Surfing the Third Wave of Computing
Contracting with eObjects

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1 RESEARCH PROBLEM

During the last two decades, a "third wave of computing" has emerged: a move from a model of accessing the Internet and other internetworks almost exclusively via a desktop computer to alternative forms of distributed information technologies, such as smartphones, wearable computers, and sensors and microprocessors embedded in everyday objects.

Mobile commerce is now part of the mainstream of e-commerce technologies, with applications for mobile entertainment, retail shopping, banking, stock trading and gambling all well-established and on the rise. The widespread use of computing devices embedded into buildings and everyday objects has also moved from the vision of a few computer scientists to a (partial) reality, with current applications for home automation, energy management, healthcare and environmental monitoring, just to name a few. Current terminology used to describe the third wave such as ubiquitous or pervasive computing, ambient intelligence, or the Internet of Things, all have important limitations. Therefore, I have adopted the term "eObjects" for the central technological element of third wave computing. In summary, an eObject is an object that is not inherently computerised, but into which has been embedded one or more computer processors with data-collection, data-handling and data communication capabilities.

These technological developments have resulted in the creation of new things to be bought and sold, new activities for business and consumers to engage in, and new kinds of commercial relationships between consumers and businesses. My research project will examine how legal rules around the formation of contract and the enforceability of onerous contract clauses operate in the face of this socio-technological change. It is widely recognised that there are distinct legal problems which may arise in relation to socio-technological change. If the development and use of these new forms of information technology give rise to inconsistencies, unmet expectations and unpredictable outcomes in the law, this may well lead to substantial problems for product and service providers, as well as individual consumers using or interacting with the technologies. I intend to consider these issues in the context of Australian law and will also be guided by what is happening in international jurisdictions.

2 OUTLINE OF OBJECTIVES

My aim is to examine whether aspects of contract law in Australia, specifically as it applies to the use of eObjects in consumer transactions, appropriately protects the interests of consumers, innovators and business. I will do this in large part by examining legal problems that have arisen or are likely to arise in Australia and the international jurisdictions in regard to a context which involves eObjects and relationships among participants governed by contract. I will also evaluate the current operation of the law against the goals of contract and consumer law in Australia.

In particular, my objective is to answer the following questions:

1) in what ways will socio-technological change brought about by eObjects create legal problems in Australia, in the areas of formation of contract and enforcement of onerous contract clauses?

2) if there are significant contract law problems that do arise out of the use of eObjects, what reforms are required in order to appropriately protect the interests of product and service providers and consumers, in light of the goals of contract and consumer protection law in Australia?

3 STATE OF THE ART

3.1 The Technology under Examination

"In order to craft appropriate laws, both the technology and its uses must be well understood." (Reed, 2007)

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For the last two decades, scholars, journalist and IT consultants, have been presaging what has been labelled the "third wave of computing", "a new age of embedded, intuitive computing in which our homes, cars, stores, farms, and factories have the ability to think, sense, understand, and respond to our needs" (Forbath, 2013). The first wave comprised the introduction of mainframe computing, with a "many people to one machine" model. The second wave of personal computing saw the development of one-to-one relationships between people and their computers. The third wave envisages a move from a model of people accessing internetworked computing services almost exclusively via a personal desktop computer to a "many people to many machines" model. Advocates of the third wave predict the large scale development and use of alternative forms of distributed information technologies, of which early examples include smartphones, wearable computers and sensors and microprocessors embedded in everyday objects. Examples of concrete applications currently in commercial use or in advanced stages of development include:

- electricity smart grid technology;
- wearable electronics and other consumer devices;
- healthcare products;
- home and industrial automation applications;
- traffic applications;
- smart and driverless cars and trucks; and
- environmental monitoring.

To develop more meaningful scholarship in this particular area of technology regulation, there needs to be a good understanding of the character of the technology at issue. It is particularly important to clarify exactly what technology is being discussed. Koops, in his analysis of mapping research spaces within the discipline of technology regulation, argues that "[t]he questions raised by a certain development in technology depend very much on the character and level of abstraction of the technology at issue" (the "technology type") (Koops, 2010). Koops explains that questions of regulation will differ depending on whether a researcher is examining a concrete application of a certain technology, such as an Internet-enabled fitness tracker, to more abstract areas such as information technology, or even technology, itself.

However, despite the fact that it is easy to point to current (and potential) examples, it is difficult to arrive at an accurate scope definition of this "new model" of computing. The terminology used by researchers, industry participants and governments is not fixed, and a number of different terms are frequently used, in particular ubiquitous computing, pervasive computing, ambient intelligence, and the Internet of Things (IoT). In the literature, sometimes these terms are used interchangeably, other times they are used in different but overlapping contexts and with wider or narrower scopes of meaning. This profusion and confusion of terms may be due to a number of reasons. Terminologies and descriptions in the literature appear to be contingent on a number of factors: they vary over geographical locations, and with individual researchers, and they change over time. In particular, terminology has often varied depending on the particular entity funding the research being discussed. Also, whereas many areas of information technology research have a significant and defined technical problem or problems to be solved, the research arenas of ubiquitous computing, pervasive computing and ambient intelligence have a far greater focus on the human (rather than technical) outcomes.

Therefore, as a first step, I have completed a paper that outlines the literature on historical and current definitions of particular areas of the new model and extracts its key dimensions (Manwaring and Clarke, 2015). The paper discusses in particular the dominant terms ubiquitous computing, pervasive computing, ambient intelligence, and the Internet of Things in order to provide a clear statement of the terminology and concepts behind the new model. After tracing the history of these terms and their various uses, the paper goes on to extract and analyse the key attributes of the terms. This paper proposes a new term, "eObject", for the central technological element of the new model, and defines that term as:

> *An eObject is an object that is not inherently computerised, but into which has been embedded one or more computer processors with data-collection, data-handling and data communication capabilities.*

The core attributes of an eObject are elaborated in Table 1. These attributes are intended to be definitional: that is, a devices or system that is missing one or more of them is not considered an "eObject".

However, while this definition outlines the core attributes of the new model, by itself it does not give a full picture of the types of technologies that the literature discusses.

Therefore, the paper goes onto outline a research framework of **interactions** and **common** (rather than core) **attributes** to assist in exploring legal problems that might arise out of socio-technological

Table 1: An eObject's Core Attributes.

Attribute	Description
Object	Is a physical object, which may be natural or an artefact, of any size, and inert or living
Computer	Contains one or more general-purpose programmable computers, sufficiently miniaturised
Embedded	One or more computers are physically embedded in the object (as distinct from being socially, culturally or metaphorically embedded)
Data-Collection	Contains one or more sensors that can collect or generate data. Note that sensors are a core attribute, while **actuators** are not: an ability to act in a physical manner on the environment is **common** in eObjects, but not **essential** (other than the ability to communicate data).
Data-Handling	Includes a capability to process data.
Data Communication	Can communicate with other nodes inside the same object, or with other objects

change brought about by eObjects. Figure 1 sets out a graphical representation of these interactions, which are further elaborated in Manwaring and Clarke, 2015.

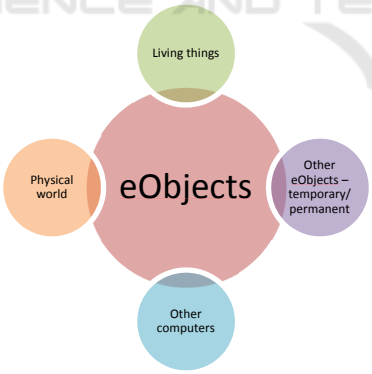

Figure 1: Interactions between eObjects.

A summary of the common attributes is set out in Table 2 the Appendix. Even though they fall outside of the core definition, they are included within the framework because their existence, inter-relationships, and even the frequency with which they appear can lead to more specific and detailed analysis of problems that might arise in relation to an eObject.

This technical framework will be supported by a conceptual framework, outlined below. Both will be used to assist in analysing the impact of socio-technological change brought about by eObjects, and the legal problems which may arise.

3.2 Legal Problems Already Identified

Academic commentators have already undertaken some preliminary analysis of legal problems arising out of aspects of eObjects in overseas jurisdictions, but the Australian conversation has been quite limited. The United States conversation began predominantly with an article in 2005 by Kang and Cuff (law and architect professors respectively), who outlined a ground-breaking vision of a mixed real/virtual shopping centre created by the use of existing and future eObjects technologies (Kang and Cuff, 2005). For example, translating this to an Australian experience, a shopping centre customer may enter a shopping centre, go into a department store, look at the child restraints on display, take out her smartphone to look at product review and price comparison sites and then buy a restraint from a completely different store with a mobile shopping application. Her smartphone then alerts her to a shopping task he has forgotten: consequently she checks the shopping list created by her smart fridge and diverts to the supermarket to buy milk and bread. Her incidental movement through the shopping centre may lead to the collection of information about which store windows she looks into, and her use of e-loyalty cards to the collation of information about her pink iced donut consumption.

Kang and Cuff were interested in examining the effect of the use of "pervasive computing" (a subset of eObjects) on the laws affecting the public sphere. They concluded that this vision of a shopping centre with embedded and mobile information technologies produced a significant need for legal development in areas as diverse as the law of contract, property law, privacy and telecommunications regulation. Brenner also undertook a significant analysis of pervasive technology in 2006, but confined it to the criminal law.

Following on from the Kang and Cuff collaboration, Fairfield undertook a preliminary examination of the divergences between "online and offline law", and the difficulties this might raise when virtual experiences are mixed with real life experiences: for example, mobile phone applications which display images and videos when they are pointed at real objects, such as museum exhibits (Fairfield, 2012). Fairfield raised a concern that the US courts, when faced with lawsuits

involving mixed reality applications, may have a tendency to apply intellectual property laws (particularly copyright) which might limit further re-use of purchased items, rather than consider "real world" implications under contract law and property law. Interestingly, Kang and Cuff identified somewhat the opposite problem: they were concerned that their hypothetical shopping centre owners would assert their private property rights over Internet connectivity ports within the shopping centre to shape and control information flowing to their customers.

In these general preliminary investigations, contract law emerged as an important theme. Peppet went further and narrowed his focus to the impact of eObjects on the law of consumer contracts. He provided a preliminary analysis of some of the possible effects of eObjects on contract law and the impact of underlying technological conditions on doctrine. In particular, he argued that the greater availability of information that consumers have about products and onerous contract terms means that US courts should be less likely to hold a contract unenforceable on the grounds of unconscionability and related "unfairness" grounds (Peppet, 2012).

However, most of the legal literature which exists discussing eObjects concentrates on the privacy and data protection implications of the ready availability of this potentially vast store of data about individuals, their lives, and their preferences: and in particular the inadequacy of existing laws to protect individuals. However, the legal conflicts which may arise are unlikely to be confined to commercial and government dealings with data concerning the activities and information of individuals. For example, Walker Smith contends that the increasing amount of information available to sellers about the way their customers use their products is set to increase product liability claims as the nature of foreseeability of harm changes (Smith, 2013-2014). Werbach argues that many legal rules, in areas as diverse as evidence law, corporate disclosure regulation, civil and criminal procedure and patents law are problematic. The problems arise because these rules are based on assumptions about information scarcity and abilities to control information flow may no longer hold true in societies where sensors which collect, process and communicate large amounts of data are prevalent (Werbach, 2007).

The key research question posed in my introduction was whether or not socio-technological change created by the new model of eObjects is likely to create new legal problems. In particular, I would like to investigate the effect on the law that applies when consumers enter into contracts mediated by eObjects. The existing US literature on eObjects points, in a very preliminary way, to implications particularly in the area of contract law and consumer protection law, which have not yet been examined for their potential effect in Australia.

For example, what issues might arise around enforceability of contracts formed through interaction with "invisible" devices? When can a movement through an embedded space constitute an intent to create legal relations? How does differential access to information affect a consumer's rights in a transaction? These are just some of the questions that remain to be answered in this research space.

Some initial guidance from scholars concentrating on privacy may be useful. Such scholars have spent some considerable time analysing, in the context of privacy policies, the problems with adequate notice that eObjects might bring about. Related issues might well arise in relation to notice required for the formation of contract and reasonable notice required for the enforcement of onerous contractual terms.

Legal problems arising out of the increasing practice of entering into contracts online, using a conventional computer, have attracted some scholarly attention. Kim in a recent book discusses in detail doctrinal problems that have arisen due to the US courts' desire to enforce shrinkwrap, clickwrap and browsewrap contracts (Kim, 2013). She argues that both form and substance of wrap contracts are fundamentally different from paper contracts, and that in their struggle with these differences, the courts have actively distorted contractual doctrine. For example, Kim argues that courts have construed assent to contractual terms from mere notice in ways that are problematic and inconsistent, resulting in judicial decisions that "make it difficult to predict what may constitute adequate notice in any given case or what level of action constitutes a manifestation of consent".

She concludes that "while a specialized body of law is unnecessary, doctrinal adjustments should be made to address the problem of wrap contracts". Other commentators, such as Moringiellio and Reynolds, would not necessarily agree with Kim's arguments around distortion, but instead believe that traditional doctrines of contract law are sufficiently adaptable to cope with new technologies (Moringiello and Reynolds, 2013). However, even they acknowledge that when faced with new

technologies such as smartphones, that "different factual scenarios might well require some creative judicial application of settled law to the new facts". Whether you would assess the issue as merely a need for "creative judicial application", or support Kim's idea that this creative application does amount to a substantial "distortion of doctrine", it is clear that this may well lead to legal problems of uncertainty, whether strict legal uncertainty or practical uncertainty.

What I wish to examine in this dissertation is whether the possibility of contractual disputes surrounding the use of eObjects may lead to additional uncertainty or other legal problems. For example, to add to the existing uncertainty surrounding conventional online contracting, the mechanisms by which users manifest, or by which courts assume manifest, assent to contractual terms, may well change with the advent of eObjects. For example, one of the common attributes of eObjects is an increasing emphasis on implicit human-computer interaction (iHCI). In an eObjects world, a desktop computer, smartphone and a sock may all contain computing power, but a consumer interacts with each of these devices in different ways. If the devices are used to mediate contracts with consumers, their ability to "deliver" text, and therefore contractual terms, is also fundamentally different. Admittedly, a "tap" on a smartphone icon is not very dissimilar to a "click" on an "I agree" button, and therefore it is arguable existing doctrine is easily applied in that context. However, even supporters of traditional doctrine recognise that a failure to adapt the presentation of contractual terms to a smaller screen may affect whether there is reasonable notice.

And, once we move to eObjects without a conventional screen, the interaction becomes even more different, sufficiently to raise questions about assent to contractual terms. Is a wave, or a blink, or merely walking into a room, the same as a click on a hypertext link? When might a contract formed with an iHCI interface be unconscionable? Will electronic signatures legislation have to change to incorporate gesture-based contracting, or will agreement by conduct be sufficient for all purposes?

It may be easy to conclude that existing doctrine governing contractual agreement by conduct will be sufficient to deal with the simple question of whether some form of contract has been formed. However, the question still remains as to what terms are included part of that contract. As Kim points out, one of the outcomes of widely available e-commerce has been the increased length and complexity of terms contained in consumer contracts. Retailers, who in the offline world would not traditionally subject their customers to signing a paper contract at all, and therefore only expecting to enforce minimal conditions around price and returns, are taking advantage of the electronic form to deliver many pages of terms and conditions. These terms and conditions also tend to include provisions unrelated to the main bargain (what Kim calls "crook terms"), such as consent to collect a consumer's information and sell it to third parties. For example, if a consumer goes into Myer and buys a dress, the consumer's contractual obligations are limited to payment of the tag price. Myer is also subject to statutory warranties under the Australian Consumer Law. However, if a consumer buys the same dress via the Myer website, she is subject to fully four pages of terms (over 3500 words). These terms include a clause allowing third party advertisers to access your IP address, and also to track pages to which you subsequently navigated.

eObjects are contemplated with an ability to deliver text which is limited compared to conventional desktop technology. How, then, will reasonable notice of onerous terms be delivered to consumers? For example, for a consumer using Internet-connected spectacles, how will these four pages be represented to her/him? The problem of a small screen has already been recognised by scholars discussing wrap contracts, but must this problem is likely to be multiplied in the context of wearable electronics. Considering the function of Internet-connected spectacles and where they are likely to be used, that is, on the move and in public places, the likelihood that consumers will be able to adequately read consumer terms is not high. It is already clear that most people spend little to no time reading consumer terms and conditions. The increased difficulty of accessibility and legibility will most likely not mean a reduction in the number of transactions, merely a reduction in the already low number of people who actually know what bargain they have made. How will judges respond to this issue, if at all? And if judges will not respond, should the legislature?

However, there may exist opportunities arising out of eObjects to improve the consumer contracting experience. For example, the portability of certain consumer eObjects may actually result in better informed consumers. As discussed above, Peppet argues that greater accessibility to review sites with smartphones by consumers in brick-and-mortar stores means that US courts should be less likely to hold a contract unenforceable on the grounds of

unconscionability and related "unfairness" grounds. There may be other forms of technology available that might be used to assist in notification of onerous terms: the question is of course whether suppliers would be willing to use these or would need to be coerced by some form of regulation.

4 CONCEPTUAL FRAMEWORK

4.1 Law and Socio-technological Change

The current state of technology limits, in practice, what actions we can perform, what objects we can create, and what relationships we can form. It is thus common for technological change to impact the law, which limits what actions we may perform, what objects we may create and use, and what relationships will be recognized. (Bennett Moses, 2007).

Where technological change gives us the ability to perform new actions, manufacture new objects, or form new relationships, the question must inevitably be asked: should these new actions, products and/or relationships be permitted, prohibited, encouraged, or limited in some way? And if so, how?

This question of course presupposes the widely-held belief that in many cases there are legitimate reasons for law or, more broadly, regulation, to change as technology, or the socio-technological landscape, changes. Brownsword has characterised this issue as the challenge of "regulatory connection": the discrepancy between existing law and other regulation created to order a previous socio-technological environment, which then require "reconnection" with new actions, products and relationships made possible by new technologies (Brownsword, 2008). This issue has also been characterised as a concern that law inherently has problems "keeping up" with technological changes, sometimes referred to as the "pacing problem" (Marchant et al., 2011).

The need to address regulatory connection, or disconnection, in a timely manner is drawn out by examination of the potential effects of what has been labelled the "Collingridge dilemma", or as Collingridge himself described it, the "dilemma of social control" (Collingridge, 1980). This is the recognition that potential benefits of new technology are widely accepted before enough is known about future consequences or potential risks to regulate the technology from the outset, while by the time enough is known about the consequences and possible harms to enable regulating it, vested interests in the success of technology are so entrenched that any regulatory effort will be expensive, dramatic and resisted.

Some contemplated eObjects are as yet purely speculative technologies, or are at such an early stage of development that they have not progressed past the experimental phase into marketable products. However, the possible negative results of the Collingridge dilemma may dictate a need to respond to technologies which are not yet in existence or in commercial use. Once a technology has been fully developed, there is usually a strong incentive to resist any regulatory change, due mainly to the expense of changing technological design. Therefore, in some cases it may make sense to implement new regulation before the technology is fully developed and/or the risks are fully known.

However, just because a technology is new, or significantly changed, does not by itself mean that its applications operate outside of the scope of existing law. A new technology, especially in the ICT industry, is rarely completed unregulated by existing law: a new product, for example, is still in many cases subject to existing tortious principles and product liability regulation, those selling it subject to consumer protection and competition law, and creators able to protect it under existing intellectual property legislation. Even with the very real problems envisaged by the Collingridge dilemma, there is no need to "overreact" to technological change with unnecessary regulation. The action of a thief who steals a driverless smart car is still a breach of the NSW Crimes Act 1900. What may be subject to legal uncertainty, at least, is who is liable in an accident causing injury or property damage: the thief, the owner, the manufacturer, the programmer of faulty software?

In my dissertation, I propose to begin with the conceptual framework proposed by Bennett Moses in 2007. Bennett Moses classifies problems that might arise out of a failure of regulatory connection in the context of technological change into four categories (and associated subcategories):

(1) there may be a need to create special rules designed to ban, restrict, encourage, or co-ordinate use of a new technology; ["**new harms or benefits**"]

(2) there may be a need to clarify how existing laws apply to new artifacts, activities, and relationships; ["**uncertainty**"]

(3) the scope of existing legal rules may be inappropriate in the context of new technologies; ["**under- or over-inclusiveness**"] and

(4) existing legal rules may become obsolete. ["**obsolescence**"] (Bennett Moses, 2007)

Bennett Moses' approach is helpful particularly because it also recognises that some changes in technology will not give rise to regulatory disconnection, and even those which do to some extent will not create problems in all of the above four categories. This approach also actively discourages any assumptions that just because technology a technology is new, it automatically generates uncertainty or a need for new rules.

These categories of legal problems are not the only ones that may arise. In my work to date, I have identified another category: that of "practical uncertainty". Practical uncertainty, unlike "legal" uncertainty as defined by Bennett Moses, arises where the "correct" interpretation of a legal rule might well be arrived at by judges in time, but the delay in itself may cause problems for business and consumers, such as an initial surge in litigation or insurance premiums. There may also be other categories to be discovered.

4.2 Innovation

So how do we discover whether one or more of these types of problems arises in the case of particular eObjects? How do we best approach a review of existing regulation to examine if there is a need for new legal rules to manage new risks or to encourage new behaviours, or there exist legal rules which are obsolete, under or over-inclusive, or are uncertain?

Koops, in his 2010 attempt to map the field of technology regulation research, placed particular importance on the dimension of "innovation" and the fact that non-innovative technologies are more likely to operate within existing regulatory frameworks than "radically new technologies" (Koops, 2010). However, he also explains that "innovation" is not confined to technologies that did not exist previously, but also to technologies which may have existed for some time, but some form of change in the socio-technological environment has led to them becoming far more widely used. He argues that "[i]t is far from rare that a change in the scale of a technology gives rise to significant regulatory questions".

It is useful then, to examine the innovations contained within or around eObjects to see where problems falling into one or more of Bennett Moses' categories will most likely arise. The innovations will be identified with the assistance of the technical framework already developed. Although some of the technology seen in eObjects, such as Internet connectivity, may not be "radically new", when compared with other innovations such as cloning or nanotechnology, a search for innovation should not be narrowly circumscribed to mere technical advances. For example, it is part of the very nature of eObjects that many more "things" will be connected to the Internet than previously: a change in scale this significant is likely to cause social change, which in itself may give rise to legal problems.

5 METHODOLOGY

The methodology adopted includes:

- a literature review of the technical literature; and
- a doctrinal and comparative research methodology which analyses Australian law and the law in certain other foreign jurisdictions who use eObjects in commercial activities.

5.1 Doctrinal Methodology

Doctrinal research has been described as "the systematic exposition, analysis and critical evaluation of legal rules and their relationships". It requires a study of existing and future developments in legislation, case law and academic commentary. Doctrinal research methodology is arguably well-suited to examining problems around law and emerging technologies. For example, new technological developments may throw up novel questions of liability for harm caused. In this instance, good doctrinal research will anticipate the types of question that might arise in litigation and suggest how they ought to be decided. It may also suggest the need for law reform to the extent that the problems arising are not amenable to judicial resolution.

Doctrinal research traditionally examines the systematisation and classification of existing law, but it can be argued that good (or at least interesting) doctrinal research should go further also aspire to "push … through settled legal questions to address questions that are complex and unresolved in the legal system" (Roux, 2014). To answer my question regarding the pacing problem, I will be examining the operation of case law and legislation to seek for areas where the law, in its operation on commercial situations involving the use of eObjects, is inconsistent, incoherent, unpredictable, or is otherwise unlikely to meet criteria for an appropriate balancing of commercial and community interests. I want to look at the way that when faced with new situations are rules acting the way they should.

I am seeking to examine "how [the law] ought to be understood and how it might be improved", in situations where it impacts on the commercial use of eObjects. Therefore, my ultimate aim in this research is not only "clearly and succinctly to express the norms (principles, standards and rules) that have been established" (Roux, 2014) in relation to eObjects but then "creatively to develop the implications of settled law for unresolved questions", assuming of course in my examination of established law that such unresolved questions do actually exist.

However, academic, legislative and judicial discussion of the law in this area in Australia is quite sparse. As with many emerging technologies, there are few specific primary law sources relating to eObjects, and little domestic academic commentary on which to draw. So to confine myself to examining only the Australian doctrinal landscape runs the risk of missing important issues. Therefore, in order to make a rigorous assessment of it and where the law is failing in relation to the commercial use of eObjects it is sensible to examine law and commentary relating to issues arising in other jurisdictions outside of Australia.

5.2 Comparative Elements

In order to examine foreign law appropriately, my doctrinal methodology includes elements of comparative law methodology. The examination of foreign law has become a common feature of doctrinal research in the last forty years. I am not concerned with the comparison of other jurisdictions for their own sake: my examination of other jurisdictions is unabashedly utilitarian and intended primarily to provide more material for my analysis of what, if any, legal problems are likely to be of concern in Australia in relation to eObjects (Van Hoecke and Warrington, 1998). Narrowly focussed comparative law research of this type has recently been recognised as a subset or type of doctrinal research. Therefore, my approach to gathering material and the analysis of that material will be doctrinal in nature. Of course, the nature of the legal problems in each of the jurisdictions examined is likely to be different, considering the differences in language, intent and values of the underlying law of each system.

I will use my examination of foreign law to answer two main questions:

- What issues have already arisen in relation to eObjects?
- How have those issues been previously been resolved by the legislature, judiciary and government agencies?

The results will assist in informing my analysis of a third question: what solutions might be suitable for Australian law? Attempting to gain these types of insights is seen as a traditional and useful way to use comparative law "simply because the different systems of the world can offer a greater variety of solutions than could be thought up in a lifetime by even the most imaginative jurist who was corralled in his own system" (Eberle, 2011). This is not confined to an examination of legislation and cases on the books: in examining commentary sources in other jurisdictions, I can benefit from the different experiences and "future-gazing" skills of other academics outside of the Australian sphere.

5.2.1 How will I use a Comparative Methodology?

Comparative law research can be defined as "the science or practice of identifying, explaining, or using the similarities and differences between two or more legal systems or their constituent parts" (Clark, 1998). Therefore, the first step I will need to take in my comparative research is to look at "one mass of legal data in relationship to another and then assess… how the two lumps of legal data are similar and how they are different" (Eberle, 2011). Once I have completed this key act of explicit comparison, I will then need to apply critical reasoning in order to answer the question "[w]hat do the divergences and similarities reveal?", in relation to my particular problems (Eberle, 2011).

However, it has been argued that the amount of comparison required in each case falls along a spectrum, rather than defined as an absolute. My own approach will be to use comparative law methodology on a relatively narrow scale, rather than being "thoroughly comparative" (Reitz, 1998). Following Reitz's suggested method, I intend to engage in explicit comparison but "solely as a frame to make clear ... the reasons why a domestic lawyer ought to be interested in the example of a foreign legal system", rather than a comparison on a larger scale of the "general patterns and themes" of the differing systems.

The type of comparative methodology elements I intend using will follow my doctrinal methodology relatively closely: I intend to "focus… on drawing out the lessons that foreign legal systems have to teach" from a doctrinal perspective, using the comparative method outlined by Reitz (Reitz, 1998). Aside from the requirement of explicit comparison, much of the

method he outlined is analogous to methods employed in standard non-comparative doctrinal research, such as a requirement to focus on all sources of law, such as statute, cases, and academic commentary. However, I will have to put into play distinctly comparativist skills when examining, as all comparative studies must do, the similarities and differences between compared jurisdictions.

Considering my object in the comparison, to discover new issues and new solutions in relation to the applicability of law in Australia to eObjects I will also need to engage (at least at a basic level) with the "long-running debate about whether legal transplants are possible given that the law is deeply embedded in the political, social and economic conditions of a particular jurisdiction" (Dias-Abey, 2012). Technological conditions must also be added to this list, as differences in these may also have an effect on the utility of legal transplants. Many information technologies, eObjects included, are not the same worldwide: they differ across jurisdictions, across industries, and across organisations.

5.2.2 Choice of Jurisdiction

Which jurisdiction or jurisdictions, then, will be the most likely to produce the breadth of material I am seeking within the scope of this dissertation? The United States offers an attractive target, not only due to language and the common law system, but also because of its large population and significant existing and projected corporate and consumer investment in these types of technologies. In relation to corporate activity, the United States is the base for companies who have made significant investments in the hardware and software underlying eObjects, or are acquirers of such companies: such as Apple, IBM, General Electric, Intel, Cisco, Ford, Broadcom and Google. For example, IBM has recently announced plans to invest USD3 billion over the next four years in its new Internet of Things business unit. In 2013 and 2014, Google spent approximately USD5 billion acquiring Nest (home automation), Waze (traffic applications) and Dropcam (home security monitoring). On the consumer side, American ownership of smartphones has almost doubled since 2011, and as of October 2014, 64% of American adults owned one. A recent consumer survey (albeit with a small sample size) in the US on projected consumer adoption of IoT devices indicated that 30% of consumers currently own or plan to buy an in-home IoT device (such as networked thermostats, vacuum cleaners and refrigerators) by the end of 2016, and the survey predicts that ownership of wearable IoT devices (such as fitness trackers and smart watches) will reach a similar number within the same timeframe. This amount of corporate and consumer investment in eObjects indicates that the likelihood of issues relating to coherence, certainty and applicability of contract and consumer protection law to eObjects being canvassed at a judicial, legislative, and/or academic level is high.

However, many of the technologies under discussion are very new, and therefore it is likely that comparative examination of only one jurisdiction will be insufficient to significantly assist in answering the research questions posed. It is therefore important that a number of jurisdictions be examined in order to uncover sufficient evidence for problems that might arise out of socio-technological change, to which judges, parliaments and other rule-makers should be expected to respond in Australia.

There are a number of countries in Asia and Europe with significant public and private investment in eObjects, such as South Korea, Germany, Japan and Denmark, and increasingly China, but lack of familiarity with the native language of these countries makes them less suitable subjects for my comparative research. Some assistance may be found in examination of European Union regulation, which is published in English, and may well contain regulatory reactions to developments in European countries with noteworthy investment in eObjects. Other likely subjects will be major English language jurisdictions such as Canada, the United Kingdom, Hong Kong, Singapore and India, particularly as investment in these areas expands.

6 EXPECTED OUTCOME

The categorisation of legal problems is important because it assists in ensuring that any legal problems identified are specific and defined, and reduce the likelihood that there is an overreaction to socio-technological change. I will use Bennett Moses' categorisation of legal problems outlined above (along with my own refinements) to assist in a legal analysis of the socio-technological change brought about by the introduction of and growth in scale of the use of eObjects. I will do so by discussing some of the critical innovations contained in eObjects, based on the technical framework already developed. Those innovations will be examined to identify the new things, activities and/or relationships that may be created.

After examining the circumstances in which the current law currently fails to address issues raised by the use of eObjects in commercial transactions, I will then proceed to the next part of the analysis. This will then constitute an attempt to answer the question: if there are significant contract law problems that do arise out of the use of eObjects, what reforms are required in order to appropriately protect the interests of product and service providers and consumers, in light of the goals of contract and consumer protection law?

Firstly, I will need to adequately identify and describe the goals of contract law and consumer protection law that are relevant to the use of eObjects. This will require a critical examination of contract and consumer law theory. Then, I will need to choose a framework in order to answer the reform question. Regulatory theory appears to me to be the most fruitful theoretical framework in which to work. However, I do not intend to look at regulatory theory in general, but rather to concentrate on the branch of regulatory theory which concentrates on regulation of technology. I will also investigate whether or not it makes sense to narrow the focus even more: that is, to concentrate on regulatory theory which concerns itself with information technology rather than technology in general, or even that which concentrates on cyberspace.

I will examine the practicality and utility of particular regulatory theories when applied to a real-world challenge: the emergence of a new form of technology. I intend to develop a set of principles on which any reform proposals should be based, a model that ensures that consumer rights, incentives for innovators to develop new products and incentives for businesses to distribute these products are appropriately protected, and any conflicts between those rights are appropriately resolved. This model will be based on the insights derived from my examination of regulatory theory, but also on the results of my comparative analysis of Australian and international jurisdictions and what is currently working (and not working) in the real world. One challenge to be addressed in the development of this model is the criteria by which "appropriate protection" is to be judged.

7 STAGE OF THE RESEARCH

I have completed the literature review of the technical literature, and constructed a technical framework from which to examine the technologies at issue. This has been published as an article (Manwaring and Clarke, 2015), and will form the basis for Chapter 2 of the dissertation. I have adopted and elaborated upon a conceptual framework through which to view the research questions. A second article is in progress, where I am using the conceptual and technical frameworks together to uncover legal problems which may arise out of the use of eObjects in a variety of situations.

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APPENDIX

Table 2: Common attributes of eObjects.

Attributes	Limits
Active capacity	An eObject may be able to perform acts which have an impact on the physical world, through the use of different types of actuators (devices which move things)
Adaptability	An eObject may adapt or be responsive to context (eg physical environment) and/or an individual (often referred to as "context-awareness")
Addressability	An eObject may have, at any given moment, an address that is unique, and that is at least potentially knowable (eg IP address, cell address, geo-coordinates)
Associability with living beings	An eObject may have degrees of personal association (either physical, emotional or based on a legal relationship) with particular individual humans and/or groups. These can range from family cars, to phones, to jewellery, to chips implanted in the human body. Associations may also exist with animals or plants (eg tracking movement or propagation of endangered populations).
Autonomy	An eObject may be fully autonomous, or have some degree of autonomy from human users or systems of which they form a part. The decision-making capabilities of eObjects may exhibit varying degrees of sophistication.
Dependency	An eObject may depend on remote services and/or infrastructure
Geo-Locatability	Any particular eObject, or all eObjects in a system, may be locatable in universal physical space or some bounded physical space
Human computer interaction (HCI)	An eObject, or a system that has eObjects as elements, may be "used" by obvious or explicit interaction (eg mobile phones), or by implicit human computer interaction (iHCI) where the eObject interface is unobtrusive or invisible
Identifiability	An eObject may have one or more identifiers each of which may be unique, and each of which may be at least potentially knowable (eg International Mobile Equipment Identity (IMEI) number for mobile phone handsets, International Mobile Subscriber Identity (IMSI) number for GSM SIM cards, Media Access Control (MAC) address for a network interface card)
Network Locatability	Any particular eObject, or all eObjects in a system, may be locatable in universal network space or some bounded network space (although they can appear and disappear intermittently)
Mobility	An eObject may be operational while moving within a physical space, when used by a person on the move or acting autonomously. A system that has eObjects as elements may maintain services to people while they are on the move, or autonomous operations, within some bounded physical space, by utilising multiple eObjects or successive eObjects encountered by any of its elements while on the move.
Operational, economic and social impact	An eObject's features and performance may be beneficial to some parties and detrimental to others
Portability	An eObject may be fixed in place, somewhat limited in movement by cables and connectors (ie tethered) or fully portable. Note that this is a subtly different concept from that of mobility: a mobile eObject can operate while on the move, whereas one which is merely portable can be moved from one physical place to another, but cannot operate while in transit.
Prevalence	A category of eObjects, or a system that uses eObjects to perform some function, may be in many places ("pervasive"), or in all places ("ubiquitous")
Use pattern	A person may have, or may use, one particular eObject or multiple eObjects, and may do so only once, with varying frequencies, or continuously.
Volatility	Due to its form factor, an eObject may have variable connectivity, restricted energy, limited storage capacity and slow or intermittent processing capabilities
Vulnerability	An eObject may be more or less vulnerable to security breaches, theft, and physical damage or destruction