The ghost in the machine: Legal challenges of neural interface devices

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Neural interface devices and the melding of mind and machine, challenge the law in determining where civil liability for injury, damage or loss should lie. The ability of the human mind to instruct and control these devices means that in a negligence action against a person with a neural interface device, determining the standard of care owed by him or her will be of paramount importance. This article considers some of the factors that may influence the court’s determination of the appropriate standard of care to be applied in this situation, leading to the conclusion that a new standard of care might evolve.

INTRODUCTION

Prosthetics are not new. For over 3000 years, people who have lost limbs have been offered the use of artificial limbs. Those limbs, sometimes crude in design, often functioned well. Carl Breshear, a Master Chief in the United States (US) Navy, continued the arduous task of Navy Diving, even after his leg was severed, thanks to his leg prosthesis. Similarly, Douglas Bader was a celebrated Second World War pilot who continued to fly, even after losing both legs in a pre-war accident.

The ability of the human mind to instruct and directly control these devices is fast becoming a reality – to the extent that a melding of mind and machine may occur. If this happens, the law may experience difficulty in establishing where liability for injury, damage or loss should lie. The law needs to carefully consider the common law liability of people with neural interface devices, for the damage they might cause.

Policy factors such as the benefits and risks to both society and the individual with the neural interface device will influence the development of the common law. A desire for certainty in the law suggests that answers to legal disputes should, as far as possible, be predictable. Even when a court departs from its own previous decisions, it often seeks a new rule which is consistent with the foundation of principles of the law so as not “to fracture a skeletal principle of our legal system”. The courts’ ability to move quickly enough to accommodate changes to society, as a result of the advancing technology, may impact adversely on those who have a neural interface device. To avoid this possibility, the legislature may be well advised to consider the issue of the civil liability of those with a neural device, before such a dispute arises in the court. This article seeks to identify the legal issues that may play a role in determining a negligence action where the defendant has a neural interface device.

The article proceeds as follows. First, the nature of neural interface devices is briefly discussed. It will be noted that the technology is revolutionary. Secondly, it summarises the law of negligence and highlights the key concern in terms of neural interface devices – that of establishing the appropriate standard of care. Thirdly, it examines competing arguments suggesting, on the one hand, that the standard of care applied will be the same as applies to the “ordinary person”, or, on the other hand that either a lower or higher standard of care would apply. If the standard is to be lower than the objective

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2 Carl Breshear’s story was immortalised in the Hollywood film Men of Honour.

3 Douglas Bader’s story can be found in Brickhill P, Reach for the Stars (WM Norton and Company, 1954).

standard this creates problems for the public because there would need to be compelling reasons why the public should be afforded less recourse in the event of injury. In an environment where the existence of the neural interface device might not be known to those interacting with the person, the standard should arguably be the same as the objective standard. It might be appropriate for the standard to be higher than the objective standard as a result of the expertise that might be necessary to facilitate the safe use of the neural interface device, that is, because the user has undertaken extensive training in the operation of the neural interface device. Finally, some concluding remarks will be made focusing on various policy factors which may be influential.

**NEURAL INTERFACE DEVICES**

The human senses, including sight, sound and touch, play an integral role in facilitating the interaction between people and electronic devices such as computers, scanners and multifarious mobile devices, “[b]ut remove those senses from the equation, and electronic devices can become our eyes and ears and even our arms and legs, taking in the world around us and interacting with it through man-made software and hardware”. Clausen assures us that this is already happening and according to neuroscientists like Crutcher, “[a]nything can happen”.

The creation of “neuro technologies to evaluate and treat nervous system disorders and to restore lost neural functions” is occurring “at the intersection of neuroscience, computer science, engineering and medicine”. This field of neurology is different from the advances in robotics where researchers strive to make robots more like human beings. Commonly known as androids, these new generation robots are designed “to function not as programmed industrial machines but as increasingly autonomous agents capable of taking on roles in our homes, schools, and offices previously carried out only by humans”.

In contrast, neural interface systems include devices that sense brain signals, a signal processor and a device to effect action, such as a neuroprosthetic limb, in clinical terms an assistive technology. For example, the person with a neuroprosthetic arm and hand wants to pick up a grape so neural impulses move from the brain to the signal processor. The signal processor interprets what the brain wants to happen and then sends instructions to the neuroprosthetic arm and hand. The arm and hand move towards the grape and as the neuroprosthetic fingers and thumb close in on the grape, signals are sent back to the signal processor notifying it of the pressure being applied to the grape. The signal processor sends impulses back to the brain which acknowledges what the fingers and thumb are “feeling” and, via the signal processor, the brain tells the fingers and thumb when to stop closing in on the grape, ensuring the grape does not get squashed. This type of “closed-loop” neural interface device is, for the purposes of this article, the type of device the defendant has and upon whom a standard of care is to be applied. See Figure 1 below for a graphic representation of how a closed-loop neural interface device works.

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6 Clausen, n 5.
10 Donoghue, n 8 at 512.
This closed-loop neural interface device is different from an “open-loop” neural interface device. An example of an open-loop neural interface device is a car that is controlled by the human mind. The neural impulses are interpreted by the car and it responds accordingly, but the car does not send messages back to the human brain directly. The neural interface devices, for the purposes of this article, must have the capacity to communicate with the human mind, not through the eyes or other senses but directly with the mind through the body’s nervous system. That is not to disregard the fact that the eyes and ears will be involved in decisions affecting the operation of the device but, just as the biological leg presses down on the car’s acceleration pedal, it does not require any other sense to determine the pressure to be applied. The biological leg, with the foot, communicates directly with the brain to operate the accelerator. Once the required speed is achieved, and this is confirmed by the eyes, the pressure applied to the accelerator is adjusted by the leg as instructed by the neural impulses. The ability for the neural interface device to communicate directly with the human mind, just as the biological limb does, makes the neural interface device analogous to a part of the human body. This is different from an open-loop neural interface device that can interpret neural impulses and then act, but does not communicate directly with the human mind. It is only through the use of the person’s eyes or other senses that decisions to send further instructions from the brain to the device can occur. These open-loop devices are similar to other tools upon which a person exerts control.

One of the major goals of neural interface devices is to work as “a kind of replacement part, or prosthesis, for the motor system” that offers a physical means to reconnect action intentions to the world. There are a number of neural interface devices that are being developed to assist those with particular ailments. Dr John P Donoghue, director of the Brain Science Program at Brown University, was awarded the KJ Zülch Prize in 2007 for pioneering BrainGate, a new brain implant that has allowed people with paralysis to move a computer cursor, to read email, control a television, play video games, control a wheelchair or operate a robotic arm – using thoughts alone. The DEKA Arm (or Luke Arm), a neuroprosthetic arm, was developed by Dean Kamen of DEKA Research and Development Corporation together with over 300 scientists. It was commissioned by the US Defense Advanced Research Projects Agency. A remarkable attribute of this neuroprosthetic arm is that the

12 The brain, spinal cord and nerves connecting to every other part of the body.
13 Donoghue, n 8 at 512.
14 Brown University Office of Media Relations, Brown Scientist John P Donoghue Wins Major Neuroscience Award, Press Release (20 August 2007), http://news.brown.edu/pressreleases/2007/08/neuroscience-award. Presently, the current version of BrainGate, BrainGate2, is undergoing clinical trials at Massachusetts General Hospital in Boston, Massachusetts and Stanford University Medical Center in Palo Alto, California: see http://www.braingate2.org/clinicalTrials.asp.
person can, through the neural impulses from the brain (efferent) and signals sent to the brain (afferent), pick up a grape or raisin and know the difference without looking.\textsuperscript{15} In early 2012, BrainGate and the DEKA Arm were used in combination to enable a person to give herself a drink of coffee for the first time since becoming paralysed almost 15 years earlier.\textsuperscript{16} In May 2014, the US Food and Drug Administration (FDA) approved the marketing of the DEKA Arm, enabling these devices to move from clinical trial to commercial availability.\textsuperscript{17}

Such sophisticated technology and integration of machine with the human body will raise legal issues, as Clausen believes that “melding brain and machine makes the latter an integral part of the individual”.\textsuperscript{18} The ability of the signal processor to accurately interpret the neural impulses is being improved but “unfortunately current prosthetic technology is a poor substitute” for the biological limb. Holm and Teck Chuan Voo believe that legal issues arise if it becomes impossible to distinguish between the will of the person and the operation of the technology, where the natural neural system assimilates with the technology.\textsuperscript{19} This article examines the impact of this technology on the standard of care of a person with a neural interface device. Ultimately, this impact on the law depends on whether neural interface devices and their incorporation with the human body is so radically different or unique from any other circumstance previously considered by the courts, that the law should recognise a different or unique application of the law of negligence.

**NEGLIGENCE**

Negligence proceedings in Australia are determined within a fault-based, common law system.\textsuperscript{20} To succeed in a negligence action, the plaintiff needs to establish, on the balance of probabilities, that: the plaintiff was owed a duty of care; the defendant breached that duty of care; and damage was caused (this last element includes a determination of causation and whether the “damage is within the scope of the defendant’s liability”).\textsuperscript{21}

The range of circumstances in which a duty of care is owed by one to another (fellow road users, employer and employee and the like) is very well traversed. Whether a person has a neural interface device or not is unlikely to affect whether that person owes a duty to another. The question of damage is similarly not likely to be affected. Proving a breach of duty will be considerably more difficult where there has been melding of mind and machine. For the purposes of this article, it will be assumed that the defendant, who has a neural interface device, owes a duty of care to the plaintiff.

In establishing whether a person has breached the duty in terms of a failure to take precautions against the risk of harm, there are a few matters which must be considered. First, the risk must be foreseeable, that is, a risk an ordinary person foresaw, or ought to have foreseen. Secondly, that risk must have not been insignificant. Finally, in the circumstances, a reasonable person in the position of the defendant would have taken the precautions.

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\textsuperscript{17} FDA, *FDA Allows Marketing of First Prosthetic Arm That Translates Signals From Person’s Muscles to Perform Complex Tasks*, Media Release (9 May 2014), http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm396688.htm.

\textsuperscript{18} Clausen, n 5 at 1080.


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STANDARD OF CARE

Should the standard of care for a person with a neural interface device be different from the standard of care that normally applies?²²

The court applies an objective test when determining the standard of care in a matter.²³ The court must establish what a reasonable person would have done in the particular situation by taking into account all the circumstances of the matter at hand.²⁴ Courts have generally been reluctant to consider the peculiar characteristics of the person in order to move away from the reasonable person, the objective standard of care.²⁵

But should a person with a neural interface device be equated with the average “fully limbed” person? The neural interface device cannot be considered identical to a biological limb. The ability of the device to interpret neural impulses, whilst very good, is not functionally equivalent.²⁶ The general rule which applies in determining cases where the plaintiff is seeking damages for negligence, weighs against the court taking into account the specific characteristics of the defendant.²⁷ However, it could be argued that a defendant with a neural interface device falls within a specific class of person for whom the court should recognise a different standard of care from that of the objective, reasonable person. Circumstances where the courts have decided to vary the objective standard provide support for a different standard of care for those with neural interface devices. These include age²⁸ and skill or knowledge.²⁹ These different standards of care highlight the court’s willingness to consider the special circumstances that exist with a specific class of individuals.

The standard of care could be an extension or variation of an existing standard of care, that is, the same standard as previously recognised by the courts for a particular class of people that differs from the objective standard. Such a variation or extension might go so far as establishing a new or novel standard of care to the extent that the standard becomes that of a reasonable person with the same, or similar, neural interface device in the same, or similar, circumstances. In determining whether a defendant with a neural interface device might be considered as a different class from the reasonable person, the class of people with skill or knowledge and physical impairment need to be considered.

Skill or knowledge

The functional difference between a biological limb and the neuroprosthetic limb may require a person who has a neural interface device integrated into his or her body to undertake a degree of training before using the device. This training would lead to the development of knowledge regarding the limitations and possible adverse responses the neural interface device may have. The training might enable a person to achieve a level of expertise to such a degree that the standard of care determined by the court may be greater than the reasonable person. The skill in operating the device might be compared with the skill required to perform specialised medical procedures, or tasks involving

²² The person with a neural interface device has the potential to have a different objective standard of care because the qualitative difference between the device and a biological limb or body part is such that the device cannot be considered as having the degree of complexity and sophistication as its biological counterpart. Accordingly, the fact that the person has a neural interface device cannot be a subjective element that is considered upon the application of the objective standard of the reasonable person, such as physical disability, and this is discussed further below.

²³ See Glasgow Corporation v Mair [1943] AC 448 at 454; Bolton v Stone [1951] AC 850 at 860; Paris v Stepney Borough Council [1951] AC 367 at 384. See also Civil Liability Act 2003 (Qld), s 9; Civil Liability Act 2002 (Tas), s 11; Civil Liability Act 2002 (NSW), s 5B; Civil Liability Act 2002 (WA), s 5B; Civil Liability Act 1936 (SA), s 31; Wrongs Act 1958 (Vic), s 58.

²⁴ Stickley, n 21 at [11.3]-[11.7].


²⁶ Ohnishi, et al, n 19 at 43.


²⁸ See McHale v Watson (1966) 115 CLR 199.

²⁹ See Rogers v Whitaker (1992) 175 CLR 479.
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specialist training such as those undertaken by qualified electricians. This might also occur where the neural interface device is such that it enhances human attributes, that is, provides individuals with abilities beyond those capable of the biological limb.

An example of the way in which the standard of care has differed as a result of skill or knowledge, is with respect to medical practitioners. In Rogers v Whitaker, for example, the High Court held:

The standard of reasonable care and skill required is that of the ordinary skilled person exercising and professing to have the special skill, in this case the skill of an ophthalmic surgeon specialising in corneal and anterior segment surgery.\(^{30}\)

Likewise, many professions attract a different standard of care including lawyers, engineers, valuers, accountants, manufacturers, and builders.\(^{31}\) Generally, the standard is that of an ordinary skilled member of that profession who acts with reasonable care and skill.\(^{32}\) That standard of care is applied to the facts of a case to enable the court to ascertain whether or not there has been a breach of the duty of care owed by the professional. Application of this principle to the determination of the appropriate standard of care to be applied to a defendant with a neural interface device is discussed further below.

Physical impairment

The courts have not applied a different standard of care for people who have psychological or emotional infirmities.\(^{33}\) The court will not apply a standard of care of a person suffering from that particular mental illness, but will apply the objective standard expected of the ordinary person.\(^{34}\) However, in situations where a person is physically handicapped, the courts have, in assessing contributory negligence, applied the standard of what can be expected from a reasonably prudent person suffering from this disability.\(^{35}\) In South Australian Ambulance Transport Inc v Walhdeim,\(^{36}\) a driver with defective hearing was absolved from contributory negligence for failing to hear an ambulance siren. Despite this different standard of care, “the defendant may have to take correspondingly greater precautions in other respects to compensate for it”.\(^{37}\) The test of reasonable care in these situations “may depend on whether the defendant … embarked upon a task demanding alertness having regard to what he or she knew or ought to have known about the disability”.\(^{38}\)

\(^{30}\)Rogers v Whitaker (1992) 175 CLR 479 at 483. See Bolam v Friern Hospital Management Committee [1957] 1 WLR 582 at 586. See also Whitehouse v Jordan [1981] 1 WLR 246 at 258 (Lord Edmund-Davies); Maynard v West Midlands Regional Health Authority [1984] 1 WLR 634 at 638 (Lord Scarman). See also civil liability legislation throughout Australia, eg, Civil Liability Act 2003 (Qld), s 22; Civil Liability Act 2002 (Tas), s 22; Civil Liability Act 2002 (NSW), s 50; Civil Liability Act 1936 (SA), s 40; Wrongs Act 1958 ( Vic), s 48.


\(^{32}\)Rogers v Whitaker (1992) 175 CLR 479 at 483. See also civil liability legislation throughout Australia, eg, Civil Liability Act 2003 (Qld), s 22; Civil Liability Act 2002 (Tas), s 22; Civil Liability Act 2002 (NSW), s 50; Civil Liability Act 1936 (SA), s 40; Wrongs Act 1958 ( Vic), s 48.


\(^{34}\)Rogers v Whitaker (1992) 175 CLR 479 at 483. See also civil liability legislation throughout Australia, eg, Civil Liability Act 2003 (Qld), s 22; Civil Liability Act 2002 (Tas), s 22; Civil Liability Act 2002 (NSW), s 50; Civil Liability Act 1936 (SA), s 40; Wrongs Act 1958 ( Vic), s 48.

\(^{35}\)Adamson v Motor Vehicle Trust (1957) 58 WALR 56; Carrier v Bonham (2002) 1 Qd R 474.


\(^{37}\)Sappideen and Vines, n 25 at [7.70].

\(^{38}\)South Australian Ambulance Transport Inc v Walhdeim (1948) 77 CLR 215.

\(^{39}\)Sappideen and Vines, n 25 at [7.70].

\(^{40}\)Stickley, n 21 at [11.12].
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There have been cases where physical disability has not afforded any differing of the standard of care.39 However, in the Western Australian Court of Appeal decision, Town of Port Hedland v Hodder (No 2), Martin CJ stated that the plaintiff’s visual impairment was to be taken into account when determining contributory negligence.40 President McLure found that the plaintiff’s visual impairment did not alter the standard of care.41 These different judgments of the majority highlight the distinct possibility that when the court is determining a negligence matter involving a person with a neural interface device, it is possible that the court will find an attenuated standard of care for this class of persons.

In the US the objective standard of care for a person with a physical disability has been applied, for example, where an employee was blind.42 This perspective is in line with what Oliver Wendell Holmes Jr, said shortly after stating that the standards of the law are standards of general application:

There are exceptions to the principle that every man is presumed to possess ordinary capacity to avoid harm to his neighbors, which illustrate the rule, and also the moral basis of liability in general. When a man has a distinct defect of such a nature that all can recognize it as making certain precautions impossible, he will not be held answerable for not taking them. A blind man is not required to see at his peril; and although he is, no doubt, bound to consider his infirmity in regulating his actions, yet if he properly finds himself in a certain situation, the neglect of precautions requiring eyesight would not prevent his recovering for an injury to himself, and, it may be presumed, would not make him liable for injuring another.43

It could be argued that a person with a neural interface device which cannot interpret neural impulses as accurately as the natural body44 has a physically impairment, so this authority would support a different standard of care. However, it can also be argued that a person with a neural interface device is not physically handicapped but is different from the reasonable person because the person has replaced the missing or physically impaired limb with a neural interface device and his or her capabilities may be far beyond the person with a physical handicap. The neural interface device remains an artificial limb that is controlled by the human mind and carries with it the imperfections that, on the one hand, may be regarded as a handicap but on the other hand, simply different operational mechanics from a biological limb.

Application of the factors determining standard of care

The common law recognises many circumstances in which the standard of care expected of a person takes account of some matter that warrants identifying a class of persons or activities as required to exercise a standard of care different from, or more particular than, that of some wholly general and objective community ideal.45 As noted above, a different standard of care has been recognised by the courts for various classes of defendants: children; professionals; and persons with a physical disability.46 However, the onus of establishing facts giving rise to such a special or different class or category will be upon the party asserting it.47

39 Henderson v Public Transport Commission of New South Wales (1981) 37 ALR 29 at 34 (Gibbs CJ, Murphy and Aickin JJ), for example.
40 Town of Port Hedland v Hodder (No 2) (2012) 43 WAR 383; [2012] WASCA 212 at [259].
41 Town of Port Hedland v Hodder (No 2) (2012) 43 WAR 383; [2012] WASCA 212 at [298]. The majority was made up of Martin CJ and McLure P.
42 Roberts v State of Louisiana, 396 So 2d 566 (La, 1981).
43 Holmes, n 27, p 108.
44 Ohnishi et al, n 19 at 43.
These different standards of care are based on one or more of a number of factors, many of which were discussed by the High Court in *Imbree v McNeilly*[^48] which involved a review of the standard of care to be applied to an inexperienced driver. In this case, the first respondent, Jessie McNeilly, was a young man of 16 years who did not have a learner’s permit and this was known by the appellant, Paul Imbree, who allowed McNeilly to drive a four-wheel drive on a wide, gravel road between Kings Canyon and Hermannsburg in the Northern Territory. McNeilly steered the vehicle to avoid debris on the road then turned sharply the other way while accelerating and rolled the vehicle. Imbree suffered spinal injuries that rendered him a tetraplegic. Imbree brought proceedings against McNeilly and the owner of the vehicle for damages, a sum of $9.5 million was awarded at trial, reduced by 30% on account of contributory negligence. On appeal, the New South Wales Court of Appeal found that McNeilly had not breached his duty of care, applying *Cook v Cook*,[^49] and increased contributory negligence to two-thirds. Imbree was granted special leave to appeal to the High Court arguing that McNeilly should be held to have owed him the same objective standard of care as a licensed driver.

The difficulty for the High Court in *Imbree* was the necessity to decide whether, in keeping with *Cook v Cook*, the learner driver owed a different standard of care to the instructing passenger than the standard of care owed to everyone else in the car and around the car. Knowledge of the instructing passenger that the driver was inexperienced was the basis of earlier decisions for asserting that by placing him or herself knowingly in a dangerous situation, a lower standard of care is to be applied. It is the court’s discussion of the factors that impact on deciding what standard of care is to be applied in a negligence matter that assists in assessing the appropriate standard of care for a defendant who has a neural interface device. It is not suggested, however, that the person with a neural interface device is equivalent or analogous to an inexperienced driver. It is simply the analysis conducted by the High Court that provides a methodology that assists with the determination of any standard of care.

When determining the standard of care owed by the learner driver, Gummow, Hayne and Kiefel JJ considered the following principles:

1. The standard to be applied is objective. It does not vary with the particular aptitude or temperament of the individual;[^50]
2. The learner driver owes a duty of care to all other road users that requires the learner to meet the same standard of care as any other driver on the road. The learner will be held to the same standard of care as any other driver in fulfilling the learner’s duty to take reasonable care to avoid injuring other road users;[^51] and
3. Knowledge of inexperience provides no sufficient foundation for applying different standards of care in deciding whether a learner driver is liable to one passenger rather than another. It is not disputed that the learner driver owes each of those persons a standard of care determined by reference to the reasonable driver.[^52]

When applying these principles to a person with a neural interface device, the first principle will be complied with if the standard of care is to be that of the reasonable person of ordinary prudence, with the same neural interface device in the same, or similar, circumstances, and this is to be applied objectively without reference to the individual’s aptitude or temperament.

In relation to the second principle, when looking at a person with a neural interface device, the other drivers on the road are not every other physically able person, but only those who have a similar neural interface device. The neural interface device is not equivalent to a car, it is not a “tool” in the same way that a car is disconnected and separate from the driver. Those individuals with a neural interface device are not “driving the neural interface device” in the same way as the learner driver is “driving the car”. It is the functioning of the neural interface system – the mind, the neural processor...

and the device – that is to be compared with that of a fully able person with no neural interface device. It is the ability of the person to act in unison with the neural interface device that will determine the appropriate standard of care that the defendant with a neural interface device owes to the public, regardless of what task is being undertaken, be it driving a car, building a house, transplanting a kidney or any other task chosen. For example, as a driver of a car, the standard of care would be that of a reasonable driver with the same, or similar, neural interface device in the same, or similar, circumstances. 53

In summary, the neural interface device is not a “tool” as the car is, but an integral part of the human body. Similarly, the physically able individuals are “driving” physical limbs, for example, while the person with a neural interface device is “driving” something that is not a physical limb but a substitute. If the standard of care is to be that of the reasonable person of ordinary prudence, with the same neural interface device in the same, or similar, circumstances, and this standard requires the person to meet the same standard of care as any other person with the same neural interface device, this complies with the second principle. In compliance with principle three, again, this standard of care is determined by reference to the reasonable person with a neural interface device and that same standard of care is owed to everyone.

Despite complying with the three principles, recognition of a different standard of care for a person with a neural interface device from the person without a neural interface device would have further support. In *Imbree*, Gummow, Hayne and Kiefel JJ considered circumstances where the common law recognises a different standard of care to be applied. This is where the standard of care expected of a person or activities is required to exercise a standard of care different from, or more particular than, that of some wholly general and objective community ideal. They identified this occurrence amongst professionals such as medical practitioners and specialist medical practitioners. Their Honours also recognised a different standard of care for those at the other end of the spectrum, namely children. They held that in all other cases in which a different level of care is demanded, the relevant standard of care is applied uniformly. No distinction is drawn according to whether the plaintiff was in a position to supervise, even instruct, the defendant although, if the plaintiff was in that position, a failure to supervise or instruct may be of great importance in deciding whether the plaintiff was contributorily negligent. 54

As was determined by the court, no amount of supervision or instruction can alter two facts:
1. Unless the vehicle has been specially modified to permit dual control, it is the learner driver, not the supervisor or instructor, who operates the vehicle; and
2. The skill that is applied in operating the vehicle depends entirely upon the aptitude and experience of the learner driver. 55

This is not the case with respect to the person with a neural interface device. That person is not instructing or supervising the device in the same way as the instructing driver may be supervising the learner driver, as they are actually operating the device and it is their aptitude and experience upon which the device is operated. Demonstration of relevant ability, however, is beside the point. What is at issue is the definition of a standard of reasonable care, not any external recognition of attaining an ability to operate the device in accordance with that standard. Even if the individual was required to hold a licence to certify proficiency in operating the neural interface device, for the same reasons as the court held in *Imbree*, to describe the relevant comparator as a “licensed person” diverts attention from the central inquiry: what would a reasonable person with a neural interface device do? Being authorised by the applicable law to have a neural interface device and move freely with the public is neither a necessary nor a sufficient characteristic of the reasonable person with a neural interface device. The reasonable person with a neural interface device is to be identified by what such a person


would do or not do when operating the neural interface device, not by what authority a person would need to have in order to lawfully be with the public.\textsuperscript{56}

In addition to these principles, the following issues could be considered in determining the appropriate standard of care if a matter came before the courts where the defendant was a person with a neural interface device.

**An increased potential danger to a neighbour of physical, financial or other injury.**

The court might consider the increased danger to the public as a result of mistaken interpretation of neural impulses by the neural interface device. This might result in a higher standard of care required of the defendant to ensure the safety of those with whom they are in contact. To meet that standard of care owed, the individual might be required to warn the public of their neural interface device. Legislative reform throughout Australia has seen the introduction of civil liability legislation that clarifies obligations on medical practitioners with respect to the provision of warnings and information.\textsuperscript{57} This legislation might be amended to include similar requirements for persons with neural interface devices.

It might be argued that it is dangerous for the public to interact with a person who has a neural interface device and that anyone who does so is aware of the danger of such a device not operating as accurately as a biological limb. This would presume that, like a normal prosthetic limb, the neural interface device is easily identified as being different from the biological limb. In turn, it could be argued that the presumption of knowledge of obvious risks of engaging in this dangerous activity would exist. Such a presumption of knowledge of obvious risks currently exists in civil liability legislation with regard to voluntary assumption of risks (a reverse onus provision applies).

The level of risk a person with a neural interface device may present to the property and person of others will need to be considered by the courts in the future. It might be determined that the person is engaged in a special or potentially dangerous activity and therefore, must know or inquire of possible hazards that might affect their ability to satisfy their duty of care to the public at large. Custom and practice of usage of the particular neural interface device would be of assistance when assessing the facts of the case but would not solely determine negligence.

The risks inherent in the neural interface device will dictate what the unreasonable risks are. If there is an unreasonable risk of injury to the public, a higher standard of care than would apply in respect of an ordinary situation facing a reasonable person might be applied.

**Skill or knowledge of the defendant.**

As discussed above, it could be argued that the defendant requires skill and knowledge to operate the neural interface device. This might result in a higher standard of care required of the defendant. Factors that will be of significant influence in the court’s determination of the appropriate standard of care to be applied to a defendant who has a neural interface device in relation to skill or knowledge include the following:

1. To operate the neural interface device, the defendant will need to be trained on the procedures necessary to achieve the desired reaction by the neural interface device. Just as a child learns to walk and interact physically in the world, the defendant will also learn to operate the neural interface device and develop competence in the skills necessary to interact with the world around them.
2. The defendant will, or should, know how to overcome the shortcomings of the neural interface device and act appropriately to avoid injury to another.
3. Despite the training undertaken by the defendant, there will remain a degree of uncertainty as to how, or if, the device will respond or operate in accurate compliance with the neural impulses.
4. There will be an inability to anticipate reflex reactions by the neural interface device and this links in with sane automatism.

\textsuperscript{56} *Imbree v McNeilly* (2008) 236 CLR 510; [2008] HCA 40 at [58].

\textsuperscript{57} See, eg, *Civil Liability Act 2003* (Qld), Ch 2, Pt 1, Div 5 (Duty of Professionals).

\textsuperscript{58} See, eg, *Civil Liability Act 2003* (Qld), s 14.
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While it is difficult to conclude what standard of care the court will establish, that standard of care of a person with special skill or competence in operating the neural interface device is likely to be that of the ordinary skilled person exercising and professing to have that special skill.\textsuperscript{59}

Policy considerations

Expectations of the neighbour

If it is not obvious to the public that the defendant has a neural interface device, it could be expected that the public will regard the defendant as “an ordinary person” and expect the defendant to use due care and diligence.

Perceived differences of the defendant from the objective reasonable person.

There might be an expectation that the neural interface device is equivalent to a natural arm but a realisation that this is not the case.\textsuperscript{60} Such difference needs to be recognised and an appropriate standard of care different from the objective standard of the reasonable person could be applied.

It would be presumed that, like a normal prosthetic limb, the neural interface device is easily identified as different from the biological limb. It might, therefore, be argued that it is dangerous for the public to interact with a person who has a neural interface device and that anyone who does so is, or ought to be, aware of the danger of such a device not operating as accurately as a biological limb.\textsuperscript{61} Such a presumption of knowledge of obvious risks that the neural interface device might not respond correctly to the neural impulses and the corresponding assumption of risk, currently exist in civil liability legislation.\textsuperscript{62} However, such a presumption will be challenged as advances in technology make the neural interface device virtually indistinguishable from a biological limb.

Administration of justice.

To recognise the difference between a neural interface device and the biological body part it has replaced is fundamental in the court’s role of administering justice, which is, determining just outcomes. This is supported by the court’s recognition of a different standard of care for children, individuals who have special skill or knowledge above that of a reasonable person and persons with a physical disability, as discussed above.\textsuperscript{63} However, recognition of the person with a neural interface device might currently be obvious but with improvements in technology and the development of more realistic neural interface devices, the obviousness will diminish. So too might the chance of misinterpretation of neural impulses by the devices disappear. As a result, the standard of care applied to a person with a neural interface device, if found to be different from the objective standard, might eventually become the objective standard.

However, the objective standard requires different acts in different circumstances, that is, how a reasonable person would react in similar circumstances.\textsuperscript{64} Some factors would include:

1. The realisation of risk which the conduct involves;
2. The perception of circumstances; and
3. Intelligence, knowledge and experience to recognise the chance of harm to others.

In determining a breach of this standard, a court will consider whether, as a result of extensive training in the operation of the device, the person will know of the potential risks of the neural


\textsuperscript{60} Ohnishi et al, n 19 at 43.

\textsuperscript{61} Ohnishi et al, n 19 at 43.

\textsuperscript{62} See Ch 2, Pt 1, Div 3 of the Civil Liability Act 2003 (Qld). See also Ch 2, Pt 1, Div 4 in respect of engaging in a dangerous recreational activity. In other States of Australia, similar provisions exist: see, eg, Civil Liability Act 2002 (Tas), Pt 6, Divs 4 – 5; Civil Liability Act 2002 (NSW), Pt 1A, Divs 4 – 5; Civil Liability Act 2002 (WA), Pt 1A, Div 4; Civil Liability Act 1936 (SA) Pt 6, Div 3; Wrongs Act 1958 (Vic), Pt X, Div 4.

\textsuperscript{63} See n 46.

\textsuperscript{64} Yong Shire Council v Shirt (1980) 146 CLR 40.
interface device not functioning in complete compliance with the neural impulses as intended. The risk may well be regarded as reasonably foreseeable and if determined to be not insignificant, then the person will be expected to take reasonable precautions.65

With policy considerations there is always a balancing test that requires the recognition of the interests of, and the likely harm to, others as determined in law compared with the likely advantage to the defendant.66 In recognition of the possible dangers inherent in the use of neural interface devices balanced against the benefit to society for its citizens in need to be able to have these neural interface devices, parliament might consider introducing legislation requiring persons with these devices to obtain insurance.67

Legislation might also set the standard of care to be applied to people with neural interface devices. Circumstances have already been legislated to effect such a different standard of care. For example, s 31(2) of the Civil Liability Act 1936 (SA) makes allowances for defendants who are influenced by prescribed drugs such that, in determining the standard of care, the reasonable person will be taken to be intoxicated to the same extent as the defendant.

CONCLUSION

The above analysis suggests that the standard of care should be that of a reasonable person with the same, or similar, neural interface device in the same, or similar, circumstances. This variation of the standard of care might result in a lower standard of care than that of the objective standard. Factors supporting this idea include:

1. A neural interface device is not a biological limb;
2. Communication between the brain and the neural interface device is not as accurately interpreted by the device as the communication between the brain and the biological limb;68
3. The impulses from the device may alter the workings of the brain in ways identified, for example, when deep brain stimulation is used for treatment of Parkinson’s Disease;69 and
4. Policy considerations, such as the benefit to society for its citizens in need to be able to have these neural interface devices, justify the increased risk of harm to the public.

Alternatively, it could be argued that the standard of care should be higher than that of the reasonable person if a person with a neural interface device is required to do one or more of the following:

1. Undergo a specified training program to facilitate competence in operating the neural interface device;
2. Undergo specific training to recognise and anticipate adverse outcomes;
3. Take necessary precautions to minimise adverse outcomes;
4. Acknowledge that the abilities of the neural interface device are an enhancement of human attributes; or
5. Obtain compulsory insurance against damage or injury caused to another’s property or person, similar to the compulsory third party insurance required of motor vehicle owners.

The risks apparent to the defendant, his or her capacity to meet those risks and the circumstances under which he or she must act will also be considered by the court. The precautions undertaken by the person to minimise the chance of injury to another will generally be expected, therefore, the exact standard of care to be applied is uncertain but consideration of a new standard of care for this new class of person appears inevitable. As stated by Braidotti:

65 Stickley, n 21 at [11.46]. See also s 9 of the Civil Liability Act 2003 (Qld) and corresponding provisions in other Australian States: Civil Liability Act 2002 (Tas), s 11; Civil Liability Act 2002 (NSW), s 5B; Civil Liability Act 2002 (WA), s 5B; Civil Liability Act 1936 (SA), s 32; Wrongs Act 1958 (Vic), s 48.
66 Stickley, n 21 at [11.90]-[11.94].
67 Imbree v McNeilly (2008) 236 CLR 510; [2008] HCA 40 at [129]-[130], [180]-[181].
68 Ohnishi et al, n 19 at 43.
At their most ambitious, efforts to compensate for damaged or destroyed sensory organs have come to involve the invention, manufacture and implantation of bionic counterparts for eyes and ears. These connect the conscious mind and the vibrant, colourful, noisy external world – with life changing consequences for recipients.

Once the stuff of science fiction, the bionic enterprise of today is built on a realisation that has transformed human innovation during the past decade; that no single discipline in science, engineering or medicine is up to the task. Instead, each specialist field has mastered some of the components needed to solve an overall problem, whether related to vision, hearing or any other among a spectrum of healthcare challenges. 70

The specialist field of law will also need to prepare for the incorporation of neural interface devices with the human body. These devices will enable the human mind to instruct and control these neural interface devices through efferent and afferent communication 71 between the device and the brain. 72 This melding of mind and machine challenges the law in determining where civil liability for injury, damage or loss should lie.

The analysis of the current law and considerations of the factors that will impact on the determination of the appropriate standard of care that should be applied to a person with a neural interface device has been discussed in this article. As a result, a variation of the objective standard of care applied to the reasonable person may better recognise this new class of person whose biological body part has been replaced with a neural interface device. It could be argued, therefore, that the standard of care should be that of a reasonable person with the same, or similar, neural interface device in the same, or similar, circumstances. While existing authority will bind the courts, the common law system provides the flexibility to embrace fundamental changes in society without fracturing the existing legal principles. 73 As McHugh J said in Perre v Apand Pty Ltd, "[w]hile stare decisis is a sound policy because it promotes predictability of judicial decision and facilitates the giving of advice, it should not always trump the need for desirable change in the law". 74 Neural interface devices and their incorporation into the human body is so radically different or unique from any other circumstance previously considered by the courts, that the law should recognise a different or unique application of the law of negligence.

71 Information flowing from both the brain to the device and from the device back to the brain, respectively.
72 IEEE, n 15.
73 Mabo v Queensland [No 2] (1992) 175 CLR 1 at 43 (Brennan J).