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Go Further

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EXECUTIVE SUMMARY

The world of work is changing dramatically, already causing significant disruption in patterns of jobs and raising questions about what work will look like for individuals, what skills will be needed, and how youth might prepare for productive work in a future where they will have many jobs and even multiple careers over a lifetime.

Writing on work futures is generally in agreement about the major drivers of change, including technological change — artificial intelligence, robots and big data, as well as innovation in materials, propulsion and energy strategies, climate change, globalization, population pressures and changed demographic profiles. The implications for jobs are more vague, and futurists spread along a continuum stretching from predictions of dystopian futures to optimistic predictions of a better life for all.

In this research we review the literature on work futures, noting a long history of concerns about technological disruption that have proved unfounded in the broad sense, but acknowledging that the disruptive effects of the drivers above will lead to uneven patterns of change. Machines are already taking over many repetitive jobs and increasingly encroach on professional work such as accountancy or office work. It is apparent that there will be a shift in emphasis to more skilled, and professional jobs, but pundits are divided on whether these changes will bring net job losses or net job creation.

Trends away from routine jobs towards non-routine manual and especially cognitive skill work are already apparent, and will continue. There are a number of threads in the literature concerning the skills that will be increasingly valued in the new workplace. These include entrepreneurial skills, involving adaptability, autonomy and self-direction, in a situation where workers will need to sell their skills across many jobs, and incorporate freelance work among these. Increasingly, people in all jobs will need digital skills, and STEM / STEAM skills are advocated by many

as the basis of much of the changing economy. Interpersonal skills will become more important as many routine jobs, or routine aspects of jobs, are taken over by machines, and there will be a need for people to work creatively at the human-computer interface. Many argue that this will make jobs more interesting and rewarding, creating more room for personal and community values, creativity and imagination. The general view is that people, in future jobs need to be working with machines, rather than competing with them.

In this research our aim has been to interrogate these work futures through the predictive construction of '100 jobs of the future', that go beyond generalities of trends and skills, and offer a grounded, but complex and imaginative projection of future work. Through creating this list of jobs, we have generated a representation that we hope will inform the public, and youth yet to enter the labour market, on what future of work may entail, and what skills and interests will best prepare people for this future. Other commentators have come up with such job lists, but our aim has been pursue this in a rigorous fashion by drawing on selected industry and disciplinary experts well-placed to talk about trends in their fields.

After a comprehensive review of the literature (summarized above) we identified key domains, such as agriculture, health and games, that will become an increasing focus of future work, and used these to identify eleven experts familiar with cutting edge developments in their fields of expertise, but also thought leaders well-placed to comment on the future more generally. We interviewed each of these experts

using a protocol based on the literature findings, asking them first to identify trends and areas of growth in their disciplines, then through a structured conversation, identified broad work patterns, specific jobs that may be created and become important, and the skills that such jobs would demand. We then synthesised the information gathered from each interview to scope and develop a sample of 100 future jobs that captured the breadth of trends, skills and work patterns identified.

The experts' perspectives were broadly consistent with the literature, but they provided fresh insights and varied perspectives on a range of aspects of future work. A number talked about the increasingly intimate relationship of machines to humans, and human needs, and the possibilities this opened up. A number saw the human-machine interface as being a major focus for future jobs, for translators of technology for users, or as interpreters and communicators of people's needs to programmers and designers.

The interviews affirmed the unique advantages we as humans have over machines, and productive ways we can work with machines rather than compete with them.

Regarding skills, the experts had much to say. Transdisciplinarity was a major theme, referring to the need for a strong disciplinary base but combined with breadth of knowledge of other areas, with technology skills, and with creativity. Another theme was the importance of human skills, increasingly relevant in a world where machines do the routine work, and relevant also for cross-disciplinary team work. A third theme was the need for flexibility and adaptability in the face of change, and the importance of the capacity to continue to learn, and be strategic about learning, over a lifetime.

The sample of 100 jobs of the future portrays a world of work that continues to offer a breadth of career opportunities across all sectors. Whilst we set out to identify new jobs and explore the impact of the major drivers of change on the future workplace, our research kept reminding us that the world of work has always been evolving and technology has already disrupted

many domains. At the same time, some jobs will change very little, for example those that involve skilled manual work that machines cannot duplicate or jobs that make economic sense to continue as they are.

Some of the 100 jobs of the future are variations of those that already exist, possibly with more technology enablement that delivers instantaneous outcomes where currently processes are protracted, or more personalisation that modifies the role to become mainstream in a different form. For example, a *personal brand manager* or a *data privacy strategist* will evolve from job roles that currently service organisations, to roles that service individuals in a future world where managing digital identity and security becomes a necessity. In contrast, a future *nostalgist* that recreates remembered experiences

for the elderly, or a *100 year counsellor*, who enables centenarians to enjoy a "third age", are new jobs that will emerge as medical advances keep extending human life.

We also clustered the 100 job roles into eleven broad categories based on the type of work undertaken:

Technology, People, Law, Business, Environment, Urban, Agriculture, Health, Data, Experience and Space.

Unsurprisingly, we found that jobs across all these categories are influenced by the major drivers of change: technological advances, climate change, data democratisation, globalization, population pressures and changed demographic profiles, and most also require a multidisciplinary skill set. A wellness consultant or nutritionist having a health job, for example a *health shaper*, will require a high level of digital and data literacy to provide bespoke services informed by health data and predictive modelling; a design engineer of the future, for example an *autonomous vehicle profile designer* with a tech job, will also need to have a background in interior design, and possess excellent creative and visual artistic skills required in experience jobs. This fusion of skills and perspectives from different domains will create new multi-disciplinary fields that advance what is possible, trigger new drivers of change and redefine the jobs of the future.

...the world of work has always been evolving and technology has already disrupted many domains.



A JOURNEY INTO THE FUTURE OF WORK

A revolution is occurring in the world of work.

Over the next decade, almost every job will be affected. Some jobs will disappear entirely. New jobs, not even thought of today, will come into being. We can see this happening already, with fields such as retail, entertainment, health care, manufacturing and education being profoundly affected as technology advances. Some of the drivers fuelling this revolution are: automation, robotics, the internet of things, climate change, globalisation and an ageing and increasing population.

These changes in the world of work have been documented by many futurists, they have been the subject of many conferences and symposia, and their implications have been articulated in an array of commissioned reports.

While the pundits largely agree on the broad drivers and changing landscape of industries and work futures, they are divided on the larger scale effects for societal futures. Some pessimistically predict widespread loss of jobs, an economic disruption, and increasing inequality leading to social unrest. Others see opportunities and changes in work patterns that will make our lives more interesting and fulfilling. All predict changes in the way we work, in the shape of our working lives, and in the skills that we will find increasingly useful.

What will these changes mean for young people?
What skills will they need to enter the labour market?
And what will they do in these new jobs?

Most of the jobs of the future do not yet exist. That makes it difficult to say exactly what people will need to do to get those jobs. However, the patterns

are becoming clear — some skills will continue to be highly rewarded, while others are likely to be taken over by machines.

In this research, we have interviewed eleven experts — people selected from a range of industries and domain areas who are well-placed to see where the future is heading — to create a series of informed perspectives on future work. In the interviews, we asked our experts to talk about trends and skills, but more than this, to provide a grounded view of the future by nominating what sorts of jobs may be created, and how current jobs will change. In this, we aim to provide a snapshot of future job worlds that will bring into sharper relief the possibilities being opened up. The perspective we have developed is both informed, and optimistic.

In preparing for these interviews, we have undertaken a comprehensive review of the literature in order to inform both the selection of the experts, and the questions that form the basis of the interviews. We believe this report adds to our existing knowledge of work futures by pulling together these highly informed experts' views, focusing their attention not only on trends and potentialities, but also on the specifics of future workplaces. By doing this, we hope to bridge the gap between the policy and practice-focused perspectives found in the literature, and a need for the public, and young people in particular, to gain an insight into what the future might hold, and how they might productively prepare for a rewarding place in it.

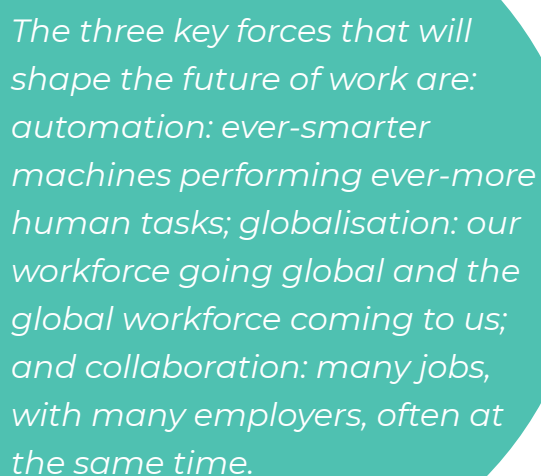




WHAT THE LITERATURE SAYS ABOUT THE FUTURE OF WORK

This literature review provides an overview of the changes about to revolutionise workplaces, the skills that are growing in demand (and those that are not) and how work is likely to change in the future.

CHANGE DRIVERS FOR THE WORLD OF WORK



The three key forces that will shape the future of work are: automation: ever-smarter machines performing ever-more human tasks; globalisation: our workforce going global and the global workforce coming to us; and collaboration: many jobs, with many employers, often at the same time.

- The New Work Order (Foundation for Young Australians, 2017b, p.11)

How we work is being impacted by mega-trends including “globalisation, technological progress and demographic change” (OECD, 2017, p.2). The key sites for technological progress are in “Big Data, artificial intelligence (AI), the Internet of Things and ever-increasing computing power” (p.4). For the International Monetary Fund (2018), the major factors driving labour market trends are “automation and cheaper capital goods” and “global integration” (p.12) making a global marketplace. Research by Pearson and Nesta (Bakhski et al., 2017) adds environmental sustainability, urbanisation, increasing inequality, and political uncertainty (p.12) to this list. Australian research has come to similar conclusions.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) point to the “growth in computing power, device connectivity, data volumes and artificial intelligence” ((Hajkowicz et al., 2016, p.7) as trends to watch in coming years. While stressing these are yet to be fully felt in the Australian economy, each of them have been growing exponentially, so that their impacts are likely to be both sudden and significant. Each of these individual drivers of change are linked to all the others impacting Australia — so that we are seeing the growth of the peer-to-peer marketplace, significant demographic change, the end of the mining boom, and regional economic changes impacting our Asian trading partners coming together at the same time. We will consider these change drivers in more detail throughout this report.

A HISTORY OF PANIC

While it is impossible to predict the future solely on what happened in the past, it is important to remember that people have been very concerned about the devastating impact of technology for hundreds of years, and yet many (if not most) of their worst predictions never occurred. Robert Malthus' (1798, np) famous prediction of societal misery related to the inevitability of population increase has not come to pass. The Luddites destruction of machines in the first industrial revolution, which they blamed for destroying their jobs and trades, proved ill-informed (Frey & Osborne, 2013). In 1930 Keynes, the leading economist of his day, warned the world needed to prepare for "technological unemployment" (IMF, 2018, p. 6) where large numbers of people would be replaced by machines and would never work again.

Yet, although the technological changes introduced over the last 200 years have brought large scale economic shifts, eventually they have led to ever more jobs. It is true that this has often involved significant dislocation, and that this frequently took many decades to settle, however, ultimately more jobs were created than destroyed (Quigley & Chalmers, 2017).

In 2014, the Pew Research Centre (Rainie & Anderson, 2017, p.2) asked 1,408 experts if this time, machines would create more jobs than they would take. The

experts were split almost 50:50 on whether there would be more or fewer jobs in the future due to technological change. Some predicted a 'jobs apocalypse' (where virtually every job currently being performed by humans would eventually be taken over by robots) — some have presented this as a future we should strive towards (Srniczek & Williams, 2015). The other extreme predicted the main problem in the future will be a chronic shortage of workers for all the jobs about to be created.

Despite these disagreements about the short to mid-term employment prospect resulting from technology and other change drivers, everyone agreed that we are living through significant and world changing times and that if people are to remain employable, they will need to acquire and develop new skills. These do not only refer to technological knowledge and skills, but also to 'soft' skills such as collaborative capability, empathy and entrepreneurial skills.

It is also argued that if we want to avoid the significant social dislocation caused by the pace and scope of technological change we will need governments, policy makers and businesses to work together to address these threats and how to alleviate them (Bakhshi et al., 2017).

UNEVEN IMPACTS OF CHANGE

Whether experts predict the mass elimination of jobs (Frey & Osborne, 2013), or more new jobs being created than lost (AlphaBeta, 2017), overwhelmingly everyone agrees the changes occurring in the labour market will be significant, substantial and likely to require a large proportion of the workforce to engage in retraining, reskilling and lifelong learning (Riad, 2017). This will require businesses, governments and education facilities finding new ways to reach a growing number of people needing access to the skills essential for the new economy (CEDA, 2015). In such a fast-changing world, even those leaving school today may not have the skills they needed for jobs they will be applying for.

For the foreseeable future, the challenge of 'cybernation' is not mass unemployment, but the need to educate many more young people for the jobs computers cannot do.

- Changing Jobs: The fair go in the machine age (Quigley & Chalmers, 2017)

While there are too many people qualified for many current jobs that are disappearing, there are also skills shortages where companies struggle to find those with the right skills to fill their vacancies (Commonwealth Bank, 2017; OECD, 2013). A "2017 talent shortage survey found that 40 per cent of employers reported difficulties in finding skilled talent, while the number of employers filling these gaps by retraining and developing people internally has more than doubled since 2015" (WEF, 2018, p.3).

Many predict a hollowing or polarising of workplaces (IMF, 2018; OECD, 2017) producing winners and losers, with the highly-skilled rewarded by high-paying jobs while the low-skilled find themselves in low paid jobs that are increasingly monitored, managed and working under automated surveillance technologies (West, 2108).

The polarisation of jobs within workplaces has been a recognised trend in industrial relations for a long time (Deery & Welsh, 2001) and the disparate treatment of workers in such polarised workplaces has been extensively documented (Brown, Ashton & Lauder, 2012; Brown, Hesketh & Williams, 2004; Ehrenreich, 2006, 2011; Kusnet, 2008; Wynhausen, 2005). A common theme in this literature is that those with hard to obtain skills are offered full time employment on good wages, while those with easy to replace skills are often not fully integrated into their workplace, work as part-time or casual employees only when they are needed by their employer, and are paid significantly less (Davies et al., 2011). And while new jobs are

certainly being created, these are often 'better ... but also fewer' (West, 2018), and require much higher skills to obtain (CEDA, 2015). Figure 1 shows that the trend in new jobs has moved towards professionals and skilled workers.

However, others take a much more positive perspective on the future. As technology replaces jobs that are "dull, dirty, dangerous and demanding" (Hajkowicz et al., 2016, p.78), the future of employment will involve jobs that are more rewarding and creative (CEDA, 2015; Commonwealth Bank, 2017; FYA, 2017a; Hajkowicz, 2016; Sundararajan, 2017) — some authors stress that future jobs will allow employees to be more fully 'human' (AlphaBeta, 2017, p.8; CEDA, 2015; Frey & Osborne, 2013; FYA, 2017a).

A further complication here is that those caught in low-paid and low-skilled jobs, or who have been pushed out of the job market entirely, are more likely to see their career as a relatively fixed part of their identity (Dolby, Dimitriadis & Willis, 2013; Kenway, Kraack & Hickey-Moody, 2006; Weis, 1990, 2005) — that is, to see themselves as being their job title rather than understanding the full breadth of skills they possess that could be adapted to changing work possibilities. The rapidly changing nature of work will mean people will be unlikely to remain 'one thing' throughout their

whole career, with some estimating that “a 15-year-old today will experience a portfolio career, potentially having 17 different jobs over five careers in their lifetime” (FYA, 2017b, p.3).

A trend towards the ‘hollowing’ of workplaces is likely to accelerate as jobs replaced by technology increasingly come from the middle of the employment hierarchy. And as those in the middle see their jobs being replaced, they in turn take the jobs of less skilled employees (Bakhshi et al., 2017; FYA, 2017a; IMF, 2018). Increasingly, gaining employment depends on first having various credentials and qualifications (FYA, 2017b) with educational qualifications being used as a way to sort and eliminate applicants (Brown et al., 2004).

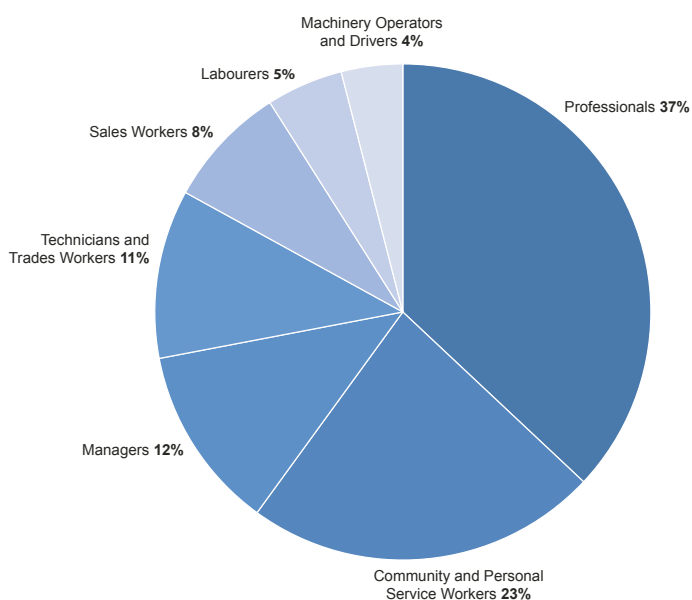


Figure 1: “Share of total new jobs in Australia, five years to November 2017” from Australian Jobs 2018, p.22 - © Commonwealth of Australia (CC BY 4.0)

This means that competition for jobs at the bottom of the jobs hierarchy will become increasingly fierce (Australian Government, 2018) with “graduates ‘pushing down’ into lower skill level occupations where they are competing with people with fewer or no qualification” (p.3). Those currently without credentials may struggle to gain the skills needed to obtain jobs with more rewarding remuneration due to the expense and social distance they have always faced in gaining a university qualification (Kenway et al., 2006; Weis, 1990, 2005) — university being easier to successfully complete if someone in your family has previously attended. Also, the expense of a university education, in terms of time, fees, forgone earnings, and the uncertainty of a likely career post-qualification,

weigh more heavily on young people who do not know anyone with such a qualification (Teese & Polese, 2003).

Unskilled people tend to have left school early. Given that future employment is predicted to require lifelong learning (FYA, 2017), this will make life difficult for those who struggled at school the first time.

Policy solutions mostly stress education and retraining as needing to become even more central to government policy concerns (IMF, 2018; OECD, 2013). Such solutions, however, stress that governments require the cooperation of education providers and businesses, especially since the training needed to acquire the skills for particular businesses are often very specific to those businesses and are often only fully understood by those businesses too. Further, ongoing and lifelong learning is often presented as being the responsibility of the individual worker. However, workers have difficulty in meeting the expense of retraining (both in terms of time without a wage, as well as the cost of the training itself) and difficulty knowing what training will best prepare them for future jobs (Sundararajan, 2017).

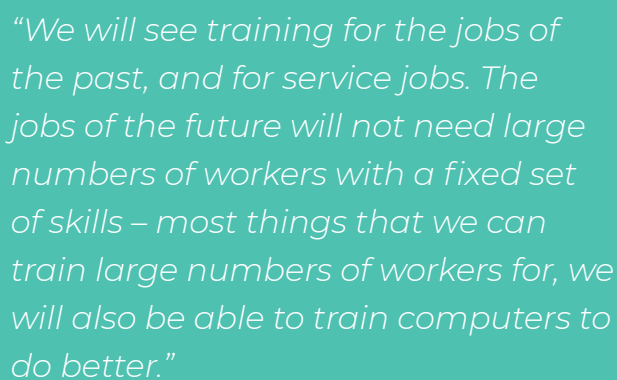
There are a number of clear messages in this plot. First, potential job losses are polarised: Jobs in administration and sales (and many service areas) will disappear, while jobs in the technical professions and personal services will remain. Second, many of those jobs remaining are characterised by nonroutine thinking and especially high levels of originality and creativity.

- Australia's Future Workforce? Durrant-Whyte et al., CEDA, 2015

Many believe that STEM (Science, Technology, Engineering and Mathematics) qualifications will be increasingly in demand (Commonwealth Bank, 2017), stressing that too few Australian students are gaining such qualifications (FYA, 2017b). However, a degree in STEM by itself will not guarantee a job in the future, and will certainly not bypass the need to continue on with lifelong learning (FYA, 2017).



AUTOMATION. COMPUTERISATION. NEW TECHNOLOGIES



“We will see training for the jobs of the past, and for service jobs. The jobs of the future will not need large numbers of workers with a fixed set of skills – most things that we can train large numbers of workers for, we will also be able to train computers to do better.”

- The Future of Jobs and Jobs Training. Rainie & Anderson, 2017, p.15)

Until recently, technological progress has involved the automation of highly routine physical tasks (Hajkowicz et al., 2016). This has meant that the burden of technological progress has been felt mostly in manufacturing, mining and related industries. Today, many believe that automation will occur in any task able to be specified by an algorithm and performed by a robot or computer system (Frey & Osborne, 2013). Often the jobs facing this new wave of automation are associated with those in the middle of the job market, that is, jobs such as bookkeepers or paralegals, jobs which until recently seemed both safe and relatively well-paid. Robots have much more difficulty replacing work that involves fine motor skills — such as making beds or folding towels – or in locating items in unstructured space — such as tidying magazines on a coffee table (Brynjolfsson & McAfee, 2012) at the lower end of the labour market. This is the cause of the hollowing out of workplaces referred to above, where jobs remain at the top and bottom, but those in the middle increasingly disappear.

Moore’s Law states that ‘the number of transistors on computer processors will double’ every two years (Hajkowicz et al., 2016, p.31). This leads to exponential growth in computing power over time and this in turn means that computers and robots become increasingly more effective and efficient. This opens up more jobs to being taken over by machines. However, rather than necessarily destroying jobs, new technologies are likely to replace the dull aspects of jobs and thereby make the job as a whole more rewarding, interesting and enjoyable (Hajkowicz, 2016). As Hajkowicz says, “Spreadsheets didn’t kill accountancy jobs, it just changed them”.

A frequent piece of advice given to young people regarding automation and the future job skills they will need, is for them to augment their abilities to work with technology (Davenport & Kirby, 2016; Quigley & Chalmers, 2017). That is, they are more likely to be successful if they 'race on the machine rather than with it' (Hughes, 2017, p.132).

The fact that jobs can be replaced by machines does not automatically mean that they will be. "(T)here are legal as well as ethical obstacles that may prevent such a substitution or at least substantially slow down its pace" (Arntz et al., 2016, p.7). For instance, while bookkeeping, accounting and auditing are generally seen as job categories highly likely to be automated, few of these jobs can be performed without some level of "group work or face-to-face interactions" (Arntz et al., 2016, p.14). Humans still prefer to have complex interpersonal interactions with other humans, rather than with machines.

And while the work of bookkeepers and some lawyers can be automated in theory, those of "gardener, hairdresser, or home health aide" (Brynjolfsson & McAfee, 2012) remain beyond technology's reach. It is estimated that rather than technology replacing all jobs that it in principle can, that "Over two-thirds of the shift away from automatable tasks will be driven by people changing the way they work, not changing jobs" (AlphaBeta, 2017, p.13).

The future of work will be primarily about how people can collaborate effectively with machines to do what neither can do alone.

- Commonwealth Bank jobs and skills of the future report, 2017, p.12



THE SKILLS OF THE FUTURE

Predicting the skills necessary for future jobs begins with the obvious problem of specifying skills for jobs that do not currently exist. The World Economic Forum estimates that 'up to 65 per cent of children entering primary school today are likely to work in jobs that do not yet exist' (Raid, 2017, p.17). In fact, 'it is much easier to accurately identify the jobs that will be destroyed by technological change than it is to predict those that will be created in the future' (CEDA, 2015, p.21). For instance, one report says that 'modelling ... suggests almost five million jobs (in Australia) face a high probability of being replaced in the next decade or two while a further 18.4 per cent of the workforce has a medium probability of having their roles eliminated' (CEDA, 2015, p.8).

Some economists have shown that while this structural change has been occurring in the types of skills needed in the workplace, this has not reduced levels of employment, so that 'the new labour saving technologies did not reduce the demand for labour' (Arntz et al., 2016, p.23). The nature of labour is, however, changing.

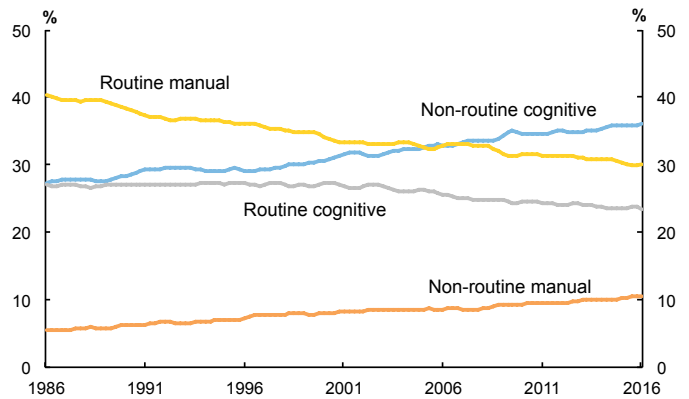


Figure 2: "Change in employment by skill type" from Australian Jobs 2018, p.29 - © Commonwealth of Australia (CC BY 4.0) Colour change from original.

Males

Females

Rank	Occupation (Males)	Count (Males)	Occupation (Females)	Count (Females)
1	Sales Assistants (General)	170,168	Sales Assistants (General)	355,843
2	Truck Drivers	142,710	Registered Nurses	197,124
3	Electricians	113,458	General Clerks	186,529
4	Carpenters and Joiners	101,134	Receptionists	146,698

Figure 3: "Top four occupations" from 2071.0 - Census of Population and Housing: Reflecting Australia - Stories from the Census, 2016, Australian Bureau of Statistics - © Commonwealth of Australia (CC BY 4.0)

58% of students aged under 25 years in Australia (are) enrolled in fields of study that will be radically affected by automation in the next 10-15 years. If we focus just on VET students, the proportion of students being trained in the at-risk occupations rises to a significant 71%. ... Such jobs include woods trades, horticulture, and printing.

- The New Work Order. Foundation for Young Australians, 2017b, p.25

The shift from routine to non-routine skills

The shift in skills needed due to automation and computer technology is nicely illustrated in the Figure 2 which shows the relative changes in employment by skill type over the 30-year period in Australia from 1986 to 2016. Routine cognitive jobs decreased slightly and routine manual jobs decreased by a quarter, but non-routine cognitive jobs increased by almost a quarter as well, while non-routine manual jobs almost doubled from one-in-every-twenty to slightly more than one-in-every-ten jobs.

Technology is increasingly eliminating jobs that young people (FYA, 2017b) and the poor (West, 2018) have traditionally used to enter the labour force. A recent Australian report stressed we need to rethink our education policies given that the overwhelming majority of young people are 'enrolled in fields of study that will be radically affected by automation over the next 10-15 years' (FYA, 2017a, p.36).

Australian Government (2018) analysis of trends in current high employment industries shows that most of the industries with the largest proportions of people with no post-school qualifications are predicted to decline as a share of total employment. These are industries that traditionally have employed large numbers of working class people, such as agriculture, manufacturing and electricity, gas, water and waste. One concern is that few of the new 21st century industries employ large numbers of people.

Not all jobs that can be automated will be automated, and jobs that cannot be automated today may be tomorrow. While it is not possible to predict with certainty which jobs will continue into the future, it is clear that certain skills are much less likely to be automated than others. This difference relates to how routine the work is. "Routine tasks are defined as tasks that follow explicit rules that can be accomplished by machines, while non-routine tasks are not sufficiently well understood to be specified in computer code" (Frey & Osborne, 2013, p.17).

Whether in manual or cognitive work (see Figure 3) the major growth in jobs has been in the non-routine sectors. The skills that have had increasing demand include "creative intelligence, social intelligence and

problem solving" and these are what are sometimes referred to as "21st Century skills, enterprise skills and employability skills" (FYA, 2017a, p.32). These skill sets include "confidence, communication, creativity, project management, enthusiasm for learning, critical thinking, teamwork, digital literacy, financial literacy and global citizenship". In fact, "the categories of interpersonal, creative and information synthesis are projected to increase from just under half of all work activity to almost 70 per cent over the thirty years from 2000 to 2030" (Charmers & Quigley, 2017, p.65).

Routine tasks are harder to define, and often relate to a single part of a job, rather than the job in its entirety (Hughes, 2017). This is not limited to low-paying jobs, but rather it is said to be the case that "a large part of what professions learn in their long educations can be automated" (p.135). However, UK research has found that "Jobs with salaries of less than £30,000 a year are almost five times more likely to be lost to automation than jobs with salaries of more than £100,000 a year" (Charmers & Quigley 2017, p.60).

The industries that came into existence in the US after 2000 were only employing half of one per cent of all US jobs (Quigley & Chalmers, 2017, p.21). When Facebook purchased Instagram for a billion dollars, it employed only 13 people (Quigley & Chalmers, 2017, p.83).

This raises a question concerning how well we are able to predict the skills that will remain essentially human and those that will be taken by machines. An interesting example is that of the driverless car. While these are yet to take over any jobs, it must be remembered that driving was, until very recently, often presented as a good example of the kind of job that computers would be unlikely to be able to achieve in the near term, and yet "today Google's driverless cars have driven over 2 million miles" (Bakhshi et al., 2017, p.22). One estimate in the US is that "driverless deliveries would put at least 2.5 million drivers out of work" (West 2018).



THE ENTREPRENEUR

“In tomorrow’s job market adaptability, resilience, buoyancy and entrepreneurial capabilities are of growing importance. This is because of the increased pace of change fuelled by technological innovation and globalisation increases the need for workers to handle minor and major transitions. Workers will need the capability to handle a career dead-end (or job loss) and create their own job in another space.”

- Tomorrow’s Digitally enabled Workforce: Megatrends and scenarios for jobs and employment in Australia over the coming twenty years. Hajkowicz et al., 2016, p.14

A common thread to the predicted jobs of the future is that they will require entrepreneurial skills. Although entrepreneur can mean very different things to different people, it is often taken to mean that “the future workforce will need to be more autonomous and self-directed, working on tasks independently with less supervision and support from managers or supervisors. Many more people will work externally, from home or a remote office. Young people of today will need to manage their own time more, make more decisions about priority and importance of tasks and be more personally motivated and driven” (FYA, 2017b, p.18).

Entrepreneurs are also seen as risk-takers, those who start their own businesses. The barriers to starting a business are decreasing due to the easy availability of computing power and connectivity, the low-cost of these, the availability of financing (including crowd-funding), the fact many businesses are now much less capital intensive, and because marketing and gaining customer feedback are easier today in an interconnected world. The reduction in these entry costs are reflected in the results of a global survey of over 12,000 Millennials that “found 68% of respondents (believed) they have the opportunity to become an entrepreneur” (FYA, 2017a, p.18).

Sometimes becoming an entrepreneur is promoted as a way to avoid the increasing inequality in society, where we should “aim for a future of crowd-based capitalism in which most of the workforce shifts from a full-time job as a talent or labour provider to running a business of one — in effect a microentrepreneur who owns a tiny slice of society’s capital” (Sundararajan, 2017, p.7). However, while such a shift is seen as providing workers with a larger stake in the economy than they previously may have had, it also comes at a cost where “young entrepreneurs face increasing financial uncertainty” (Lagarde, 2017, p13).

The notion of the growing importance of entrepreneurial skills is a central piece of advice being given to young people, and so schools and universities are being encouraged to teach these skills (Brynjolfsson & McAfee, 2012) so that entrepreneurialism “becomes a lifestyle” (UKCES 2014b, p.14). It is generally predicted that entrepreneurial skills will become essential as more people move to working in ways that are less fixed to a single employer so that their jobs become more like ‘portfolio workers’ — that is, freelance, one-person businesses.

While such work is often seen as highly precarious, that is, where “platform workers may have multiple jobs, work long hours and under high stress” (OECD, 2017, p.14) and while it may mean “all jobs will be less secure and an ever-greater portion of the workforce will become part-time, on-demand, independent contractors without benefits” (Hughes 2017, p.139) “one survey found 88 per cent would continue freelancing even if they were offered a traditional full-time career” (Hajkovicz et al., 2016, p.37).

There are strong reasons to believe the freelancer and portfolio worker will become a much more common model in tomorrow's labour market' (Hajkovicz, 2016, p.19).

These new jobs allow for much more flexibility and as such “provide greater opportunities for underrepresented groups to participate in the labour market” (OECD, 2017, p.2). The age of lifelong employment is effectively over, with workers “now staying in jobs, on average, for about 3.3 years” (Charmers & Quigley, 2017, p.133).



STEM, STEAM AND DIGITAL SKILLS

“Digital competency will be a basic competency for all workers in the future. It needs to be included as a core component of school education, both in terms of content and delivery, as distinct from the teaching of specialised ICT, technology and computer science subjects.” Australia’s Future Workforce? CEDA, 2015, p.15

- “So ubiquitous will ICT be in the future that it will be added to reading, writing and arithmetic as basic competencies expected of all Australians.”
CEDA, 2015, p.26

In *The Global Auction* (Brown et al., 2012) the authors point to seemingly contradictory facts. The first is that as the world becomes more driven by technology, the expectation is that more people will need STEM qualifications to obtain well-paying jobs, and yet fewer students appear to be studying STEM subjects at tertiary level. Despite this, the authors point out that “the STEM workforce in the United States totals about 4.8 million, which amounts to less than a third of the 15.7 million workers who hold at least one STEM degree” (Brown et al., 2012, p.38). Nonetheless, despite this apparent over-supply of STEM professionals, the call to encourage more young people into the field is “reinforced by a strong steer from government based on the view that you could make a manager out of an engineer but you couldn’t make an engineer out of a manager” (Brown et al., 2012, p.38).

While this could be understood as diminishing the importance of holding a STEM qualification, it is very much a minority opinion. In fact, the growing importance of holding such qualifications is a strong theme in the literature, such that many are concerned there will be a looming skills shortage in Australia due to our growing need for these skills (Office of the Chief Scientist, 2016).

The Commonwealth Bank (2017) refers to a forecast “that 45 per cent of employers are seeking to increase their STEM-qualified staff over the next 5-10 years” (p.11). Others predict that workers will need to use the thinking skills acquired in STEM education in virtually all future job roles — “Workers will use the foundational skills of mathematics and science for 9 hours a week (up 80 per cent from today) and advanced technology skills for 7 hours a week (also up 75 per cent from today)” (FYA, 2017a, p.7).

STEM skills are often aligned with calls for digital competence.

While most commentators believe that STEM skills will be the most secure pathway to the jobs of the future, not everyone agrees. For instance, Sundararajan (2017) believes “As the cognitive capabilities of digital machines expand, students may need less education in science, technology, engineering, and math and may benefit from a greater emphasis on design thinking, entrepreneurship, and creativity to prepare them for a micro-entrepreneurial career” (p.11).

This emphasis on creativity and design thinking is taken up in increasing interest in combining STEM education with arts and design, to provide the A in ‘STEAM’ education. Further, STEM is also linked to digital literacy: “The jobs of the future require problem solving and digital skills, and innovative and creative thinking, all taught through STEM” (Commonwealth Bank, 2017, p.11). Another report argues that “over 50% of jobs will require significant digital skills and yet our young people are not learning them in schools” (FYA, 2017a, p.2). Figure 4 provides estimates of the proportions of future jobs that will need various levels of digital literacy, with more than half of future occupations needing much more than the skills learnt in merely operating computers.

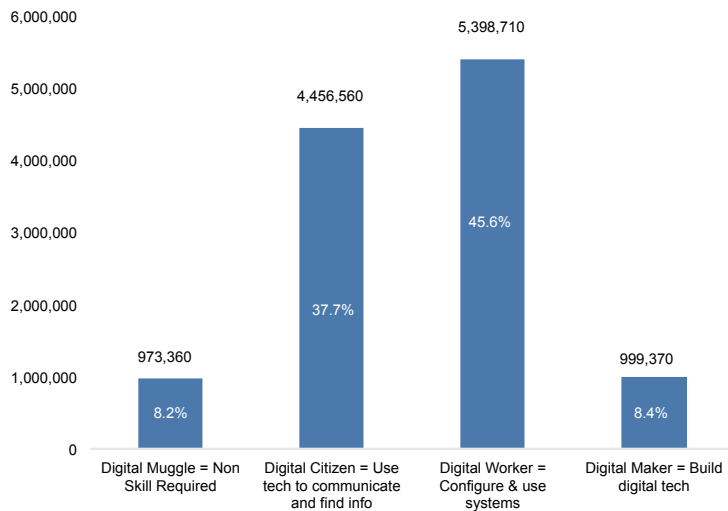


Figure 4: "Australia's labour force has high digital literacy needs in the next 2-5 years", Foundation for Young Australian, 2017a, p.30. The right to reproduce and communicate the material has been granted by Foundation for Young Australians

PROBLEM SOLVING

Problem solving skills are unlikely to be taken over by computers in the near term and are predicted to become increasingly important at work, including taking more work time as the average job will see them increase by 90 per cent to require 12 hours per week by 2030 (FYA, 2017b, p.7). The same report stresses "The skills that will matter most in the workplace of the future are, by a wide margin, problem solving, judgment and critical thinking" (p.16).

Problem solving skills in demand will include: "Originality and Fluency of Ideas. Learning Strategies and Active Learning — the ability of students to set goals, ask relevant questions, get feedback as they learn and apply that knowledge meaningfully in a variety of contexts" (Bakhshi et al., 2017, p.66).

By looking at the skills required in job advertisements, research has shown that "the proportion of jobs that demand critical thinking has increased by 158%, creativity by 65%, presentation skills by 25% and team work by 19%" (FYA, 2017, p.7).

The issue with many of the skills needed for future jobs is that they often require extensive experience in the workplace to acquire and this can put young workers at a disadvantage where jobs are only available to those with experience, and acquired on the job. Some have warned that the jobs used by youth to enter the workforce are also the jobs technology is displacing (Brynjolfsson & McAfee, 2012; Ross, 2016).

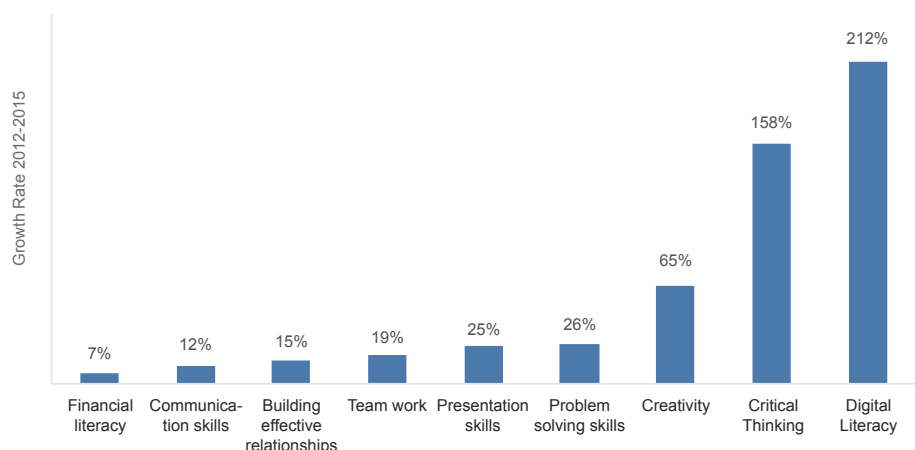


Figure 5: "Recent growth in demand for select enterprise skills", Foundation for Young Australians, 2017, p.10. The right to reproduce and communicate the material has been granted by Foundation for Young Australians.

INTERPERSONAL SKILLS

Interpersonal skills remain a clear advantage humans hold over machines. Frey and Osborne's (2013) research stressed that many jobs will potentially be able to be done by machines, however, whether they will be done by machines is not simply a question of the machine's ability to do a particular task, but also of our willingness to choose a robot over a human. As Schwab (2016) asks, "would we consult an AI-driven robot doctor with a perfect or near-perfect diagnostic success rate — or stick with the human physician with the assuring bedside manner who has known us for years?" (np)

Frey and Osborne (2013) stress that computers struggle with what they call 'social intelligence' and as such "real-time recognition of natural human emotion remains a challenging problem" (p.29). Whereas: "socially intelligent employees are able to quickly assess the emotions of those around them and adapt their words, tone and gestures accordingly" (Davies et al., 2011, p.8).

It is also true, however, that humans have predictable cognitive biases and that these often undermine our ability to see the fairest or best solution to many problems (Kahneman 2011). It is in such tasks that a programmed algorithm may well perform better than a human and that 'Such algorithmic improvements over human judgement are likely to become increasingly common' (Frey & Osborne, 2013, p.21).

Computers will outcompete human labour "when a problem can be specified — in the sense that the criteria for success are quantifiable and can readily be evaluated' (Frey & Osborne, 2013, p.16). "People get bored, people get headaches. Computers don't" (Brynjolfsson & McAfee, 2012). More complex skills that require novel thinking and adaptability given the needs of the context "will be at a premium in the next decade, particularly as automation and offshoring continue" (Davies et al., 2011, p.9).

This shift in jobs of the future towards the kinds of skills that humans can do and that machines cannot is presented as a trend towards making employment

not only more enjoyable, but also fundamentally more human (see, AlphaBeta, 2017). For instance, it is estimated that "automating routine tasks will improve job satisfaction by 62% of low-skilled workers" (p.23).

Interpersonal, human skills will also be important as demographics change. An ageing population is causing a shift in the profile of Australia's workforce. For instance, a quarter of all new jobs created in the five years to 2017 were in Health Care and Social Assistance (Australian Government, 2018, p.11). However, an ageing population does not only impact healthcare, but also means that workplaces will need to be more accommodating of difference, since many will become 4G workplaces — where four generations of employees will be working together in close proximity (UKCES, 2014b).

Similarly, all forms of cultural differences will need to be accommodated in the workplaces of the future (Hajkowicz et al., 2016) and this is likely to become increasingly the case due to migration and globalisation (Davies, 2011; FYA, 2017a; Horton et al., 2018), particularly for Australia in the 'Asian Century' (Australian Government, 2012).

Team work has always been a feature of employment. However, a number of trends are making the need for collaboration and networking centrally important skills in the new economy. As people become more entrepreneurial and potentially work for more than one employer at a time, they will also need to have strong networks of people who know their skill set and who will recommend them for new work.


In the future, human skills such as creativity, imagination, emotional intelligence and empathy (Commonwealth Bank, 2017, p.16) will become increasingly important to augment our interactions with computer systems. The OECD (2017) points out that "the labour market is increasingly rewarding soft skills such as the ability to communicate, work in teams, lead, solve problems and self-organise" (p.19).

CREATIVITY

Creativity is also particularly difficult to program a computer to achieve. This is because creativity, by definition, produces something that is new, novel and therefore something that cannot be fully predetermined in code beforehand. In that sense, a truly creative outcome is one that can only be recognised at the end of the process when looking back — computers are rules based and creativity could be virtually defined as the very opposite of that.

However, creativity is not just about producing something that is novel or unexpected. A creative solution to a problem also needs to be 'right' in the sense that it needs to provide a positive solution to the problem at hand. Creativity skills are growing in demand. "A 2016 World Economic Forum report estimates that five years from now, more than a third of skills considered important today will no longer be relevant. Creativity and emotional intelligence will be among the top three needed" (Riad, 2017, p.18).

Allied with this, commentators predict a "low susceptibility of engineering and science occupations to computerisation' since they require a 'high degree of creative intelligence" (Frey & Osborne, 2013, p.44).



Creativity: Value will not come from the old ways, only the new, making imagination and creativity central to tomorrow's capabilities.

- Commonwealth Bank jobs and skills of the future report 2017, p.17

MANUAL DEXTERITY

Ford's moving assembly line is dominated by machines. However, there are many humans shown in the clip, performing complex spatial tasks that it is difficult for robots to achieve. These workers work alongside the machines. Such jobs have a long future.

Other jobs that are unlikely to be replaced by robots include many trades such as plumbing and carpentry. However, even here it is important to remember that disruptive technological change is likely to occur, even if it may not require a robot to operate in the same way as a human. Tasks may be changed to meet the needs of the robot (Frey & Osborne, 2013). Both “predictable physical and unpredictable physical” occupations “are expected to experience workplace change driven by automation in the near future” (AlphaBeta, 2017, p.9).

Davenport and Kirby (2016) turn the standard argument about automation and computerisation on its head and ask, “if you were a machine, what shortcomings would you readily admit to, and want to have a human making up for?” (np). They suggest that your best career path is to become what the machine would need.

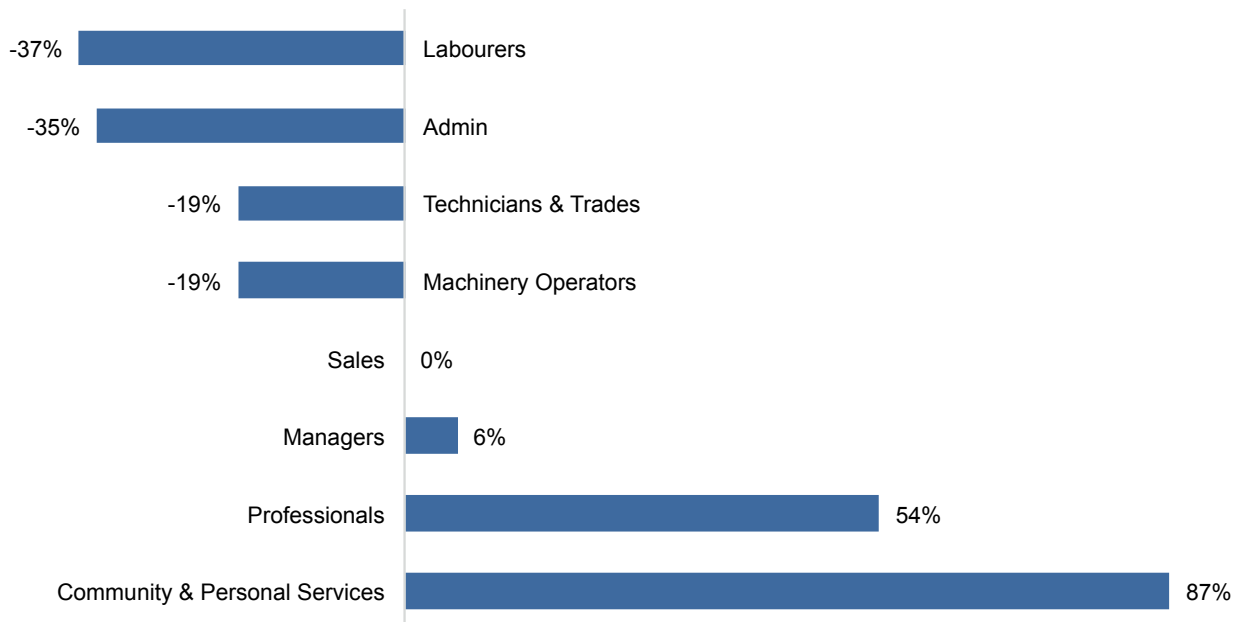


Figure 6: “Changes in high and low skill occupations 1991-2015”, Foundation for Young Australians, 2017a, p.12. The right to reproduce and communicate the material has been granted by Foundation for Young Australians.

SKILLS IN LIFELONG LEARNING

The monumental changes underway make it nearly impossible to predict with certainty the skills that will be needed and rewarded in the future labour market. However, what is clear is that people will need to retrain and to build on their skills throughout their working lives. This capacity for adaptability and retraining is likely to become a key skill that employers will look for in their employees (FYA, 2017a; Rainie & Anderson, 2017; UKCES, 2014a).

Reskilling and retraining will become increasingly necessary if people are to remain employed. In fact, individuals will be expected to 'take greater personal responsibility for acquiring and continuously updating skills for progression and success in the face of limited investment from employers and government and increasing division between low and high-skill jobs' (UKCES, 2014b p.26). Research suggests that businesses that invest in "workforce reskilling and human capital development" find that it is a "no-regret action" (WEF, 2018, p.17), in that the benefits are positive to the business regardless of patterns in skill availability.

Today's young people will need to spend more hours learning on the job than ever before ... In fact, Australian workers will spend one-third of their hours at work learning, a 30 per cent increase from today.

- The New Work Smarts: Thriving in the New Work Order. FYA, 2017b, p.14

IN SUMMARY

There have been few times in history when the future of work has been less like the past. In the past people spent most of their time making things, however, in the future relationships are likely to be as important as what is produced. In the past people worked in one job for most of their working lives, in the future a large section of the workforce will likely work for themselves. In the past people were defined by their job title, in the future they will be defined and redefined by the skills they have and how they go about marketing those skills. In the past, when you became something you were known as that type of worker, in the future people are likely to go on becoming new versions of themselves as they continuously learn new skills. The jobs of the future look to be much more dynamic, interesting and rewarding. And today, for those who engage with this project of lifelong learning, that future is within reach.



RESEARCH DESIGN

From the literature review we can see that expert opinion on future work is consistent in descriptions of major trends and future skills orientation, divided on patterns of change, and generally nonspecific on the types of jobs that will predominate over the next 20 or so years. In this 100 Jobs of the Future project our aim is to provide a grounded view of what the world-of-work future might hold, particularly for youth not yet in the market who need to prepare for a future in jobs that do not yet exist. Our aim is to be both optimistic and brave; to put flesh on the bones of an uncertain future so as to provide a multi-faceted snapshot of what future working lives might look like. Other commentators have speculated about future jobs, but we have attempted to do this in a systematic way. We have drawn upon the research described above, particularly the major predictive reports based on trend analyses, expert views and scenario projections, to identify domains of application and industries critical to future work. These included: health, agriculture, engineering and materials science, transport and mobility, computing and artificial intelligence, commerce, and education.

Based on this analysis we recruited eleven experts who are thought leaders in these broad domains, each of whom was uniquely placed to comment on future work trends in their area. We included experts who could offer transdisciplinary perspectives on future work. The list of experts together with a brief biography and summary of their perspectives is found below. Each expert has a public reputation for their work in the field, and many hold positions of leadership, and / or future forecasting and advice, in significant companies or public or academic institutions. They each, therefore, speak with authority. The interviews, of one hour, explored trends in their area of expertise, future job roles, tasks associated with these jobs, and the skills and capabilities that young people might develop to prepare for such roles.

Transcripts of these interviews were analysed to identify particular jobs that captured key elements of what the experts were describing. Overall, 100 jobs were constructed that extracted the key trends and messages of the experts, covered a broad set of fields, and represented snapshots of future work in a way that provides insights into what the future might hold, and what skills, capacities and interests might best prepare the youth of today for the work realities of tomorrow.

These 100 jobs of course do not presume to cover the totality of global work in the future. Jobs that will not change at all (we suspect there will be few of those) are not included in this list. Nor do they have a time stamp on them, although we can surmise that the futures our experts are describing will represent the realities of the next 20 years or so. As will become apparent, these realities fundamentally are shaped by advances in computing power and machine automation, science and engineering developments, and the changed possibilities in the way we interact and do business due to these. Some of the jobs are new. Quite a few are surprising and even thought-provoking. Some are not new, but represent today's jobs with new features implying different experiences, skill-sets and rewards. Many are framed by new technological realities, that being a strong focus for the experts' insights into changes in their domain.

THE EXPERTS

Following are the eleven experts interviewed to explore and speak to the current trends and discoveries made in the literature. Based on the experience they bring from their fields of expertise, they helped to design the 100 Jobs of the Future. Each expert represents someone who can speak with authority and with transdisciplinary understandings on future work in their domains.

According to Megan, the world of work is about to experience significant changes in both the employer / employee relationship and in what employees will be expected to do. People will be much more likely to be self-employed, while working in a variety of teams that form and dissolve depending on the task to be performed and the skill-sets of those in the team. Everyone will need to be in more control of their own career path, in honing their skills to ensure they remain relevant, learning to be able to promote themselves, and to manage the financial and time management aspects of working for more than one organization and in more than one team at a time. Work will increasingly involve creativity in ways that few jobs do today, as technology displaces the dull, dangerous and dirty jobs of the past. The future will not only belong to those able to learn and change as the rules of the workplace change, but also to those innovators who are able to change the rules themselves, rather than waiting for them to change. We are increasingly able to curate the entertainment we receive so that it matches our personal tastes, but this means we may feel isolated, and so will also desire shared experiences — this means that finding ways to involve us in live events that are increasingly mediated by technology will open up major new fields of entertainment. Data is increasingly important, as will be those able to interpret, explain and communicate the meaning lying behind that data in ways everyone can understand. The accelerating shift from a production towards a service economy will make better designed human and interpersonal interfaces a central concern of all business models. Finding ways to encourage everyone in society to better engage and participate to their fullest will require people with a deep understanding of intercultural, cross-generational, and gendered behaviours who can approach others with the empathy needed to create technologically driven spaces where everyone will feel welcomed and involved.



Megan Brownlow

Pricewaterhouse Coopers

Megan Brownlow is a former Partner and former National Industry Leader for Telecommunications, Media and Technology (TMT) at PricewaterhouseCoopers (PwC) where she performed strategy, due diligence, forecasting and market analysis work for clients. Megan also lead PwC's industry thought leadership program, The Outlook, which forecasts future revenues and trends across 12 TMT sectors. She started her career as a broadcast journalist in radio and television.



Sheryl Connelly

Ford Motor Company

Sheryl Connelly has served as Ford Motor Company's futurist for more than a decade. She is responsible for identifying global trends, exploring potential implications and cascading these insights on futuring to organizations throughout the company, including design, product development and corporate strategy. She is a member of the Global Advisory Council on transportation for the World Economic Forum. Fast Company magazine named her one of the Most Creative People in Business in 2013 and 2015. Connelly has been a featured speaker at TED Global. Before working for Ford, she practiced law.

Sheryl says that while the past belonged to those with a deep understanding and highly specialised skills, the future will reward polymaths: that is, those with a sweep of knowledge across a broad range of disciplines. In fact, being able to see connections and the unexpected applications of knowledge derived from one sphere and how it might be applied in new and interesting ways will be a key driver of innovation and human creativity. Such transdisciplinary knowledge will link technology and artificial intelligence with human creativity making that world much more human in the process. In the past, people were often expected to fit themselves to technology, and this often made people feel like an insignificant cog in a much larger machine. The new technological environment will become more person-centred, tailoring the world to our needs and desires, whether that is purely focused on entertainment or on personalised medicine or upon the share economy that will allow us to have more while owning less. All of this will exist within the constant connectivity that has already brought about significant social changes, however, there are downsides to being constantly connected to the world in terms of our mental health and levels of anxiety. We will see the rise of preventative, rather than responsive, health care, including mindfulness. We will also increasingly find ways for people to disconnect from our hyperconnected world for some downtime. Many of the jobs of the future will involve finding ways to hack our lives to make them easier and more rewarding, automating the mundane tasks we have to do while presenting us with more options and better ways to achieve our goals. The ethical, intercultural and cross-cultural issues associated with living in the new spaces technology will provide for us will require new classes of specialists able to protect us in those spaces and to ensure that we are treated ethically while we navigate them. All of which will involve people with the skills to think across fields and to see the possibilities these new ways of interacting will enable.

Representing the National Farmers Federation, Mark made many points about the need for better connectivity (or internet access) across rural and regional Australia. With access: health issues can be managed and reduced, innovation may increase as farmers will have access to a greater variety of input knowledge and examples, and technologies regarding farm management and production (including farm data) can become cloud accessible. Farmers will need consultancy support to transition to this digital way of farming, while design and manufacturing of the technology (software, hardware — precision farming, automated equipment, livestock monitoring and management, and drone operations for monitoring and weed control are some examples) is also needed. Global food security issues, climate change, and our changing relationship with food will result in new commodity development, ethical and production challenges, and international trade opportunities. Urban farming may come to be profitable, coinciding with a potential shift of the population out to the regional and rural areas where farm gate sales will generate tourism opportunities and produce reconsidering of transport needs.



Mark Harvey-Sutton

National Farmers Federation

Mark joined National Farmers Federation (NFF) as Manager Rural Affairs in 2016. Prior to this, Mark was a/g CEO of the Sheepmeat Council of Australia, as well as Policy Director of the Cattle Council of Australia. Both organisations are members of NFF. Prior to that, Mark worked for the Australian Government across a range of roles, including Assistant Director, Meat and Livestock Policy at the then Department of Agriculture Fisheries and Forestry, and as Departmental Liaison Officer for the Minister for Regional Australia, Regional Development and Local Government. Mark is admitted as a Lawyer in the Supreme Court of the Australian Capital Territory.



Daniel Johnson

Queensland University of Technology

Professor Daniel Johnson leads the QUT Games Research and Interaction Design Lab. Daniel has also worked in the games industry with companies such as NextGenVideos and The Binary Mill. His research interests include motivations for videogame play, the player experience, the impact of videogames on wellbeing, and gamification. He worked as a postdoctoral fellow at the University of Cambridge for the Engineering Design Centre and remains an Affiliate of the Cambridge University Well-being Institute. Over the past decade, Daniel has undertaken consultancies exploring usability, user-experience and design issues in entertainment and non-leisure software.

The future will belong to those who can make the most of joining the unique advantages of humans and machines, and, as Daniel points out, especially in ways that design experiences that enhance all aspects of life. So much of life is full of things we find tedious. With the ongoing development of game technologies, designers will make the boring amusing. They will do this by transforming the interfaces we interact with and how data is collected. User interface designers will use their deep understanding of human nature and the capabilities of technology, so as to ensure our interactions are seamless, intuitive and natural. Increasingly, we expect to be amused and engaged at all times and in all of our interactions, and this will require highly creative people who are able to structure our interactions in ways that engage and delight us, and this is not a job likely to be replaced by machines any time soon. However, as the new technology will have the potential to gather deeply personal information about us, we will need to develop ways to protect and enhance our personal, physical and emotional wellbeing. Navigating the complexities of surveillance, privacy and the capabilities of new technology will require experts who can help us decide how much or how little of our lives we should be sharing and with whom. If used effectively, technology will allow us to interact with others in ways that will allow each of us to bring out the best of our skills and abilities. Key skills for the future workforce will include being able to interact and communicate across teams, knowing how and when to use technology to solve problems and how to ensure our physical and mental wellbeing, learning to create environments that bring joy, that create spaces for us to be together, and to enable us to change the world in ways that will humanise technology, the world of work, and all other aspects of our lives.

With an ageing, growing population, carer roles will continue to be needed. In the future these roles will expand such that emotional intelligence and creativity will become a central focus. Similarly, health practices will benefit from becoming increasingly technological as we develop tools to understand and explore health issues with greater complexity and accuracy. As more people move to running their own micro-businesses, the need for 'wrap-around' services that support them in managing the varied aspects of successful business administration will multiply. These will act as brokers or contractors specialising in helping those managing their gig careers to multiply. Regional centres will become much more appealing and will offer increasing benefits as community becomes much more valued. Skills of communication, marketing, information management, and technology use will become core to many jobs, and these skills will increasingly be held in the one person.



Ivan Neville

Department of Jobs

Ivan Neville is currently the manager of the Labour Market Research and Analysis Branch and has responsibility for the analysis of the Australian labour market and the identification of the current and future demand for skills. This involves speaking with more than 10,000 employers each year. The branch seeks feedback from employers on how new and young job seekers can enhance their employment opportunities, and Ivan regularly gives presentations around the country on both this topic and a broad range of other labour market issues.



David Ramadge

eBay

David Ramadge is the Senior Director of Product & Shipping at eBay Australia. He has over a decade of global technology product and business leadership, both within commerce and other software disciplines. In 2017 Dave re-joined eBay after nearly 10 years based in Silicon Valley, where he oscillated between innovating at scale in large technology companies and building startups. Between his two eBay stints, Dave worked at Google in Product Strategy & Operations on products such as Google Maps and Local Search. He was also Co-Founder & COO of Neoglyphic Entertainment, a start-up focused on building advanced 3D and machine learning software for content creation and discovery in the entertainment industry.

David focused the discussion on powerful futures coming from a combination of big data analytics and artificial intelligence — machines that can build other machines, and algorithms that can anticipate our needs. He talked of emerging technologies such as materials and propulsion science driven by space exploration, and 3D printing with an expanding range of applications, for instance including synthetic meat. He focused on the increasing complementarity of machines and humans, for instance, with health technologies and their application in diet apps, health trackers etc. Commentators talk about the ‘singularity’ where the dividing line between human and computer becomes blurred to the point where we can no longer distinguish them as separate. He saw the next step for machines will be for software to be developed that can interpret how to generate and use data to get at people’s underlying thoughts and emotions. He was optimistic that humans, in 20 years, will remain ahead of machines in our ability to make decisions on data, in creativity, ethical mindedness and emotional intelligence. The level of technological understanding will increase for all jobs of the future, but jobs will open up for people who can successfully stand between people and machines, and who can understand people, think creatively and abstractly around algorithmic software, and blend these skills to make software more powerful, intuitive and rewarding. His advice: ‘Learn how to code, and learn how to paint’.

Speaking from the perspective of food production through agriculture / horticulture, Ben acknowledged that these careers are going to become even more technological. Farmers will further rely on machines, computers, and programs to support production. Precision farming, land management, harvesting including fruit picking may all include drone and robot technologies. Farming skills will move beyond managing complex changing natural systems toward integrating technological tools into the production process. Specialised training and trainers will be needed to use and manage these technologies. Farms will need support to manage safety aspects of new technology and this with app development for machine operating instructions, compliance checking, and training all opening as growth areas and industries.



Ben Rogers

National Farmers Federation

Ben Rogers has a wealth of experience in the Industrial Relations/Workplace Relations area both as Principal Solicitor in the ACT Government, and previously with Comcare and private legal practices in New South Wales. The National Farmers Federation has begun a bold project to identify how to harness technology to boost innovation and productivity across the agriculture sector, so as to reach new markets, attract the best human talent and lighten our environmental footprint. Ben's role at the National Farmers Federation focuses on how this may impact the world of work now and into the future.



Susan Thompson

City Futures Research Centre

Professor Susan Thompson is an urban planner and Head of the City Wellbeing Program in the City Futures Research Centre. City Wellbeing focuses on planning, designing and building environments that support people's health and well-being as part of everyday life. Susan's academic career encompasses research and teaching in areas ranging from social and cultural diversity in urban planning, to migrant women's meanings of home, and the use of qualitative research in built environment disciplines. Susan is a frequent contributor to professional practice forums on issues such as healthy urban planning, cultural diversity and community safety.

For Susan, technologies bring different possibilities in how we might interact both with each other, and with the world around us. However, no technological change is simply positive or without problems of its own, since any change can bring to the fore new challenges. Many of the issues we face today are 'wicked' or extremely complex problems. Even if a solution to one aspect of the problem is found, it can inadvertently make other aspects worse. Susan believes the best way to address wicked problems is by bringing different people together with optimism and a shared concern for their own communities. Susan believes technology can help to connect us both as individuals to one another, as well as a purposeful, democratic community. In particular, the environmental problems we face, including those caused by consumerism, pollution and waste, will best be solved by us working together to understand our needs as a community and to see if we can use technology as a tool to make everyone's life better. In this sense, we have much to learn from Indigenous communities, who retain an ongoing and strong connection to both land and community. Susan focuses on creating urban environments where people flourish, not merely as individuals, but as citizens, communities and cultures.



Jude Walker

FutureWorking

Jude Walker is a labour market analyst, futurist and demographer. She conducts environmental scans and uses these, and the results of her other research projects, to start data conversations with groups, including schools and business groups. She provides insights into the future of work, particularly in relation to the introduction of new technologies. She works to identify how education/training, employment and economic sectors might work together more effectively to contribute towards better social and economic outcomes.

Jude emphasised in her conversation the need to provide young people with cross-sector capability. She described, to achieve this, a model which outlines a set of thinking capabilities: futures thinking; persistence thinking; complexity thinking; entrepreneurial thinking; and design thinking. In talking about preparing for the future she argued that youth need citizenship and communal living skills. They need to think deeply about their values and relationship to people, and they need to learn how to learn. In the future world of work, where stability in jobs will no longer be the norm, people need change resilience and risk tolerance. Describing the focus of future jobs, she emphasised the importance of translation work — at the interface between technologies and people. Future jobs will involve understanding how to interact effectively with people, alongside being comfortable with technology. Helping people translate and adapt new technologies will be an area of future job growth.



Xungai Wang

Deakin University - Institute for
Frontier Materials

Professor Wang is Director of ARC Research Hub for Future Fibres and Pro Vice-Chancellor, Future Fibres at Deakin University. He leads the University's fibre and textile related research activities. He served as the Director of the Institute for Frontier Materials at Deakin University until end of 2017. The Institute is multi-disciplinary, bringing together researchers from engineering, chemistry, materials science, physics, biology, mathematics and other disciplines to develop new materials and structures that are affordable, suitable to purpose and sustainable. Professor Wang investigates new applications for fibres and textiles, and how to add value to natural fibres and in functionalising textiles.

The workforce will change to explore multi-disciplinary skills, which are needed to generate additive manufacturing. For example mechanical, electrical, programming skills will each be required and will be found in one person or one team. Working collaboratively in teams ensures that ideas are considered from multiple perspectives and products can be manufactured with greater capacity and complexity. Robots will be involved in more complex, collaborative thinking too, which will require a higher level of programming skill than is currently known. This includes considering the design of products from biomimicry where nature ensures energy and materials are minimised in production and combined in elegant solutions. There is a lot of problem solving in this thinking and design. It also includes circular economics where material utilisation is designed carefully and materials are harvested from other products and separated to be used again after this product is used / finished. Mass customisation will become the way of shopping as everything is infinitely tailored to suit personal tastes and body shape. Imaging technology will be available as a phone app that will translate body images into measurements to generate individualised and customised products. Learning may change and become more focused instead of longer programs, specific courses will become preferential.

A major theme in Sally-Ann's exploration of work futures was the need to harness technology to address solutions to problems that the designers of the technology didn't anticipate. Workers of the future who can do this will need a deep understanding of human-computer interactions, as well as the ability to creatively adapt these technologies using their knowledge and insights from across a range of disciplines. Their passion for solving problems will be driven by an innovative approach to addressing human needs. For Sally-Ann, the strength of computer science is not about coding, but in the capacity it develops in people enabling them to break down complex problems, to think algorithmically, while being creative and solution focused. She emphasised that individuals need both knowledge and passion for their discipline, but that this needs to be combined with a breadth of understanding and increasingly also with ICT knowledge. At the work organisation level, she emphasised the need to trust and empower the creative possibilities available in cross disciplinary teams that are focused on design. The future for organizations lies in their developing cultures and habits of adaptability directed towards proactive creation. For individuals, the future will reward those able to invent their own job titles.



Sally Ann Williams

Google Australia

Sally-Ann Williams is Executive Program Manager at Google Australia where she leads efforts in CS/STEM education (K-12); research collaborations with universities; entrepreneurship and startup engagement. Her work leading Google's CS/STEM education engagement is focused on scalable and sustainable change in curriculum and teacher professional development to support national priorities in STEM education in Australia and New Zealand. In working with the startup community, Sally-Ann has helped create and drive national engagement strategies on innovation and entrepreneurship including serving on the Board of Fishburners (Australia's largest Tech co-working space), contributing to the foundation of StartupAUS (a non-profit working to transform Australia through tech entrepreneurship), and mentoring startups through many different programs. She also leads Google's University Research engagements in Australia & New Zealand.



WORK FUTURES: LOOKING FORWARD

Across the experts there are differences in emphasis that relate to the experts' varied disciplinary backgrounds and current interests. Nevertheless, a number of strong themes come through in their analysis of trends, possible directions jobs will take, and the skills that will help young people gain these future jobs.

FUTURE TRENDS

Much of the experts' thinking about the future concerned the impact of technology on our lives and our work — these included: big data and algorithms, 3D printers and prosthetics, intelligent materials, and vastly more nuanced and complex ways of communicating. In this they were almost uniformly optimistic, pointing out the possibilities for better and healthier lives, enhanced communities, and more space opened up in jobs to be more fully human, removing the drudgery that will be taken over by machines. Of course, there was an acknowledgement of the negative possibilities of disruption to lives and to workplaces, but mostly the experts focused on the positives. None of them subscribed to a dystopian vision of the future. Of course, these emphases relate to their positions as professionals looking to the future, and also to the focus of the interviews, on future jobs. Implicit in many of the job changes they describe are job losses.

While all of the experts acknowledged the substantial changes related to technological innovation and widespread access to this, each of them focused on particular discipline areas. There were common themes here too. Some talked about changes due to

an aging population, and healthcare more generally, stressing the ways in which jobs in the health sector will be more interesting and successful with better information and technological advances in care. These changes are expected to free up health workers to focus more on the human aspects of their jobs.

With environment jobs related to climate change, much of the discussion was implicit, focusing on new energy processes, intelligent building materials and customised design, low energy production, built in recycling of materials, and the production of lighter, stronger materials that are more energy efficient.

In both e-commerce and entertainment we have the possibility of greater choice and more tailored products that, if managed well, will enrich our lives.

These trends and themes have also been identified in the work futures literature, but the experts provided numerous additional insights, particular within their fields of expertise, about the potential jobs, the benefits technology would provide, and how young people might grapple with the opportunities that will flow from these changes.

HUMANS AND MACHINES

A number of the experts talked explicitly about the relationship of machines to humans and to human needs. In the health sector, and in material science and engineering, it is clear that we will have in the future much more intimate contact with machines. This will be true whether it be intelligent implants (well beyond pacemakers or knee replacements), personal communication devices, or intelligent clothing that monitors and provides advice. David Ramadge talked of the 'singularity' where the dividing line between what is human and machine becomes blurred.

A number of the experts saw this human-machine interface as being a major focus of many future jobs. These jobs will involve translation of computing advances to human applications, and the interpretation of innovative software and hardware for people. In the other direction, jobs are likely to open up for those able to communicate human needs and

possibilities to programmers, who may be expert in technical matters but need insight into the possibilities these can provide for individuals and communities.

A number of the experts talked explicitly about the advantage humans will always have over machines, in our ethical judgments and in our understandings of human needs and responses. A number argued that machines will take away the drudgery from many jobs while opening spaces for more human interactions producing more rewarding and varied work. In the future, it is likely machines will perform much more complex tasks, to the point of designing other machines. The key, for individuals, is to find ways of working with machines, and so avoid being replaced by them. This, of course, will not only be a matter left to individuals and their strategies, but also for companies and government to help us manage for our betterment.

SKILLS FOR FUTURE WORK

The experts had much to say about the types of skills that will be needed to prosper in future work, but also the dispositions people will need to retain future oriented skills. One theme that comes up strongly is the move towards cross-disciplinarity. This took various forms:

- People having deep knowledge of one area supplemented with wider knowledge to support working in cross-disciplinary teams
- People marrying disciplinary knowledge with knowledge of technology in order to understand the meaning of data, and of data needs
- People being able to work across disciplinary ideas, for instance in STEM, and technology, but with a creative orientation: 'learn how to code, and learn how to paint'.

Another theme was the likely growing importance of human skills; the capacity to understand and communicate with people, so as to be able to work at

the technology-human interface. The ability to work effectively in teams will be vital, particularly when working freelance across a range of projects, often concurrently. Having community and citizenship skills will also be important while working with technology applications.

The third strong theme that emerged was the need for flexibility and adaptability in the face of change. Future workers will have many jobs over a lifetime, and people who can adapt, and stay ahead of the needs of the workplace, rather than waiting to be shown, will prosper in this environment. The capacity to learn, and to be strategic about learning, will increasingly become the key to success. In the future, qualifications are predicted to be shorter term, more varied, but also something people will need to continually update through all phases of life. Life-long learning will be universally acknowledged as the only way to retain skills needed in society.



THE 100 JOBS

The jobs that were created from these interviews are described, and grouped in the next section. They form a varied and fascinating set. Many were explicitly described by the experts, but many also were projections based on what was said about future work trends and the capabilities that people will require to navigate them, in some cases amalgamating the views of a number of interviewees. The jobs cannot therefore be ascribed to individual experts.

Some of the jobs are surprising, providing fresh perspectives on our likely future lives. The job of Nostalgist, in charge of preserving and highlighting productive memories for older people, is one of these. We will have Aestheticians helping us with our appearance, and Cyborg Psychologists helping us come to terms with our synthetic organs. Many jobs have to do with innovative design, such as 3D Printed Building Design, or Fusionists working at the interface of professions. There are jobs that are the result of environmental concerns, such as the Cricket Farmer, or Weather Control Engineer. Many of the jobs exist in some form today but the future job involves its inclusion of technology, or different dynamics caused by social movement. We have tried to make these changes explicit in our descriptions. With each job, we have described the key skills implied.

Together, the jobs give a complex and surprising set of insights into possible futures. They offer a grounded experience of what future work might look like for individuals, and by implication what our future lives might entail, in ways that most work future literature does not provide.

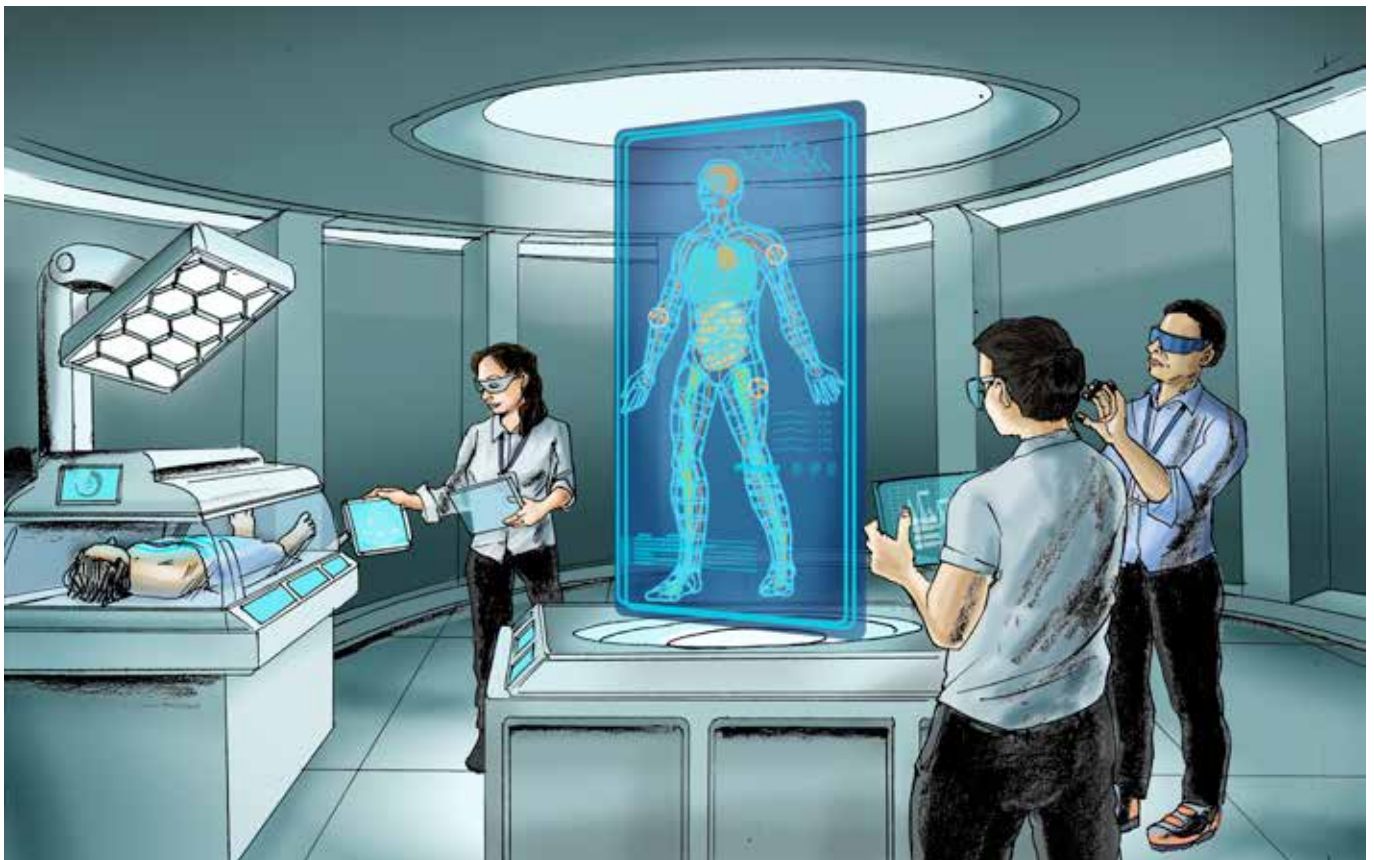
Through this research we believe we have uncovered new lines of thought about work futures. This helps to put flesh on the bones of the future in a way that

the public, and particularly young people who need to think themselves into such futures, can relate to. Within the job descriptions there is optimism about possibilities for future human and community lives, but also warnings, for instance, about privacy issues, sustainability challenges and what needs to be in place to tackle these. There are also challenges for how we think of ourselves in relation to ever more complex, personal machines that will increasingly become central to our lives.

Of course, these jobs, while many and varied, do not represent a complete future of jobs, in no way does this represent an exhaustive catalog of all jobs that will be performed in the future. Many jobs, for instance, will change very little, particularly those that involve skilled manual work that machines cannot duplicate. We have not described these. There will be many other jobs that arise from future trends that our experts have not thought of. The 100 jobs we have described, however, provide an authoritative snapshot into future work and future possibilities while offering a glimpse of the skill-sets likely to be rewarded in the future workplace. We base our claim of 'authoritative' on the quality of the experts and the positions of insight they hold, across a range of disciplines. We have, with this research, presented a largely optimistic, complex view of the future, that we believe will be useful in bringing to the attention of young people soon to enter the job market, just what the future might hold for them, and what are the interests, values, dispositions and skills that will best prepare them to be productively involved in this future.

NEXT STEPS

These expert interviews, and the jobs emerging from them, invite further analysis. We intend to transform them from an item of insight and interest, to a useful tool to help youth in thinking about preparing for the future, and its possibilities for them. We intend to sort the jobs into broad career interest categories, and also more specific future role and task themes. For the career interest categories, we intend to use the well established RIASEC dimensions (Holland, 1996, 1997) that categorise jobs into Realistic, Investigative, Artistic, Social, Enterprising, and Conventional types, and for the specific future role and task themes, we will draw upon the literature review and data generated from the interviews with experts as part of this project. We will create an interactive resource that young people can use to explore their own career interests, and from this to imaginatively project into possible interesting and rewarding work futures.



Nanomedical Engineer (Artist's impression)

100 JOBS OF THE FUTURE

Technology jobs

- 1 Additive Manufacturing Engineer
- 2 Automation Anomaly Analyst
- 3 Biomimicry Innovator
- 4 Bioprinting Engineer
- 5 Child Assistant Bot Programmer
- 6 Digital Augmentation Officer
- 7 Digital Implant Designer
- 8 DigiTech Troubleshooter
- 9 Energy and Data Systems Installer
- 10 Ethical Hacker
- 11 Gamification Designer
- 12 Integrated Home Technology Brokers
- 13 Machine-Learning Developer
- 14 Mechatronics Engineer
- 15 New Materials Engineer
- 16 Quantum Computer Programmer
- 17 Robot Ethicist
- 18 Robot Mechanic
- 19 Satellite Network Maintenance Engineer
- 20 Shadowtech Manager
- 21 Smart Dust Wrangler

In this report, the 100 jobs of the future are organised by broad category of application, such as 'people jobs', 'hands on jobs', and 'data jobs'. This is to provide a simple scaffold to help people to browse among roles that may be of interest to them. Some jobs may fall into multiple broad categories, particularly those that involve use of digital technologies, but they are only represented once here to eliminate redundancy. The jobs are also coded by whether they exist now (albeit perhaps with a different name, different work context, or using different tools), or are predicted to emerge in the future.

People jobs

- 22 100 Year Counsellor
- 23 Aesthetician
- 24 Aged Health Carer of the Future
- 25 AI Educator
- 26 Community Support Worker
- 27 Cross-cultural Capability Facilitators
- 28 Cyborg Psychologist
- 29 Decision Support Worker
- 30 Digital Memorialists and Archivists
- 31 Displaced Persons Re-integrator
- 32 Drone Experience Designer
- 33 Early Childhood Teacher
- 34 Lifelong Education Advisor
- 35 Local Community Co-ordinator
- 36 Nostalgist
- 37 Personal Brand Manager and Content Creator

Business and Law jobs

- 38 AI Intellectual Property Negotiator
- 39 Blockchain Talent Analyst
- 40 Chief Ethics Officer
- 41 Community Farm Finance Broker
- 42 Drone Airspace Regulator
- 43 Fusionist
- 44 Innovation Manager
- 45 Personalised Marketer
- 46 Real-Virtual Transfer Shop Manager
- 47 Sharing Auditors
- 48 Trendwatcher

Environment jobs

- 49 Aged Persons Climate Solutions Consultant
- 50 De-extinction and Conservation Geneticist
- 51 Digital Apiarist
- 52 Entomicrobiotech Cleaners
- 53 Flood Control Engineer
- 54 Integrated Ecology Restoration Worker
- 55 Waste Reclamation and Upcycling Specialist
- 56 Water Management Specialist
- 57 Weather Control Engineer

Urban jobs

- 58 Automated Transit System Troubleshooter
- 59 Autonomous Vehicle Profile Designer
- 60 Biofilm Plumber
- 61 Biometric Security Solutions Engineer
- 62 Human Habitat Designer
- 63 Integrated Energy Systems Strategist
- 64 Massive 3D Printed Building Designer
- 65 Net Positive Architect
- 66 Regional Community Growth Co-ordinator
- 67 Sustainable Energy Solutions Engineer

Agriculture jobs

- 68 Agroecological Farmer
- 69 Bio-jacker
- 70 Cricket Farmer
- 71 Farm Safety Advisor

Space jobs

- 72 Offworld Habitat Designer
- 73 Terraforming Microbiologist

Health jobs

- 74 Data-based Medical Diagnostician
- 75 Genetics Coach
- 76 Health Shaper
- 77 Memory Optimiser
- 78 Nanomedical Engineer
- 79 Nutri-gutome Consultant ('Gut-bug keeper')
- 80 Virtual Surgeon

Data jobs

- 81 Algorithm Interpreter
- 82 Behaviour Prediction Analyst
- 83 Data Commodities Broker
- 84 Data Privacy Strategist
- 85 Data Farmer
- 86 Data Storage Solutions Designer
- 87 Data Waste Recycler
- 88 Forensic data analyst
- 89 Freelance Virtual Clutter Organiser
- 90 Predictive Regulation Analyst

Experience jobs

- 91 Analogue Experience Guide
- 92 Food Knowledge Communicator
- 93 Haptic Technology Designer
- 94 Media Remixer
- 95 Multisensory Experience Designer
- 96 Space Tourism Operator
- 97 Sportsperson of the Future
- 98 Swarm Artist
- 99 Virtual and Augmented Reality Experience Creator
- 100 Virtual Assistant Personality Designer

TECHNOLOGY JOBS

1

Additive Manufacturing Engineer

Additive Manufacturing Engineers will be responsible for making everything from satellite dishes to refrigerators.

Additive manufacturing will have been around for 20 years. It involves the building up of a material product, layer by layer, using material in fine powder form. It is the opposite to traditional methods, where material is removed to carve a shape. It is closely allied to 3D printing, which is one method of additive manufacturing.

Additive Manufacturing Engineers will be increasingly in demand to design purpose built products, in particular prototypes, and high tolerance miniaturised machine parts.

The **Additive Manufacturing Engineer** will work with designers, technicians and material scientists.

Additive Manufacturing Engineers will have strong engineering skills, problem solving, and creative design skills. They also need strong communication skills and collaborative dispositions to work in multidisciplinary teams.

2

Automation Anomaly Analyst

Sometimes, artificial intelligence will come up with a solution or recommendation that seems counter-intuitive, wrong, unethical, or just plain weird. In those circumstances, people will contact an **Automation Anomaly Analyst** for help and advice.

Automation Anomaly Analysts specialise in tweaking algorithms to make them better suit people's needs, and 'winding back' the data inputs that have led to the strange result.

Automation Anomaly Analysts commence by understanding the client's experience of the anomaly, and then act quickly to restore normal function.

In some instances, the anomalous result may turn out to be a new and useful solution, in which case the **Automation Anomaly Analyst** may not make any changes at all. In other instances, they may need to reboot systems entirely and start from scratch."

Automation Anomaly Analysts will be fast-thinking and fast-acting. They will have intimate knowledge of AI algorithms, and have up-to-the-minute knowledge of the latest trends in this area. They will be expert coders, and also good data processors.

Automation Anomaly Analysts will often be freelance or work in small to medium enterprises - these **Automation Anomaly Analysts** will need to be enterprising and entrepreneurial, with the aim of being the person that is top of mind to contact when a strange result happens.

Some big corporations and government agencies may have their own **Automation Anomaly Analyst** team.

3

Biomimicry Innovator

The **Biomimicry Innovator** seeks sustainable solutions to human challenges by emulating nature's engineering processes. For instance, researchers are modeling energy-saving climate control systems on gas exchange mechanisms in termite mounds, or efficient and painless needles based on mosquito mouthparts.

The **Biomimicry Innovator** will be committed to sustainable innovation that is grounded in biological research, where they seek to understand the engineering complexities of plants, animal and microbe specialties. Transport strategies and materials properties are two further areas where diverse insect adaptations provide blueprints for innovations.

The role extends past research as they work to apply this knowledge to create products and processes that tackle global issues such as waste management, energy efficiency and agricultural solutions that mimic how ecosystems survive.

Biomimicry Innovators will have advanced skills in biological science and will be driven by a curiosity of the natural world. They will have practical understandings from many engineering fields as they transform and problem solve. They will harness their research data to bring creative ideas to interdisciplinary teams. Good communication skills will enable them to communicate their research-inspired ideas with other collaborators as they work towards innovative solutions.

4

Bioprinting Engineer

3D printing will have an increasing range of applications in the future, including printing organic materials.

One possibility is synthetic meat, to respond to concerns about the climate and ethical ramifications of meat production.

Another is 3D printing of tissue such as cartilage, bone or muscle, or potentially internal organs, for tailored human implants.

Research on such implants is moving at a fast pace.

A Bioprinting Engineer will create viable tissue for human implants, using hardware and software associated with next generation 3D printers.

A Bioprinting Engineer will have strong engineering skills and STEM knowledge and will work in teams with biologists, medical specialists and software designers. They will have design skills and well-developed communication and interpersonal skills for effective teamwork.

5

Child Assistant Bot Programmer

Living in a digital age has certain benefits.

One such benefit is that children's games and toys can be programmed for specific purposes.

A Child Assistant Bot Programmer designs humanoid robots (kiddobots) that will support children to play safely. These bots can be personalised and programmed to align with family preferences, values and rules. They read nursery rhymes, personalise stories, teach basic numeracy and language skills, develop general knowledge, support the learning of spatial skills, and use coding games to develop digital literacies.

The bots are also used as tools to supervise and manage children's free time, ensuring that they are physically safe and that they are safe in their online explorations too.

Children now only attend childhood education centres with their kiddobot (upgraded to match the centre's overall system) to keep them safe, guide their interactions, and provide a platform for their education.

The **Child Assistant Bot Programmer** will have knowledge of AI programming and humanoid robot mechanics. They will also understand early childhood and child development as well as learning theories and practices. The programmers may work in teams with robot designers and program developers to ensure the flexibility in programs to include personalised family personalities and needs as well as to integrate with early childhood centres' systems.

6

Digital Augmentation Officer

The Digital Augmentation Officer, a high level strategic role in most corporations, is responsible for choosing the right AI technology and other technological solutions (such as robots) for tasks within the organisation.

They also design work processes where humans and machines can work together to complement each other. They provide employees with the right augmentation options and negotiate training and time to transition to them to full capacity.

In addition, as more humans seek implants and body / brain modifications that increase their capabilities as cyborgs, the **Digital Augmentation Officer** will oversee the different management, working conditions and workplace rights that they will need.

The **Digital Augmentation Officer** will have strong management and strategic skills and can inspire people. They will also understand anatomical and mechanical systems, ensuring that physical capabilities are enhanced responsibly and for maximum productivity.

7

Digital Implant Designer

A **Digital Implant Designer** creates 'body hacks' that will be implanted into people's bodies and brains to ensure their health and enhance their lifestyles. Implants may include:

- integrated health and fitness trackers that monitor everything from fitness activity to blood nutrient levels to gut flora
- devices that help to manage health conditions by regulating or replacing body systems
- global positioning systems
- devices to augment the senses (e.g. extending the range of vision, improving hearing, eye cameras)
- devices to manage real-time digital interaction with people and bots (artificial intelligence) and provide real-time information feeds from the internet

Digital Implant Designers need to be creative and have knowledge of design processes. They will have technical skills relating to implant technologies and digital systems integration, along with knowledge of human biology and medical advances. Communication skills will be needed to work with clients, healthcare professionals, scientific researchers, systems engineers, and medical scientists.

8

DigiTech Troubleshooter

If your home network won't read the data from your bio-implants, your augmented reality game is glitching, or your household robot is stuck in a loop cleaning the same part of the kitchen, then you can contact your local **DigiTech Troubleshooter** for help.

DigiTech Troubleshooters work with households and businesses to solve problems with digital technologies that aren't easily fixable using at-home troubleshooting algorithms. These used to be known as 'IT Helpdesk' roles, but now most of the simple problems with technology can be solved using bots and AI.

The **DigiTech Troubleshooter** is there for more advanced issues, to diagnose what is happening and make sure that you are reconnected as soon as possible.

DigiTech Troubleshooters will have good listening skills so that they can interact with clients and diagnose problems with technology. They will be familiar with the commonly used household or business digital technologies for networking, systems integration, implants, augmented reality and robots. They will have good software use and basic programming skills, and will also be able to perform hardware fixes. They will need to be patient and methodical and be good problem-solvers.

This will be a 'high growth' role, with strong and increasing demand for **DigiTech Troubleshooters** in local communities as well as business.

9

Energy and Data Systems Installer

An **Energy and Data Systems Installer** will evolve from an electrician. The technical skills and knowledge base of the electrician will remain fundamental to this new role but the focus of the work will be integrating smart technology systems to streamline and optimise energy use.

Energy and Data Systems Installers will create intelligent home and office environments that are customised to optimise their energy use while continually learning and adapting to user behaviour. They will be able to install data capture devices and support clients to monitor and manage their energy consumption efficiently.

There may also be opportunities to specialise in local renewable energy solutions, such as wind, solar and bio energy, working with clients to design systems that deliver self-sufficient energy usage while brokering renewable energy surplus within the broader energy network.

Energy and Data Systems Installers will have a niche skill set that is very practical, enjoy working with their hands, and work to technical specifications and safety regulations. They will be problem solvers with highly developed communication skills to understand the unique energy needs of their clients and use new technologies to design safe and efficient systems to optimise energy performance.

10

Ethical Hacker

Also known as 'white hats', **Ethical Hackers** identify weaknesses in cybersecurity systems.

In a world where everyone is constantly digitally connected and data is collected about everything, hacking will become a major problem. Personal data may be taken hostage for ransom and identity theft will have serious repercussions.

Ethical hackers will get into the minds of cyber-criminals and look for security vulnerabilities. They will use the same tools as criminal hackers to probe systems for weaknesses, including social engineering, water-holing (monitoring social media of employees), algorithmic analysis, botnet armies and automated attacks.

Ethical Hackers will work for big companies, government agencies and cybersecurity firms. They will find and fix potential problems, patch security risks and fight off attackers.

Ethical Hackers will be puzzle-solvers. They will have highly developed analytical skills and enjoy finding and solving problems. They will be data-driven and detail-oriented. Ethical hackers will often work in teams and so will need high levels of interpersonal capability. They will also be excellent programmers and have a strong knowledge of cybersecurity issues and trends.

11

Gamification Designer

Gamification is the process of adding game logic and processes to enhance user engagement to achieve better outcomes.

Gamification can be used in a range of domains from education to healthcare to improve learning outcomes or enrich lives.

With connected digital devices underpinning social and economic networks, this technological ecosystem will increase the depth and breadth of gamification opportunities. Gaming will become a pervasive part of our lives with organisations using gamification to incentivise behaviours and increase engagement. For example, public health organisations could offer reward points towards a holiday for buying healthy groceries online or increasing physical activity.

As the use of gamification grows, games will connect with each other and blend with the real world forming a mesh of interdependent activities that blur lines of separation.

Interconnected and integrated gaming experiences will fundamentally change human behaviour.

Gamification Designers will design games for a rich variety of domains.

They will have a mix of skills and domain expertise. They will have a high level of technology literacy and expertise in psychology and user experience.

They may specialise in a particular domain such as primary education, public health or aged care.

12

Integrated Home Technology Brokers

Integrated Home Technology Brokers will work with households to design home support solutions that include household robots, data management and privacy, body implants for family members, and home controls.

People will own smart houses, which provide comforts and adjustments depending on the needs of individual family members.

Body implants will monitor physical needs.

Robots of different kinds will provide home maintenance and domestic support.

Integrated Home Technology Brokers observe the family at home and talk with them to identify their home technology needs. They then design the right kinds of home technology packages to meet those needs and help support families to understand, adjust to, and interact with their new home solutions.

Integrated Home Technology Brokers will have up-to-the-minute knowledge of the latest home technologies, including body implants, smart home devices, domestic robots and data management and privacy solutions.

They have skills in digital systems integration and user interface / user experience design. They need strong interpersonal and analytical skills, to observe households and identify their technology support needs.

13

Machine-Learning Developer

Machine learning (ML) is a type of artificial intelligence (AI) that enables computer systems to learn from data to modify and improve an algorithm without needing human intervention to update or rebuild the model.

ML automates the process of modifying a mathematical model as new patterns emerge in data as the system it is analysing evolves and changes over time.

This form of AI gives an analytical computer model the ability to self-learn, adapt and respond in real-time so it is continually optimising its performance.

In a world where personalisation and responsiveness are highly valued, **Machine-Learning Developers** will be highly sought after across all industries.

Machine-Learning Developers will be computer scientists with expertise in software engineering and data science. In addition to having these highly specialised technical skills, **Machine-Learning Developers** need to be creative, have a deep understanding of the problem domain their models are analysing, appreciate the legal and ethical requirements with regard to data privacy and guard against the system developing illegal, unethical, or antisocial traits.

14

Mechatronics Engineer

Mechatronics Engineers will build and optimise robots.

With skill sets that integrate knowledge from mechanics, electronics, control theory and computer design, their aim is to optimise a robot's ability to do the job it was built for.

There are many types of robots, but all have mechanical construction, electrical components and computer programming code. In the future, nearly all robots have artificial intelligence coding, which means that they can learn and interact with their environment without being directly controlled by humans.

Many robots from the future will be bio-inspired, including robots that resemble humans, animals and plants in different ways. The reason for this is that there is recognition that nature's engineering structures and processes often provide optimal ways of doing things.

Robots will be found everywhere — they provide security, assistance and support to people, and do physical tasks such as maintaining farming equipment or cleaning.

Mechatronics Engineers will have excellent technical skills, including disciplinary backgrounds in mechanical engineering, electronics, and computing. They will be good problem-solvers, will have specific knowledge of industry standards, and will be comfortable working with computers. They will be logical thinkers who are good at maths and often will have high levels of practical capability and attention to detail.

15

New Materials Engineer

Frontier materials, such as carbon nanotubes, aerogel, transparent aluminium or e-textiles, will transform the way we relate to everyday items.

New Materials Engineers will combine STEM discipline knowledge with creative ideas for applications that can improve lives.

These may include silk implants for damaged eardrums; strong, lightweight materials that save energy; or materials that can be recycled many times across their lives.

A **New Materials Engineer** will work in cross-disciplinary teams that combine science, engineering, computing, marketing and social science. They could work for dedicated companies or be freelance, offering their skills to teams centred around product design.

A **New Materials Engineer** will have strong STEM disciplinary knowledge combined with computing skills and a creative, entrepreneurial outlook. They will need strong people skills to work in cross-disciplinary teams and insight into human needs.

16

Quantum Computer Programmer

Quantum computers use atomic quantum states in very low temperature devices, programmed using multiple laser beams, with interactions at the level of individual atoms.

Quantum computers make use of the rules of quantum mechanics to process information. In classical computers, processing is linear and sequential. But quantum computers rely on simultaneous superpositions of many inputs at once. Quantum computing speeds up processing exponentially over classical computers.

The different mode of logic functioning of quantum computers make them ideal for certain applications — artificial intelligence, cryptography, molecular modelling, medical diagnostics, weather prediction, financial modelling. They can seamlessly encrypt data to solve complex problems that even the most powerful supercomputers of the early 21st century could not.

Quantum computers operate with specialised programming languages, and **Quantum Computer Programmers** versed in these will apply their expertise to new and more complex problems. The power and complexity of quantum computers will also represent challenges, and there will be a need for a strong core discipline of **Quantum Computer Programmers** who really understand how to creatively write error correction software for quantum computer applications.

Quantum Computer Programmers will need high level coding skills which imply clear problem analysis for the creation of complex algorithms. They will need human skills to interface with engineers and understand the particular structure of the problems that require solution. They will need patience and persistence.

17

Robot Ethicist

Ethicists are ethics experts.

A **Robot Ethicist** will be concerned with the ethical issues that are associated with artificial intelligence, robots, cyborg technologies and augmented / virtual reality.

When a new technology or scenario involves emerging and contentious methods and applications where there are ethical or moral implications, an ethicist is frequently asked to provide input. They impart unbiased interpretations to help governments, businesses, professionals and families make informed decisions.

Key topics with which **Robot Ethicists** engage include robot rights (that people have moral obligations towards machines, particularly AI), weaponisation of AI and robot morality. The **Robot Ethicist's** analysis and input are aimed at preventing legal claims and making people feel confident and informed in their decisions.

Robot Ethicists will understand logic and how it interacts with human emotions, beliefs and moral standards. They will listen to and comprehend a variety of different opinions based on multiple logical and philosophical approaches, and fairly assess them. They will have excellent analytical skills and a contemporary understanding of ethics as applied to digital technologies.

18

Robot Mechanic

If your home assistance robot is malfunctioning, your autonomous car won't start, or your ag robot has ground to a halt in the middle of its vertical crop field, what do you do?

You contact your **Robot Mechanic! Robot Mechanics** will maintain robots and autonomous vehicles to keep them running smoothly. Their work will include hardware maintenance and fixes (assisted by mechanic-assistance robots), but will also extend to electrical components, firmware and software updates and patches.

Remote and virtual assistance can also be part of this job, using augmented and virtual reality visualisation tools and robot self-repair systems.

Robot Mechanics will have great diagnostic skills, problem-solving skills, and practical technical skills, in terms of both robot machinery and software. They will have good customer service capabilities, and excellent time management and organisational capacities. They will often be freelance or work in small robot 'garages' (sometimes they offer mobile services), so need to be entrepreneurial in outlook.

19

Satellite Network Maintenance Engineer

"In 2022, SpaceX launched 4,000 small satellites into low-Earth to beam back a high-speed wireless signal to everyone on Earth. From that date, everyone on earth had access to high-speed global internet".

Satellite Network Maintenance Engineers will be responsible for keeping the global wireless satellite network functioning.

Using satellite self-repair tools and space drones to do routine maintenance, **Satellite Network Maintenance Engineers** will also upgrade software, firmware and hardware inside the satellites. They will progressively upgrade the network using new satellite technologies that yield a stronger signal and need less maintenance.

Satellite Network Maintenance Engineers will have great diagnostic and problem-solving skills. They will have technical skills in satellite technology and may have formal qualifications in aerospace, mechanical or electrical engineering. They will have an understanding of spacecraft subsystems, satellite communication systems, spacecraft operations and ground control systems.

20

Shadowtech Manager

Shadowtech Managers will work in large organisations to manage technology used by employees that is not officially endorsed by the organisation.

Use of software and devices that are not officially endorsed can lead to compatibility challenges, data back-up issues, and even security breaches. However, because everyone in the future will have their own virtual personal assistant, biological digital implants, and support robots, it is inevitable that people will be using technology that isn't endorsed.

The Shadowtech Manager will be there to manage the company's 'BYO-robot' policy, and to facilitate the secure integration of an enormously wide variety of shadowtech that is being used.

Shadowtech Managers will specialise in systems integration and compatibility. They will have expertise in network security and the functions and vulnerabilities of the massive array of devices, implants, virtual assistants and robots that employees are likely to own.

Shadowtech Managers will be good at complex problem-solving and will be highly digitally literate.

21

Smart Dust Wrangler

Smart Dust Wranglers instruct and control the MEMS (tiny microelectromechanical systems) that make up smart dust.

These tiny sensors are less than the size of a grain of sand, and move about in swarms using tiny polymer wings. They collect data about any environment in which they are located, which is then beamed up through their mesh network to be analysed.

Smart Dust Wranglers work in many areas, including ecology restoration, where smart dust is used to monitor the natural environment; in smart cities, where smart dust monitors the air and water to keep toxins within safe levels; and in police surveillance, where smart dust can locate and track criminals and persons of interest.

Smart Dust Wranglers program the smart dust swarm. They choose the correct type of smart dust with the right sensors, and how many MEMS will be required for the particular job. They program the individual MEMS to detect certain types of data in the environment, then create a whole-of-swarm data collection program so that the data from thousands of MEMS can be mined to find an answer.

Smart Dust Wranglers will have expertise in programming, data analytics and systems co-ordination. They will be analytical and have strong attention to detail. They will have knowledge and skills in their domain of specialisation (such as farming, smart cities monitoring, ecology restoration or policing). They may work with data scientists and artificial intelligence to analyse the data that has been collected.

PEOPLE JOBS

22

100 Year Counsellor

In the future our lives will be further extended by health and medical advances, so that we can expect our 'Third Age', after childhood and mid-lives which are focused on work and family, to be potentially 'the best time of our lives'.

A **100 Year Counsellor** will work with people over all of their lives, but particularly into the third age, so as to support them to have a productive and fulfilling life at any age.

They will work with individuals and groups, such as **Local Community Growth Co-ordinators**, to advise on how to effectively align psychological, social and economic aspects of each age, to maximise people's human potential. They will also have a role as advocates for age transition management.

The **100 Year Counsellor** will need to have human skills such as empathy and a caring disposition, but also good knowledge of health technologies such as anticipatory prosthetics, and the ability to communicate with professionals such as age-transition psychologists, nostalgists and whole-of-life educators.

23

Aesthetician

Aestheticians work with people to enhance their physical appearances.

With technological advances and developments in biochemistry, **aestheticians** will design advanced beauty solutions involving the face, hair and body. They will offer personalised skin and haircare services designed specifically for the individual's beauty and health needs, based on digital analysis.

Many **Aestheticians** will work closely with the aging population. They will design environmentally responsive makeup, hairstyles, eye lenses and fashionable face or body prosthetics for individualised looks, and consult about clothing choices that enhance a person's overall appearance.

They may work with 3D Printed Fashion Designers and Virtual Avatar Generators as part of integrated image management services.

As surveillance in public places is now an everyday part of life, **Aestheticians** may help people to build physical appearances that maintain their privacy through the use of image-scrambling finishes and projections.

Aestheticians are highly creative, and have well-developed communication skills to work effectively with clients and collaborators. They will be able to use digital tools to analyse people's beauty and health needs and apply digital solutions. They will be hands-on practitioners, and need to keep abreast of the latest developments in aesthetic digital and physical solutions.

24

Aged Health Carer of the Future

Aged Health Carers provide health support and caring services to elderly people.

In the future, with continuing advancements in medicine, elderly people who need ongoing care will be much older than those in residential facilities and nursing homes today.

Robots do much of the manual work (such as lifting and transport), provide support with daily living tasks, monitor patients, and manage records. Medication is managed by automated delivery systems.

Aged Health Carers are primarily responsible for ensuring the quality of life of elderly people, by spending time with them, interacting with them, and facilitating meaningful activities that they enjoy.

Aged Health Carers need high levels of emotional intelligence. They must be good listeners, having true empathy for older people and their families. They need to have some knowledge of medical and healthcare issues, and some digital literacies to interact with healthcare systems and robots. They will have knowledge of human psychology to help elderly patients feel valued and supported.

25

AI Educator

AI Educators will teach people about making the most of artificial intelligence.

This might include learning how to work with their household robots and digital assistants, through to learning how to use algorithmic tools to analyse big data or make decisions.

Unlike an algorithmic interpreter, who is there to explain exactly how artificial intelligence arrived at a particular answer, the **AI Educator** will teach people how machines learn and adapt.

They will work with people to help them work out when and how to use their robot / assistant, 'feed' it the right data, and interact with it in ways that will get them the answers they want.

AI Educators will have excellent interpersonal skills, and have knowledge of teaching strategies that work with different kinds of clients. They will be digitally literate, and have good practical knowledge of robot / digital assistant interaction. A basic knowledge of machine learning will also be required.

26

Community Support Worker

Most people now live in small, close-knit communities within huge, sprawling metropolises.

Each community has at least one or two **Community Support Workers**, who work with the **Local Community Co-ordinator** to bring people together and ensure their well-being.

Community Support Workers work closely with people who need extra social support, such as the recently bereaved, people who are unwell and people who have just moved into the community. The client gives them permission to monitor the sensors in their home and in their bodies, so that they can provide personalised support when it's needed most.

Community Support Workers connect people with others in the community, and also connect them with targeted psychological support, healthcare and social integration services.

Community Support Workers will be highly empathic people with strong social skills. They will be excellent listeners. They will have educational backgrounds in psychology and / or social work, and depending on their areas of specialisation, may also have postgraduate qualifications in working with older people, migrants, disabled people or children. Community support workers will be well networked, and have in-depth knowledge of the support services available to their clients.

27

Cross-cultural Capability Facilitators

In the future, the importance and value of human diversity will be recognised, particularly the understanding that cultural groups have different and equally valid beliefs, needs, preferences and ways of communicating.

Cross-cultural Capability Facilitators will be experts who have deep responsiveness towards, and respect for, people from diverse cultures and backgrounds. They will work directly with people in cross-cultural contexts to facilitate negotiations or projects. Many will also work with software programmers, robot designers and augmented / virtual reality experience creators so as to match the experiences they are creating with user needs and expectations, given their cultural backgrounds.

Cross-cultural Capability Facilitators will have strong knowledge of, and commitment to, principles of diversity and inclusion, international mobility, conflict resolution and cultural sensitivity. They will likely to have spent significant time within a range of cultures learning their mores and dispositions. They may speak several languages, although real-time digital translation will reduce this requirement somewhat. They will be good listeners, be empathic and diplomatic. Depending on their work specialisation, they may also need to be competent programmers, robot builders, or augmented / virtual reality designers, or at least be comfortable working with people in these roles to build culturally sensitive digital experiences.

Cyborg Psychologist

A **Cyborg Psychologist** will work with people who have synthetic organs, robotic limbs and body implants, to help them come to terms living as cyborgs.

They will also help clients who are suffering from digital addictions and compulsions, or those who have been having trouble distinguishing between the physical and the virtual world.

Technological advances mean that nearly all people will have some level of technological enhancement. Virtual and augmented reality will be part of everyday life for millions. But some people may struggle with various aspects of their digitally enabled life so **Cyborg Psychologists** will be there to help them.

Given the challenges that their clients will be facing, they may use AR and VR-based interventions, or they may prefer to use traditional techniques that involve talking directly with clients, and supporting them in challenging situations.

Cyborg Psychologists will need to relate to and empathise with a wide range of people. They will need to have excellent listening and oral communication skills, and the ability to cope with emotionally demanding situations. **Cyborg Psychologists** will have in-depth knowledge of the impact of digital technologies on human psychological health and well-being and of therapeutic techniques to address these.

Cyborg Psychologist (Artist's impression)



29

Decision Support Worker

The average person makes 33,500 decisions every day. About 230 of these are just about food! In the future, people will all have virtual assistants that use recommender systems (based on machine learning algorithms) to help them make decisions. If the person has been working with a personal brand and content manager, a health shaper, a psychologist or a personal nutrition specialist, they may well make changes to the recommender system's algorithms to help the person make better decisions. However, sometimes automated decision support systems go wrong, or aren't able to help with decisions because there isn't enough of the right data available. Sometimes, people need to make very big decisions with significant potential repercussions, and prefer to work with a human to make sure the choice they are making is the appropriate one. **Decision Support Workers** will listen to the needs of their clients, pull together additional helpful data that the client may not have access to, and make sense of it all to help with decision-making (with the help of algorithmic tools). They will counsel and support people to make decisions, and also to put risk management strategies in place.

Decision Support Workers will like working with people, and have strong interpersonal skills. They will have knowledge of how recommender systems work, and how AI systems use data to make decision recommendations. They will also be able to tweak and fix automated recommender systems. **Decision Support Workers** will be aware of the data sets that are publicly available to help with decisions, and which data sets can be bought by people to help them make decisions of different types. They will know about risk associated with decisions, and risk management approaches. Decision support workers will have excellent data analysis skills.

30

Digital Memorialists and Archivists

People leave behind many jobabytes of data when they die. Collecting, managing, curating and archiving this data is an important job.

Digital Memorialists and Archivists work with surviving family members and loved ones to determine which parts of a person's digital identity should live on publicly, which should be retained by the family, and which should be archived.

They may work with someone approaching the end of their lives to record their data preservation wishes, so as to enact those wishes afterwards. A large part of a **Digital Memorialists and Archivists** job will be to craft a respectful portrait of someone that can live on after they have died, while also retrieving data that might be useful for other purposes. They will work with digital archiving artificial intelligence tools to process, sort and store digital data.

Digital Memorialists and Archivists have excellent listening and communication skills. They will be sensitive and empathic people, and able to generate compassionate impressions of others through creativity. They will be excellent digital researchers and analysts, and will have digital literacies to work with artificial intelligence and data presentation tools.

31

Displaced Persons Re-integrator

At one point in the early 21st century there were tens of millions of displaced people in the world, due to war and persecution, and the effects of climate change causing sea level rise.

Increasingly, displacement occurs as people move to seek new jobs in a world of work that is changing as a result of the rise of artificial intelligence and other advanced technologies.

Supporting people who have moved from their previous communities, helping them to find or create new communities, and settling them in to their new lives, will be an important job role.

Displaced Persons Re-integrators will work for government, aid organisations, and local communities, as part of the suite of social services offered to all people.

If a family finds that they need to move away from where they are living, a **Displaced Persons Re-integrator** will help them find and move to a new community, facilitate their entry into new jobs and schools, and help with retraining. They will work with local community co-ordinators and social support workers to help the family find new friends, and connect with local people from the same cultural backgrounds.

Displaced Persons Re-integrators have qualifications in international development, social work, or community studies. They are socially and culturally aware, and are comfortable with listening to, and providing support to people who are distressed. They have good networking skills, and will regularly liaise with global, national and local government agencies, schools, businesses, community and cultural organisations to help them re-integrate their clients.

32

Drone Experience Designer

Drones will perform increasingly varied roles, such as delivery, emergency care, surveillance, mapping, entertainment, and videography to name just a few.

The **Drone Experience Designer** will work with drone fleet controllers and with their customers to optimise people's interactions with drones. Drones will have the capacity to provide accurate and immediate service to customers.

The **Drone Experience Designer** will help the use of drones and user interaction to be engaging and efficient. In some ways, the drone experience designer will be like a 'drone customer service coach'.

The **Drone Experience Designer** will understand drone technology and the software systems involved in designing flight paths and delivery logistics. Like all public relations personnel, they will have high-level communication skills needed to ensure clients' needs are understood and met, while their expectations are managed. They will have a good understanding of safety and privacy concerns, strong people skills, including empathy, and be capable of designing innovative solutions to improve drone interaction with the public.

33

Early Childhood Teacher

With a growing population, demand is high for early childhood education.

The **Early Childhood Teacher** and the **Local Community Coordinator** work together to offer locally relevant curriculum.

Early Childhood Teachers will do much of what they did in the early 21st century, but with an emphasis on engaging children in meaningful interactions and learning about localised ideas and issues. Important values will be encouraged: community and social engagement; environmental sustainability; intercultural competence; healthy behaviour, and digital technology literacies.

In the same way as now, the role of the **Early Childhood Teacher** will be to support young children to learn and discover their potential.

Robots will do much of the basic care and ensure child safety (using sensors to physically and psychologically monitor the children). The data from the sensors will be read by the **Early Childhood Teachers** and used in curriculum design decision making with a focus on the individual child.

Early Childhood Teachers will be empathetic with high level communication skills. They will be digitally literate and use data to make curriculum decisions. They have disciplinary skills in education, and knowledge of child development. They will collaborate well, especially at the local level.

34

Lifelong Education Advisor

Increasingly, people will have multiple careers over their lifetime.

Even if they stay within one career path, with the constant introduction of new technological solutions and changing social realities, the need for constant updating of skills and retraining will become a feature of a life's work.

With this, education and training pathways will become more complex, with a diversity in providers, especially those focused on short term targeted credentialing.

Lifelong Education Advisor will help clients with the best stackable and transferable micro-credentials that have industry currency, while providing individuals and groups advice on emerging career paths, and how to stay abreast of advances in technology.

A **Lifelong Education Advisor** will also help with the curation of informal learning opportunities.

A **Lifelong Education Advisor** will have the skills to keep abreast of social and technological movements and movements in industry credentialing, and will need strong human skills to be able to ascertain their clients' skills, interests and dispositions, and the ability to communicate possibilities effectively. They will need a combination of technology and human skills to be able to match people with the possible applications of the latest software advances, and industrial / commercial innovations.

35

Local Community Co-ordinator

Local Community Co-ordinators (Lococos) will be there to bring small communities / neighbourhoods together, and co-ordinate activities that help the community and its residents thrive.

There will be widespread understanding that if people live in strong local communities, then they will be healthier and happier.

Technological advances in at-home solar and wind power, corner shop 3D printing, and urban farming will strengthened the localisation movement.

The **Local Community Co-ordinator** facilitates all of these functions, and will help to find solutions to local problems. They will be responsible for bringing people together to socialise and to pursue shared interests and hobbies, fostering intercultural and intergenerational understanding, and building happiness at a local level.

Local Community Co-ordinators will know everyone in the community, and are there to help people who are having a tough time by drawing them in to the support networks of the community.

Local Community Co-ordinators will be extremely social people, with high levels of empathy. They have backgrounds in social work or community cultural development, and have skills in negotiation. They will be familiar with the latest trends in community building, local energy and waste practices, and procurement.

36

Nostalgist

A **Nostalgist** works to recreate remembered experiences for the elderly.

Because people are so long lived, there will be a strong trade in recreating the best parts of life for people from 80 or 100 years ago.

Nostalgists can help people who suffer from dementia feel safer and happier by building familiar environments and experiences that resemble the past..

Nostalgists combine interior design expertise with personal digital research to design a personalised experience for their clients. People may wish to live in environments designed by **Nostalgists**, or to visit them virtually with the assistance of a virtual reality experience creator.

Nostalgists have excellent digital research skills, and will be good at listening to people to elicit details of the required memories. They have a strong command of interior and environmental design, and may collaborate with other professionals, such as, **Virtual Reality Experience Creators** and **Aged Health Carers**. A love of history and an eye for historical detail will be essential in this role.



37

Personal Brand Manager and Content Creator

A **Personal Brand Manager and Content Creator** will work with people to market themselves using digital tools.

The Brand Manager helps people to discover what their career aspirations are, and then constructs an avatar (virtual self) that aligns with this. They will design a brand and digital presence for the person, including curating artefacts such as images and 3D video of the person, building social networks and making posts to build that person's social media influence.

Personal Brand Manager and Content Creators need to have written, oral and visual communication skills, to create a persona for someone else. They need to be able to listen to their clients to discover what their career plans are. They need to have skills and knowledge about social media platforms, as well as specialist knowledge about marketing, branding, and career opportunities. Advanced skills with digital media such as holographics, 3D video, and augmented reality will also be needed.



Nostalgist (Artist's impression)

BUSINESS AND LAW JOBS

38

Artificial Intelligence (AI) Intellectual Property Negotiator

AI Intellectual Property Negotiators will know the value of creativity.

They will negotiate on behalf of their clients for the ownership or use of new technologies, products, software, or other creative outputs.

In the innovation age, demand for intellectual property titles, such as patents, trademarks, industrial designs and copyright, will be enormous and very complex.

As well as negotiating on behalf of people who are developing artificial intelligence software and algorithms, the **AI Intellectual Property Negotiators** will negotiate on behalf of artificially intelligent entities that have created new things. They will also represent people when artificial intelligence has used their ideas without permission.

AI Intellectual Property Negotiators will have advanced skills and knowledge in intellectual property law within their jurisdictions. They will have excellent analytical skills, along with interpersonal negotiation and persuasion capabilities. They will have strong attention to detail, and keep up to date with the latest in artificial intelligence developments.

39

Blockchain Talent Analyst

In the future, job recruitment will be managed by **Blockchain Talent Analysts** who work with blockchain — that is, verified and distributed measures of talent and hireability, including cognitive ability — to support recruitment. Data from online and networked behaviour, evidence of previous work and sensor-based data will provide a wealth of information about habits, preferences, skills and interests of potential employees. Blockchain can bring all these together to compile a comprehensive digital dossier about a person's hiring potential.

Similarly, information asymmetries will be reduced and time-consuming tasks such as navigating the internet for jobs, filling in forms and transferring CVs to online templates will become a thing of the past. Instead, with your digital CV verified and cemented into blockchain, it will be available for those hiring, thus enabling employers to find the best employee match more easily. The personal brand manager and content creator will be involved in managing an individual's data set.

The **Blockchain Talent Analyst** will work with employers to figure out what kind of person they want for a role (doing analysis of the employer's capability and attributes profile using AI tools), and will then use talent analytics algorithms and 'search bots' to find the right person for a job. Interviews will no longer be required as the evidence to make accurate decisions will be collated through the **Blockchain Talent Analyst**.

The **Blockchain Talent Analyst** will have high level skills in analysing and interpreting algorithms, and interpersonal skills in communicating with clients and understanding the basis of their needs. They will have advanced understanding of ethical implications of data mining and personal privacy standards.

40

Chief Ethics Officer

Chief Ethics Officers work in large companies and government organisations.

Their role is to ensure that corporate social responsibility is considered in all of the company's activities, and that the company is genuinely ethical in its practices.

The **Chief Ethics Officer** oversees the company's adherence to zero waste policies, and its energy consumption and production targets. They make sure that the company is being socially inclusive, and its products and services are good for consumers.

It is widely recognised how expensive unethical behaviour can be (such as how much money is lost through not recycling or upcycling waste materials). Companies are committed to being as ethical as they can.

Chief Ethics Officers will also lead departments of staff and artificial intelligence units that are devoted to virtual ethics - such as making sure that unwanted social biases aren't creeping into algorithms, and that people's data is kept private.

Chief Ethics Officers keep up to date on the latest in robot and AI ethics. They have strong knowledge of the law, and professional / cultural codes of ethics related to their industry. They possess skills in critical thinking and problem-solving, and also management of information. **Chief Ethics Officers** lead teams, so they require people management and corporate leadership skills. They are good negotiators and mediators.

* Pink number indicates future job



Ethics Officer (Artist's impression)

41

Community Farm Finance Broker

Many farms have moved to crowd funded production. As a key part of the wider 'sharing economy', this broker of financial support will link farmers with individuals / families prepared to invest in their own food production.

The farmer will continue to manage their farm and produce food, while the financiers will receive either produce or money for their investment.

Typically, the local agroecological vegetable farm, cricket farm or aquaponic fish farm will be mostly owned by local residents and community organisations. The net effect of this is that everyone will be involved and interested in their food production processes, and food security will be strengthened.

The **Community Farm Finance Broker** will be good with numbers but also good at marketing ethical opportunities and motivating people to make community minded choices. They will have a good understanding about agroecological farming practices and about the difficult choices that sometimes need to be made. They will be high-level communicators and convincing in promoting a point of view and in persuasive discussion.

42

Drone Airspace Regulator

Drone Airspace Regulators will develop road rules for the sky.

At any given time in urban spaces, there are thousands of drones flying about overhead. Some drones are used for surveillance and keeping an eye on the environment, others courier items from place to place, and a third type films images and video for use in marketing and advertising. **Swarm artists** use yet another type of drone to create spectacular art displays, and there are also recreational drones, which allow people to experience flight while they are piloting from the ground.

Without airspace control regulations, including specified 'airlanes', drones would bump into one another, fly into unsafe spaces, and collide with buildings constantly. All drones must have collision-avoidance technology enhancements, and must fly in the prescribed areas. For instance, pizza delivery drones must not fly in the spaces reserved for emergency services drones, and they must stay several metres clear of buildings at all times.

A **Drone Airspace Regulator** will provide advice, guidance, and direction on airspace issues relating to drones inside and outside controlled airspace. They will develop and implement strategies and policies for the safe and efficient operation of drone airspace in accordance with global, national, and community legislation.

Drone Airspace Regulators will have comprehensive knowledge of the regulatory role, strategic plan and responsibilities of the drone airspace regulation agency. They will have technical knowledge of air control issues, and strong written and oral interpersonal skills. They will be able to work with digital tools that monitor drone behaviour and technology updates, and make recommendations about changes to policy.

43

Fusionist

Fusionists will use design approaches to bring together professionals from art, engineering, research, science, and other disciplines to create innovative ideas, experiences, and solutions to complex problems.

Fusionists will be employed across many industries, where they will act as bridges between people with specialist disciplinary knowledge. For instance, a fusionist could be part of a team responsible for designing a new kind of attractive smart fabric for clothing that changes its properties depending on the weather conditions. Other team members may include a materials engineer, a fashion designer, an artist, and a digital sensor designer.

A **Fusionist** will blend knowledge and skills of different team members to create an overall approach to the design of the fabric, and translate and coordinate the specific tasks required to complete the design.

Fusionists will be excellent communicators, with exceptional listening, written and oral communication skills. They will be able to understand technical concepts from different disciplinary areas and be up-to-date with the latest technology and research developments in their areas of interest. Fusionists will be experts in design and solution development. They will also have well-developed organisational and project management skills.

44

Innovation Manager

An **Innovation Manager** will work as an independent consultant or within an organisation to create an environment that fosters innovation.

They will develop strategies and processes that bring together a mix of experts, lead brainstorming sessions, encourage collaboration and sharing of ideas to design and develop innovative solutions.

The **Innovation Manager** will seek out new methodologies and technologies to maintain a fertile environment for innovative thinking to flourish and be realised. They will think 'big picture', considering the cycle of innovation from inception to marketplace, and play a role in readying the market for new products and services.

Innovation Managers will be highly creative and future orientated, seeing the world through the lens of curiosity as they detect new developments and early trends. They will have significant knowledge of organisational development, drawing on analytical skills to create enabling structures and processes. They also have the leadership qualities and influencing skills to support people through organizational change.

45

Personalised Marketer

Personalised Marketers develop and implement marketing strategies that use individualised content to market products, services and experiences to people and their automated decision support systems.

Through personal data collection based on body and behaviour sensors, and monitoring communities and the environment,

Personalised Marketers find clever ways to engage people and influence their behaviour.

Personalised Marketers can work for marketing and advertising agencies, inside big companies, as freelancers, or for the government. They use algorithmic tools to figure out what people are interested in and motivated by, and match this up with advertising that will work for those people.

Personalised Marketers will be good at data analysis, and using automated tools to assist them with analysis. They will have educational backgrounds in marketing and advertising, and have knowledge of cross-platform marketing tools (such as augmented reality, personalised recommendation systems, and social media). They will create compelling stories, while having a deep understanding of what motivates consumer behaviour.

46

Real-Virtual Transfer Shop Manager

As people spend more and more time in virtual and augmented reality, they want virtual versions of the objects, clothing, and furniture that they own in physical ('real') life.

They also want to be able to take home physical versions of things they have encountered in the augmented or virtual world.

The **Real-Virtual Transfer Shop Manager** will make this happen, by using 3D-printing and other advanced fabrication methods to create physical versions of virtual objects, and scanning / design tools to create virtual versions of physical ones.

The Real-Virtual Transfer shop will have self-service options for people who want a direct and simple transfer of an object.

The **Real-Virtual Transfer Shop Manager** will deal with very large and more complicated service requests.

The **Real-Virtual Transfer Shop Manager** will have good attention to detail, and excellent digital design skills. They will be able to use 3D printers and fabrication machines. They will have well developed interpersonal skills, to listen carefully to clients' needs, and problem-solving capabilities.



47

Sharing Auditors

A **Sharing Auditor** will analyse homes and businesses for assets that can become part of the sharing economy.

The sharing economy is a peer-to-peer based system for acquiring, providing or sharing access to goods via an online platform.

Owners rent out something they are not using, such as an autonomous car or spare household robot, to other people who need these things.

In the future, where there is a strong emphasis on minimising waste and maximising efficient use of resources, nearly everyone will share some of their belongings.

A **Sharing Auditor** will visit a home or business, and will advise on what people can rent out to others, and which sharing platforms to use. The owner will sign up for a sharing service, and then people will rent items from them. It will not be uncommon to see drones carrying furniture and robots between houses as part of the sharing economy.

Sharing Auditors will have sound judgment and good interpersonal skills. They are analytical, and know about the latest trends in the peer-to-peer sharing economy.

48

Trendwatcher

Trendwatchers will know what is likely to happen next, and how to make the most of it.

In a future where the pace of change is incredibly rapid, they will be employed by big companies and government agencies to watch the latest developments in science, technology, social issues, and the environment.

Trendwatchers will be across the future developments in multiple areas, as new opportunities often occur at the intersection of trends (for example, the development of DNA-based data storage technologies that increase data storage capacity exponentially, at the same time as swarm technologies that allow very big data approaches to city surveillance).

They will feed information and recommendations back to CEOs and government leaders so that they can use them for strategy.

In business, **Trendwatchers** will be particularly interested in how to turn new developments into opportunities to make new products or services, find new markets or access them in new ways. In government, they might work with predictive regulation analysts or in Executive Director portfolios.

Trendwatchers will be interested in trends across multiple disciplines and areas of human activity. They will have excellent information analysis and synthesis capabilities, and they will be good at horizon-scanning and identifying what might become an opportunity. Their oral and written communication skills will be well developed.

ENVIRONMENT JOBS

49

Aged Persons Climate Solutions Consultant

As the planet warms we already have longer and hotter spells of weather, and more severe storms, that are dangerous for elderly citizens in particular.

Adverse effects from these weather events are concentrated in elderly populations.

An **Aged Persons Climate Solutions Consultant** will work with government, councils, and with elderly people directly to design strategies to guard against these effects of extreme weather.

Solutions will involve warning systems and automated monitoring, community retreats, and systems of health care workers advising and supporting individuals.

The **Aged Persons Climate Solutions Consultant** will be knowledgeable about the health implications of weather events, and skilled in devising creative strategies particular to the needs of different people and communities. They will have good communication skills working with government and with the elderly, and empathy and understanding of the needs of older people. They will have technology skills enabling them to conceive of and advise about monitoring and control systems.

50

De-extinction and Conservation Geneticist

During the early Anthropocene (the geological period during which human activity started to be the dominant influence on climate and the environment, before ecology restoration began), many species of animals and plants became extinct.

About 40% of bird species, 30% of amphibians, and 55% of insect species disappeared during this time.

Thankfully, governments realised the importance of healthy environments, and ecology restoration became a priority activity globally.

Most **De-extinction and Conservation Geneticists** work with ecology restoration workers to rebalance ecosystems. Some work in agriculture. However, some **De-extinction and Conservation Geneticists** work in novelty areas, bringing dinosaurs, aurochs, Tasmanian tigers and woolly mammoths back to life for wealthy people who want to own them as pets. This is a controversial area of de-extinction genetics, as reintroduction of extinct animals and plants can lead to harm to modern species, and cause imbalance in ecosystems.

De-extinction and Conservation Geneticists will have strong analytical, critical thinking, and problem solving skills. They will be good at maths and research, and have advanced qualifications in life sciences, genetics and the species they specialise in.

51

Digital Apiarist

While technological options for plant pollination have been developed, keeping live bees is still the best way to ensure that food crops and other plants are healthy and keep reproducing.

Historically, bees nearly died out because of climate change, reduced diversity of plants, pesticides, parasites, and diseases.

Now bees are thriving, in part because of digital apiarists.

Digital Apiarists work on smart farms in urban regions, and also in wilderness areas. They are experts in hive and bee health, pollination processes, hive design, and appropriate selection of bee colonies for the plant profile in different areas.

Digital Apiarists do visit hives in person, but they also use digital sensors on bees, inside hives, on plants, and in the air and soil to monitor what is happening to hives. They rely on AI and big data algorithms to help them make sense of the data that is generated. Through the use of remote delivery systems, they can make adjustments to the temperature and humidity, the availability of water, and deliver medicine to the bees if needed.

Digital Apiarists often work with smart farmers and ecology restoration workers.

Digital Apiarists will love nature and working with plants and animals. They will have strong knowledge of insect biology, pollination processes, and plant diversity. They will have good analytical skills, and be able to use digital tools for monitoring, analysis, and interventions. They will need to work with others. Depending on hive locations, some travel may be required for this role.

52

Entomicrobiotech Cleaners

Entomicrobiotech Cleaners will use bacteria and insects to clean up pollution and waste.

At one stage in history, there were 9 billion tonnes of plastics in the world, most of which ended up in the ocean or in landfill. Depending on the type of plastic, it can take 1,000 years for a plastic bag to break down, while plastic bottles take 450 years or more. More than 10,000 oil spills of crude or refined petroleum products occurred, killing countless birds and sea animals.

During the clean-up, scientists discovered that certain types of bacteria and insects love to consume petrochemicals. For instance, wax worms (*Galleria mellonella*) find polythene delicious, and can break down a plastic bag in a few hours. Bacteria called oilcoceanspirallales consume crude and refined oil in the ocean.

In the future, **Entomicrobiotech Cleaners** will farm these bacteria and insects, and deploy them in environmental clean up efforts.

There will be long-term programs to clean up very old plastic and oil from many decades ago — it will take a long time to eat 9 billion tonnes of plastic! There will always be demand for **Entomicrobiotech Cleaners** and their 'cleaning crews'.

Entomicrobiotech Cleaners will have strong knowledge of the biology of insects and bacteria, and how to keep them healthy. They will use environmental sensors and analytical algorithms to let them know the waste profile of the area they will be working in, so that they can deploy the right bacteria and insects to clean up, and in the right order. Travel will be required for this job role. **Entomicrobiotech Cleaners** will have strong stomachs. They aren't worried by bugs or gooey substances (agar or liquid nutrient used for bacteria growth).

53

Flood Control Engineer

Climate change has resulted in a substantial global rise in mean sea level. Localised extreme storm events often produce excessive rain and cause flooding, so all water management strategies need to cope with large variations in water volume. Smart cities have been redesigned, transport options have been re-negotiated and even rainwater management for individual homes have been reconsidered. Living shorelines made of mangroves, marshes, wetlands, oyster beds, and coral reefs have been re-established to protect the coastlines. Technologies that use AI sensors and environmental monitoring manage movable flood barriers when needed. These may channel water or dissipate wave energy, mitigating the effects of the flood.

Green infrastructure, such as rain gardens and green roofs, are used to channel rainwater into natural designs that absorb rainwater and stormwater. Smart cities increase their ability to handle large volumes of water but developing community-based rain gardens, bioretention gardens, and bioswales (sloped landscape features that channel water into vegetation-filled ditches)."

In such a future, the **Flood Control Engineer** will liaise with the regional and **Local Community Growth Co-ordinators** to ensure localised knowledge about these systems, so that they will be managed well when needed.

The **Flood Control Engineer** will be in high demand as their skills in hydrology and water flow management use cutting edge technologies matched with integrated ecological understandings. They will be communication networking experts as well as leaders in their field to ensure that the communities can manage the systems in times of flood.

54

Integrated Ecology Restoration Worker

Integrated Ecology Restoration Workers, also known as 'rewilders', are employed by the government to undo environmental damage and restore the natural environment to a healthy state.

Over a fairly short period of time during the late industrial age, significant damage was done to the environment through industrialisation including by pesticides, plastics pollution, and single crop farming.

Integrated Ecology Restoration Workers restore healthy habitats for flora and fauna, repair wilderness areas, and rebalance ecosystems through direct interventions. Where a species has become extinct, they may work with de-extinction geneticists to revive it through cloning or genome editing, with the overall aim of restoring genetic diversity.

Integrated Ecology Restoration Workers have advanced skills in ecological science. They have practical and theoretical knowledge of interactions between organisms and their environments, including climate, geology, and other animals and plants.

Integrated Ecology Restoration Workers will be very practical people who enjoy working with plants and animals. They need research skills to find out how natural environments used to be before they were damaged.

55

Waste Reclamation and Upcycling Specialist

Resources are finite and reclamation is profitable.

Waste Reclamation and Upcycling

Specialists turn waste into high quality materials so they can be turned into products.

The lack of raw materials, high costs of extraction, and new strategies for waste separation and utilisation will make this field a lucrative and prestigious one.

Waste Reclamation and Upcycling

Specialists focus on both ends of the production line: they offer expert knowledge of materials science to product designers so that reclamation is successful and the lifespan of products is maximised, as well as engineering increasingly clever ways to reclaim materials from waste. The recently designed infini-cycle processing reduces all materials to their basic chemical components allowing for endless recycling of materials. Additionally, nanobot waste sorters ensure that all materials are reclaimed. Everything will be designed to minimise waste and meet the zero waste targets mandated for all on the circular economy. Energy generation and high efficiency are key considerations to the **Waste Reclamation and Upcycling Specialist** as energy loss will become unacceptable.

A Waste Reclamation and Upcycling

Specialist will be highly qualified in materials science, industrial design, and manufacturing practices. Their engineering background will ensure they have exceptional problem solving and digital skills. Their well developed communication and interpersonal skills will ensure they can work successfully across a range of industries within cross-disciplinary teams

56

Water Management Specialist

Water is the lifeblood for food production, advanced manufacturing, communities and wilderness areas, not to mention individual needs for survival.

Water Management Specialists manage water sources, efficiency, protection, distribution and health, and put in place measures to ensure that water is recycled, reconditioned and distributed appropriately.

The water industry has adopted advanced sensor and communications 'smart' solutions to water management driven by stricter government compliance requirements, the evolution of smart cities, and the need for water conservation in ecoagriculture and other heavy water use industries. Sensors have been distributed in all area networks to monitor water flows, water quality, ensuring that water is distributed equitably.

The **Water Management Specialist** ensures that specific strategies, such as wastewater reclamation, water recycling, targeted watering to the root systems of plants, and groundwater management strategies are working.

The **Water Management Specialist** has hydrological interests and expertise, and collaborates with many other ecological and urban engineering and design specialists to ensure technological solutions for water management and efficient water use are constantly in development. Thus high-level communication skills will be required.

57

Weather Control Engineer

Weather Control Engineers, also known as geo-engineers, will be employed by governments to ensure that the planet's climate is appropriate, and has enough diversity to support the many different ecosystems that exist.

Weather control engineers use carbon capture and storage technologies to cool the planet, as well as deploying chemical filters into the atmosphere to deflect sunlight.

They can create rain by seeding clouds using drone technology, control lightning with lasers, and drain energy out of hurricanes and cyclones to reuse for other purposes.

Weather Control Engineers tend to be conservative with the tools they use, because too much climate manipulation can have catastrophic results. As it is, weather control is tightly regulated internationally.

Before **Weather Control Engineers** can put any intervention into action, they need to run in-depth computer simulations that model the consequences of any weather manipulation.

Weather Control Engineers have advanced level qualifications in climate science and meteorology. They will be particularly aware of how changes in weather interact with other elements of natural systems. Weather control engineers use big data and algorithmic tools to simulate and model weather conditions, so need to be highly digitally literate. They will be analytical people, with a strong ethical code.

URBAN JOBS

58

Automated Transit System Troubleshooter

These days, most of the vehicles on the roads drive themselves. The passengers in those cars get on with work, leisure activities, or even sleep while the car takes them where they need to go. These autonomous cars have many sensors on them, and they are networked together. They communicate with one another about their position, speed, the traffic conditions, hazards, and other environmental conditions. Traffic lights don't exist anymore, as an automated transit management system ensures that everything runs smoothly and efficiently. The transit management system also makes sure that accidents don't happen and everyone stays safe.

However, occasionally things go wrong that the automated systems can't correct. Robots can easily deal with a single autonomous car breakdown — within two minutes they clear the car off the road and bring a replacement vehicle for the passengers. But they have more trouble dealing with the occasional human-driven old car, who may break the road rules and behave erratically. Sometimes hackers will break into a traffic management system and cause chaos. Very occasionally, an extreme weather event that wasn't anticipated by the climate modifiers can bring everything to a standstill.

When things go wrong with the transit management system, the **Automated Transit System Troubleshooter** steps in.

They use monitoring systems and sensors to tell them what has gone wrong, and make rapid decisions about the best way to fix the problem. They may use digital algorithms to help them predict the consequences of different courses of action, and robotic or human workers to clear obstacles to traffic flow and get cars moving again.

They may also draw upon the expertise of an ethical hacker or cybersecurity personnel to repair the systems damage caused by malicious attacks.

Automated Transit System Troubleshooters will be decisive and quick thinking. They will be able to make sense of multiple sources of data in order to inform decisions. They will be effective risk managers, and competent using digital technologies. They will be clear communicators. They have strong disciplinary knowledge of traffic engineering and transport systems.

59

Autonomous Vehicle Profile Designer

In the future, driving will be optional as autonomous vehicles become more affordable and varied, leading to extended choice in forms of mobility.

As a result, the car as a transit experience will be redesigned. The basic car unit will be made up of a chassis with an electric drive-train and autonomous driving electronics.

An **Autonomous Vehicle Profile Designer** designs the cabin that will fit on top of the basic car unit. Each cabin will need to transform into multiple possible configurations, including bedroom, dining room, conference room, playroom, and gym (amongst others).

The **Autonomous Vehicle Profile Designer** will also 'skin' the inside and outside of cars



60

Biofilm Plumber

— that is, use augmented reality overlays to make the car's look and feel reflect the personality and visual preferences of its owners. A car's skin will become an extension of its owner's personal avatar.

Autonomous Vehicle Profile Designers will have a background in interior and industrial design, and possess excellent creative and visual artistic skills. They will have knowledge of new materials and their properties, such as transparent aluminium. They will be experienced in computer-aided design and the use of augmented reality engines.

Biofilm Plumbers install and maintain coatings of biofilm onto the walls of sewerage and wastewater pipes and liquid composting bins.

These biofilms are made of millions of friendly bacteria that then break down complex organic matter (waste) of various types.

The bacteria are embedded into a sticky layer of extracellular polymeric substance, which binds to the wall of the pipe.

Just as it's beneficial to have the right balance of bacteria in your gut, it's important to have the right bacteria breaking down your waste.

Using digital bacterial analysis tools, **Biofilm Plumbers** diagnose problems with biofilm and rebalance bacteria if the waste breakdown isn't working properly.

Biofilm Plumbers will be good at working with their hands. They will be good at problem-solving, and have an understanding of bacterial biology. They will be able to read and interpret schematics and plans. They may work as freelancers, or in teams of human habitat workers. As with plumbers in previous eras, they will sometimes need to work in dirty or smelly conditions.

61

Biometric Security Solutions Engineer

The days of losing your keys, forgetting your multiple passwords and having your identity stolen are in the past.

A **Biometric Security Solutions Engineer** creates individualised biometric signatures to use across all physical and digital secure access points, such as online banking and home, office or car access.

Biometrics measure physical and behavioural attributes such as fingerprints, iris and retina images, face and hand scans, voice recognition, and habitual patterns of behaviour.

Identity theft will no longer be possible as access systems will require multiple, randomly designated biometric measurements to confirm identification.

The **Biometric Security Solutions Engineer** determines which sensors are appropriate for the security solution, then applies software solutions to analyse and match the authentication factors. Biometrics security integrates with the overall security systems of a building or virtual system.

Biometric Security Solutions Engineers will be comfortable working with both software and hardware, and will understand the use of biometrics to develop unique identification solutions. They will be practical and enjoy gadgetry and electronics. They will also understand systems and be able to communicate well with colleagues in other security fields to ensure that biometrics take up their place in a suite of security measures.



Autonomous Vehicle Profile Designer (Artist's impression)

62

Human Habitat Designer

Human Habitat Designers develop and design land use and the built environment, including air, water, and the infrastructure of urban areas, such as transportation, communications, and distribution networks.

The number of people living in cities keeps increasing. As a result, **Human Habitat Designers** have been designing smart cities with taller buildings, elevated transportation, vertical farming, and vertiports (aircraft and space shuttle ports with vertical runways).

They use regenerative theory, circular economy practices, and net positive design principles to build effective mass living and working arrangements. While millions of people live in these enormous vertical settlements, **Human Habitat Designers** also focus on building local communities that enhance health and wellbeing. All buildings are constructed with environmental sustainability and ecosystem balance in mind, and are maintained in this way as well.

Human Habitat Designers rely on thousands of environmental sensors distributed through cities, the data from which are analysed using advanced algorithms to inform the design and maintenance processes.

Human Habitat Designers evolved from the urban planning profession. They have knowledge of planning theory, and may have an educational background in architecture, economics, environmental management or science, geography or sociology. They will be interested in social, economic, environmental, and cultural issues, and their intersection. They have good written and oral communication skills, attention to detail, and analytical and problem-solving skills. Their visuo-spatial skills are excellent, as are their digital literacies and ability to make sense of big data using algorithmic techniques.

63

Integrated Energy Systems Strategist

Employed at city or regional level, the **Integrated Energy Systems Strategist** works with the Regional and Local community growth co-ordinators, energy and data systems installers, **Human Habitat Designers** and **Sustainable Energy Solution Engineers** to design urban energy systems that are efficient, sustainable and safe.

They bring deep knowledge of people's energy needs in the local area together with the environmental affordances of the local area to design a high-level plan for energy systems across the regions. Working with the **Sustainable Energy Solution Engineers** the resources of an area will be considered in energy generation (such as the wind, sun, wave, water access). They may order retrofit programs for existing energy systems to upgrade to renewables to bring all localised systems up to required standard.

The **Integrated Energy Systems Strategist** will have a high-level role in determining how energy systems are integrated and managed. They will be leaders with skills in managing people and complex ideas and systems. They will be policy enforcers and politically savvy.

64

Massive 3D Printed Building Designer

Large scale 3D printers efficiently and effectively construct houses in two days and high-rise buildings in four weeks by working around the clock.

While technicians are employed to maintain 3D printers the key to the success of this practice is the **Massive 3D Printed Building Designer**.

Carefully planning the construction and designing the print from the bottom up requires skills in engineering design, visual creativity and digital dexterity. The materials for construction are recovered from waste or recycled from the demolition of previous constructions and will be designed to harden quickly, generating solid, reliable structures.

New technologies are used to ensure these quickly constructed buildings provide insulation, water collection, small scale food production, and waste management. The **Massive 3D Printed Building Designer** works alongside smart city designers, landscape architects, energy and data systems installers, construction engineers, and **3D Printer Handlers**.

Massive 3D Printed Building Designers will have a well-developed understanding of materials science to ensure that the recycled products perform to high standards. They will also have a strong sense of aesthetics to ensure they are architecturally creative and curious in their use of their high level visual-spatial skills. The designers will adapt clients' ideas into practical reality demonstrating their high-level communication skills. **Massive 3D Printed Building Designers** will be able to transfer theoretical knowledge to practical application.

65

Net Positive Architect

With new materials, intelligent design and integrated sensor systems, buildings will be designed to produce more energy and water than they consume.

New rooftop photo-voltaic systems, and other onsite energy production and storage, intelligent building materials that insulate, produce energy and monitor the building environment, and advanced analytics software, allow buildings to be run such that they are suppliers to the national energy grid.

A **Net Positive Architect** will design building solutions, working with clients, software engineers and materials engineers, to create viable and responsible commercial buildings or houses.

The **Net Positive Architect** will have spatial design skills combined with knowledge of new materials, green building processes and software solutions. They will have communication skills as they work with other professionals and with clients to create solutions that are innovative and attend to specific needs.

66

Regional Community Growth Co-ordinator

Although urban living in smart cities remains the popular choice, many are looking for something different. With connectivity now in place in all areas across the world including remote and rural areas, working online while living in rural settings is attractive to many. No more commuting while living and working in one place reduces infrastructure and ensures a significant cost saving to organisations.

However, the transition to regional living can be difficult for those long-term urbanites. This is where the **Regional Community Growth Co-ordinator** will provide assistance, working with **local community co-ordinators** and **human habitat designers** to make regional areas vibrant and interesting for people of all ages and interests.

Regional Community Growth Co-ordinators will market regional benefits and attractions to urbanites, encouraging them to re-locate. They will also market opportunities to regional organisations to ensure ongoing regional viability, distributed workforces, community collaborations, and networks. Focussing on artistic communities and food production will be key in these roles.

The **Regional Community Growth Coordinator** will have marketing skills and be a high-level communicator. They will be digitally literate as much of their communication is mediated via online conferencing. They will also be highly organised and efficient networkers as they coordinate people, ideas, opportunities and organisations.

67

Sustainable Energy Solutions Engineer

Developing energy sources that serve both current and future energy requirements without compromising our climate or environment is a job that will always exist and remain in high demand.

Renewable energy and energy efficiency continue to be essential considerations and yet, continue to provide significant challenges. Energy recapture is part of the solution.

Sustainable Energy Solutions Engineers will design energy generation, storage, transport, and use systems that are efficient, sustainable and safe.

New generation strategies are constantly being developed and tested and include strategies such as: solar, wind, bioluminescence, gravity, tides, bacteria and microbial fuel cells, biofuels, and hydrogen fuel cells. Storage chemistry is now well researched and in low cost production. The infrastructure around energy sharing has been updated and transformed into safe systems which focus on local generation and capable storage systems that no longer require statewide networks of unsightly and dangerous poles / wires.

The **Sustainable Energy Solutions Engineer** will be diversely capable with high-level science knowledge so that they can integrate systems to ensure maximum generation for each site. They will collaborate and communicate well as often they will work in teams that include the **Regional Community Growth Coordinator** to ensure that solutions are applied in regional contexts. They will also be creative and solutions orientated.

AGRICULTURE JOBS

68

Agroecological Farmer

The **Agroecological Farmer** grows crops and biofuel, while restoring agricultural balance.

They cultivate agricultural ecosystems, the different elements of which work together to create an effective, efficient and sustainable means of feeding and fuelling the planet.

Many **Agroecological Farmers** will be based in urban areas, where they run vertical farms, but others will still be located in rural areas.

The **Agroecological Farmer** cultivates trees, shrubs, and 'weeds' among crops, using intercropping techniques to create microclimates that are beneficial, and to repel pest insects. They will provide targeted irrigation to the root systems of plants, preventing run-off that might cause erosion and loss of soil nutrients.

Agroecological Farmers will use a wide range of technologies in their work, including robots for fieldwork, gene editing for hardy crops, and big data-informed practice. Sensors are embedded into the soil and air, measuring exactly how much of the right green fertiliser is needed, what the temperature is, and how much watering is required.

Agroecological Farmers have knowledge of how plants, soil, insects, animals, nutrients, water and weather interact with one another to create the living systems. They know about how to grow food and biofuel in sustainable ways. They enjoy working with plants, and have practical skills in fieldwork and robot repair. They have good data analysis skills, and can use algorithmic software to learn what the best sustainable and productive farming options might be.

69

Bio-jacker

Bio-jackers are genetic engineers who undertake precision genome editing of plants and animals, including humans.

Depending on their specialist area of expertise, plant **Bio-jackers** may manipulate the growth patterns and appearance of plants, along with the nutrition profiles of fruit and vegetables.

Human **Bio-jackers** alter the genetic make-up of people, in order to fix gene patterns that cause disorders and illnesses, and in some instances to change their appearance and / or physical abilities. This is a tightly regulated area, and the work of **Bio-jackers** must be thoroughly checked and certified for their potential impact to genetic diversity and the health of the host.

Bio-jackers undertake complex genetic analyses to identify potential genetic modifications that can fix potential problems or meet other needs, and then undertake genome editing using plasmids to transfect the target cells.

Bio-jackers will need in-depth knowledge of genetics, the processes of genetic engineering and genome editing, and what the results of these procedures are likely to be.

Bio-jackers will work in teams and will need to be able to collaborate with others, such as genetic coaches and healthcare workers. They will also need training in advanced bioethics and genetic diversity practice.

70

Cricket Farmer

People will turn towards more efficient protein sources.

Cricket farming will be an urban agriculture practice that produces large quantities of high-quality protein, micronutrients, calcium, zinc and heme iron (considered superior to plant-based iron).

Crickets consume plant products and produce very little waste making them an efficient energy source.

Vertical systems that require very little space where crickets thrive in optimal conditions will be designed. Robots and intelligent systems will monitor each cricket module, maintaining optimum growing conditions, monitoring inputs and growth rates.

Crickets will be turned into high protein flour for bread products and protein bars or deep fried to produce crispy snacks.

A **Cricket Farmer** will use a variety of technologies and have a high level of digital literacy. They will use robots to monitor the crickets, and be able to maintain the machines and programs. They will manage the cricket selective breeding program where they design a range of cricket varieties to match different market needs. They will design and test cricket products to fill an increasing variety of product niches. **Cricket Farmers** will be good collaborators and skilled communicators as they will be a key player in the food production industry.

SPACE JOBS

71

Farm Safety Advisor

Until fairly recently, farm accidents accounted for about one in five work-related fatalities.

In the future, a combination of human interventions and digital technologies will ensure that workplace accidents on farms are very rare.

Farm Safety Advisors will visit farms in a district or community to inspect and advise farmers on risk identification, management and planning.

Farm Safety Advisors will be informed of potential risks through software that uses a combination of big data and accident histories, and sensor technology that informs of existing or emerging hazards in the environment.

Farm Safety Advisors will ensure that autonomous vehicles and agricultural robots have the latest safety software installed, and that bodies of water such as dams are fenced off electronically from access by small children. They will develop safety plans for farmers and provide advice on the latest in safety practices and technologies.

Farm Safety Advisors will be familiar with farming practices and processes. They will have an eye for detail, and keen judgement. Awareness of farm hazards and their likelihood is important, as is the ability to use digital tools to assess risks. **Farm Safety Advisors** will have excellent knowledge of the latest in safety products and technologies, and will be able to communicate these options to farmers.

72

Offworld Habitat Designer

As humans continue to explore space, plans to colonise other planets and moons will be developed.

Offworld Habitat Designers work with other specialists and scientists, such as the **Terraforming Microbiologist**, to build habitable buildings on other worlds.

Beginning with scientific space stations but soon moving into tourism, Mars was the first planet to be offworld colonised, and several space stations are already in development with other planets and moons following after.

There is a need to design complete habitats for these offworld environments. This includes: points of interest, things to do (ranging from sport to adventure to exploring), accommodations and restaurants, along with all of the necessary support structures and infrastructures to manage and maintain.

The new habitats are designed to complement existing ecologies, so the **Offworld Habitat Designers** need to have high-level ecological awareness to ensure that comparable systems are put in place and local aspects are used within the new habitat design. Most existing habitat elements are hostile to human habitation. How do we ensure that the gravitational force in the area is suitable and stable? How do we protect people from radiation? How can we ensure an optimal mix of breathable air? These factors are at the forefront of the designers' minds, something that Earth habitat designers don't ever have to worry about.

The **Offworld Habitat Designer** will have ecological and architectural skills and understandings and be creative in how they meet the challenges and possibilities in offworld locations. They will also have high level-communication skills as they will be designing alongside others.

73

Terraforming Microbiologist

With the recent successes in space travel, notions of inhabiting other planets, especially Mars, has become a reality rather than a dream.

While it is possible to build space stations that have habitable spaces inside them, people can still not walk outside without a spacesuit.

In the future, **Terraforming Microbiologists** will work as part of big terraforming teams to make Mars entirely habitable, and it is anticipated that this will be possible within a few decades.

Mars still presents significant challenges with the lack of a magnetic field and significant atmosphere, however **Terraforming Microbiologists** will be part of the solution. They will nurture microbes to make Mars' soil fertile and its atmosphere more breathable. NASA will fund much of this research.

Terraforming Microbiologists will be skilled microbiologists with a keen interest in space programs. They will have high level communication skills as they work as part of a collaborative, where multiple scientists share research and engage in the big ideas around the specific problems.

HEALTH JOBS

74

Data-based Medical Diagnostician

The **Data-based Medical Diagnostician** will specialise in making sense of data in order to make medical diagnoses in complex cases or where the patient has mysterious symptoms.

The diagnostician will draw together large amounts of data from many different sources, including the patient's health tracking implants, environmental monitoring devices, tests that have been run by doctors, genetic profiles, and the life history data for the patient.

They will also have access to billions of documents and diagnostic databases containing information about diseases.

They will be assisted by AI algorithms, which can scan and analyse data quickly, and identify anomalies, but the diagnostician will be responsible for piecing together the relevant information and identifying what is wrong with the patient and how to treat them.

Once a diagnosis is made, the diagnostician will relay it to other members of the medical team, with recommendations about the right therapeutic approaches to take.

The **Data-based Medical Diagnostician** will be highly creative and also have advanced data analysis skills. They will have significant medical knowledge and excellent pattern recognition capabilities. They will be able to think and act quickly, and will use AI tools to find solutions. They may not need patient caregiving or treatment skills, as this can be undertaken by others once the diagnosis is made.

75

Genetics Coach

Genetics Coaches will work either individually or in coordination with genetic engineers and health care teams to provide information and support to people about their genetic profiles.

Technological innovations and continued developments in genomics will open up a whole new field in genetic healthcare, which will also extend into genetic hyper-performance and hyper-aesthetics.

Genetics Coaches will explain to clients what their genetic analysis results mean, and the implications for their lifelong health and wellness. They will help clients make decisions about whether or not to correct genetic problems through precision genome editing. They will also provide advice about genome tweaking for aesthetic or athletic performance, although there will be tight ethical and genetic diversity regulations monitoring in this area of their work.

Genetics Coaches will need strong interpersonal skills, and the ability to translate complex analyses into information that people can understand. They will need knowledge of genetics and the processes of genetic engineering and genome editing, and the ability to interpret results of these procedures. **Genetics Coaches** who work in teams will need to be able to collaborate with engineers and healthcare workers. They will also need training in advanced human bioethics.

76

Health Shaper

Health Shapers work with clients to build health solutions customised to their lives and needs.

To do this, they use technology that genetically profiles their clients, incorporating previous health data, making use of environmental monitoring, and integrating constant behavioural tracking.

The **Health Shaper** prevents many illnesses through crafting comprehensive individualised health solutions, with the aim of reducing illness in the community, especially given an ageing population.

Assisted by machine learning and big data mining tools, the **Health Shaper** identifies and develops bespoke wellness solutions for their clients. Nutrition, exercise, and therapeutic interventions are planned based on data analysis and interpretation. Predictive physiotherapy is also used as a strategy used to bring alignment in their clients' skeletal-muscular systems.

A **Health Shaper** sees the human body as a complex integrated system. They listen to their clients' needs and communicate clearly so as to ensure the health care solutions they provide are understood and can be followed precisely. They have high level technology skills that allow them to gather and collate diverse data sets focused on all aspects of their clients' health and interpret results to provide advice and develop optimal health and wellness solutions.

77

Memory Optimiser

Information overload can be a challenge. Throughout the day, people are constantly 'plugged in' to augmented reality-based personalised information and news feeds, and are exposed to a wide array of digital visual and multisensory input.

Some people may need periods of time where they 'unplug', possibly with the support of an analogue experience guide. Others find that their day-to-day ability to process the data that they receive is insufficient.

The **Memory Optimiser** augments people's working memory capacities through digital implant technologies, and can also free up existing capacity through judicious memory erasure.

The **Memory Optimiser** needs to be very careful about using these techniques, as there can be serious psychological and cognitive processing consequences both for people who are amnesic (that is, who have gaps in memory) and for those who are hyperthymic (that is, who remember too much). They identify the right implant or memory erasure technique, and then design an integrated memory solution for the client. They do not operate on the patient themselves, but instead work as part of a team that includes bio-engineers, implant and erasure surgeons, and cognitive psychologists.

Memory Optimisers will be specialists in cognitive psychology, with an emphasis on memory function. They will be familiar with digital memory enhancement and erasure techniques and technologies, and know how to use both to create an integrated memory solution. They problem-solve with excellent attention to detail, with educational backgrounds in biotechnology and brain architecture.

78

Nanomedical Engineer

Nanomedical Engineers design and plan personalised medical treatments that use nanoparticles.

Nanoparticles are microscopic particles that can be tailored to detect and target viruses and cancer cells, and to create images of diseased parts of the human body to help diagnosis (similar to smart dust, only much smaller). Some nanoparticles called nanocages can also carry treatments for diseases, such as chemotherapy molecules. Others can target and destroy blood clots that have formed in the wrong places inside the body.

Nanomedical Engineers will have knowledge across engineering, medicine and science, specialising in biochemistry and nanoengineering. Given data about a patient's health and a diagnosis, they will fabricate the right type of nanoparticle for the task, and functionalise it ready for use, by bioconjugating molecules to surfaces or particles. They will work in a team of nanoparticle engineers, nanoparticle diagnosticians, and nanoparticle pharmacy specialists, so will need strong teamwork skills as well as highly developed analytical skills.

79

Nutri-gutome Consultant (‘Gut-bug keeper’)

Nutri-gutome Consultants will be experts at optimising people's health by working on, and through, the human digestive tract and the trillions of microorganisms (mostly bacteria) living within it.

The bacteria are involved in food digestion and absorbing nutrients from food, but they are also important to wider processes such as immune regulation and brain function.

Nutri-gutome Consultants will be known colloquially as '**gut-bug keepers**', but their role will be very important — they will monitor the health of the bacteria and the digestive tract. If dysbiosis (an imbalance of bacteria) is found, they will design and implement interventions to ensure rebalancing. These solutions will include change of diet, pre- and probiotic administration, and microbiota cultivation and transplantation.

Nutri-gutome Consultants will work with body sensors and algorithmic analysis to identify dysbiosis and restore health.

Nutri-gutome consultants have a background in human biology and health science. They often have an interest in nutrition and dietetics, and all have knowledge and skills in microbiology and biotechnology. They have good attention to detail and analytical skills, as well as problem-solving capabilities.

DATA JOBS

80

Virtual Surgeon

In the future, surgery is much less often needed because of **Health Shaping** and genetic engineering. However, when surgery is required, we need to get surgeons to patients as quickly and efficiently as possible.

As Virtual Reality technology continues to evolve, surgeons will be able to perform sophisticated surgery without needing to be in the same room, or city, as the patient. This becomes very important for patients in rural areas, and for maximising the reach of highly specialised surgeons. Virtual surgery is minimally invasive. The small robotic arms that are used are inserted into one tiny incision to do their work.

High tech imaging technology with laparoscopic cameras will help surgeons view anatomy surrounding the operable area and help guide their instruments. Artificially intelligent surgical assistants provide real-time information and offer advice based on thousands of previous surgeries. Nanoparticles can be deployed to provide treatment in targeted areas. Augmented and virtual reality overlays mean that consultation can happen in real-time.

The **Virtual Surgeon** will need the skills of diagnosis and fine motor control surgeons currently have, but will have the technology supports described above to learn how to control and maximise effectiveness of the intervention. They will, as any doctor does, need to have strong people skills for patient consultation, although diagnosis will be done on the ground by AI machines and local medicos. They will also need skills in dealing with diverse centres remotely, and productively.

81

Algorithm Interpreter

The basis of data analysis and decision-making is the algorithm that breaks data into patterns, which are then used for predictive intervention, such as predicting the personal preferences of individuals and what they are likely to purchase.

However, many people or companies working with algorithm-based decision-making software, or machines, will have a limited understanding of where these interpretations come from or the basis on which these decisions are made.

An **Algorithm Interpreter** will help people understand how algorithms work and why artificial intelligence has come up with decisions it has.

Interpretation topics might include algorithms for insurance evaluations, loan applications, employment decisions, court judgements, and dating app rejections. They will translate white box decision outcomes (when system workings are known) into plain English for people of all ages and cultural backgrounds. Some will help make sense of black box decision outcomes (when the internal workings of the system are not known). They may also interpret and report individual or company needs to software designers to maximise the effectiveness of the AI product.

The **Algorithm Interpreter** will need strong knowledge of coding processes and of statistical analysis. They will also need insight into human needs, and communication skills necessary for unpacking clients' perspectives, and helping them with decisions based on the machine learning algorithmic output.

82

Behaviour Prediction Analyst

Our online presence is constantly increasing, signalling our tastes and preferences for clothing, music and entertainment, hobbies etc.

Similarly, patterns of behaviour of communities are able to be tracked through the increasing amount of data that is collected, stored and analysed. Algorithms are being invented to make sense of patterns in this data.

A **Behaviour Prediction Analyst** is a data scientist trained in the development of algorithms that can take big data sets to creatively project future patterns of behaviour across a variety of uses. These might include the personalised marketing of products, crime prediction, insurance company decisions, town planning, or government decision making.

A **Behaviour Prediction Analyst** will need skills in data mining and analysis, implying a logical problem-solving disposition. They will need critical and creative thinking skills, to identify unexpected patterns, but also strong human skills to be able to think through the way people behave so as to make sense of their patterns of activity and what these say about their individual and communal needs.

83

Data Commodities Broker

Data is very valuable. In the future it is used to inform every sphere of human activity, including marketing, product and service development, healthcare, and government services.

Data Commodities Brokers sell collected data on behalf of people, communities and corporations, that will then be fed into machine learning algorithms for different purposes.

In historical times, people gave away their data for free. The data that was captured through their online behaviour (e.g., web sites that they visited, interactions with other people) was taken and used for sales and marketing of products back to those people.

These days, data is sold to different agencies. People can decide which types of agency their data will be sold to, what it will be used for, and for how much money they are prepared to sell it. For instance, a community area contains environmental sensors that pick up information about its residents, the environment, energy use, and patterns of consumption. The community employs a **Data Commodities Broker** to negotiate the sale of this data.

Data Commodities Brokers will have a background in sales or commerce, with specific interests in financial and data management. They will have strong maths, logic and problem-solving skills, and have data-based research capabilities to understand the market demand for a particular type of data. They will work with algorithmic software to undertake projections. They will have solid negotiating skills, and an understanding of data law.

84

Data Privacy Strategist

A **Data Privacy Strategist** will be responsible for designing solutions to protect people's data.

In the future, data privacy will be harder than ever to safeguard, because everyone will be always be 'plugged in' to networks through the digital implants in their bodies that ensure their health and enhance their lifestyles.

Hacking will be a major problem as personal data can be taken hostage for ransom, and identity theft can have serious repercussions.

Data Privacy Strategists set up systems and software to reduce the risk of hacking. If a system is hacked, they may work to repair it, recover data, and minimise the impact on people's lives.

Data Privacy Strategists have strong analytical skills, and will be detail-oriented. They have high levels of digital literacy, and knowledge of the latest trends in cybersecurity. They have coding skills, and understand systems architecture, firewalls, networking and operating systems.

85

Data Farmer

Reminiscent of the gold farmers of early online games and the bitcoin miners of the early 21st century, these bulk data analysts called **Data Farmers** create and wrangle semi-autonomous algorithms that identify and trace connections between otherwise unrelated sets of data.

Part accountant, part detective, part service worker, **Data Farmers** 'milk' their algorithms regularly to extract meaningful extrapolations from stochastic data comparisons. They then pass what they've learned on to businesses, community co-ordinators, and government agencies to predict trends that can be used for new products and services, regulation of commerce, and community / environmental strategies.

Data Farmers will have good programming and algorithmic design skills. They will be creative and have cognitive flexibility to combine or group data in different ways, and to identify the connections between them. They will be good problem-solvers and have excellent analytical skills. Many **Data Farmers** working in industry will need to be quite entrepreneurial, as they will often be freelance, or employed by small to medium enterprises. They will need to pitch to businesses and sell the meaningful connections and predictions that they've identified.

86

Data Storage Solutions Designer

As digital systems become more complex and pervasive, huge demands are made on data storage.

Such technologies as Augmented (AR) and Virtual Reality (VR), Artificial Intelligence (AI), and sensor technologies, have huge data storage demands, not only in terms of capacity but in robustness and durability.

Data Storage Solutions Designers will draw on a variety of innovative and fast changing data storage systems to create purpose built solutions for clients. For instance, one solution involves DNA storage. DNA is smaller than even a microchip, and can reach a density of 215 Petabytes of storage per gram. Just four grams of DNA can contain a year's worth of information produced by all of humanity combined; DNA is durable, and lasts for over 100 years. Other possible solutions include nanoparticles, in 'soft matter' to make a liquid storage device, or holographic versatile discs.

The Data Storage Solutions Designer will have high level digital engineering skills, able to select and creatively suggest the modification and application of existing technologies to specific storage problems. They will need to understand the nature and requirements of a variety of data forms and storage requirements. They will often work in transdisciplinary teams to develop viable solutions, implying strong collaborative and communication skills.

87

Data Waste Recycler

As part of routine data management processes, or an intervention led by a virtual clutter organiser, data may be recommended for deletion. In a world where data is extremely valuable and is used to inform everything from the marketing of products and services to healthcare and determining how much food to produce, erasure is a serious matter.

Data Waste Recyclers receive data that are recommended for deletion from companies, communities and individuals. They assess the data for usefulness. Depending on what they find, they may recommend selling the data using a data broker, archiving it, discarding it, or returning it to service, with or without cleaning and further refinement.

Data Waste Recyclers are an important part of the data health of the world in which we now live.

Data Waste Recyclers will have exceptional attention to detail. They will be good at analysing and interrogating data sets for usefulness and dangerous features (such as bugs, corruption or anomalies). They will know what data can be used for, and what types of data are most in demand by different types of users. They will be familiar with the latest in data management and archiving techniques.

88

Forensic data analyst

Forensic Data Analysts can work in the police service, in private enterprise security firms, and as freelance consultants.

Forensic Data Analysts dig into data produced in and around a crime scene, and follow data trails left by people, to understand what happened in a crime. Assisted by machine learning-based algorithmic tools, they sift through data to uncover evidence of illegal activities and cybercrime, including credit and cyber-currency fraud and hacking.

Some forensic data analysts are involved in e-discovery, which involves gathering data and evidence electronically (including data collected from behavioural sensors and online communications) to prosecute or exonerate people who have been accused of crimes.

One specialist type of **Forensic Data Analyst** uses microbiome data (bacteria and other microorganisms that live on and around people's bodies) collected at the crime scene to identify and track individuals based on the unique and molecular signatures of their microbiota.

Forensic Data Analysts are highly analytical, systematic thinkers who have a deep understanding of the various data trails left by people that can be useful in crime fighting. Trained in police work, they also know how to use artificial intelligence tools to mine data for evidence that could be useful. They often work in teams of cybercrime police, legal professionals, and AI forensics programmers, so they need good teamwork skills.

89

Freelance Virtual Clutter Organiser

People living in advanced nations often own many physical belongings that “clutter” their environment and lead to stress.

In the future age of waste reclamation and upcycling, people will no longer live with clutter in the physical world. However, they will have a lot of virtual clutter. This is because of all the data that they create, access, use and store. Not only will people have numerous online user accounts, they also generate data from their body and household sensors. Everyone consumes a lot of media, including augmented and virtual reality and multisensory experiences.

This is where a **Freelance Virtual Clutter Organiser** will help. Every household will have a data management system, but sometimes things can get overwhelming and it can help to have a person intervene to remove excess data and organise the rest. **Virtual Clutter Organisers** use data management software and artificial intelligence to make their jobs easier, but much of their role can't be done automatically. They will start by asking the client about what isn't working in the household data management system, where there is too much data, or where data could be organised better. They will then perform diagnostic tests, and implement data management solutions, which may include updating software, adding new servers or data storage, rearranging how data is organised and retrieved, and educating clients about data management strategies.

Freelance Virtual Clutter Organisers will be highly organised. They will be good at problem solving, and use software to identify problems and come up with solutions. They have good interpersonal skills to work with clients. As freelancers, they will be entrepreneurial — they will be good at marketing their services to new clients.

90

Predictive Regulation Analyst

Predictive Regulation Analysts forecast which aspects of upcoming changes to technology, business, society and the environment need government regulation, and to prompt government to put pre-emptive new laws and other measures in place if needed.

Predictive Regulation Analysts work inside government regulatory authorities that oversee commerce, enforce quality standards, safety, and use of resources. They use artificial intelligence algorithms to help them predict changes out in the world, although much of what they do is about interacting with businesses and technology companies in person to identify what the next big developments are going to be.

They make recommendations to government about changes that need to be made to existing regulations, or new laws that need to be drafted. For instance, in the early 21st century, the rapid introduction of Uber (peer-to-peer ridesharing) into the personal transport market meant that governments did not have enough of the right kinds of regulations to make sure that Uber drivers and passengers were safe and protected financially, and that the company was paying taxes on the income it was making. In the future, this kind of situation is very unlikely to occur, because **Predictive Regulation Analysts** can see when something is likely to change, and will ask the government to change regulations quickly.

Predictive Regulation Analysts will be experts in the laws and regulations operating in their jurisdictions. They will be familiar with the systems and processes of law, and able to use algorithmic tools to help them predict developments. They will be decisive, and have excellent oral communication skills to find out what is happening in an industry, and written communication skills to write briefs for governments recommending law changes. Most importantly, they will have strong knowledge of technological, social and business trends, and be able to use this knowledge to identify what will be happening next.

EXPERIENCE JOBS

91

Analogue Experience Guide

Analogue Experience Guides support people to 'unplug' from digital life and reconnect with the natural world, without digital implants or augmented reality.

Analogue Experience Guides help people to appreciate a simpler and slower life by experiencing natural environments such as forests or mountainous areas without digital infrastructure or surveillance.

Along with psychologists and other healthcare workers, they may work with people to help them recover from digital, implant, or aesthetic modification addictions.

They may employ approaches such as: horticultural therapy (cultivation of plants); yoga; mindfulness techniques; traditional food preparation and cooking methods without bioprinting or other processing; and analogue art-making.

Analogue Experience Guides have strong interpersonal skills, and specific skills in their preferred therapeutic techniques. They have a deep appreciation of nature, horticultural skills, and prefer to live simply without too much digital input.

92

Food Knowledge Communicator

You feel like a snack and are about to purchase some locally produced organic crispy crickets!

Food Knowledge Communicators help us to change our relationship with food to make it healthier and more ethical.

A **Food Knowledge Communicator** designs communication campaigns to enable us to source real-time information about food products.

Augmented Reality (AR) is used to present the details about the production of each food item, and its nutritional values, which can be used as part of a personalised nutrition plan developed by a **Health Shaper** or a **Nutri-gutome Specialist**. The AR information enables greater connectivity to our food, and supports healthy eating behaviour.

The Food Knowledge Communicator will understand people, and will be able to market new opportunities so that the health and ecological benefits are highlighted and they are convincing. They will be invested in issues of food and agroecology and health, as well as global trade and food ethics. They will be dynamic individuals with passion for their work.

93

Haptic Technology Designer

Haptic technology applies kinaesthetic or tactile feedback to bring realistic touch control, touch sensing, and precise motion tracking to virtual and augmented reality experiences.

The **Haptic Technology Designer** uses algorithms to manipulate ultrasound waves.

These waves are condensed into invisible buttons or hotspots that we cannot see, but can feel. The waves can then be arranged in a way that makes multiple invisible buttons distinguishable to the touch. Haptic feedback can be added to holographic projections so that a loved one can deliver a virtual hug while enjoying a virtual conversation. Similarly, clothes in an online store can be trialled and tried on to ensure fit and feel are as desired.

Designers apply haptic technology to holographic, virtual and augmented reality experiences in a variety of fields — such as: entertainment, communication, business, medicine, and education.

Haptic Technology Designers will explore opportunities to apply haptic technologies in innovative ways. They will have electronic engineering skills. They will have high-level skills in creativity and communication as they design applications with haptic technology.

94

Media Remixer

With individuals having access to a plethora of media, a **Media Remixer** will combine a variety of media from across time to create blended one-of-a-kind products or experiences.

The remix will combine video, audio, images and augmented reality to create artefacts such as marketing campaigns, educational tools, wedding montages, entertainment and bespoke experiences such as installation art or travel adventures.

A **Media Remixer's** work will communicate their unique remix style and personal brand, and they will build a niche client base.

Media Remixers will work in a freelance capacity working on a portfolio of projects for a range of clients at the same time.

A **Media Remixer** will be both an artist and a producer with a passion for creativity and, skills and expertise in digital media. They will also need to be entrepreneurial and have business development and sales skills. Many will have a secondary skill set and domain expertise that enables them to specialise in particular artefacts or experiences. A **Media Remixer** will need to invest in developing their personal brand and a profile to communicate their unique remix style, build reputation and grow their target market.

95

Multisensory Experience Designer

Multisensory Experience Designers bring together virtual reality, haptic and biofeedback / biometric technologies to create fully immersive basis of games and leisure activities, marketing campaigns, and education / training.

They work in teams with specialists in each of these fields to create experiences that are indistinguishable from the physical world, or alternatively that are incredibly different from the physical world, but are still 'hyperreal'.

Multisensory Experience Designers know that while vision and hearing are the most dominant senses, a truly immersive experience also needs to have elements of touch and even smell to bring it to life. They make the most of implants that most people have in their central nervous systems to simulate certain elements of the experience, as well as implanted eye lenses, and ultrasonic waves for touch.

Multisensory Experience Designers will be very good at 'visualising' experiences across multiple senses. Using biofeedback mechanisms and tools, they will create personalised experiences for users. They will have backgrounds in user interface and user experience design, along with coding and human psychophysiology. **Multisensory Experience Designers** will need to be good team workers and have reasonable knowledge of haptic, virtual reality, and biometric technologies.

96

Space Tourism Operator

Virtual tourism is now very popular, but sometimes there is no replacement for going to a place in person.

Space Tourism Operators make the most of this fact. They will take shuttle-loads of tourists into orbit, to visit our space stations and potentially beyond.

Space Tourism Operators will work with shuttle pilots, spaceport personnel, and space traffic control systems operators. They will also work with marketing specialists and pre-tour health and fitness trainers. Some **Space Tourism Operators** will specialise in leading tours for space restoration enthusiasts, who collect space junk left over from previous space missions to recycle and reuse. Other specialist tours will be for space memorabilia collectors, who like to discover and explore abandoned spacecraft and satellites, and create a record of where they are.

Space Tourism Operators will have extensive knowledge of locations in our solar system. They will have strong logistical and organising skills to plan tours, and good marketing capabilities to advertise tours to the public.

Space Tourism Operators will be healthy and fit, with a strong health and safety record. They will need excellent interpersonal skills and be quite entrepreneurial.

97

Sportsperson of the Future

While robot sports will be popular, the more conventional human-based sports will still exist in the future.

As in previous eras, sportspeople will train hard to improve their performance, and sport will remain highly competitive.

Technological advances will transform most sports, with high-tech track and field surfaces, maximum bounce shoes, and low-drag uniforms to push the boundaries of human limitations.

Mega-stadiums will allow fans to watch personalised feeds of their favourite players. Team members will be fitted with tiny earpieces so that they can communicate with one another and their coach during the game. Refereeing will be completely computerised.

As a **Sportsperson of the Future**, you will be fit, strong, fast and flexible, with excellent reflexes and quick decision-making capabilities. You will need good interpersonal skills to interact with your teammates, coach, and fans. You will need some data interpretation skills in order to make the most of the information that various sensors tell you about your performance and your body. Depending on the sport and its regulations, you may be allowed to have body implants to help enhance your performance, but if so this will be strictly controlled. You will need to be abreast of the latest in technological advances in your sport, so you can make the most of them.

98

Swarm Artist

Swarm Artists use swarms of hundreds of drones moving in formation in different ways to create art, music, or performance-based cultural experiences.

Swarm Artists surround audiences with drone orchestras, immerse them in sound and light shows, and do spectacular light painting. They may use robot or human performers as part of the experience, as well as multi-sensory techniques employing advanced haptics (touch-based technology) and biofeedback to create a personalised experience for every audience member.

Swarm Artists will be employed by governments to create drone-based fireworks displays for celebrations. No one will use actual gunpowder in fireworks, as drones are much safer and more environmentally friendly.

Swarm Artists will be highly creative, and have advanced skills in the latest visual and performance art techniques. They may be classically trained musicians, performing or visual artists, with additional education in staging and storytelling. They have expertise in biofeedback and sensor technology, as they will use physiological monitoring to ensure that every audience member is having the best possible artistic experience. Many **Swarm Artists** will be either freelance or work in small companies, so they need to have good entrepreneurship skills.

99

Virtual and Augmented Reality Experience Creator

The **Virtual and Augmented Reality Experience Creator** specialises in designing digital experiences that are used for tourism, games and entertainment, marketing, and healthcare purposes.

Virtual Reality Experience Creators build entirely immersive simulations of real or imagined places, including multi-sensory tourism experiences anywhere on earth or beyond, or immersive movies and games.

Augmented Reality Experience Creators build interactive overlays over the real world, to add to what is there. It is used in numerous places, such as to create retail pop-up stores, virtual changing rooms (where you can try on clothes without getting undressed), interactive museum exhibits, visualisations of tumours in surgery, and virtual navigation beacons for travel.

Virtual and Augmented Reality Experience Creators need to have strong visual communication skills. They need to have coding skills and be able to use VR / AR engines. They will be familiar with principles of user interface and user experience design, and be comfortable with 360 degree cinematography. Depending on the focus of their work, they will need to collaborate with games designers, film script writers, marketing specialists, medical professionals, and museum curators (amongst others).

100

Virtual Assistant Personality Designer

Virtual assistants will be common in the future.

They are programmed to take care of the more mundane aspects of working life. They manage email and communications, store and retrieve data, and organise schedules, as well as offering real-time advice, news, and information feeds that are tailored to the owner.

Each virtual assistant will come with a pre-programmed personality, however, this can be customised and individualised to enhance user satisfaction.

The **Virtual Assistant Personality Designer** does this re-programming.

They will interview the human user and discuss the personality traits most desired, and then design and program that personality. People may often ask for their virtual assistants to have the personalities of relatives, friends or celebrities, which is now relatively easy to do given the amount of digital data that is now collected about everyone. The **Personality Designer** also troubleshoots any personality issues that emerge over time.

Virtual Assistant Personality Designers will know about user interface and user experience design as it applies to AI and generating avatars. They will program with attention to detail and will be empathetic people who are highly intuitive and observant so that they can develop synergistic personalities for the virtual assistants. They also will use their high-level research skills to ensure that their avatars replicate the intended model personality.

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