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The Five-dimensional Space of the Futures of Work: A View to 2030

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Abstract. We advance a structured view of the Futures of Work (FoW) using a futurist's lens to advance two goals: advancing core dimensions to the FoW while outlining the Futurist's approach to considering possible futures. Professional futurists point out that they do not predict the future, but rather, build a number of futures – in plural. These views of the futures are presented as scenarios to help decision makers consider alternatives and better understand interactions among the planning dimensions. The scenarios that drive planning are constructed by drawing on characteristics or dimensions that will shape our futures. It is these dimensions that we present here. We offer five foundational dimensions for the FoW, articulating them as opposing perspectives to frame the issue: (1) Virtuality versus Compressed working arrangements; (2) Atomistic work versus Holistic work; (3) Algorithmic versus Human decision-making; (4) Neoliberal capitalism versus Safety-net capitalism; (5) Übermensch versus Nihilists. We use these dimensions to provide scenarios to illustrate their use. We conclude by reflecting on the shock of the 2020 pandemic and the roles of firm size relative to the futures of work.

Keywords: Future of Work, Scenarios, Foresight, Planning, Markets, Labor, Automation

1 Many Views of the Future of Work

The future earns its attention. Here, we focus specifically on the many possible Futures of Work (FoW) with an explicit attention to the structuring of that work, possible working arrangements, the working context and the expectations of workers. In this article we are theorizing on the framing of FoW, per Weick [1]. Our view is premised on the realization of multiple futures, acknowledging that there will be many future realities that build from our many current realities. And, while we cannot predict the future, we can use what we know to provide structured insight. To this, our theorizing on the FoW begins here by advancing five dimensions, detailed below, each of which builds from our present and serves to help shape or frame the unknown future. These dimensions help us to better understand that there exist many possible futures of work (which is why the article title is in plural). Using the dimensions, we can begin to construct multiple FoW scenarios to better understand the ways in which current arrangements implicate the future. These scenarios serve to evoke, rather than fully describe possible futures.

Our focus to the future is limited here to knowledge work: that which demands cognitive engagement, expertise and the mastery of a body of knowledge [2]. Knowledge work itself is a broad concept, spanning the work of Amazon Mechanical Turkers to design and other creative work that requires collaboration and interdependence as no one person can know enough about a problem or product to succeed [3]. We know that other known forms of work will be present in our future. For example, service work has been on the rise for decades and various forms of labor are now, and will continue to be, a substantial portion of the contemporary workforce – in developed and developing economies. Each of these forms of work will be part of all the futures we can envision. This noted, our focus to the FoW is the work and arrangement specifically designed to support the expertise- focused, digitally- enabled, collaboration- centered and often concept- reliant knowledge work.

Writing about the FoW has been increasing of late, given the rise of more open and global labor markets, increases in automation (now to include artificial intelligence), changes in demographics and urbanization. One stream of this work focuses on changes to the working arrangements and are often dystopian [4, 5]. A second stream focuses on the importance of structuring work and training [6] or particular innovations that are seen as redefining work [7]. A third stream, and the one we build from, develop structured views of the future that rely on scenario planning for analysis [8, 9].

As we consider possible futures of working, our future time horizon is 2030. Futurists typically look out 10-20 years from the present [10]. Ten years is far enough in the future that quantitative predictive methods are mostly

impotent (with some important exceptions, such as population demographics and, separately, climate change). Yet, 2030 is not far enough into the future that it is indistinct. This time frame means that the future leaders in this time horizon are just entering the workforces of today. Today's 25-year-old worker will be a core part of middle management and charged with the operational goals of their firms and organizations. Likewise, the 3.7 million American students who finished their first year of middle school online in the pandemic will be entering the workforce¹.

To make our case for the FoW dimensions and planning approach presented here, this paper continues in four sections. In the next section, we advance our approach for how to consider the future, building out from methods developed by futurists and scholars involved in the broad intellectual space of Future Studies². In the paper's third section, we build from our first contribution -- structured thinking about the FoW -- to articulate our second contribution: the five foundational dimensions that will be used to frame scenarios about the future. These dimensions serve to structure and frame the scenarios we advance in the paper's fourth section, noting that these scenarios are merely examples to demonstrate how the five dimensions are scaffold for policy and strategy.

2 Structured Thinking About the Future

Future Studies developed during the cold war decades as several factors converged. First, there was a need to understand the geopolitical terrain in a world in which global powers can target each other from afar. In the US, much of this futures study came out of the Rand Corporation, a government-focused think tank. Second was one of the first attempts -- and a successful one -- for a giant corporation, Shell Oil, to professionally prepare itself for the future. Finally, the maturation of computer information systems allowed thinkers to develop numerical forecasts, and simulations that were impossible a few years before. Such was the work of the Club of Rome, which gained considerable public attention in its 1972 seminal first report, "The Limits to Growth" [11].

Futurist methods are a mix of qualitative and quantitative approaches [12] or example, reliance on trends can be both quantitative, by building a predictive regression model, or qualitative, by interpreting multiple trendlines creatively into the future. Futurist studies are also characterized by attention to the synthesis or considerations of multiple forces, with the goal of articulating plausible or possible future arrangements across a range of factors or dimensions. This means that futurist approaches combine both the analyst's discipline of building from what is known and the innovator's willingness to build from circumstantial evidence [13].

The scenarios method is one of the most common foresight methods [14, 15]. Alexander [13] writes that a scenario is a work of creative fiction-- a story. "Generally, we create scenarios by starting with some part of the present, such as a geographical area or organizational type, then imagine how it would change under the impact of one or several trends. ... They are narratives, clearly more art than science." One of the core reasons for using scenarios is, as Galer [16] notes, "...because humans are narrative creatures, stories can be powerful." That is, the act of consuming a scenario gives us a window into possibilities. At their best, scenarios allow adversaries to interact creatively in a safe space, such as with the 1991 Mont Fleur Scenarios, which helped South Africa move past apartheid [16].

Rhisiart et. al., [9] point out that scenario generation is intended as a policy support tool. They write that "Conceptions of the future structure the decision-making processes of the present. The way in which we use the future has a major influence on the possibilities and options that are revealed to us, both inside and outside government." They note that scenario building is a reaction to the weaknesses inherent in 'static' models in the strategy field, particularly where organizations have a 'pre-commitment' to a course of action. Johnston [17] articulates three goals of why scenarios are useful: informing -- providing inputs -- both conceptual and empirical to inform decision-making; enabling -- developing the capacity to deal with uncertainty; and influencing -- shaping policy and other outputs.

¹ See https://nces.ed.gov/programs/digest/d13/tables/dt13_203.10.asp.

² This is also known as the discipline of Foresight. See <https://wfsf.org/about-us/futures-studies>.

Building from this guidance, one goal of this paper is to advance an approach for theorizing on the future and to build theory and knowledge. Futurists typically write for a specific policy-making audience or in response to specific guidance from a funder or client. In contrast, our approach is guided more by our interests in the futures of work and a desire to advance scholarship in this area. To do this we draw Futures methods while focusing on the FoW. Following our discussion of the five dimensions that shape the FoW, we advance eight brief scenarios to validate the five dimensions' value.

3 Five Dimensions Framing the Futures of Work

Futures scenarios should build from a structure of knowns, drawing on characteristics to be used to shape possibilities: creating dimensions for consideration. Examples of possible dimensions are changing demographics, automation, climate change, or structural changes to policy (such as nationalizing health care). The goal of scenarios is to create plausible – but not necessarily probable – futures, that allow for planning and analysis. And, the dimensions used to structure these scenarios are the framing.

Futurist methods encourage developing these framing characteristics or dimensions as sets of contradictory possibilities [15]. For example, one might consider two possible futures: one where each person is responsible for their own personal safety (a 'wild west' view) and the other where the state provides complete protection and public safety prevails over individual liberty (a 'socialist's dreamworld'). These two views reflect how a characteristic (personal safety) can be developed into two contrasting dimensions: individual or collective action. And, we intimated in the evocative naming of these how these are plausible, not likely, serving to structure the scenario and establish a rhetorical position.

Wilkinson [18] calls these dimensions "uncertainties" and writes that when examining an issue (an issue in our case is the FoW), "... at first, all uncertainties seem unique. But by stepping back, we can reduce bundles of uncertainties that have some commonality to a single spectrum, *an axis of uncertainty*. If we can simplify our entire list of related uncertainties into two orthogonal axes" and to then use those two axes and build a 2x2 matrix with four very different, but plausible, quadrants of uncertainty. "Each of these far corners is, in essence, a logical future that we can explore."

To guide our selection of dimensions, we began by first using the extant literature to provide us an initial set of possibilities, discussing what we were finding. We used these discussions to guide additional literature work. This iterative process was driven by the competing tensions of future studies: to be guided by the evidence but open to emerging trends and issues. Our work with the literature led us to finding articles from a wide variety of disciplines. And, we drew on a number of industry and think-tank reports [19]. In doing this, we rejected dimensions that were focused on the environment and sustainability because with that kind of focus the future of work becomes a second order effect (even as it is critical for the human race). After much discussion, we did not create dimensions that create clear value choices (e.g., more inclusive work, work that provides for emotional safety), even as we stand by these as critical aspects of the future of work. The reality is that selection is a judgement call: we chose some of them because we felt that they were the right ones, that the dimensions we selected would challenge us and readers to consider these potential futures and to see these as viable axes of uncertainty [20]³.

One mechanism the Futurist approach employs is to frame the complexity relative to a smaller number of dimensions, then using these dimensions to emphasize differences. This is done by attending to the ends of a continuum or maximizing the differences in a dyadic relation. This simplification serves both to articulate and magnify the ways in which possible futures might be characterized: the dimensions provide the framing for, the dyadic differences the scaling of, future scenarios.

The five dimensions that frame our scenarios about the FoW are summarized in Table 1 and detailed below. These dimensions reflect a synthesis of dimensions that are used to define other studies of emerging work arrangements, along with those papers containing analyses of FoW planning scenarios. The first dimension focuses on the nature of working arrangements, contrasting a more online-oriented and virtually-centered knowledge work with a second approach that relies on more informal engagement and interaction [8, 9]. The second dimension focuses attention to the structure of work and embodies the tensions between defined and task-centered work structures and more open-ended and interdependent approaches [7,21]. The third dimension emphasizes the locus of decision-making and

³ To this point, we appreciate the comments of all four reviewers, who and provided their own well-reasoned positions on our dimensions while suggesting relevant others. Their commentary has strengthened this paper!

control, drawing on current discourses on AI and algorithmic management [5, 8]. The fourth dimension emphasizes the market structure that frames what firms and workers must consider [6, 22]. With the fifth dimension, we focus on the expectations for the kinds of workers for the knowledge-driven economy [4, 23]. Many readers will be familiar with the first three dimensions. In a broad FoW framing, the latter two of the five, in our judgement, deserve greater attention and more structured consideration, since they bring to the fore important debates on the structure of markets and the expectations the future has of the knowledge workers that will do the work.

Table 1: Five dimensions of the FoW

- | |
|---|
| <ol style="list-style-type: none">1. Virtuality versus Compressed Working Arrangements2. Atomistic versus Holistic Work3. Algorithmic versus Human Decision-making4. Neoliberal capitalism versus Safety-net capitalism5. Übermensch versus Nihilists |
|---|

Dimension #1: Virtuality versus Compressed Working Arrangements

This dimension emphasizes the spatial arrangements of work. This dimension focuses attention to the intertwined roles of space, place and both digital and personal connectivity [24]. The spatial arrangements of work reflects some of the mega-trends of population migration into dense super-cities and concerns with commuting and crowding [25]. Knowledge work can be disconnected from specific physical spaces, but it is often collaborative. So, co-location is more about exchange than access to scarce resources or heavy machinery. This is one of the reasons for the rise of dense open office designs, cubicle farms, coworking spaces and open seating [26-28].

We advance this dimension as changes to working arrangements have been core to discussions about the FoW. As work becomes more virtual and workers are more dispersed, do people need to be physically proximate? Even as work allows for more virtuality, the interdependence among knowledge workers encourages constant informal interaction. This, in turn, encourages workers to live closer together. But, moving is hard in crowded spaces, space is at a premium, and people have to learn to pursue their work wherever they find themselves. Thus, the rise in urbanization is both a bane for movement and commuting, and a source of informal interactions and connection.

Taken together, the FoW could be one where knowledge work is primarily pursued through virtual means, allowing people to work and live at a distance. Or, the knowledge work of the future could be pursued through the tight-knit social worlds of constant informal interaction that blurs work and non-work time, highlighting urbanization and spatial compression.

Dimension #2: Atomistic versus Holistic Work

Atomization has two components, the structure of the task and the contractual relationship of the worker with the employer. Traditionally, the latter dimension – the contract – has received more attention. These fluid work arrangements are part-time, zero-hour and outcomes-oriented, flexible, temporary, freelance jobs, often enabled by a technology platform. From Tayloristic factories to today's gig economy this structure is not new, it just looks different today. The percentage of workers in atomized contracts has been relatively constant at 10% to 15% of the economy in both the USA and UK [29].

Increasingly, attention is being focused on atomizing tasks, not on the factory assembly line of Taylor factories, but in computer-enabled tasks. For example, software construction tasks can be decomposed and parsed to each individual designer, coder, tester, UI designer. At the extreme are the tasks of several minutes on Amazon's Mechanical Turk, gracefully detailed by [30].

Atomization has contentious benefits and costs. It benefits workers and employers by making work more adaptable. Some workers benefit from increased flexible lifestyles. Conversely, atomization may degrade humans by making them anonymous cogs in a machine, ghosts, that are expandable with any change in the employer's

condition. Implicit in all this, is the inherent contradiction between specialization and collaboration future. Work is atomized because of the increased need for expertise, yet collaboration and teamwork are still required.

Dimension #3: Algorithmic versus Human Decision-making

This FoW dimension focuses attention to a core element of managing: decision-making. Managers and leaders who can combine experience and intuition to guide their decision-making are revered: books are written to help others understand their greatness. It seems a small step of 'ifs and thens' to see experience as data, intuition as some sort of advanced pattern-matching heuristic, and that a tuned algorithm, driven by machine learning, drawing on even more data, could be even more powerful, and certainly more rational and efficient.

There is evidence that contemporary society is growing comfortable with guidance based on machine-learning: we lean on systems for driving directions, music playlists and decisions about which food to eat. There is a growing literature focused on algorithmic or platformic management - the uses of data from participants on the platform to develop algorithms that determine or decide what is possible [21, 31]. Lyft and Uber's algorithms dictate how long drivers have to accept a ride, if they can get access to new customers in slow periods, etc. Algorithmic decision-making is embedded in fraud detection, loan-making and increasingly in hiring decisions. There are also clear concerns that include broad-scale and often valid worries of dehumanization (reducing people to fungible entities) issues with surveillance, and the lack of 'algorithmic transparency:' the ability to understand what data are being used and the ways in which these data shape a decision or output [32, 33].

In contrast to the logic of algorithms, we know that knowledge workers are creative entities. And, increasingly, are being asked (if not required) to make the decisions. The collections of digital devices, resources and data that knowledge workers pull together reflect patterns of need and idiosyncratic choices into what are termed "digital assemblages" or digital kits or, more obtusely, personal information systems [34-36].

Moving from the individual knowledge-worker as the locus of decision-making, entrepreneur thinking, start-up cultures, and the role of the innovator have amplified the need for risk-taking, decision-making groups, and the power of small and coherent leadership teams to disrupt and innovate [37, 38]. Human-centered decision-making may lead to mistakes, but also leaps of greatness. This dimension focuses attention to futures that rely on the high-speed and data-reliant approach of algorithmic decision-making or the reliance on the more experiential, intuitive, and varied approaches human of decision-makers.

Dimension #4 Neoliberal capitalism versus safety-net capitalism

This dimension focuses on the economic context of work, building out from the role of markets. Markets provide a forum for exchange, connecting sellers and buyers. Markets have architectures: rules and norms that guide and structure the transaction [39]. We see the future as relying on market principles: What is in play is the set of rules and norms that structure these markets, advancing two different models. In the unfettered market of neo-liberal capitalism, the individual worker seeks work based on transactional arrangements: gigging for their life and livelihood [22]. In these markets, the firm seeks workers by posting for work, careful to make no promises beyond current needs. Both the firm and the worker act in their own best interests, based on transactions, unfettered by market constraints. This neoliberal arrangement locates all decisions to the transactors and companies value this flexibility from the marketplace [40]. Neoliberal markets are flexible, sterile, on-demand, unfettered from regulation, with no expectations to support, reward or sustain workers.

Another way to see the market space is one where the architecture - the policies and norms and systems - provide for distributions of risks and costs: there is a safety net built in for both firms and workers. Taxes and rules provide for social benefits and cover for underemployment, pay rates are capped at the upper end, and there is a minimum wage (if not a universal basic income) [23]. Employment is seen as a relationship between worker and firm: looking beyond a specific task or deliverable, with seniority providing for more security. Labor market protections in the form unions and employment laws extend beyond formal organizations. Firms are provided protection from market

fluctuations through active state intervention (akin to the ways in which China have supported their large international firms [41]).

The essence of this dimension is the structure of the markets in which the FoW exists. Workers and firms will adjust to the incentives, adapt to the risks, and engage with other parties. Importantly, the markets of the FoW will be technologized: new platforms supporting interaction, expanded data collection and uses, and new forms of organizing will emerge. The choices made clear in this dimension focus attention on what kinds of markets we will see in the future.

Dimension #5: Übermensch versus Nihilists

This dimension focuses on the ethos or soul of the worker: what kinds of people are needed for the FoW? The FoW discourses advance fundamentally philosophical differences about who we are as human beings. We frame this as did Nietzsche: in dialectical terms. Are we fundamentally beings that aspire to higher goals and values? Or do we seek to make do and slide down to the easy, the nihilistic? The quest for meaningfulness in life and in work seems eternal: from Plato's views on the soul (as discussed in his *Phaedrus*, per [42]) to death camp survivor Frankl [43] in his "Man's Search for Meaning." Scholars and philosophers aspire for all of us work that is meaningful. Going even further, the French philosopher Simone Weil aspired for us not just work, but hard work, as a moral calling. Work that is at the highest spiritual meaning - a metaphysical experience. Such workers would be 'Übermensch:' a superior person, one who rises above baseness and craven interests to pursue higher goals and purity. A FoW full of Übermensch would work together in seamless and ego-less ways, to all's best interests, acknowledging both shared and individual goals, attending the proper balance of work and life, caring for their employer's principal needs, and always with an eye towards higher goals of enlightenment, self-actualization and the social welfare.

In the face of these high-performing aspirations, many people report that they do not like their jobs and do not find their work meaningful. The management literature is full of approaches to motivate workers [44]. Kalleberg [45] calls this the mismatched worker, noting that what workers are asked to do often differs from what workers seek to provide. Still, many workers aspire to happiness, rather than meaning. And there, too, one can look at this through Nietzsche, for he was also critical of mass culture and of the emerging utilitarian stream that our purpose in the world is to be happy. Gig workers report that flexibility to set their own working schedules, and to be away from office politics and commuting, are worth the precarity of temporary jobs and the loss of workplaces benefits such as retirement, vacation and health care [30].

We see this dimension as fundamental to the FoW because arguments about the FoW often assume that all workers who toil at work are Übermensch -- or that they are repressed Übermenschers. And, that if the nasty boss, odd job roles, or cruel economic system, are removed, their true Übermensch will be able to surface. Yet, the evidence does not bear out these implicit beliefs. The dichotomy of the meaning of work is intertwined with the underlying assumption that work helps define who we are (in England one asks, 'where do you live?', as it indicates status. In the US, 'one asks what you do?').

4 Narrative Scenarios Exemplars

In Futures Methodologies, dimensions are structured to encourage thinking of non-obvious possibilities. In this section, we take four of the dimensions and create 2x2 matrices, resulting in eight scenarios (see Table 2a and 2b). We then use the futures methodology approach of constructing a creative narrative of each of these futures. One of the key components of that is to create an evocative label, one that helps to convey the kind of future the scenario represents. In developing these futures scenarios, the focus is on plausibility: can we imagine a future like this? Plausible futures allow us to explore and consider the current trends, carried forward in time, to better assess what it might take to encourage or alter such paths. Plausibility also means these futures have roots in socio-technical processes and arrangements that are already evident today.

These scenarios we designed to be generative: to invite readers to develop, to add details and consider implications. Futurists see scenarios as offerings, evocative sketches of possibilities: illuminating arrangements and

raising discussion. Seen this way, details of the future are more for science fiction writers, hardly worthy of a journal article: framing the story is the real contribution [17]. Futurists also make the case that any detailed scenario-writing should be specifically situated in specific settings [11].

Table 2a: Future Scenarios; Examples using dimensions #1 and #2

	Virtuality	Compressed/f2f
Atomistic work	<p>M-Turk World[#] Platform workers perform many tasks scattered in rich and poor nations.</p> <p>[#] Named for Amazon’s Mechanical Turk.</p>	<p>Back Office Gaanv[#] Gaanv factories are better able to socialize and train workers in close-proximity.</p> <p>[#]Gaanv is Hindi “for village.”</p>
Holistic work	<p>Immersive Virtual Office Knowledge workers enter Mixed Reality work mode</p>	<p>Artisan on Main Street[#] Professionals come together in Manhattan and in main street to collaborate and feed off each other.</p> <p>[#] Main Street represents the primary retail street of a village.</p>

Table 2b: Future Scenarios; Examples using dimensions #3 and #5

	Algorithmic decision-making	Human decision-making
Übermensch	<p>A world of Poets Now that AI/robots do much of the labor and decision making, humans have time to create and read poetry</p>	<p>AI serves humanity AI is heavily regulated and is intermediated at important points by human decisions. Robots work alongside humans</p>
Nihilism	<p>A world of Homer Simpsons[#] Now that AI/robots do much of the labor and decision making, humans have time to sit on the couch and watch cartoons. [#] Homer Simpson embodies base working-class stereotypes: crude, lazy, addicted to junk food and idly watching television.</p>	<p>Disneyworld Happiness Humans work hard to collect currency to travel to the magic kingdom.</p>

We expand on four of these scenarios by building on a practice that is common in foresight approaches [12,18]. The writing of these narratives is disciplined creative work, educated fiction. The scenarios are stories of plausible futures that need to be both empirically and conceptually rooted in the milieu of the present. We expand these narratives here as a proof of concept and not for any other use. In and of themselves these narratives are cartoonish since they are extremes, but for policy makers they accelerate thinking.

Immersive Virtual Office: Knowledge workers do all their work through Mixed Reality (MR) work mode. Workers interact with documents, other humans, and objects via advanced headsets and new projection technologies. The worker is able to speak to and see their partner in much the same way regardless of distance. Offices and 3rd spaces have many noise and distraction cancelling features. Companies have reduced typical office space requirements from 20 m² to 10 m² as offices are used for occasional meetings, socializing, and showcases. Workers are commonly given a yearly grant to spruce up their home workplaces. They need to provide video

evidence of their expenditures. MR works well in driverless cars much as we can work on our laptop in the passenger seat today.

Artisan on Main Street: Professionals come together in Manhattan and in main street to collaborate and feed off each other. The paranoia of corona subsided after cures and vaccines were found in 2022. Humans craved getting back into tight spaces and doing meaningful work together, feeding off the energy of proximity. At about the same time 3D printing technologies finally reached mass use, allowing more tasks to be done in small groups. Coworking made a resurgence, in spite of WeWork's multiple bankruptcies, driven by a number of competing and franchised multinational firms.

AI serves humanity: AI is heavily regulated and is intermediated at important points by human decisions. Robots work alongside humans. The UN "Commission on the Future of the Human Species", chaired by historian Noah Harari, proposed a regulatory framework for AI that was, surprisingly, passed with some adjustments, by the EU and the USA. Blackbox decision-making was, from that point forward, approved on a case-by-case basis. This means that so-called 'algo work allocation' ('AGA'), such as Uber-like driver scheduling algorithms, are presented to FDA-like commissions for consideration ahead of use.

A world of Homer Simpsons: After two years of rolling coronavirus waves and stay-at-home orders, and now that AI/robots do much of the labor and decision making, humans have time to sit on the couch and watch cartoons. The economy is growing, yet unemployment remains at 25%. Universal basic income allows many to skip work partially, or fully – and be entertained. They need less human interaction because of an emerging genre of social AI – a new class of agents and robots called Friendz. Friendz are more advanced forms of software agent Alexa and robot Pepper.

This scenario essentially asks: why shouldn't we seek what the renowned futurist Arthur C. Clark desired? Namely, "full unemployment"⁴? Or rephrased and simplified according to Keiper [45], there are two (extreme) narratives: (1) Techno-optimism. When technology (re: AI) allows us all to achieve self-actualization, and (2) Techno-Dummies: We all become couch potatoes like Homer Simpson. There is widespread assumption that the Homer Simpson future will be driven by AI which will play out in a range of increasingly more intelligent machines, ever-more pervasive computing, and the rise of cognitive computing.

5 What It Might Take to Reach These Futures of Work?

The five-dimensional space introduced above provides a framework to examine the FoW. These dimensions build from and extend contemporary studies of work and the literature engaged in conceptualizing possible futures of work [5,6,8,9] These dimensions are our first contribution: a way to structure analyses about the many possible futures of work.

These five dimensions are advanced as dichotomies of the future: as if the future will be either one extreme or the polar opposite. And, some of contemporary public debate is about these extremes, such as the utopian and dystopian futures in the face of AI being hotly debated [47]. Likewise, Gershon's [22] treatise on neo-liberal market structures helps make clear these dimensions are both powerful structures about the future and that the framing we provide brings them into stark relief. We know the future is unlikely to present any of these in their extreme measure. Rather, our future will be at some midpoint of each of the five dimensions. That is, the FoW will reflect a reality bounded by this *five-dimensional space*.

The five-dimensional space framing the FoW must be seen in the context of larger social forces and other global events. We note two here: shocks and the power of size.

⁴ From interview of Arthur C. Clarke conducted by Gene Youngblood on 25 April, 1969, Los Angeles Free Press, Free Press Interview: A. C. Clarke author of '2001', Start Page 42, Quote Page 43, Column 4 and 5, Los Angeles, California. Retrieved from Digital Independent Voices Collection at revealdigital.com on 18 May, 2020.

5.1 The shock of the Coronavirus pandemic: The elephant in the room

We write this article at the beginning of the 2020 pandemic era. It is risky to anticipate impacts from such broad-scale and fast-moving current shocks. Yet that is precisely what the tools of a futurist afford. The dimension most impacted is our first: “virtual or compressed.” We present some implications based, in part, on [48]. It seems likely that office design will move away from crowded open space for some years to come. Knowledge workers will not want to work in open-work settings. Distances of two or three meter’s spacing apart will be expected, even though this may be insufficient. Kitchen space for “collisions” will be impacted. More people will eat at their desk, fewer together. Traditional closed-door offices will be popular again, and partitions for cubicles will become much higher. Knowledge workers may decide to work from home more often, leveraging all that we are learning. Many firms, and knowledge workers may opt to move out of crowded urban areas, leaving Manhattan, New York for Manhattan, Kansas.

5.2 The impact of company size and the tech giants

A second social force to be considered is that of large multinational firms such as Walmart or Volkswagen – and particularly the five technology giants (Facebook, Amazon, Apple, Alphabet and Microsoft, or FAAAM). These firms represent service work, knowledge work, and manufacturing. Amazon is both one of the largest public companies in the world, one of the largest high-technology firms in the world, and one of the largest employers of service and low-wage workers. Increasingly these and other large firms have outsized impact, even as the share of employment of U.S. Fortune 500 firms, the largest public U.S. firms, is roughly the same today as in the 1950s.

These firms seem like permanent fixtures, much like Bethlehem Steel seemed to be in the 1960s, or General Motors in the 1970s, or IBM in the 1980s. In their moment, large firms can alter the ways in which policies and plans unfold, with an institutional presence much like the pull of gravity. Still, at the same time, the 21st century has been about entrepreneurialism: start-ups, unicorns, and innovation are seen as the moniker of the future. The five in FAAAM emerged beginning in the 1980s (one since 2000).

We know there are powerful economies of production and scale for large organizations. They exist beyond any one person’s views or effort: rules and systems get reified. Small firms come and go, forming and reforming: the essence of Schumpeter’s creative destruction. Small firms are about connections and people (individuals) working together. The five dimensions do not dictate the future of organizing, they frame the ways in which future organizations will need to adapt, and we imagine that our FoW in 2030 will see both large and small firms thriving and failing, perhaps for different reasons than now.

6 Conclusion

Our first contribution comes in defining the key dimensions of our futures of work. Whether it be for future planning of a labor not-for-profit in Czechia, a consulting company in Japan, the Jobs and Small Business ministry in Canberra, or a FoW researcher in Chicago, we posit that the five dimensions framing the FoW, as detailed in Table 1, are a useful starting point and a useful foundation for disciplined thinking about 2030.

Our second contribution is to advance the Futurist’s approach to disciplined thinking about the future. This approach draws on what is known to identify core dimensions that help to frame the future. Then the futurist’s approach is to use these dimensions to create dichotomous perspectives that reflect plausible, not probable, futures. Done well, the dimensions force attention to intersections and interactions that shape future scenarios. These future scenarios, often constructed as 2x2 matrices to help illustrate tensions and choices, are then used for planning and analysis

To this point, the scenarios we developed in Table 2 are generative. We provide them as invitations to help envision possible futures that reflect the trends we can see emerging but cannot yet fully understand. Futurists traffic in doing this and we draw on their methods to consider the ways in which robotics, artificial intelligence, the shifts towards virtual and distributed work, population shifts towards mega-cities, reshaped work spaces that dichotomize the trend towards creating both larger and smaller organizations, and the increasingly pervasive roles that data and

analytics will play in guiding technology and information-enabled work. As such, these scenarios serve only to illustrate our two contributions, they are simply examples.

Finally, we note the roots of the 2030 FoW are already evident today as we write this in 2020. And that is how it should be, as futurists always point out: the future is a blending of the present with the new. For example, we use powerful new mobile devices, but live in homes constructed in 1960, often with one power outlet per room. The seeds of our future are being sown, and our work serves to provide both a set of dimensions and a structured means to consider the FoW.

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