response to students' physical attention, mental strain and emotional engagement, all of which can already be determined by pupil tracking today (Rizzotto, 2017).

While these trends, some of which we are already experiencing today, give us a good indication of how our classrooms, lessons, curriculum, students and teachers will be like in the future, there are bigger themes underlying these trends that are being discussed when it comes to the future of education. These themes concern the changing nature of the embedded system structures and mental modes that are driving these trends.

Some authors warn against the education sector adopting a narrative of 'technology-led change' (Facer, 2011, Sternberg and Preiss, 2013). Technologies are adopted and appropriated within existing social values, structures and expectations. For example, although massive online open courses (MOOCs) filled headlines in 2009, low rates of completion almost a decade later show that there is something more to education than ingesting content and passing tests. Back in the 1980s, even though many argued at the time that new media such as newspapers, radio, motion pictures and television would revolutionise schooling, they didn't play as great a role as some might have expected. Just because the technology exists, does not mean that they will be used in the way that it was designed for.

Consequently, instead of thinking about the future of education in technocentric terms, many authors stress the need to explore bigger questions and trends about the interaction of technologies and

sociocultural contexts, such as the future role of schools as learning institutions, and the changing definitions of knowledge and learning.

NATURE OF KNOWLEDGE

A big theme across the aforementioned trends is the shifting nature of knowledge, or what it means to know. This has a precedent in the introduction of texts and printing presses which changed our need for remembering and made it easier to access conceptual knowledge. The calculator allowed us to outsource the algorithmic part of mathematics. The portability of devices like smart phones has facilitated their use as external memories, information sources and links to the world wherever we are. Why 'know' when you can Google? Why remember when you have the cloud? Our relationship with digital technologies is changing our mental and cognitive processes, such as how we store, access and manipulate information.

The increasing capacity of technologies to perform analytical, cognitive-like operations has also meant that what constitutes knowledge and learning for humans is changing (Säljö, 2010). In the past, knowledge was transferred primarily from teachers to students via written text. Accordingly, the institutional interpretation of learning at that time heavily emphasised the copying and memorising of information (Säljö, 2010). Knowledge was seen as a stock, a quantity of something accumulated for future use. It was stable, static and could be stored. Effectiveness of education was thus measured in terms of how well the transfer and reproduction of knowledge had occurred.

Knowledge today is less of a stock and more of a flow (Evans-Greenwood et al., 2015). It is a continual process and transcends a block of time (schooling years) or a particular space (learning institutions). Since information is abundant and every moment is an opportunity for discovery and skill-building, skills such as filtering information, selecting what to learn (and unlearn) and making insightful use of resources has become increasingly important.

SKIPPING SCHOOL?

The changing nature of knowledge is also challenging the traditions and role of schools and universities. Knowledge is not confined to books and heads of elders but defined through social interactions and experience (Facer, 2011).

Given that knowledge flows can happen anywhere, learning institutions will no longer be the only sources and gatekeepers of knowledge (Evans-Greenwood et al., 2015). The authority of the textbook will increasingly be challenged as alternative narratives become widespread (Säljö, 2010). Instead of a place of formal instruction and providing answers, places of learning have to equip students with the intrinsic desire to acquire knowledge themselves and impart the right skills to ask the right questions. Instead of jealously guarding its stock of knowledge, institutions must be seen as convenors and actively contributing to social interactions, life experience, and the community (Evans-Greenwood et al., 2015).

Learning institutions must also rethink what it means to certify students as being 'educated'. Curricula that focus solely on content, tests and credentials that measure knowledge stocks will no longer be accurate measures of knowledge. Schools of the future will have to think about the boundaries of the human body and technological change as memory, lifespan and cognitive capabilities are all in the process of becoming augmented, amplified and prolonged (Facer, 2011).

VIRTUAL CONNECTIVITY AND HEALTH

FITBITS FOREVER

When it comes to health, first and foremost virtual connectivity is driving changes in the patient experience. The big shift here is towards the use of digital medicine. This typically refers to the range of technologies and data analytics that are reshaping healthcare delivery (Editorial, 2017). This acceleration is driven by cloud computing (Eggers and Macmillan, 2015a). This trend is not just about what happens in the hospital but also about what happens in the home. This is because the move is towards wearable sensors and in-home devices as a means of remotely gathering health data and enhancing therapy (Editorial, 2017).

The idea of the 'quantified self' where individuals track their data is already a reality thanks to Fitbits and other devices. Referred to as bio-telemetry, wearable technology, including smartwatches, eyeglass displays, and electroluminescent clothing, are among the many devices under development or already in the marketplace (Taylor, 2017).

The intention is that sensors can help monitor patients outside the hospital in order to inform medications, treatments and even virtual rehabilitation (Taylor, 2017). It is also intended that bioinformatics and analytics allow for better personalised risk assessments. Sensors and wearables are also beginning to be incorporated into clinical trials to

measure traits and behaviours, as well as in longitudinal, observational studies (Editorial, 2017).

Driven by a push for effectiveness and cost efficiency, in-home devices will potentially allow the health system to rely more greatly on the community, peers and families to supplement care. As costs on the health system rise with an aging population, this strategy is likely to prove increasingly attractive (Eggers and Macmillan, 2015a).

Humans have long sought immortality or at least longevity. As Harari suggests, in the 21st century, the pursuit of immortality will remain a strong target, alongside "happiness and divinity" (Harari, 2015). Some of the most striking developments to this end have been in precision medicine - enabled by major advances in genomic sequencing and gene editing. However, health care is also increasingly becoming about big data (Taylor, 2017). The use of personalised sensors will only increase the amount of data available.

With a push towards personal sensors and monitors, there are growing concerns about surveillance, privacy and big brother. At this level of pervasiveness, a big challenge will be to evolve our ethical capacity to keep pace with our data management skills (Heinonen, 2015). In the near future, we will engage in more heated debate on the acceptable relationship between the benefits gained by giving out personal data and the advantages afforded by privacy (Heinonen, 2015). On the flipside, citizens may also increasingly realise the importance of their personal data as an asset. This won't just be a matter of privacy but a matter of data as a currency or a tradable asset (Guilló, 2015). Perhaps without knowing it, most consumers using online apps already barter or sell their personal data for savings, convenience and customization, making information a currency in the truest sense (Eggers and Macmillan, 2015a).

Another important concern is the implications for equality. Supporters claim that digital health and personal devices can help build the 'intuition' of the health system and improve outcomes for the patient. The reality is that not everyone has equal access, interest or ability to respond to the signals they receive. Real world constraints may mean that the supposed benefits of availing our bodies of third party monitoring may not eventuate (IFTF, 2010). Currently, digital healthcare is skewed to the affluent and healthy, sometimes referred to as the "fit-rich". It is the fit-rich that are early adopters of digital medicine – those who exercise, don't smoke and eat well and are least likely to benefit (Editorial, 2017).

FAILURE IS NOT AN OPTION

In the future, users of personal health devices might not just track their daily steps but also be given behavioural nudges by policymakers and insurance providers to reward healthy lifestyles (Eggers and Macmillan, 2015a). This is part of an overall shift in health care systems is to a focus on wellness and prevention.

Already, poor health is being framed as not just a negative for the individual, but expensive and inefficient for the insurance companies, the wider health

system and the nation. With this perspective, governments and business are likely to increasingly promote wellness care through incentives, requirements and payment models, particularly in countries where government is the primary payer.

The question here is whether or not knowing more and more about our own bodies is a positive trend. At what point will users be penalised for returning poor results? This is not to say that many sensor and monitoring programs commences with anything less than the best intentions. Rather we also need to think through the long-term consequences of this trend of highly pervasive monitoring (Eggers and Macmillan, 2015a). Some go as far as to suggest that in the future all human behaviours negatively affecting health will be forbidden (Bas, 2015). On that day, the pursuit of happiness may become a requirement rather than a right.

BRAIN BOOSTERS

The co-option of advances in medicine and technology for human enhancement is not a new trend but it is increasingly pervasive. This goes beyond preventative health towards performance maximisation. This is particularly true for the enhancement of mental (cognitive) performance. Authors such as Swan (2012) see mental performance as the new health frontier.

In the past, nature and nurture were seen as deterministic of cognitive performance as well as identity and possibilities. In other words, we largely had to make do with what we were born with. However, developments in robotics and artificial intelligence are causing us to question what it means to be human. It is also causing us to question whether we can upgrade humans.

To this end, cognitive performance is likely to be seen as something that can be optimised, much like physical performance, with a range of drugs and other interventions available to deliver improvements. Harari (2015) and other authors such as Heinonen (2015), go as far as suggesting that a convergence of humans and machines is inevitable in the long-term. This effort to expand the human potential (both physical and mental) is being driven by unprecedented advances in health care, neuroscience, technology, computing, nanotechnology and learning. The possibilities range from enhanced longevity and physical strength through to improved IQ and learning abilities (Eggers and Macmillan, 2015a).

It is worth noting that this isn't all just about performance enhancement. For example, neural interface technology has a lot of potential for patients suffering from paralysis. One example is a tiny brain implant called a Stentrode™, which wirelessly transmits to an external computer that uses machine learning to interpret the pattern of brain signals. This could potentially be used by a patient to control an exoskeleton with their mind. Of course, other applications can also be imagined.

Whether brain enhancements become widely superior to a google search in boosting boost brainpower can only be speculated. However, it does raise a question of what happens

if more extreme interventions eventually become normalised and therefore expected? This is not to say that performance enhancers are anything new, as evidenced by the brain boosting pills popped in Silicon Valley or the caffeine sipped all over the world. However, the potential ramifications of more radical enhancements on social norms need more exploring. Even if individuals today might imagine that they would resist future enhancements, would that remain the case if everyone else around them began to be improved (Harari, 2015)?

Health might seem like a strange topic to include in a report that looks at the social, economic, cultural and political implications of virtual connectivity. However, good health underpins our ability as humans to socialise, work, learn and live a fulfilling life. While developments such as wirelessly transmitting brain devices might seem unrelated to connection at this stage, who knows? One day they could underpin the next social network through which we interact or act as a replacement for our smart phones. Such scenarios may not seem likely but they are plausible. And it is the role of strategic foresight to explore that which might otherwise be overlooked.

CONCLUSION

Powerful drivers of change are interacting and counteracting in often unpredictable ways - at scales and speeds neither the planet nor humanity has experienced before. We can't control the future but we can at least become better navigators as it comes to pass.

As you'll have now realised, we haven't included predictions of the next cryptocurrency boom or robot takeover. What we have done is try to give readers a deeper ability to anticipate and interpret emerging trends and more confidence to contribute to the debate.

By making futures accessible, we hope that this report has helped to unlock your thinking about what's possible, plausible and desirable. We hope you'll have a stronger 'antenna' for spotting signals, paradoxes and trends that are informing discussions about the future.

Above all, when you see technological changes dominating the headlines, remember that technology is not in the driver's seat. Humans have a unique capacity for foresight, strategy and planning. But, above all, humans are still human with all the truths that entails, no matter how fast or far technological change takes us.

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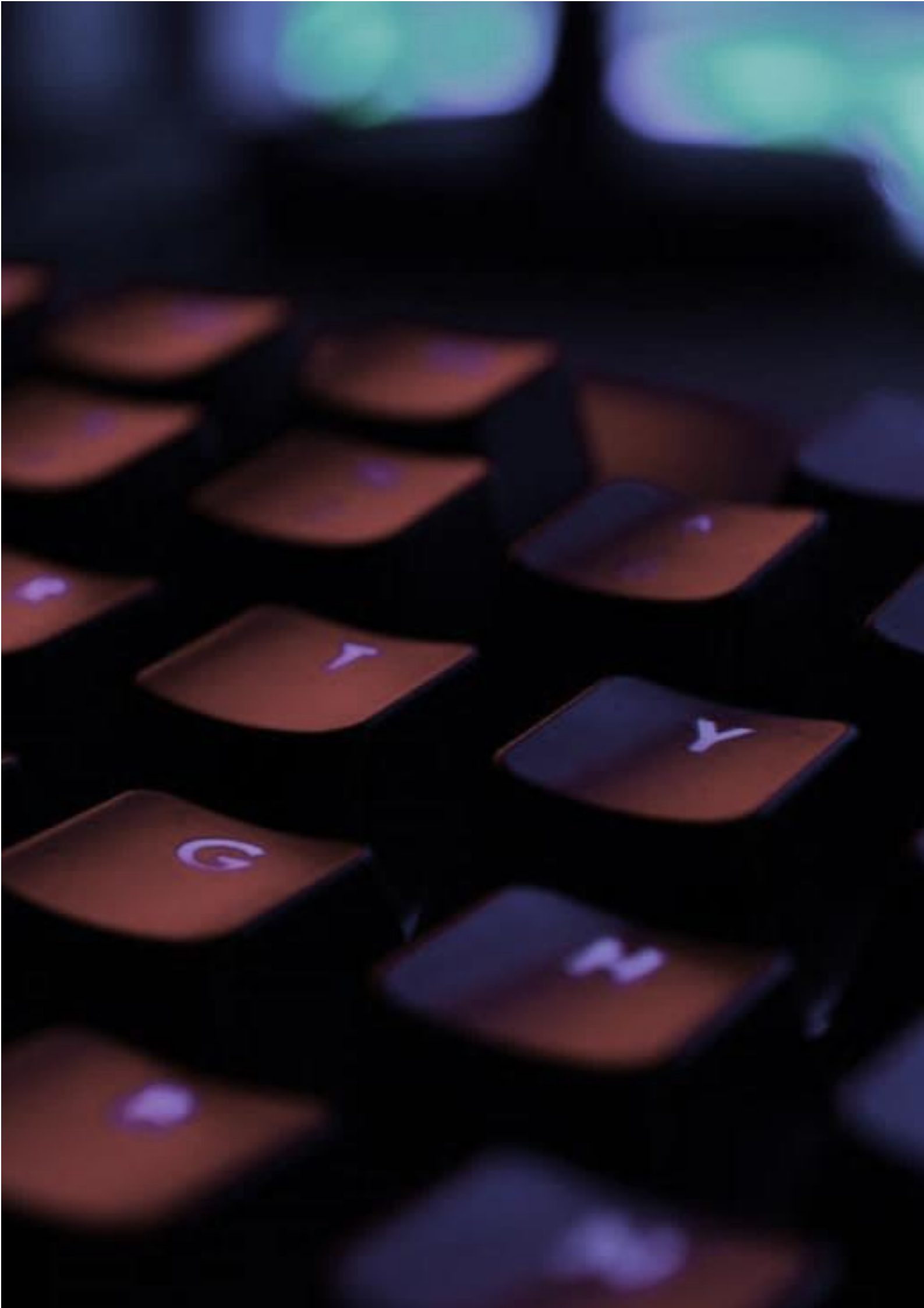
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