The future of AI: Generational tendencies related to decision processing

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Abstract Advances in artificial intelligence (AI) have resulted in the automation of human-based decision processing and have become entwined with almost every aspect of our lives. While advantageous in many respects, when conditions permit a decision to take place related to the acceptance, adoption or rejection of embracing AI into one's everyday life, many elect not to do so. Such decisions can be based on a lack of knowledge of how to determine the benefits of such modernisation of thought but can also be the result of specific tendencies associated with different generations. This paper examines three generations — Baby Boomers, Gen Xers and Millennials (born 1946 to 1994; reaching adulthood 1967 to 2015) — who collectively participated in nearly a half-century of some of the most significant technological advances in history. These changes contributed to each of these generations' understanding of, comfort with, and decision making that

ultimately determines their attitude toward and rate of adoption of AI. In light of Bourdieu's theory of practice, we examine social models and theories of innovation to better understand decisions associated with each generation regarding their attitudes related to AI — primarily based on their interpretation of perceived benefits offered by such advancements in technology.

KEYWORDS: artificial intelligence (AI), Baby Boomers, decision processing, generational, Gen Xers, Millennials, social theories

INTRODUCTION

Artificial intelligence (AI) is a complex technology that encompasses numerous definitions: McCarthy's early definition that 'Artificial intelligence is the science and engineering of making intelligent machines, especially intelligent computer systems';[1] Wang's five components — structure, behaviour, capability, function and principle;[2] or 'thinking humanly, thinking rationally, acting humanly and acting rationally'.[3] Regardless of definition, AI is 'heavily reliant on the collection, usage and processing of big data'.[4] For this paper, we define AI as, 'technology that relies upon big data and machine learning (ML) to assist in, or substitute for, critical and non-critical decision processing by humans'.

In this paper, we conceptualise that our propensity to accept or reject advancements in AI in our lives is, to some degree, influenced by the characteristics of an individual's generation, specifically with regard to one's critical and non-critical decision processing. Furthermore, we posit that such decisions are further influenced by previous rates of adoption of computer-based technology innovations that occurred during specific generations.[5–7]

To address these concepts, we first present a brief history of AI. Next, we examine the characteristics of three generations — Baby Boomers (1946–64), Generation X (Gen Xers) (1965–79) and Millennials (sometimes referred to as Gen Y) (1980–94) — as well as important technological innovations that occurred during those periods. We excluded Traditionalists (born 1925–45), Gen Zs (born 1995–2012) and Gen Alphas (born 2013–present) for the following reasons:

1. Traditionalists did not experience sufficient advances in technology during their formative years to merit inclusion;
2. Due to advancements in AI since the early 1990s, Gen Zs and Gen Alphas tend to regard AI as being intrinsic to their lives, some even suggesting 'Whereas Millennials grew up excitedly awaiting access to better and shinier tech, AI Natives expect access to highly functional tools right now',[8,9] thereby significantly reducing concerns of how AI might negatively affect them.

Next, we reference a series of social theories and models in efforts to address our three generations' methods of decision processing: Required Elements for a Social Engineered Cyber Attack Theory (RESCAT);[10,11] the Technology Acceptance Model (TAM);[12] the Theory of Diffusion of Innovations (DIT);[13] the Theory of Planned Behavior (TPB);[14] Locke's works on human understanding;[15] Hume's work related to human nature and human understanding;[16] and Adam Smith's theories examining nascent capitalist economies.[17,18] Finally, we suggest additional research to expand upon our observations and findings.

AI: A BRIEF HISTORY

From the early 20th century, science fiction introduced the concept of functioning

robots using AI.[19] In 1950, British polymath Alan Turing, considered by many to be the founding father of AI, authored the first detailed paper on AI, creating the Turing test — a concept that computers could think similarly to the human brain.[20]

Five years later in 1955, Herbert Simon, Allen Newell and John Shaw created the first computerised AI program,[21] believing that computers could be taught to think, akin to Russell and Whitehead's Principia Mathematica incorporating mathematical theorems.[22] Using his Logic Theorist program, Shaw went on to prove 38 of the 52 theorems of Russell's principles.[23,24]

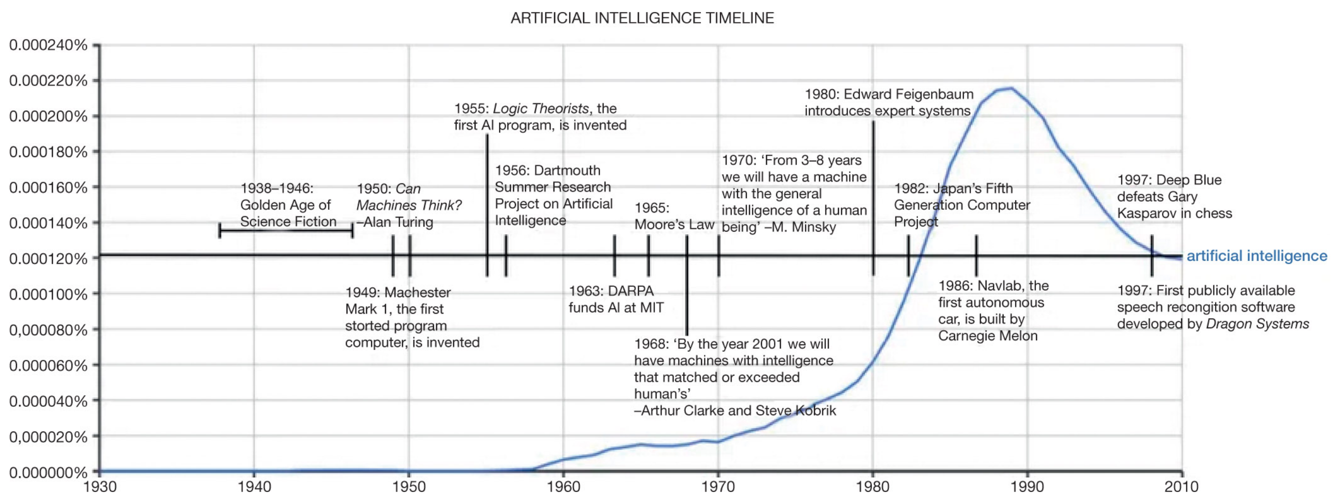
In 1970, Minsky predicted that within eight years, computers would be capable of emulating human thought.[25] Initially restricted by a lack of sufficient computing power to achieve his ambitious prediction,[26] these limitations diminished as computers became capable of processing millions of instructions per second at significantly lower costs, as described by Moore's Law.[27]

In 1981, American philosopher John Searle developed the Chinese Room Argument (CRA), a cognitive test to determine if it was possible for a machine to be intelligent.[28] Searle's intent was to refute a popular hypothesis of AI scientists and philosophers at the time that 'the appropriately programmed computer is really a mind'.[29]

Many advances made in AI occurred from the 1960s through 2000s (see Figure 1) including Newell and Simon's General Problem Solver (GPS) — an AI program designed to solve virtually any problem,[30] and Weizenbaum's ELIZA Program developed at MIT, designed to make natural language conversations possible with a computer, so named 'to emphasize that it may be incrementally improved by its users, since its language abilities may be continually improved by a "teacher"'.[31] Advances in AI resulting from these projects and others led the Defense Advanced Research Projects Agency (DARPA) to commit to funding for additional AI research that continues to this day.

DARPA's director of I2O described an initial three waves of the development of AI (see Appendix) starting in the 1970s (handcrafted knowledge, statistical learning and contextual adaptation) and four key components (perceiving, learning, abstracting and reasoning).[33,34]

The first wave, handcrafted knowledge (logical reasoning — 1970–90), takes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1938–1946: Golden Age of Science Fiction
1950: Can Machines Think? –Alan Turing
1955: Logic Theorists, the first AI program, is invented
1956: Dartmouth Summer Research Project on Artificial Intelligence
1965: Moore's Law
1970: 'From 3–8 years we will have a machine with the general intelligence of a human being' –M. Minsky
1980: Edward Feigenbaum introduces expert systems
1982: Japan's Fifth Generation Computer Project
1997: Deep Blue defeats Gary Kasparov in chess
artificial intelligence
1949: Machester Mark 1, the first stored program computer, is invented
1963: DARPA funds AI at MIT
1968: 'By the year 2001 we will have machines with intelligence that matched or exceeded human's' –Arthur Clarke and Steve Kobrik
1986: Navlab, the first autonomous car, is built by Carnegie Melon
1997: First publicly available speech recognition software developed by Dragon Systems

Figure 1: The history of AI
Source: Anyoha[32]

knowledge about a particular domain such as logistical issues, game playing and computerised tax applications, characterises it and fits it into rules that the computer subsequently studies to determine any implications based upon those rules. This wave is weak in perception, nonexistent in learning and abstracting and strongest in reasoning.

The second wave, statistical learning (1990–present), describes the ability to recognise voices, faces and other images, subsequently attempting to train statistical models to learn. This wave's strengths are perception and learning, but weaker in abstracting and reasoning.

The third wave, contextual adaptation (2010–present), describes the construction of explanatory models for classes of real-world phenomena: the process of training a computer using extensive data that provides multiple examples of what is being analysed so mechanised decision processing can occur in a very short period of time. This wave's strengths lie in perception, learning and reasoning and less so in abstracting.[35–38]

Some predict that in wave four (2030 onward), AI will be capable of anticipating and performing most human tasks through abstract thought processing — features related more to artificial general intelligence (AGI).[39,40]

It is worth noting that advances in AI during waves one to three are not mutually exclusive, as certain aspects of each wave continue to be incorporated into ongoing research and developments in AI-based applications. In order to accommodate the development and implementation of increasingly complex designs in AI applications, however, the requirement for exponential increases in computing power is becoming more important than ever.

Launchbury surmised AI applications will be 'built around contextual models where over time, systems will learn how models should be structured, perceive the world based on that particular model, use that model to reason and make more precise decisions, and use that data to abstract further',[41] all important factors that affect our critical and non-critical decision processing.

Rosenblat's prediction of the feasibility of AI one day being able to 'construct an electronic or electromechanical system which will learn to recognize similarities or identities between patterns of optical, electrical, or tonal information, in a manner which may be closely analogous to the perceptual process of a biological brain'[42] has proven insightful and impressively accurate.

Aspects of AI are commonly categorised as 'narrow AI' ('*augmenting human intelligence* for important functions routinely performed by humans') or AGI.[43] Narrow AI, the largest area of AI exists in many current commercial applications in 'highly specialized systems that are very good at specific, well-defined tasks … and nothing else'.[44]

Certain advances in AI may not be considered beneficial by all generations. Individual interpretations of how AI can affect our lives and our responses to such changes can be significantly affected by our determination of whether we consider advances in AI as continuous (gradually impactive and less immediately disruptive) or non-continuous (dramatic and immediately impactive). We argue that our comfort level for AI-based innovation is influenced by generational factors — specifically that Baby Boomers, Gen Xers and Millennials have experienced very different technological milieus. The concepts of DIT and the distinction between continuous and discontinuous innovation are crucial elements in these differences.

Next, we examine the characteristics of specific generations and advances in technology that occurred during the associated time periods.

GENERATIONAL CHARACTERISTICS AND TECHNOLOGY INNOVATIONS

In Table 1 we categorise generations by years spanning each generation and corresponding age ranges (as at 2019), a brief summary of each generation's characteristics, and major technology innovations that occurred during the associated time periods.

Baby Boomers (1946–64)

An estimated 76m Baby Boomers were born during the post-Second World War era from 1946 to 1964. They experienced the Cold War era, a burgeoning hippie movement and a period of tremendous economic and productivity growth. This positively motivated generation was affirmed by *Time* magazine in 1967 when bestowing their annual 'man of the year' award.[45]

The Baby Boomer generation was catapulted into the world of technology: Apple computers, the World Wide Web, USB and Ethernet, DNA fingerprinting and Jarvik 7 — the first implantable artificial heart.[46] Commonly classified as optimistic, hard-working and desirous of keeping up with burgeoning changes in technology through both formal and self-education, this generation welcomed rapid changes with enthusiasm.

While Baby Boomers tend to have lower rates of adoption of technology than Gen Xers and Millennials, adoption rates have increased from 25 per cent in 2011 to 68 per cent in 2019.[47] Historically large consumers of traditional media such as television, radio, magazines and newspapers, many have transitioned to Facebook (90 per cent) and other social media platforms to remain in communication more easily with others.[48]

Gen Xers (1965–79)

Sandwiched between Baby Boomers and Millennials (sometimes referred to as the forgotten generation or 'neglected middle child'), an estimated 65m Gen Xers[49] experienced a multitude of innovations in technology: IBM introduced their first mass-produced computer operating system (OS/360); Digital Equipment Corporation (DEC) released the first computer to use integrated circuits; man went to the moon; optical fibre, video games and barcodes were introduced; and Cray Computing created the world's first super-computer (Cray-1).[50] Similar to Baby Boomers, Gen Xers enjoy accessing newspapers and non-electronic version of books and other media, but they too are electing to use social media platforms at increasing rates. They have a propensity to do their banking in person, although due to the reductions in physical banking facilities, are being forced into using electronically based financial transaction applications.[51]

Millennials/Gen Y/Gen Next (1980–94)

Millennials (sometimes categorised into subgroups Gen Y and Gen Next) are

Table 1: Generational classifications, characteristics and technology innovations

Year born	Age range	Generation classification	Generational characteristics	Technology trends
1946–64	55–73	Baby Boomers	Optimistic, hard-working, self-educating	Television was the emerging technology
1965–79	40–54	Generation X (Gen Xers)	Authority must be earned, education is important, appreciate sponsored learning	Rapid advancements in technology were occurring
1980–94	25–39	Millennials Generation Y Gen Next	Pragmatic, believe education never ends, quick to question, will work collaboratively	World Wide Web, connectivity, mobile applications

Source: Kayser, C. (2020), 'Cybercrime through Social Engineering – The New Global Crisis'

estimated to number 72m globally.[52] Starting in the 1990s, two of the most impactive technological inventions were the Internet and social media. These innovations greatly influenced how humans interacted and communicated, reshaped the art of physical (cursive) writing, made people less concerned about spelling accuracies due to auto-correction applications, and significantly affected the need to learn simple or complex calculations that could be achieved using a spreadsheet or smartphone. Millennials were the first generation to migrate en masse from conventional cable network television programming to streaming services such as Netflix, HBO and YouTube. Their rapid adoption of using smartphones, smart watches, computers, laptops and tablets, particularly via social media platforms, has become a preferred method of communication.

Millennials and Gen Ys are considered pragmatic, believe strongly in pursuing the best and highest level of education possible, are quick to challenge much of what they are taught, read or told, and continuously seek out products or services considered beneficial in conducting day-to-day activities, or providing personal enjoyment such as advances in entertainment.

Furthermore, we note that progressive generations have higher rates of adoption of advances in technology individually (see Table 2) and within the workplace (see Table 3).

Referencing a number of social theories and models, we next examine how each generation tends to regard advances in AI.

THE SOCIOLOGICAL ASPECTS OF AI-BASED DECISION PROCESSING

A short history of modernity

Philosophers such as John Locke and David Hume provided the basis for a new political philosophy (classical liberalism) and a throughgoing empiricism as the basis of knowledge obtained through the senses. Adam Smith's *The Wealth of Nations* (and his less well-known work, *Theory of the Moral Sentiments*) justified a nascent capitalist economy. Innovation became the hallmark of capitalist economics, recognised even by two of its most vehement critics, Marx and Engels.[53] Capitalism led to the creation of a unique Western culture conducive to individualisation and innovation, particularly

Table 2: Technology adoption by generation

Adoption by generation (%)				
Technology	**Baby Boomers (60–9)**	**Baby Boomers (51–9)**	**Gen Xers (35–50)**	**Millennials (18–34)**
Internet users	76	83	92	97
Broadband at home	60	66	72	76
Mobile phone	87	91	95	98
Smartphone	46	59	77	88
Tablet computer	41	35	55	52
Social media (any kind)	45	54	73	89
Facebook	46	52	71	80
Pinterest	17	19	32	36
Instagram	8	8	24	47
Twitter	8	8	24	47

Source: Rainie, L. and Perrin, A. (2016), 'Technology Adoption by Baby Boomers (and everybody else)', Pew Research

Table 3: Use of technology and applications in the workplace by generation

Application usage in the workplace	Baby Boomers	Gen Xers	Millennials
Computer-based word processing	69%	70%	72%
Online or cloud-based word processing/spreadsheets	33%	43%	51%
Collaboration	18%	23%	25%
Graphics/design/publishing	21%	19%	19%
Custom mobile app specific to job	15%	19%	23%
Customer management/marketing	12%	19%	14%
Financial / accounting	18%	13%	17%
Social media management	6%	10%	13%

Source: CompTIA's Managing the Multigenerational workforce study, n = 995 (2017)

in the US, Canada and Western Europe, sometimes referred to as WEIRDness (Western, Educated, Industrialised, Rich and Democratic).[54] We embody a cultural constellation of values and life circumstances that are unique in human history. These characteristics enable us to be open to innovation in ways considered unimaginable to our pre-Enlightenment ancestors, and pose wicked problems never before graced by humans.

Shoshana Zuboff contends that 'Capitalism evolves in response to the needs of people in a time and place', and that assembly line production produced 'the first modernity'. Digital innovation produced 'the second modernity'. Both resulted in distinctive forms of individuation.[55]

The first modernity is rooted in the logic of the assembly line (first decade of the 20th century) and is based on 'the transformational power of a new logic of high-volume, low-unit-cost production' that created 'a thriving population of mass consumers'.[56] Protection of rights and safety of workers and consumers such as provided by the FDA and durable employment systems that included civil service tests and organisational career ladders were hallmarks. Individuation increased, but 'You adapted to what the world had to offer, and you followed the rules'.[57]

The second modernity, Zuboff argues, is most clearly illustrated by the introduction of the Apple iPod in 2001. In contrast to such innovations as Napster, the iPod 'aligned the company with the changing needs of individuals while working with industry incumbents'.[58] This modernity involves 'a new society of people born to a sense of psychological individuality, with its double-edged birthright of liberation and necessity'[59] — a society that, based upon the characteristics of specific generations, produces different rates of understanding and adoption of advances, such as in AI, as it pertains to their perceived benefits and needs, either voluntarily or involuntarily.

BEHAVIOURAL ANALYSIS OF GENERATIONAL DIFFERENCES

The concept of 'generation', referring to a group of people who were born or came of age about the same time, is a social construct. It is useful in understanding what people — especially those of the same cohort — are likely to share in terms of life experiences and cultural values, particularly as defined by Pierre Bourdieu's term, *habitus*.[60] Bourdieu's concept(s) of habitus, field, capital and practice are relevant to our argument that generational differences must be considered in understanding the acceptance of AI-related innovations. Power provides an excellent summary of widely accepted definitions of these concepts:[61]

- Habitus is a set of dispositions, internal to the individual that reflects external social structures and shapes how the individual perceives the world and acts in it;[62]
- Fields are structured spaces organised around particular types of capital consisting of dominant and subordinate positions; fields cannot exist without capital.[63] There are as many types of field as there are forms of capital;[64]
- Capital, as defined by Bourdieu, consists of four main types: economic, cultural, social and symbolic;[65]
- Practice, according to Swartz,[66] conceptualises this concept as 'action as the outcome of a relationship between habitus, capital, and field [and that] practices are not to be reduced to either habitus or field but grow out of the "interrelationship" established at each point in time by the sets of relations represented by both.'[67]

We can consider that members of a generational cohort will be more engaged in competing for various types of capital with other members of that cohort than they will be with those who are older or younger. They will be competing in fields which they have not made, however, and are therefore dependent upon structures created by previous generations. In societies marked by WEIRDness (as described above) continuous innovation is valued.

Mannheim noted that those within specific generations will share some immanent attributes, generational consciousness or communal characteristics, providing four requirements are met: shared experiences, actual cohesion, common attitudes and forms of behaviour.[68] These characteristics provide insight into how social influences within generations can be significant contributors to whether various members of a generation might feel compelled to investigate and adopt certain innovations in technology.

Davis' TAM suggests that a person's acceptance of computer-related technology is partially based on two beliefs: perceived usefulness (PU) — belief that using a particular form of technology will improve an action that the technology can perform or assist in performing; and perceived ease of use (PEU) — the degree of effortlessness perceived by the individual to use that technology.[69] Both Mannheim's and Davis' proposals would apply to the decision processing of all generations when deciding whether to consider investigating and adopting a new technology.

Older generations are unlikely to be adopters of innovations that are lower on PU and PEU,[70] or are radical or discontinuous (ie that challenge existing ways of doing things). Habitus leads an older generation to weigh PU and PEU as to likely risks and benefits (Baby Boomers versus Gen Xers versus Millennials). As a generation ages, it has more capital invested in the fields which it has structured and has less interest in innovation — especially if that innovation requires new learning or different allocations of capital.

Members of the rising generation who seek to implement discontinuous innovation are more likely to fail, but should they succeed, stand to reap substantial benefits in economic, cultural and social capital from members of their own generation.

Innovators are likely to come from rising generations because they have less invested in the existing order (perhaps less invested in symbolic capital). We define laggards and late majority adopters as those who have invested significant amounts of capital in perfecting their practice in established fields. Early adopters and early majority subgroups are likely to come from younger generations who have fewer investments in the status quo and are more likely to have greater capital to invest than the members of the early majority subgroup.

Complexity increases the costs of innovation and the restructuring of habitus required to adopt the innovation. Conversely,

trialability (ability to implement elements of a programme without committing to the whole programme) increases the likelihood that an innovation can be structured to pose the least disruption to existing fields and practices.

Our model assumes that the rising generation values the opportunity to compete in the fields established by the older generation, and in general, support the economic goals set by the dominant culture and accept the legitimated means for achieving those goals.[71] In our model, this means that the rising generation values the capital — economic, social, cultural and symbolic — that the older generation controls. In turbulent times, such as the 1960s,[72] a significant portion of the rising generation may reject the accepted means and cultural goals of the established generation. In Merton's classic analysis, a tendency toward rebellion as a mode of adaptation may increase and the social value of conformity may decrease.

By incorporating digital technology into our lives, humans can become smarter and wiser and in doing so, will ultimately increase our 'digital wisdom'.[73] While suggested that there can be significant risks related to advancements in technology, including AI, it is also recognised that 'We have come to believe that technological systems based on cognition are a panacea to resolve modern crises'.[74]

Many have credited Albert Einstein with professing: 'We cannot solve our problems with the same level of thinking that created them.' These words describe the importance of why we must consider enhancing liveability and efficiency by advances in technology. Older generations, however, unfamiliar with such advances, could find adopting radical changes much more difficult than generations born into a society of more commonplace technological innovation.

Reasons why we may not be successful in expanding our digital wisdom include:

- Making decisions based on partial information only;
- Forming inaccurate assumptions;
- Depending on applying educated guesses in an effort to verify our thoughts or decisions;
- Limiting our ability to determine what-if scenarios;
- Inability to deal effectively with complex decisions;
- Distinguishing the differences between emotional responses and rational conclusions.[75]

These roadblocks can become significant factors in decision processing when analysing the merits of technological advances, and potential values or threats.

SOCIAL THEORIES AND MODELS

Theory of planned behaviour

Ajzen's TPB addresses processes of self-control and focuses upon one's attitude, behavioural intention, subjective norms (elements of habitus), social norms, perceived power (elements of capital) and perceived behavioural control (characteristic of fields) in the decision to pursue innovation (practice).[76]

1. *Attitude* refers to concerns related to outcomes of performing a behaviour; using technology to perform functions previously conducted without the use of technology;
2. *Behavioural intention* is the level of motivation to want to incorporate technology into our lives; the more motivated to do so, the more likely we will;
3. *Subjective norms* are levels of approval or disapproval others would assign to their behaviour for commencing the usage of technology to facilitate certain functions;
4. *Social norms* — if others within their social groups are using technology, this would be considered normative or standard practice;

5. *Perceived power* is a person's perception of how their behaviour, when using technology, would facilitate or impede their personal performance while doing so;
6. *Perceived behavioural control* describes one's perception of the ease or difficulty related to attempting to use some form of technology.[77]

Next, we analyse how Ajzen's processes of self-control correspond to Baby Boomers, Gen Xers, and Millennials.

Baby Boomers tend to be accepting of risk, are assertive and articulate and have a strong desire to pursue advanced education.[78] Their passion for higher education supports their efforts to understand the advantages new technology can represent, and in learning how to use advances in technology. They perceive advantages of incorporating innovations in technology to perform tasks more quickly and accurately. Baby Boomers enjoy exploring new technology, and welcome acknowledgement from their peers for their curiosity, courage and ability to embrace new technology, while appreciating confirmation from peers for doing so.

Gen Xers, witnessing many changes in technology that provided more efficient ways to complete certain tasks, also tend to seek out advances in technology. Their pursuit of innovative education aids their ability to learn how to use existing or advancing technology.

Millennials/Gen Y/Gen Next have embraced technology with almost non-limiting reservations, primarily due to how the World Wide Web has affected their lives — a means to connect with others anywhere in the world at the stroke of a key, often through the utilisation of an unprecedented array of mobile applications. They are motivated to use the latest versions of technology, largely due to their passion to learn; are sensitive to being recognised as technologically competent; consider incorporating technology to complete multiple tasks; and have few challenges learning how to use new technological innovations, due also to their ongoing pursuit of education, ability to learn online and from other technology-savvy peers.

Diffusion of innovations theory

Rogers' DIT details a series of sequenced elements: knowledge, persuasion, decision, implementation and confirmation.[79] Knowledge and persuasion may not be distinct, however, as habitus influences both knowledge and persuadability. Habitus predisposes a person to favour some forms of knowledge over others (eg religious over scientific or vice versa) and cultural values that can affect persuadability. A subsequent decision will involve a consideration of the various types of capital that will be needed and the gains that the innovation might yield.

DIT shows how over time, ideas or new types of product can gain momentum within a specific population through a process of diffusion, or spread, based upon someone's perception of the innovativeness of a product, idea or behaviour.[80] Rogers' five required steps that determine how individuals, groups or communities adopt new forms of innovation is representative of structured decision processing. Figure 2 outlines these steps (which may or may not occur in the sequence in which they are presented):

1. *Knowledge* refers to an awareness of an innovation and an attempt to understand it. There are three specific questions that majority adopters and laggards want answered in this step: 1) features of the innovation; 2) what is required to adopt the particular innovation; and 3) who can provide assistance in adopting the innovation;[82]
2. *Persuasion* is the process of forming an opinion or attitude whether the innovation is worthy of consideration;

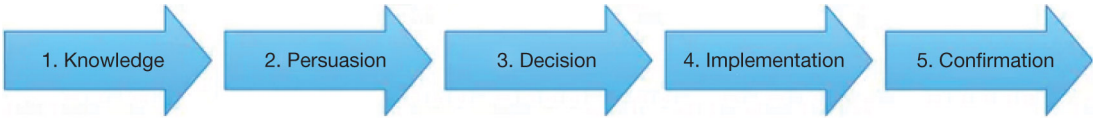

Figure 2: The innovation-decision process for individuals according to Rogers
Source: Singer[81]

3. *Decision* [making] is the initial phase of consideration of adoption of the innovation; if so, it will likely take time to evaluate the merits of embracing or adopting the innovation;
4. *Implementation* is the process of commencing the use of the innovation, evaluating it and adapting to any modifications that may be required to gain the most benefit from the innovation;
5. *Confirmation* results from the reinforcement of decisions to adopt and use an innovation — a continuum of decision-making processing to confirm whether or not the innovation is worth continuing to use or reject after extensive analysis.[83]

In the process of adoption of innovation, Rogers notes that the majority of a target population will fall within the middle category of five established adopter categories:

1. *Innovators* want to be the first to try an innovation. As risk takers, they require little to no persuasion to experience an innovation. This would apply to current generations who are much less risk-adverse;
2. *Early adopters* are aware of a need for change; their opinions tend to be highly regarded, and they do not need extensive amounts of information to examine and test new ideas;
3. *Early majority* types will not lead the way in trying or adopting new technologies, but do so more quickly than the average person;
4. *Late majority* adopters are leery of change, and only willing to consider adoption of innovations after they see empirical evidence that others have tried it, as well as their rates of success in doing so;
5. *Laggards* adopt a conservative approach to altering traditional means of conducting their lives, sometimes accepting change only through peer pressure or a need to upgrade outdated versions of applications.[84]

Finally, Rogers identifies five attributes related to innovation that will contribute to the rate of adoption, based on someone's perception of the value of the innovation:

1. *Relative advantage* is an estimation of the degree, if any, of how an innovation will improve upon previous innovations addressing similar needs or requirements;
2. *Compatibility* requires a decision whether the innovation satisfies the individual's requirements, value system and previous experiences;
3. *Complexity* relates to the adoption of an innovation, and determining if the process of adapting to the technology will be so difficult that efforts to do so may not be worthwhile;
4. *Trialability* examines whether the innovation can be tested prior to being adopted;
5. *Observability* is the process of questioning the results obtained when using the innovation, either by the individual or by observing others doing so.[85]

Reflecting upon these social models and theories, we contend that in combination with the characteristics and tendencies

related to specific generations, there are numerous factors that help to better understand different rates of adoption of advancements in technology by different generations, specifically those associated with advances in AI. While some aspects of decision processing are shared across different generations, other factors specific to familiarity and varying comfort levels, as well as perceptions of the PU and PEU of AI-based solutions, remain individualistic, as noted by our examples.

CONCLUSION

Theoretically, if quality of life can be enhanced by incorporating technology into daily routines, especially as it pertains to advances in AI, why do all generations not embrace such changes equally? Our analysis postulates that different generations vary in their willingness to adopt and incorporate technology into their lives based on the following factors we classify as opportunities and threats.

Opportunities

Subsequent generations are exposed to technological innovations at earlier stages in their lives, resulting in a 'natural process' of acceptance through primary socialisation.

Continuous and discontinuous innovations have different trajectories. While there exists no common unit of measurement that can be used to measure specific benefits of advances in AI or other forms of technology in general terms, we observed that each generation has its own criteria when determining the benefits of accepting and incorporating technological change. For those advancements collectively recognised as obvious beneficial changes in technology, such as automobile anti-lock braking and accident-prevention detection systems, acceptance tends to be more equally distributed, regardless of generational preferences.

Threats

When forced to adopt new methods of performing tasks and conducting routine activities, elevated levels of anxiety can be experienced by any generation.

Decline in developments in AI from the late 1980s through 2000[86] provided an extended period of time for those who had not determined sufficient advantages related to PU or PEU of past and existing developments in AI to embrace them. As these technological changes became more normalised and continuous within society, and acceptance rates increased, many who had previously rejected embracing advances in technology became willing to do so.

Technological change often produces 'unearned losses'. Technological innovation can dramatically alter or disrupt the development of intimate relationships or career paths. Baby Boomers may perceive that their jobs could be threatened by efficiencies introduced through AI.[87,88] Retraining may pose significant challenges for older workers, based upon disruptive innovations. Some studies reveal, however, that many aspects of AI have resulted in increased rates of return for organisations and employee satisfaction, and create more jobs than fewer.[89–91]

Given the rapidity of advances of AI, and their incorporation by organisations and manufacturers becoming more commonplace, additional research needs to be conducted to understand variances in acceptance and adoption rates by different generations. Amazon's CEO's letter to employees stating 'If you get it right, a few years after a surprising invention, the new thing has become normal' reflects how we are adapting more rapidly to changes in technology.[92] For the time it takes for normalcy to occur, different generations will continue to evaluate continuous and discontinuous change based on their specific generational tendencies. As advances in technology, particularly in AI, become more commonplace, understanding how to convey advantages of

these advancements will become increasingly more complicated — hence the need for additional research to bring generations closer together in their understanding of AI, how to effectively evaluate the PU and PEU of technological innovations and how to introduce technological change most effectively into their lives.

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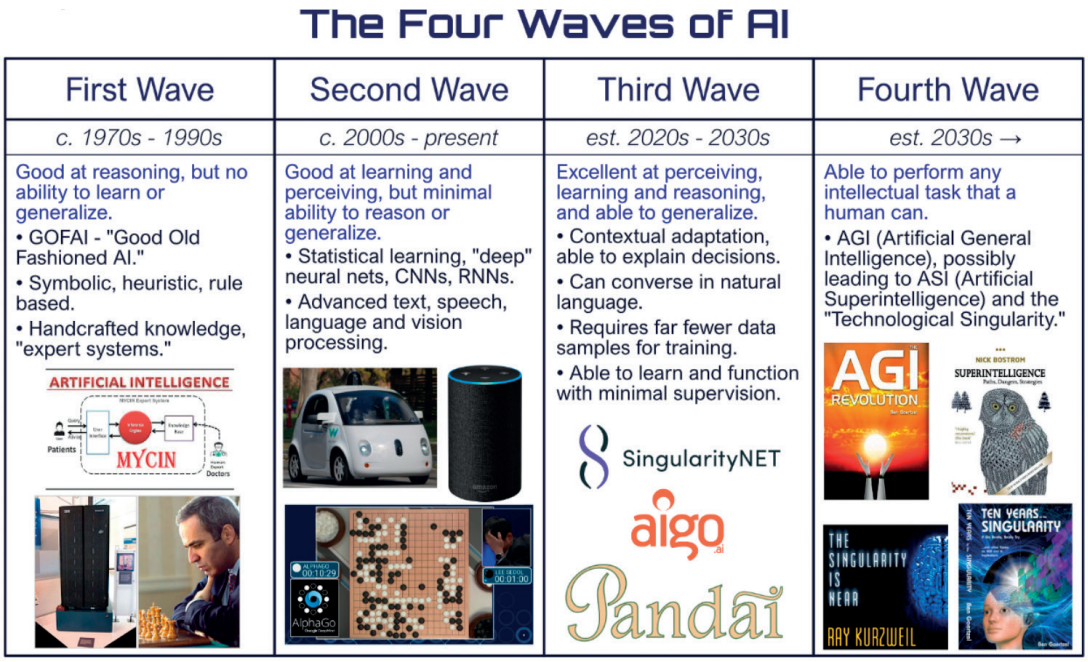
APPENDIX



Six Kin Development (adapted from DARPA's "Three Waves of AI")

Source: Jones[93]