Artificial Intelligence and Universal Design

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Major social and economic changes challenge people to think about the world in a different way, and outside the comfortable frameworks within which they have previously operated. Universal design confronts the established marketing paradigm where people are divided into segments based on particular characteristics and demographics. Instead, universal design asks that we take a holistic view of the population that encourages inclusion, equity, and avoids creating barriers to participation. Artificial intelligence challenges established assumptions of human beings as decision-makers and controllers of the world. Instead, it asks us to trust machines to be sufficiently intelligent and trustworthy to make decisions for us. So, if machines are to be truly intelligent they must grapple with the diversity of the human condition otherwise the benefits will not be equitably distributed across the spectrum of our different communities. Consequently, the development of artificial intelligence, machine learning and big data need to be underpinned by the concepts and principles of universal design (Center for Universal Design, 1997).

Universal Design

Universal Design (UD) is the means by which to achieve inclusion and inclusiveness. It is not a design discipline in its own right but a design concept that should underpin the design of everything in our world – places, spaces, services, products, policies, technology, education, entertainment, tourism and travel, for example. The principles and goals of UD guide designers to think about accommodating aspects such as different body shapes and sizes, intellectual and physical capacities, and cultural and religious affiliations (Steinfeld and Maisel, 2012). Although universal design is most commonly considered in the built environment, it is also considered in ICT, teaching and learning, service provision, written documents, and in policy development (Centre for Excellence in Universal Design Home Page).

UD also supports human rights – the right to have access to, and participate in, places, things, and activities on an equal basis with others. Human rights legislation for people with disability (Disability Discrimination Act, 1992) has created a regulatory framework for access standards, particularly in the built environment. The standards and codes supporting the legislation, while necessary, have served to confuse so that the term “universal design” is used interchangeably with disability access, or the hybrid, “universal access”. This is why universal design is often understood as “disability design” (Bringolf 2009, 2011). Notions of segregation and segmentation occurs as this group is perceived as needing special and different designs, products and services. Hence people with disability are often considered an afterthought to mainstream design thinking and this results in tacked-on ramps to

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buildings, segregated housing, and separate sections in policy documents. Inclusion by exception is not inclusion at all.

As far as possible, UD is about including everyone – it goes beyond the access codes. However, some individuals will need specialist technology, such as a guide dog, or wheelchair. This is one area where artificial intelligence has the potential to add a suite of specialist assistive technologies that will benefit people with disability. For example, technology that will do the work of a guide dog, and a wheelchair that can drive itself.

A key area for policy-makers and others who design regulations and policies is to think of the whole population and the diverse nature of the human condition. Age, size, body shape, cognition, level of education, capacity to undertake tasks, religious affiliation, sexual orientation, and cultural background all have to be considered. However, the voices of those who are in the tails of the population bell curve are rarely heard in the development of policies, plans, procedures, regulations and laws. This is where the other underpinning principle of UD comes into play and it has several labels: human-centred design, participative design, consultative design, and user-led design. They all approximate to the same thing – consult widely and find ways to include the voices of those who have traditionally been left out in the past.

Artificial Intelligence

Artificial Intelligence (AI) provides us with many opportunities and challenges. It can transform the way we live our lives by making machines sufficiently intelligent and able to operate with foresight in the environment (Nilsson, 2010). AI has the potential to enhance the lives of people with disability, older people, children and others who are not catered for in the everyday provision of goods and services. While AI holds promises of life enhancing technology for those who might be considered disadvantaged, they might also be subjected to being the most disenfranchised. When bots of all kinds can learn and relearn and adapt to changes in the environment, any bias in the programming and algorithms could serve to reinforce their disadvantage. Who has the control here? This raises questions of trust, ethics, intellectual property and regulations. Applying the principles UD can help inform and develop trust, ethics and regulation – at the beginning of policy and research documents and at the beginning of development and design processes. If not, there is a risk of needing to retrofit a metaphorical tacked-on ramp.

UD and AI can work together

Can AI be racist? This is a question asked in a Microsoft Inclusive Design Team blog post (Chou, Murillo & Ibars, 2017). Microsoft and other software developers have been following UD principles, or inclusive design as they prefer to call it, in the development of their software for some time now. They found that by designing for the broadest possible number of users they have created more accessible, convenient, and useable programs and apps for everyone. Microsoft claims its first inclusive design principle is to recognise exclusion and identify bias, which could apply to any design professional. The article discusses and describes five biases: Association, Dataset, Interaction, Automation, and Confirmation bias. Microsoft has recognised that by identifying who is excluded rather

than trying to focus ways to include everyone has made the task easier. A similar approach was developed some ten years ago by the Inclusive Design Team at the Engineering Design Centre, University of Cambridge in UK.

The Inclusive Design Team, through the development of their Inclusive Design Toolkit (Clarkson, et al, 2007) and their Exclusion Calculator, used population demographics and other factors to ascertain how many people will be left out of a design based on a particular level of ability such as seeing, hearing, lifting, grasping, etc. For example, making something useable for people with poor grip strength (eg a lever handle) makes it easier for everyone – it does not exclude people with good grip strength.

Designing universally, inclusively, from the start, provides a good platform not just for equity and fairness, but also for better outcomes for everyone. When prospective users are involved in design processes they are more likely to feel the technology can be trusted. AI should lead to greater fairness if everyone is judged by the same rules. We just need to make sure that as far as possible bias is eliminated. If not, discrimination will be reinforced within the processes, and algorithms and individuals could find themselves outside a system that won't let them in, especially if there is no person, algorithm or machine to appeal to.

Inclusion, Fairness, UD and AI

Technology can both divide and unite. Some advances have particularly helped many people with disability to participate in everyday activities. Early speech recognition software allowed non-verbal people to communicate. That software has developed to a stage where it is mainstream on smart phones and other devices. What was specialised design is now mainstream. This is worth bearing in mind for all future developments. Design for diversity and it is likely you will encompass the broader population. However, those who are not connected to what is now considered everyday technology such as home computers and smart phones run the risk of being left out entirely, or at best, partially.

Not all Australians are connected equally. The Australian Household Use of Information Technology (Australian Bureau of Statistics, 2018) report says Australians are doing more online, and we are using an increasing number of connected devices. Our homes are more connected, but almost 2.6 million Australians, according to these ABS figures, do not use the internet. Age is a critical factor. While more than nine in ten people aged between 15 to 54 years are internet users, the number drops to eight in ten of those aged 55-64 years, and to under six in ten of those over 65 years.

As younger generations age it is thought that the digital divide will lessen, but age is not the only barrier to the uptake of technology. With Internet and broadband services unequally spread across the continent, regional and rural dwellers are immediately at risk of being left out of the data and the risk of bias immediately arises.

Apart from major software companies, the business sector is yet to be convinced of the economic arguments of inclusion. One exception is the tourism industry (Lonely Planet, 2018), which is recognising that people with disability travel and they often travel with family. Consequently, inaccessible destinations exclude whole families, not just the

individual. However, this particular business case has yet to take hold in other business sectors. So, will cost-benefit ratios and profit margins be deciding factors in algorithms? AI holds the prospect of creating much public good and civic value. But who will measure and count the common good in AI? Can fairness prevail in such circumstances? AI also has the potential to provide good decisions based on big datasets, but will political decision-makers heed the advice of AI when it suits and ignore it when it does not? AI has the promise of benefits for all, but much will depend on the underpinning principles: public good, profit, and/or political expediency.

Human Rights, UD and AI

Algorithms are coded on data that are based on past information and statistics. It does not invent the future. This is where human input is required. The right to privacy and security and options for data disclosure is a key issue. Questions arise such as who will have the power to see and use the data? Will information about data and data collection processes be made transparent and provided in formats that everyone can understand regardless of their intellectual capacity, language skills, literacy levels and physical capabilities? Will data collection processes fail to capture those who are yet to be connected to the requisite technology? If AI can learn to be inclusive there should be little or no need to protect people from discrimination. Inclusive thinking in design should minimise the need for separate formats, policies, standards, designs, or codes to meet the Disability Discrimination Act, the UN Convention on the Rights of Persons with Disabilities, or Australia's National Disability Strategy.

Connected and Automated Vehicles

One area of AI that is capturing public attention is connected and automated vehicles. Trials of driverless vehicles are being conducted across the world with the aim of eliminating human drivers. Some of the technology is available in new model cars, such as automatic braking, and computer driven parking. The claim is that road accidents will reduce significantly as human error is removed. The promise of access to point-to-point transportation for people currently unable to hold a driver's licence is very appealing. The early trials and designs of vehicles are providing a learning ground for inclusive AI. For example, touch screens are of little use to people who are blind. Voice activation is a similar issue for people who are non-verbal. Voice activated instructions are problematic for people who are deaf. A step up to the vehicle is a barrier for a wheelchair user or a parent with a baby stroller. Solving these issues is the role of universal design.

Summary

AI holds the promise of life-enhancing technologies. However, the benefits must be enjoyed by all. If machines are designed to learn from data and algorithms they must also learn to be inclusive. Indeed, AI has the potential to be less biased than humans if programed with concepts of inclusion as a major component. Therefore the principles and goals of universal design and inclusive practice need to be considered from the outset whether it is a research document, a policy document or a design manual. Consulting widely with those whose voices are often left unheard is a key aspect of the universal design process. We are now

entering a world where AI can offer greater inclusion, but only if we think of it first and foremost. Inclusion cannot be tacked on as a separate endeavour part way through the process.

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