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## Bruce Maguire, Lead Policy Advisor, Vision Australia

I was home from school sick the day that Neil Armstrong walked on the moon in July 1969. It’s no fun being sick, and of course it’s beyond devastating to be home from school. But I managed as best I could, and it did mean that I was able to record the entire moon landing and moon-walk on my 7-inch reel-to-reel.

(“Dad! What's a reel to reel?” “Be quiet son and let the man tell you – I think it’s something you use when you go fishing.”)

Now I realise that if you’re in Generation Y or later you may never have heard of a reel-to-reel tape recorder, but back in the late '60s it was a cool piece of technology to own because you could record in audio all the important moments in your life. Which is what I was doing while I was home sick from school on that July Monday almost 47 years ago.

A much lesser-known event that occurred in 1969 was the release of a small book called “Prayer for the '70s”, by Norman Corwin. Eddie Albert recorded it, and you could buy it on a 7-inch 45.

(“Dad! What’s a 45?” “Be Quiet son and see if the man tells us – I think it’s a type of gun.”)

Of course, vinyl records were everywhere in the 1960s, and the 7-inch ones that spun at 45 revolutions per minute (rpm) were affectionately known as 45s, and because the record companies could record one song on each side, they were usually called “singles”.

So, on the 7-inch single of “Prayer for the '70s”, Eddie Albert spoke of how ancient miracles had been “trumped by solemn science: Daily the Patent Office registers intenser magic than the burning bush; The serpent from the rod becomes a ruby laser; The leper is healed by mycins; The blind draws vision from an eye bank.”

There was, back then, an abiding sense that if we couldn’t all follow Neil Armstrong and walk on the moon, then we could all at least walk on the summit of the technological mountain – because we had reached the pinnacle of technological achievement, immersed in our tape recorders and our 45s.

It’s rather awesome, in every sense of the word, to reflect that much of the technology that we thought of as cutting-edge and took for granted back in the '60s is now virtually unheard-of and unknown by anyone born after about 1985. And conversely, much of the technology that we now take for granted was not even imagined by most people 40 or so years ago. As a blind kid I certainly never imagined that technological developments would one day threaten to throttle my participation in the world. If someone had said, “there are going to be these things called touchscreens, and they’ll be everywhere, and they’re going to replace buttons and knobs and dials”, I would probably have thought, “Wow, how groovy – I’ll be able to use them – touch is something I can do as a blind person”.

And someone might just have said that to me back in the ‘60s, because the touchscreen is actually a product of the '60s, and the accessibility issues associated with touchscreens may even have been foreseen back then by the visionaries in the blind community.

In October 1965, E.A. Johnson wrote a short article called “Touch Display – A novel input/output device for computers”. This article was published on pp.219-220 in a journal titled Electronic Letters. Johnson worked at the Royal Radar Establishment at Malvern, UK, and in the article he described a touchscreen that he had invented, based on a mechanism that is still used in many smartphones and other devices today.

Before we go any further, we need to be clear about what we mean by a touchscreen. It’s a word that we are hearing - and possibly fearing - increasingly, but what exactly is a touchscreen? Here is one definition:

“{A touchscreen is a} type of electronic display that senses physical touch by a person’s hand or fingers, or by devices such as a stylus, and then performs actions based on the location of the touch as well as the number of touches.” (slightly adapted from <http://lms.abuad.edu.ng/claroline/work/user_work.php?cmd=exDownload&authId=1193&assigId=&workId=32&cidReset=true&cidReq=EMS303MAN>, Slide 2).

There are three basic types of touchscreen, known as Resistive, Capacitive, and Surface Acoustic Wave. The differences between them are in the mechanisms used for recognising where the screen has been touched, so that the device can respond appropriately, for example, by displaying a number, recognising text input, or whatever it has been programmed to do.

The capacitive touchscreen is actually what Eric Johnson invented in 1965, and it is still used in many devices today, such as high-end smartphones. So the 1960s live on, even though we don’t buy singles anymore or record our lives on reel-to-reel tape.

You’ll be pleased to know that we’re going to talk about coffee in a minute, but before we do that I want to emphasise two things: firstly, touchscreen technology is no more inherently inaccessible to people who are blind or have low vision than other visual display technologies. What I mean by that is that unless audio or braille interfaces are added, touchscreens are not accessible, but neither are other types of visual displays such as computer monitors or LCD panels on appliances like microwave ovens. Once the computer has calculated the point where the screen was touched, it can equally provide audio feedback as visual feedback, and it can pre-assign a certain region of the touchscreen to turn audio feedback on when it is touched. It’s all in the programming, not the underlying technology.

The second thing I want to emphasise follows on from this: touchscreen technology is not new. it has been developing for fifty years. The accessibility implications of touchscreens have been there for all to see for all that time – they haven’t just been sprung upon us – we didn’t wake up one morning to find that the world has been taken over by touchscreens. Touchscreens are inaccessible to the extent - and only to the extent - that humans program them to be. What has happened recently, though, is that we have reached a “tipping point”: touchscreens have begun to proliferate at an unprecedented rate, and that trend will only escalate. If we continue to banish touchscreen accessibility to the backwaters of our advocacy and policy-making, then increasingly those of us who are blind or have low vision will be locked out of participating in the mainstream.

I own 15 coffee machines, from a stainless steel plunger, to a 1950s Pyrex stovetop percolator, to an electric coffee siphon, to an Espresso machine with a double boiler and a ferocious steam wand, to a Mypressi Twist that is powered by small gas cartridges. Early last year I decided to replace my 2008 Nespresso machine with the latest model. In case you haven’t come across it, Nespresso is the line of coffee machines and capsules from Nestle that George Clooney uses. The Nespresso capsules are very convenient, come in over 15 varieties, and produce consistently good coffee. So in January last year I paid a visit to one of the Nespresso shops in Sydney (they actually call them Boutiques). The Manager greeted me and offered to give me a tour of the various machines in the shop (I mean the Boutique). After showing me a couple of the basic models that had tactile buttons and were easy to use, she took me over to another part of the shop and said, “you’ll love this one. You can choose from three different coffee strengths, or you can program your own, and you can program the amount of milk you want when making a cappuccino. It’s got everything”. I felt around the machine and said, ”but where are the buttons to do all those things?”. “Well, that’s the great thing about this machine,” she said proudly, “there are no buttons – you just use the touchscreen here and you just touch the option you want.” “But how am I going to know where to touch the screen when I can’t see it and there are no buttons?” I said.

There was a pause in the conversation at this point. The shop Manager was experiencing a moment of profound revelation about our society’s reliance on vision, while I was experiencing a "yet-another-manmade-accessibility-barrier" moment. Eventually she said brightly, “well never mind, we still have machines with buttons”.

That was almost 18 months ago. I know you can still get Nespresso machines with buttons, but there probably aren’t as many as there were before, and this time next year there probably won’t be as many as there are now. The trend in household appliances is to replace buttons, knobs and dials with touchscreens. There have actually been touchscreen-controlled coffee machines available since 2008, and now there are at least six well-known manufacturers that use touchscreens on their top models.

The amplifier that is part of my hifi system has a touchscreen and I can only use it because it also has a remote control. The remote control doesn't provide access to certain functions though, so I can’t interact with the amp's settings at all. If I replaced my electric treadmill I’d have to look carefully to find a model that didn’t have a touchscreen. I recently bought a new mobile broadband modem. The top model, and the one with the most functions, had a touchscreen and there was no mention that it was accessible to me as a blind person.

During the presentation I gave at the 2013 Round Table conference, I mentioned that there is a small dry cleaning boutique in walking distance of where I live. They have a lockable box on the outside so that you can collect your clothes after the shop has closed. You unlock the box by entering a PIN, which is the last four digits of your mobile phone number. The keypad for entering the PIN is on a touchscreen, and is completely inaccessible if you can’t see it. So if I want to collect my dry cleaning the same day I drop it off, I have to stay home until it’s ready. I know it’s ready because they send me a text message. I read the text message on my iPhone, which also has a touchscreen. The difference between the dry cleaning collection box and the iPhone is that Apple have made the iPhone’s touchscreen substantially accessible, whereas the manufacturers of the box haven’t. Apple showed in 2009 that touchscreens can be made accessible “out of the box”; but I still can’t get my dry cleaning out of the box. That was true in 2013, and it’s just as true three years later. And I imagine that there are more of those touchscreen-controlled lockable boxes now than there were three years ago, just as there are more touchscreen-controlled information kiosks, coffee machines, treadmills, hifi systems, printers, modems and other devices. And they are all of them still inaccessible because that's how they've been programmed.

I mentioned earlier that touchscreens are only as inaccessible as human programmers design them to be, and in 2009 Apple released the iPhone 3GS with the Voiceover screen-reader, which provided a way for people who are blind to access the phone’s touchscreen. Since then, Apple have continued to provide non-visual (synthetic speech and braille) access to its products, including the iPad, the Apple Watch, and the Apple TV. Google and other companies have also provided non-visual access to tablets and smartphones that run the Android operating system. And in March this year, two braille notetakers were released that use touchscreen-based Android tablets.

If you’ve been following developments in touchscreen accessibility here in Australia over the past year or so you might be thinking to yourself, “this talk of 45s and coffee machines and treadmills is all well and good, but he’s ignoring the elephant in the room”. In this case, the elephant’s name is Albert. Albert is the mobile payment terminal released last year by the Commonwealth Bank. It is the first payment terminal in the world to be controlled entirely by a touchscreen – there is only one button, which activates the Merchant Menu that you interact with via the touchscreen. In particular, you enter your PIN using the touchscreen’s virtual keypad that is displayed on the screen. There are over 35,000 Alberts in use across Australia now, and the number is growing by several thousand a month. You can find them in cafes, restaurants, shops and other places where you would expect to pay for goods and services. It’s not just for paying for goods and services though: because it uses a touchscreen, the screen layouts and functions can be infinitely customised, so it can be used, for example, to pay bills, make donations to charities, maybe even book a ride on an elephant.

Albert is the quintessential example of a disruptive technology. Some of its disruptive elements affect the world of financial transactions generally, but Albert is proving to be particularly disruptive in the world of accessibility and in the blind and low vision community. You can start to feel the extent of this disruption as soon as you ask the question, “is Albert accessible to people who are blind or have low vision?”. Depending on who you ask, you’ll get answers like, “yes, definitely – I used it the other day to buy a coffee machine”; or, “no, it’s totally inaccessible – I tried to use it the other day to pay for lunch at a café and eventually gave up in disgust”; or, “yes it is accessible, once you get used to it and have enough practice first”, or, “whether it’s accessible is beside the point – it’s never going to be intuitive for blind people and we need to force them to bring back those traditional keypads that are so easy for us to use”. So I doubt that there’s much that I can say about Albert that won’t be contested, or even considered heretical by some. But I think that in many ways the kind of future and the quality of participation in the world that we as people who are blind or vision-impaired will experience, depends on how we choose now to engage with Albert and the issues that it raises.

For quite some time before the release of the Albert terminal, the Commonwealth Bank was having discussions with an accessibility centre in Germany about how to make sure that Albert would be usable by people who are blind or have low vision. The decision to choose innovation over tradition by dispensing with the usual keypad with physical keys in favour of a touchscreen-only keypad, had obvious ramifications for accessibility which the Bank wanted to address in an innovative way. Since 2002 Australia has been fortunate to have had voluntary standards for the accessibility of electronic banking, and while these aren't perfect, they have resulted in greater levels of accessibility to banking products and services than would otherwise have been achieved, and they have also meant that accessibility is less likely to be overlooked in the design of new products and services. It is worth noting that these standards need updating to take account of the new technologies that have been developed since 2002, and I strongly encourage the Round Table to join with other organisations in calling on the Australian Bankers' Association to begin the update process without delay.

The approach to accessibility that was devised for the Albert terminal involves using gestures supported by audio feedback to allow a person who is blind or has low vision to enter their PIN using the touchscreen. To enter each digit of the PIN, you start by imagining a pointer on the screen positioned on the number 5. You select the digits by using single-finger swipe gestures in the direction of the digit from 5 on a standard telephone-style keypad. For example, if you want to enter a 6, you swipe to the right, because 6 is to the right of the 5 on a keypad; if you want to enter 2, you swipe up once, because 2 is above the 5 on a standard keypad. By swiping up, down, left, right or diagonally you can select any of the 10 digits. To actually enter the digit once you've selected it with the swipes, you tap the screen once with two fingers. As you swipe, the terminal makes a swishing noise (which you can hear through the speaker or through headphones) so you know that the gesture is working, and once you enter a digit, it asks you in a synthetic voice to enter the next one. Once you've entered all the digits in your PIN in this way (there are generally 4 digits) you press on the screen for about one second with two fingers, and you receive spoken confirmation that the PIN has been submitted successfully. Albert is also able to announce the transaction amount, unlike other payment terminals, which have no spoken feedback at all.

At this point, you might ask, "is that all there is to it?" The answer is, "yes – and no". In a technical sense, yes, that's more-or-less all there is to it. But in the practical, messy and unpredictable world of daily life, there's much more to it than that. I'll mention just two factors that affect the way this approach translates from concept to practice.

The first factor is knowledge and familiarity. Using the Albert isn't intuitive for a person who is blind or has low vision. If you've never used one before and someone puts one in front of you, you won't know what to do with it. That's also true, though, of the iPhone and my Gryphon Diablo amplifier, which have a touchscreen; but it's also true of most of my coffee machines and my electric treadmill, which don't have a touchscreen. As people who are blind or have low vision, we have to learn how to use almost every household electrical appliance because we can't see the visual display or read the labels on the controls. We also had to learn the layout of a standard telephone keypad, and that the key with the dot on it (assuming it hasn't worn off with use) is the number 5. Many of us learnt that piece of information so long ago that we've forgotten there was ever a time when we didn't know it, and we think it's just intuitive. There is no question that using the Albert terminal as a blind or vision-impaired person requires knowledge of the accessibility features and practice in using them. There's also no question that at present there are insufficient opportunities for people to become familiar with the features and practise using them to the point that the process becomes intuitive.

The second factor that is affecting the use of Albert in practice is that the accessibility features have to be turned on, and the way you turn them on is by selecting them from the Merchant menu, which isn't accessible to a person who is blind or has low vision. What some people are finding is that merchants often have little or no knowledge of the accessibility features and how to enable them. I know that the Bank is working with merchants to raise awareness of the accessibility features, but, both in principle and in practice, access to Albert should not be dependent on interaction with the assistant in a shop (even if it's a boutique), restaurant waiter, or service provider. Until there is a way for users to activate the accessibility features themselves (for example, by pressing a certain part of the touchscreen twice quickly, or pressing the Menu button three times quickly) then I think the acceptance of Albert's accessibility features by the blindness and low vision community will be significantly compromised.

Vision Australia has regular discussions with the Bank about how Albert’s accessibility can be promoted and developed, and last year we assisted the Bank to run some familiarisation sessions in Sydney, Melbourne and Brisbane. The world is becoming increasingly reliant on touchscreen technology, and we believe that achieving independent access to this technology is fundamental to the continuing participation by people who are blind or have low vision in all areas of life. We want to work with organisations and companies such as the Commonwealth Bank who are doing something rather than nothing about improving access to touchscreens, because as more products become accessible, the easier it will be to convince other manufacturers that they should make their touchscreen-based products accessible as well.

The argument about whether the benefits of touchscreens outweigh the disadvantages was largely settled in the 1970s as the development of touchscreens began to accelerate. They aren't just the way of the future – they are the reality of the present, and the quality of the future for people who are blind or have low vision depends to a large extent on how strategically and collaboratively we choose to engage with this technology now. Touchscreens present new challenges, but they also present new opportunities for accessibility. If we are to overcome the challenges and take advantage of the opportunities, we will have to work together as a sector. If we don't work cooperatively together to achieve consensus, then instead of riding the technological waves we will find ourselves drowned by them.

The Round Table is in a unique position to offer leadership to the print disability sector, and to monitor and provide information about the work that is underway to develop international standards and guidelines around touchscreens, as well as related initiatives such as plans for the adoption in Australia of the European Standard for Accessible ICT Procurement (EN301 549), the release of new EU guidelines for web accessibility, and developments in public sector web accessibility in the US.

The prayer for the '70s that I touched on earlier concludes with a call for a miracle so that "man should love his kind in all his skins and pigments, and kill no more.". The next chance we'll have for another prayer for the '70s will be in 2070, a mere 54 years from now. I fervently hope that the blindness and low vision community will not find ourselves compelled to call for a miracle to give us independent access to coffee machines, treadmills, dry cleaning, banking services, and all the other aspects of life that in 2070 will be controlled by touchscreens. But whether we will need such a miracle depends on the choices that we, as a sector, make now, today and tomorrow. It's up to us – and that really is all there is to it.