Touching knowledge: Digital media practice and medium theory informing learning on mobile touch screen devices

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Abstract

The years since 2007 have seen the worldwide uptake of a new type of mobile computing device with a touch screen interface. While this context presents accessible and low cost opportunities to extend the reach of higher education, there is little understanding of how learning occurs when people interact with these devices in their everyday lives.

Medium theory concerns the study of one type of media and its unique effects on people and culture (Meyrowitz, 2001, p. 10). My original contribution to knowledge is to use medium theory to examine the effects of the mobile touch screen device (MTSD) on the learning experiences and practices of adults. My research question is: What are the qualities of the MTSD medium that facilitate learning by practice?

The aim of this thesis is to produce new knowledge towards enhancing higher education learning design involving MTSDs. The project involved a class of post-graduates studying communications theory who were asked to complete a written major assessment using their own MTSDs. Their assignment submissions form the qualitative data that was collected and analysed, supplemented with field notes capturing my own post-graduate learning experiences whilst using an MTSD.

I predominantly focus on the ideas of Marshall McLuhan within the setting of medium theory as my theoretical framework. The methods I use are derived from McLuhan's *Laws of the Media* (1975), its phenomenological underpinnings and relevance to the concept of 'flow' (Csikszentmihalyi, 2014b, p. 24).

The key finding of the study is that the experience of being in control is a central issue for students when they use the MTSD to learn. In pursuing this issue I discover the relevance of paradox to my investigation, which develops as the centrepiece theme and method that I deploy for my further analysis of the MTSD.

Master by Research Declaration

I, Victor Alexander Renolds, declare that the Master by Research thesis entitled "Touching knowledge: Digital media practice and medium theory informing learning on mobile touch screen devices" is no more than 60,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Signature 

Date: 13 November 2017

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I dedicate this thesis to Bernard Verwer, Mary Renolds, Geoff Cooper, Terry Barker and Ken.

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1. Introduction

Background and context of the study

It is January 2017, and I am working at the department of Learning and Teaching at La Trobe University. My experience working in this role titled Mobile Learning Designer seems all at once a world away and yet deeply connected to that of my Radio Technician apprenticeship in 1979, which I left to pursue a career as a professional musician and artist, well before the advent of digital communications and mobile devices. My education as a young musician was to learn through *experience*, by practice and knowledge shared or handed down from respected elders. I learnt by doing and participating in what was going on, and it all revolved around the medium of the electric guitar.

In 2004, it seemed to me that what was going on was the rise of the digital revolution: I was teaching at the School of Multimedia and Communications, Edith Cowan University having just completed my Communications degree there as a "mature-age student"[1] while (still) practising as an independent artist. Having experienced first-hand how digital technologies could present new and affordable possibilities in education and for artists, I was motivated to see where these possibilities might lead. In 2006, I thought that mobile computing in the form of the smartphone looked promising although I found the devices available at that time not particularly affordable and cumbersome to use.

By the time the iPhone was launched in Australia in 2008 I imagined that it was a new type of medium that would change my life – and it did in how I accessed information, took notes, recorded and created music, took photographs and video. I found the touch screen of the device compelling and much easier to use than my previous smartphone without a touch screen. What I didn't fully understand at the time was how profoundly the device would change not only my own habits or patterns of accessing information, communication, my arts practice and how I learned, but similar changes in the habits and practices of those around me. I

[1]Throughout this thesis, I use double quotes to denote the idiomatic usage of terms whereas I use single quotes for citations. I also use double quotes to denote a quote within a quote.

noticed the scale and the pace of this change: when I commenced a professional development support role at a member service organisation in August 2008, there were barely any iPhones or other devices with a touch screen around. By 2014, smartphone and tablet sales made up close to half the entire revenue of the global consumer electronics industry according to research conducted by Andreessen Horowitz (2015) – I refer to this group of devices as mobile touch sceen devices, or the MTSD.

When the iPad arrived in 2010 (Apple, 2010), several colleagues declared that it was an educational tool and I was soon tasked with investigating its potential for professional development purposes. I began searching online, reading articles, discussing with colleagues and meeting with external consultants to find that there was much speculation but a lack of evidence to support that the iPad had proven to be effective in adult learning and teaching contexts. I noticed that people also referred to the iPad as a "tablet" which as a metaphor caught my attention in relation to the semiotics of this term; I immediately drew a a comparison to the tablet in its various forms used for scholarly purposes and a representation of knowledge that can be traced back to the cuneiform etched clay tablets of Mesopotamia, around 3200BC (Kumar *et al.*, 2003).

By 2012 it seemed that most of my colleagues and people I commuted with owned some kind of mobile touch screen device; an Apple or Android smartphone and/or tablet. The phenomenon had changed and re-set the direction of my career to become about online learning and digital publishing with an emphasis on the role of mobile devices and technologies. At work that year, after observing the uptake of Apple iOS and Android devices via Google Analytics (2017), we optimised the interface of the learning management system for smartphones and tablets. While that year at work we learnt that people were using their MTSDs to access the learning management system (LMS), there was still not much data that might help explain how people were using it in their learning.

I remember becoming confused once when one of the (instructional) designers in my team asked "I want to know what the technology can do?" because as the designers of online learning resources, I believed it was our job to know what the technology can do. But then I remembered Marshall McLuhan's widely quoted postulation 'The Medium is the Message' (2003, pp. 7-23) which he elaborated on some thirty years before the rise of the Internet:

> This is merely to say that the personal and social consequences of any medium—that is, of any extension of ourselves—result from the new scale that is introduced into our affairs by each new extension of ourselves, or by any new technology (2003, p. 7).

I saw how this view of technology might show my colleague's question in a different light. I began to think more about what the personal and social implications of the MTSD might be, and somehow put these insights to use in our learning designs. Before long I had applied to Victoria University for a research place that has resulted in this study and thesis.

The problem

Although mobile touchscreen devices have proliferated in recent years there is little understanding of how learning occurs when people interact with these devices in their everyday lives. Particularly lacking is an understanding of how students use their devices for their studies across formal and informal contexts between the home, workplace and classroom.

Within the pedagogical literature, mobile learning has not produced the results we had hoped for in our understanding and practice of how to use mobile devices in education. Norbert Pachler, Ben Bachmair and John Cook (*Mobile Learning: Structures, Agency, Practices*), urgently called for schools and institutions to attempt to understand the place of mobile devices alongside other technologies and how this could enhance the learning and learning experiences of students (2010, p. 340). My concern is that this ambition, particularly in higher education, is yet to be achieved – academics, learning designers (and other relevant support roles in universities) are still working it out, or working it through. I see the main issue is that mobile learning or m-learning (and other relevant frameworks such as TPACK[2] for example) have not taken into consideration how the proliferation of mobile devices since the advent of the MTSD may have changed the way that people learn. This central issue is perhaps best described by Pachler et al:

> However, there exist as yet no comprehensive theoretical and conceptual frameworks to explain the complex interrelationship between the characteristics of rapid and sometimes groundbreaking technological developments, their potential for learning as well as their embeddedness in the everyday lives of users (Pachler *et al.*, 2010, p. 3).

Pachler et al also explain that there is a 'lack of clarity' as to what is even understood by the term *mobile learning* and whether there is 'a need for a separate field of enquiry' (Pachler *et al.*, 2010, pp.4-5). To some extent, this should explain the reason I have turned to medium

[2]The *technological pedagogical content knowledge* (TPACK) framework (Mishra and Koehler, 2006), while widely recognised, has been noted for lack of a clear pedagogy: 'three major factors become evident, but rather than being comprised of pedagogy, content, and technology, the only clear domain that distinguishes itself is that of technology' (Archambault and Barnett, 2010, p. 1656).

theory as an alternative theoretical framework; because it is concerned with the effects of how we interact with new mediums (and the MTSD is still relatively new). Ten years ago, people were not using their mobile devices to communicate, access information or create and publish content in the ways we are able to using our MTSDs today. To describe just one example, it was not possible to capture high definition video and publish it to a social media platform with a few taps on a device. In this regard, mobile devices at that time had a fraction of the capabilities and the usability that are evident today. While the technologies that make up what one can do with a mobile device has rapidly moved on, it seems to me that pedagogical research has struggled to keep up, so I am proposing a different theoretical approach that adapts what I consider to be a relevant and time-tested alternative framework, medium theory, in an attempt to find a clarity that others have noted is lacking.

Aim, significance and scope of the study

The aim of this thesis is to produce new knowledge towards higher education learning design involving MTSDs. To help produce this knowledge, I ran a study with a class of post-graduates studying communications theory. Working with the subject co-ordinator, I designed one of the major assessments for the subject, a written critical analysis of a blog post entitled 'Mobile McLuhan' (Woodill, 2012). As part of the assignment, students were asked to use their own MTSDs and discuss this in their analysis. The students' assignment submissions form the qualitative data that I collected and analysed, supplemented with field notes capturing my own post-graduate learning experiences whilst using an MTSD throughout the writing of this thesis.

While my study involved a pedagogical intervention, I wish to make it clear that pedagogy is the object of this study and not the subject – the MTSD is the subject. The purpose of my investigation is to use medium theory to examine the effects of the MTSD on the learning experiences and practices of adult individuals rather than use a more conventional pedagogical approach. I am not aware that medium theory has been used in this way before, specifically to observe the effects of a new medium on the experience of learning, and therefore this approach is also my contribution to knowledge.

Operational definitions

Bearing in mind the subject and object of the study, I should note specific terms that are used throughout this thesis and provide an operational definition to support the contexts in which

I use each term.

Code – is referred to in two specific ways. I use code in a historical and cultural sense as a written language imbued or bound to a medium type that is essential to the way the medium works or has an effect; for example, cuneiform or music notation. As a written language, the code will have a syntax: specific knowledge and skills about the syntax are required for the people in society who use it to produce artefacts or their effects; the scribed clay tablet or musical performance to follow on from the previous examples.

This leads to the second way that I refer to code: the computer programming languages that consist of instructions or commands (software) that make it possible for individuals to have operative *interactions* with the MTSD (hardware) and other computer based mediums.

Flow and flow. I use *Flow* (upper case) to refer to an affective state that is attained when an individual participates in an activity that involves skill and challenge. Flow was conceptualised by the Hungarian psychologist, Mihaly Csikszentmihalyi, while studying arts students in the 1960s (2014b, p. 230). The aspect of Flow most relevant to this thesis is the experience of participating in a task:

> In Flow, a person is fully concentrated on the task at hand. There is a feeling that action and awareness merge in a single beam of focused consciousness (2014b, p. 24).

I use *flow* (lower case) to denote a process or part of an activity that forms an internal or external pattern – a flow of thoughts, feelings and perception or the sequence of physical (learning) activities.

Hegemony. It is from an individual's perceptual experience of his/her own control of a specific context by which I refer to hegemony. Joseph (2002) provides a thorough reference for understanding hegemony from Gramsci to historical structural and post-structural understandings. He discusses that hegemony is not just concerned with a ruling bloc or 'hegemonic elite' (Quan-Haase, 2016, p. 265) but with the conditions which 'allow it to put itself forward as leading' (Joseph, 2002, p. 125). O'Sullivan *et al.* (1994) remind us that the hegemonic elite actively seek consent from others to adopt viewpoints that align with their interests (1994, p. 133). In this respect, this thesis is but one aspect of hegemony.

Learning – any *change of scale or pace or pattern* that is introduced into the experience and thoughts of the individual. The rationale behind this definition is provided in Chapter 2.

Learning by practice, learning practice – is essentially *learning by doing* (Schön, 1998) that for the purpose of this study involves the use of mobile touch screen devices.

Medium theory – as defined by Joshua Meyrowitz in following Marshall McLuhan's approach to regard how each medium is a unique environment type that can reshape people and culture (Meyrowitz, 2001, p. 10).

Motivation (intrinsic and extrinsic). Underpinning the work of Mihaly Csikszentmihalyi and the concept of Flow as it relates to this thesis are the research efforts that have been made towards understanding motivation. According to Ryan and Deci, motivation means '*to be moved* to do something' (2000, p. 54). Talcott Parsons is one of the seminal figures to examine the distinction between intrinsic and extrinsic motivation along with Edward Deci, Richard Ryan, Teresa Amabile and Beth Hennessey.

In basic terms, *intrinsic motivation* means to do something because it is enjoyable or interesting, whereas *extrinsic motivation* means to do something because of a separable or external outcome such as a reward or punishment.

Intrinsic motivation has long been valorised in research: 'People are most creative when they feel motivated primarily by the interest, enjoyment, satisfaction, and challenge of the work itself – and not by extrinsic motivators' (Amabile, 2012). While hundreds of empirical studies have established the detrimental effects of extrinsic motivation, research has also shown that extrinsic motivation can also enhance intrinsic motivation; for example, in social contexts when individuals compete, but this depends on the perception of the individual. In more recent years, research has been undertaken to encourage a more systematic approach to facilitate creative outcomes resulting from both intrinsic and extrinsic motivation in organisational settings (Hennessey, 2015, pp. 201-203).

There are also sections in this thesis where I use the term *intrinsic* on its own, to refer to motivations, thoughts, feelings and reasons. Where I similarly use the term *extrinsic* on its own, I am referring to the pattern of use of the MTSD and other mediums.

Ryan and Deci discuss intrinsic motivation as an important construct that reflects the natural human tendency to learn; and that both classes of motives are needed to enable autonomy against the backdrop of external control (Ryan and Deci, 2000, pp. 54-64).

MTSD – or the *mobile touch screen device* refers to the most used mobile devices with a touch screen, predominantly the iPhone and iPad, along with their Android smartphone and tablet counterparts.[3]

Phenomenology. According to Smith (2016), phenomenology is a philosophical tradition that began in the first half of the 20th century. Beginning with Edmund Husserl, Martin

[3]A summary of global MTSD usage and sales is provided in the Background and rationale section of Chapter 4.

Heidegger, Maurice Merleau-Ponty and Jean-Paul Sartre are also among the early proponents of phenomenology and remain authoritative figures. Kockelmans warns that the task of defining phenomenology is a 'sphere of ambiguity' (1967, p. 24) yet in simple terms, phenomenology can be understood as the way that we experience things – the study of *phenomena*. In this respect, the phenomenon of the mobile touch screen device (MTSD) is the research subject.

Rather than attempt to expatiate on this simple definition, it might prove more useful to highlight the aspects of phenomenology that are most relevant to this study. The following description should be considered from the perspective of the perceived experience of an individual's interactions with a medium, such as the MTSD, in the context of learning:

> The basic intentional structure of consciousness, we find in reflection or analysis, involves further forms of experience. Thus, phenomenology develops a complex account of temporal awareness (within the stream of consciousness), spatial awareness (notably in perception), attention (distinguishing focal and marginal or "horizonal" awareness), awareness of one's own experience (self-consciousness, in one sense), self-awareness (awareness-of-oneself), the self in different roles (as thinking, acting, etc.), embodied action (including kinesthetic awareness of one's movement), purpose or intention in action (more or less explicit), awareness of other persons (in empathy, intersubjectivity, collectivity), linguistic activity (involving meaning, communication, understanding others), social interaction (including collective action), and everyday activity in our surrounding life-world (in a particular culture) (Smith, 2016).

I regard these aspects of phenomenology as discipline and as part of the process and practice of writing this thesis.

Perhaps the most significant phenomenological aspect relevant to the study is the *gestalt*, what Merleau-Ponty argued is the basis of perceptual experience, a meaningful whole consisting of a visible figure against a hidden ground (Toadvine, 2016). In the following chapters, I explore and expand on this concept, as it applies to the MTSD through the concepts of Marshall McLuhan and linking this work to the ideas of Heidegger and other relevant theorists.

Smith also suggests that 'phenomenology might play a role in ethics by offering analyses of the structure of will, valuing, happiness, and care for others (in empathy and sympathy)' (2016). For me, ethics is another relevant and essential aspect of phenomenology that supports the process of respectfully working with the participants in this study, to carry through their voices in the ideas that they have helped to shape with their own experiences, insights and observations that have been captured in the data. My methodological approach builds on this

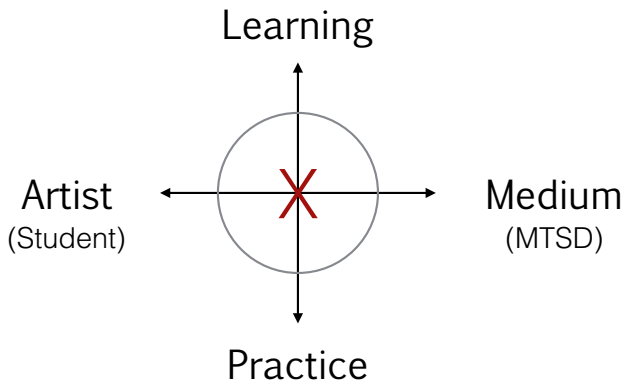


Figure 1.1: How I experience using a medium: artist and medium are interdependent, as are learning and practice ("X" denotes experience).

guiding principle by adopting methods derived from Moustakas that seek to better understand the phenomenon (the MTSD) by working to remove biased viewpoints about the participants (1994, pp. 3-9).

Summary and thesis outline

In Chapter 1, I have provided snapshots, or "samples" of my history as an artist and my work in higher education that lie behind my motive for pursuing this enquiry about the MTSD. I have provided this information to highlight that just as I regard each instrument or tool or medium that I use as an artist, I also regard the MTSD as a medium that I use with other tools – each one has its place in how I conduct my affairs. The use of the MTSD in my everyday life has become its own practice, and as a student it is part of my learning practice. Through experience, my understanding is that the relationship between practice and learning corresponds to the interchanging functions of the artist and student. In this thesis, I am concerned with the effects of interactions with the MTSD on this experience, and the aspects of the MTSD that have an effect on the mind. It is important to note that I bring this understanding to the study because later (in Chapters 4 and 5), I both utilise and try to set aside my own experiences in order to obtain a clearer and fuller picture of the (learning) experiences of the students who participated in this study. The emphasis of my approach is from the perspective and experience of the individual. My research question is: What are the qualities of the MTSD medium that facilitate learning by practice? The following paragraphs

outline how I set out to answer this question as I review and draw on the relevant literature to support my discussion and analysis of the student assignment data.

In Chapter 2, I describe in greater detail the origins of medium theory, The Toronto School and their significance to this study; to this end I define and explain terms that I use in this study and why I use them. I define *digital media practice* and argue that it is a significant enabler of using the MTSD to *learn by practice*. In order to contextualise medium theory to the MTSD and its relevance to learning by practice (learning by doing), I ascribe a definition of "learning" based on a broader definition of medium theory and introduce the concepts of intrinsic and extrinsic *flows*. I note the relevance of metaphor in the history of the *tablet* and the *artist* in their association to knowledge, education and the MTSD.

From a medium theory perspective, I question notions about what constitutes a "medium" and "content" in the effort to better understand the ways of using the MTSD that control these aspects which might lead to learning experiences. Key to this are our physical touch points of interaction with the MTSD and I draw on McLuhan to begin my argument that a significant effect of the MTSD is on our sense of touch and how this effect interacts with the mind. I look at the origin of the design approaches that have led to the development and existence of the MTSD as we experience using it today, noting that the touch screen provides a distinct experience resulting from its re-configurable touch interface. I discuss human computer interaction (HCI) design approaches, particularly the work of Mark Weiser and John Seely Brown that concern the perceptual effects of HCI relevant to the study. I introduce Mihaly Csikszentmihalyi's concepts of the *flow experience* and intrinsic motivation. I tie these concepts to Heidegger's metaphor of the hammer yielding carpenter *readiness-to-hand* and make this relevant to medium theory and the MTSD through the common phenomenological observation of *experience*.

In Chapter 3, I focus on the ideas of Marshall McLuhan within the setting of medium theory as my theoretical framework, while the methods I use are derived from *McLuhan's Laws of the Media* (1975) and its phenomenological underpinnings. I draw on McLuhan's laws to discuss the experiential aspects that involve the use of the MTSD as a learning tool and the intrinsic effects of this (extrinsic) practice. Following McLuhan's approach, I examine the visible and invisible aspects of the MTSD, or its figure and ground (McLuhan, 1975, p. 74).

I look further into medium theory constructs built on the legacy of Marshall McLuhan's work to explore the intrinsic flow of learning one encounters in the use of the MTSD. I apply McLuhan's Laws of the Media to reveal the visible and invisible (figure and ground) qualities of the MTSD medium, in contrast to the learning cognitive processes researched by Jean Piaget

(2002). Through this discussion, I develop the theme of paradox as my central method. I also bring into play McLuhan's role of the artist in society and connect this concept to my ideas about the digital media practitioner and learning practice.

I demonstrate how the application of medium theory, specifically the Laws of the Media can uncover new ways for us to think about the intrinsic and cognitive processes in the mind of the individual. I build on McLuhan's Laws of the Media and Piaget's observations about modes of thinking to identify a *combined* mode of thinking that I associate with the use of the MTSD for learning.

Chapter 4 expands on the research question, aims and descriptions of the experiment design and methodological approaches adopted to conduct the research study. I explain the purpose of the study and how I came to see the relevance of phenomenology to the investigation. Guided by the principles of respect and trust, I detail my rationale behind the design of the study including the methods and procedures of data collection and measures taken to ensure the integrity of the data. I discuss how my approach to trust the voices of the research participants differs from conventional "user experience" (UX) approaches. I describe the transcendental phenomenological methods (Moustakas, Cresswell) used to support my central discussion about the MTSD and its effects on the individual's experience of learning practice.

Situating my work in the domain of medium theory with a pedagogical objective, I also draw on the domains of phenomenology, flow theory, educational psychology and human-computer interaction (HCI). I have returned to the source of the literature in these areas, looking for new ways to apply original ideas, rather than the varied interpretations of others, many of which were made before the mass uptake of the MTSD. Through my review of the literature, I am able to draw from and connect some of the key ideas of Marshall McLuhan, Martin Heidegger, Jean Piaget, Mihaly Csikszentmihalyi and Mark Weiser to form a fresh and distinct frame for the study. This approach has helped me to focus on exploring the universal concepts that are of significance to my study of the MTSD – experience, learning, content, information, human computer interaction and flow.

Chapter 5 is my phenomenological analysis of the field study including data in the form of written assignments in the voices of the student participants and my own written reflections. To execute the analysis, the methods I use follow a ten step process adapted from *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* (Creswell, 2007, pp. 156-159). The analysis involves the process of reflecting on the initial findings using the technique of 'bracketing' or epoche (Moustakas, 1994, pp. 3-9) and describes my own experiences of learning practice using the MTSD. I then produce significant statements made by the student

participants about their learning practices using the MTSD alongside my own interpretations. From this I identify themes by grouping the significant statements which in turn informs my textural description of what happened during the research study. I conclude this chapter with reflections of the intervention.

The analysis reveals two new distinct types of flows involving the MTSD in the learning experiences and practices of the students. The first extrinsic flow is the pattern of learning tools used by students in which the MTSD becomes a conduit between learning contexts occurring in the classroom, home, workplace and everywhere in between. Contrasting is the intrinsic flow of the mind and thoughts of the individual participating in using the MTSD for learning. I compare this intrinsic condition that the students described with the corresponding ideas of Csikszentmihalyi and Heidegger. Students described this experience as 'flowing', 'constant' and/or a 'stream of consciousness' (student participant quotes).

The key finding of the analysis is that the experience of being in control is a central issue for students when they use the MTSD to learn. Students described the experience in contradictory terms: as a heightened sense of control of their learning when using MTSDs, and/or being overwhelmed by the technology and the volume of information. I pursue this issue as paradox, which becomes the centrepiece theme and method deployed for the further analysis of the MTSD. I lay out in detail the four themes that emerge from data analysis i) Hegemony: Experience of control, ii) Flow qualities of the MTSD, iii) Learning and teaching implications, and iv) Paradoxical effects of the MTSD and mobile technologies.

In Chapter 6, I begin with a composite description of the student participants' use and experience of the MTSD in their learning practices, and that having a sense of control is central. The conclusions section provides a narrative summary of the study through the themes and concepts discussed through the subject of the MTSD in this thesis. I provide a conclusion about the overall effects of the MTSD on society and discuss the need for a new digital literacy. I then return to discuss the artist, highlighting examples of artists' work to support the notion that there are existing methods that offer potential for re-thinking pedagogical approaches to the MTSD.

In my recommendations, I call for action in four areas in higher education - research, learning design, digital literacy support and systems. I expand on these recommendations to discuss a new *between* approach to learning design, the broader pedagogical implications of the MTSD, and the role that medium theory can play to inform the challenges we now face in society with the rapid rise of new technologies. Overall, I argue for new approaches that adapt to the new ways of learning that students create for themselves everyday by using the MTSD.

I include an extra statement about my original contribution to knowledge that concerns my application of medium theory to understand more about the pedagogical implications of the MTSD. My review of the literature and analysis of the data have produced two results. The first is a new concept that I have identified as a certain type of logic that can occur when we interact with the MTSD and similar mediums. I have called this concept the *theory of oscillating logic*. The second result is a new approach to learning design that can be applied to the MTSD as it is used with other mediums that students use for their learning practices. I call this approach *between design*.

2. Medium and flow

Medium theory

> A medium of communication has an important influence on the dissemination of knowledge over space and over time and it becomes necessary to study its characteristics in order to appraise its influence in its cultural setting. According to its characteristics it may be better suited to the dissemination of knowledge over time than over space, particularly if the medium is heavy and durable and not suited to transportation; or to the dissemination of knowledge over space than over time, particularly if the medium is light and easily transported. The relative emphasis on time or space will imply a bias of significance to the culture in which it is embedded (Innis, 2008, p. 33).

Medium theory is concerned with the effects that a medium, whether a pen, article of clothing or computer circuit, has on us as individuals and communities. Building on the work of Harold Innis, Marshall McLuhan first illuminated the significance of the effect of a technological medium above what it can do with his slogan 'The medium is the message' (McLuhan, 2003, p. 7). At the heart of this postulation is the observation that the mass uptake of a new invention introduces changes in the way we live - our daily routines, the supporting infrastructures and how these are controlled. The invention and adoption of the automobile, for example, massively changed the way that people commuted and travelled. The demand saw the world-wide development of sophisticated road systems to support commuting and the business of transportation. As a consequence of the mass production of vehicles and uptake of fossil fueled transportation, the ownership and control of oil production became a cornerstone in world affairs. There are other numerous examples where a new medium that is adopted widely has effected significant global change - the printing press, electricity, the telegraph, the telephone, the aeroplane, radio, television, the computer and the Internet.

The Internet did not introduce text, images or even electric communications and computers into human affairs as these all previously existed; yet among the more significant effects of the

Internet have been the "digital economy", "social media" and "online education". Business, social interactions and the way we learn have all changed by what is now possible because of the Internet – the facilitation of cross-border communications and transactions – in McLuhanesque terms, the global village (2011, pp. 25-36). The Internet is a re-invention of the global village conceived by McLuhan into the virtual world of the digital age. And we are all part of it:

> What we are considering here, however, are the psychic and social consequences of the designs or patterns as they amplify or accelerate existing processes. For the "message" of any medium or technology is the change of scale or pace or pattern that it introduces into human affairs (McLuhan, 2003, p. 8).

My specific interest in the mobile touch screen device (or MTSD) medium, is in the effect that it has on the individual, especially when the individual is involved with the MTSD in the activity that we call *learning*. Drawing here from McLuhan's view concerning human affairs, what I mean by "learning" is any *change of scale or pace or pattern* that is introduced into the experience and thoughts of the individual, how these thoughts travel and the individual's practices associated with that learning. The definition of learning that Csikszentmihalyi provides correlates with the definition I have derived from McLuhan.

> Learning is an increase in complexity in the information-processing capacity of an organism. It can be consciously pursued, or it can involve changes that happen accidentally as a result of the organism's interacting with his or her environment or reflecting on previous experience in an unintended way. In the first case we have deliberate, voluntary, intentional learning; in the second, spontaneous, incidental, unplanned learning. Deliberate learning can be either intrinsically or extrinsically motivated (Csikszentmihalyi, 2014a, pp. 528-529).

The similarities between the two definitions involve intrinsic and cognitive changes experienced by an individual brought about by interacting with information through an environment or medium. While Csikszentmihalyi quantifies learning as an increase in complexity of information-process capacity, my focus differs in that I investigate what that complexity of information-process capacity and its qualities might be. Csikszentmihalyi considers only the deliberate kind of learning whereas I take into consideration both kinds; specifically, the dynamics between deliberate and incidental learning. When Csikszentmihalyi refers to the term intrinsic, it is usually about motivation – I use the term differently and more broadly to also refer to thoughts that lead to learning. Finally, Csikszentmihalyi uses the term extrinsic here to distinguish his central concern with intrinsic motivation and criticise the practice of extrinsic motivation

(2014a, p.530). I use the term extrinsic to refer to external elements interacting with the individual from outside—mostly physical mediums and information—and how the individual uses these elements in the practice of learning.[4] The distinct feature of the way I have framed learning in this study is to question changes in the scale, pace and pattern of intrinsic and/or extrinsic aspects as meters or markers of learning; this feature is derived from McLuhan.

From this viewpoint, my research question is: What are the qualities of the MTSD medium that facilitate learning by practice?

Investigating this question involves the dynamics of the tension between *external* flows including mediums and information that the individual is exposed to, and the *internal* experiential flows of the individual specific to performing a learning task. A sub-question is: is it possible to tell when the use of the MTSD is motivating the individual or when a cognitive process occurs that enhances learning? I shall later in this chapter return to Csikszentmihalyi in consideration of this question, along with considerations that medium theory poses concerning our interactions with the technology and content, as these arise in my discussion concerning the MTSD. In this thesis and field study, I pose another sub-question: How does the learner use the MTSD to solve the problem of learning?[5] The purpose of this sub-question is to identify the role that the MTSD plays for the student as a learning tool; and the qualities of the MTSD that emerge when solving the problem of learning is in effect. This involves a condition accompanying this question that the student is interacting with the MTSD with the intention to learn. It is important to make this distinction because of the multitude of purposes that an MTSD can be used for other than learning such as social, entertainment or business purposes. In this regard, this sub-question works within the design of the study to maintain a focus on the aim of the thesis to produce new knowledge concerning MTSDs for enhancing higher education learning designs.

Since the earliest Mesopotamian cuneiform texts around 3200BC (Kumar *et al.*, 2003), the metaphor of the tablet has symbolised knowledge, learning and the classroom environment. With a culturally agnostic metaphor for knowledge, one can build and connect to newer concepts (Yost, 2008). Symbolically connected as a metaphor for learning, the ancient clay tablet and the MTSD are also both tactile learning mediums. The common issue I see concerning the two mediums is that to fully control and use the technology in its cultural setting, one requires specialist knowledge and skills (in scribing or coding). Associated with this are the

[4] I further discuss the practice of learning later on in this chapter and again when detailing my methodology in Chapter 4.

[5] Informed by my practice as a learning designer, I propose that using the MTSD to learn is a problem that needs to be solved.

forms of power that can be acquired in understanding and manipulating the language that makes the technology work. There are many contemporary individuals, Elon Musk (PayPal, Tesla, SpaceX), Bill Gates (Microsoft) and Steve Wozniak (Apple) to name just a few who have made an impact on the world by translating technologies into consumer products with their specialist knowledge as (computer) programmers. I put forward these elite individuals as an (amplified) example of this notion.

In recent years, the term "coder" has emerged to represent a person with computer programming knowledge and skills who writes 'code' as this relates to computer science (2017). I refer to *code* as a language and the underlying means to understand and control human interactions with the MTSD or another computer based medium. For the everyday learning designer in higher education, most of us "in the trade" know that having some coding skills is a digital literary asset that will help us to solve problems we might encounter in our roles. This digital literacy asset in turn informs our design decisions depending on the options available due to one's proficiency. In this way, coding is also a consideration for the academic and the student in their digital media practice because it is an enabler to control and prepare digital media for the MTSD (or computer)—if one practices. While the operation of the MTSD utilises the language of touch and gestures, in the background, it is the language of code that controls the device via these interactions—*touch events* processed by code.[6]

The Toronto School

The physical durability of a medium has bearing on its informative and expressive qualities. Zhao (2005, p. 14) refers to the Harold Innis communication model within space-time and the durability of analogue mediums such as clay, parchment and paper. The durability of digital media, as utilised by computers and devices, is dependent on the durability of the systems (people and infrastructures) that support its existence. Thus, in many instances, an analogue medium's durability is more autonomous than that of a digital medium and more likely to persist in time. Consider a future generation finding a hundred year old time capsule containing an oil painting and its digital counterpart on an MTSD; or a clay tablet and a smartphone of today. For me, the question arises of how to evaluate the communicative value of digital media artefacts that have condensed life spans, particularly in instances where

[6] I do not intend to go into the exhaustive history and HCI background about the development of touch events. For the intent of my study, it should suffice to note that touch events are sufficiently prevalent for there to be recommendations (World Wide Web Consortium, 2013) to standardise how technologies interpret and process touch interactions.

communicative value could easily outlive the medium – such as my example of the digital image on the MTSD in the time capsule. It is in asking such questions while stepping back in time that I seek to go beyond the fast changing affordances of the MTSD, such as any specific app, to explore enduring qualities of the MTSD that are likely to persist in some other form and remain relevant in how they affect the learning experiences of individuals.

The work of Harold Innis (1894-1952), Eric Havelock (1903-1988), Marshall McLuhan (1911-1980) and Walter J. Ong (1912-2003), collectively known as the Toronto School of communication theory, is a far reaching tradition. Their work stems from exploring Ancient Greek Literature and examining cultural change in relation to the introduction of new technologies, especially by contrasting oral to literate forms. Innis is regarded as McLuhan's mentor while McLuhan supervised Ong's scholarly research. Coté (2010) discusses Innis and McLuhan's insights of media artefacts in *Technics and the Human Sensorium: Rethinking Media Theory through the Body*:

> Their basic insight is that media artefacts significantly impact both culture and the human mind. On the one hand, Innis examined how the dominant medium in a given historical period enabled and constrained forms of political and economic organization in what he called the bias of communication. McLuhan, on the other hand, primarily focused on the impact of media and communication systems on the calibration of the ratio of sensory perception (Coté, 2010).[7]

However, McLuhan makes it clear that to understand a medium means to approach it as an environment: 'Any understanding of social and cultural change is impossible without a knowledge of the way media works as environments' (McLuhan, 2002, p. 26).

In *Orality and Literacy* (2002), Walter J. Ong discusses the development of the written word and type as technology; he also draws attention to the human condition as we try to match the evolution rate of text based technologies, including computers. He optimistically describes the human adoption of technology: 'Technology, properly interiorized, does not degrade human life but on the contrary enhances it' (2002, p. 82). He views the human adoption of technology involves a mechanical process of human interaction that needs to be 'interiorized' by its user to take effect illustrating this point with the musician's use of his or her instrument as the technology:

[7] Also of significance to the effects of media on our sensory perception is the "common sense", or the *sensus communis*, discussed at length by Marshall and Eric McLuhan in *Laws of media: The new science* (1988).

> To achieve such expression ... has to have interiorized the technology, made the tool or machine second nature, a psychlogical part of himself or herself. This calls for years of "practice" (2002, p. 82).

When it comes to the MTSD, the mechanical aspect of the interiorizing that Ong speaks of is the human interaction that involves touch – I shall return to this crucial point further on. Ong's 'expression' is in other words a proficiency that the artist needs to develop in being able to get the medium to do what the artist wants it to do, through physical interaction and touch. The expression that Ong's musician takes years to develop interacting with traditional instruments that have been with us for centuries, compared to the expressions made possible since MTSDs has been widespread, around ten years, might according to Innis indicate that the life of the MTSD is shortlived. If this is the case it might be for a reason other than the durability – perhaps the MTSD will be shortlived because the expressions through our interactions with the MTSD will become less meaningful to us when there is a new medium ready to easily take its place.

Ong (2002, p. 112) discusses the transformation of individuals and the world through Learned Latin – the 'Interaction produced all sorts of special results'. In the context of learning for the purpose of this discussion, it follows that interaction with a medium is essential for there to be results. When applied to the computer and the MTSD, this becomes more humanly complex within an interactive non-linear environment with dynamic content potentially loading from any world location, together with communication and information flows of one to one, one to many and many to many. The state of these information flows are essential to what has been termed as "mobility", in particular "mobile" learning, and how these are relevant and applicable to the practice of learning using the MTSD:

> It can hardly be claimed that the concept of 'mobility' has not been a concern of researchers, scholars and education practitioners for a long time. What is new, however, is the capability and the functionality of the technology usually associated with 'mobile learning', in particular the convergence of services and functions into a single device, its ubiquity and abundance, portability and multi-functionality; abundance in particular in the sense of a shift away from educational institutions having to provide technological devices towards the learner doing so. What is also new, and very significant in our view, is the boundary and context-crossing mobile technologies and devices enable in relation to learning. Mobile learning - as we understand it - is not about delivering content to mobile devices but, instead, about the processes of coming to know and being able to operate successfully in,

and across, new and ever changing contexts and learning spaces (Pachler *et al.*, 2010, p. 6).

I see that 'boundary and context-crossing' are indeed flows in the practice of learning using the MTSD that de-emphasise content. For this purpose, I shall now explore the notion of de-emphasising content further in order to support the significance of a flow that carries a person in new patterns across boundaries and contexts that leads to new understandings – or what we also describe as learning.

McLuhan's concepts (2003) of the interaction between humans, technology and society are a legacy that persists. I propose that 'the medium is the message' entails the mobile touch screen device is the message of this time.

McLuhan thought of technology as an extension of ourselves. 'Any technology could do anything but add itself onto what we already are' (2003, p. 19). Technology as humans experience in its extreme, is in the time and place of war. Much can be taken away from a person and community, whether there is the will to engage with the technology of war or not. This is different to McLuhan's concept of 'amputation', as compared to 'extension' of one's 'being in a new technical form' (2003, p. 23). Although, if technology can add as McLuhan suggests and also take away, then to describe both at once, would this not be change? Just as he puts forward that cubism collapses a dimension of space to reveal more of the whole (2003, p. 25), we can apply McLuhan to McLuhan, to see that change through technology is also an extension of ourselves. The properties and quality of our collective will determine the changes that are party to that extension.

Whether the technology adds to or changes us, for instance to learn, then what is the role of content? To begin to apply this train of thought to MTSDs, we can consider two more of McLuhan's concepts: the first is that of 'content' as media (2003, p. 23); and the second is our level of participation in hot and cool media (2003, pp. 39-50). We engage passively with hot media because it is 'high definition', not relating to machine pixels – it is saturated with information and requires low interpretation to make sense. Cool media requires active engagement and a high level of interpretation for us to make meaning of it.

We can think of a sound recording, say a podcast, accessed via a MTSD. Commencing from the medium of the device, we can try to work our way inwards to try to find 'content'. After the device, we have a series of software – the device operating system, the podcast app, then the "media player" that will "play" the audio file. Each of these is a medium containing more media. The audio file is what is conventionally regarded as content; what one applies content management processes to in an organisation where there is a volume of similar "content". This, however, is for practical purposes and does not reflect the nature of the audio file as a medium. A sound recording as recorded in a sound studio is naturally regarded

by the producer as a medium. So too, are the lyrics of a song or the sound and score of a composition by their respective creators. Does the artist, author, composer or architect think of their practice or work as "content"? Hardly! The word content is stagnant in meaning, while the word medium is imbued with life in its purpose to communicate. In this way, analysing the medium of what the word "content" might be betrays a hidden nature. In this case the word content has the potential to render a meaningless message. When there is a volume of any medium as a result of mass production, it eventually becomes viewed and treated as content, classified as something that needs to be managed or controlled; worthy of investigation in its own right. The constant grind (or function) for the digital content developer or publisher is to fill a quota of content to publish a product that has pre-determined attributes such as volume, style and format or layout. In my experience, this is more about an overall aesthetic or brand, and efficiency for speed to market, than the consideration of how to best tailor a medium to suit the medium that conveys it, so that messages are communicated with an accuracy as intended by the author. With the obsession to find content to fill placeholders, the publisher ultimately creates media diluted in its purpose to communicate ideas or express artforms. The constant driver behind this dilution is marketing logic, where at its most obvious, third party advertising competes with screen real estate, although the nuances of conforming to brand touch all aspects of messaging. McLuhan states:

> Owners are aware of the media as power, and they know that this power has little to do with "content" or the media within the media (McLuhan, 2003, p. 77).

Owners might also know that the cost of power is the dilution of the informative and expressive communication flows that education depends on.

The singular MTSD might now be seen as a complex medium containing or connecting to other mediums that each have a potential message or meaning. Within this complex model, each individual medium as found or perceived would have its own expressive of informative effectiveness. To understand how hot or cool the overall effect of the MTSD is at a moment in time, or to otherwise assign to it a temperature is problematic. When McLuhan formulated this concept, he regarded television, in its black and white visual and low-fidelity audio form, as a cool medium. By contrast, today's high definition colour TV with high-fidelity audio might be regarded as a hot medium.

Like any human activity, the process of one or more persons engaging with media involves a system. This is commonplace in the digital age where one comes into contact with content management systems even if completely unaware of it. Systems enable us to obtain the latest news or download music and video from catalogues stored on a remote (or cloud) server. The

essential component of a system is people without which the system does not function, it ceases to exist. McLuhan:

> What I am saying is that media as extensions of our senses institute new ratios, not only among our private senses, but among themselves, when they interact among themselves (McLuhan, 2003, p. 78).

Unless robots or another technology arise to procreate and sustain their own existence, the shortfall in McLuhan's model is that humans are required for this to happen. Extensions cannot operate without the human. To some degree McLuhan acknowledges that this process occurs within a system, although human embodiment is in the macro social collective (2003, p. 95). Whereas each individual human participant can also act autonomously – without human support, media cannot. At our starkest, the human can learn through awareness and observation alone.

Critics of McLuhan include Michael Warner, who argues for the prominence of the socio-political. Warner's criticism targets the emphasis on media and technologies over historical social and political conditions: 'When media and technologies receive this type of transcendental status, their social investments and rhetorical meaning disappear from the field of analysis, only to return in a mystified form, disguised as the previously latent logic of the technology' (1990, p. 8). Warner rejects the notion of technology determining culture (*technological determinism*): 'The assumption that technology is prior to culture results in a kind of retrodetermination whereby the political history of a technology is converted into the unfolding nature of that technology' (1990, p. 9). There has since been a body of work built on the foundations of the Toronto School, that with the advent of the Internet, includes research such as the question of identity and embodiment in relationship to society and technology (Viseu, 1999).

It was Joshua Meyrowitz who, speaking of Marshall McLuhan at a keynote address at New York University in 2001 said he had come to 'unbury' him, 'wrestle with his legacy and add encouragement for moving beyond McLuhan' (Meyrowitz, 2001, p. 8). A significant purpose of the address was to re-contextualise McLuhan's theories to the academic research at the time. Meyrowitz notes:

> As Paul Levinson (1999) has documented in impressive detail in his book *Digital McLuhan*, McLuhan's theories are even a better match for the current digital age than they were for the communication technologies that existed when McLuhan was writing (Meyrowitz, 2001, p. 10).

Reworking 'The medium is the message' from McLuhan's defining work *Understanding Media* (McLuhan, 2003, p.7), Meyrowitz offers his rationale in establishing the term "medium theory" to distinguish McLuhan's theories and legacy from the wider body of work researching communications and media:

> Each medium is a unique type of environment whose widespread use reshapes people and culture. I've called this approach "*medium* theory"—following McLuhan in the singular "medium" as the key "message"—rather than *media* ecology or *media* theory in general, because medium theory focuses on the unusual characteristics that distinguish one medium, or one *type* of media, from other media (Meyrowitz, 2001, p. 10).

In contrast, Neil Postman defined the term *media ecology* in his keynote address, *The Humanism of Media Ecology* at the first convention of the Media Ecology Association (2000). The emphasis of Neil Postman's view when he speaks of 'media ecology' is on the broader effects of mass media on society, compared to my approach emphasising the effect of the singular medium, the MTSD, that follows the model set by Joshua Meyrowitz. The usefulness of my position in following McLuhan's concepts and framing the *medium* rather than *media* is in its application to the specific activity of learning in society concerning higher education; by focussing on the effects of the singular MTSD medium on the research participants (and myself) I achieve a means of scoping my study to a particular mise-en-scene or frame from which I can induce and argue concepts that can be applied more generally, such as principles for higher education learning design involving the MTSD and the broader effects of the MTSD on people using it in learning contexts.

McLuhan and the digital age

The advent of the Internet saw a resurgence of interest in the work of Marshall McLuhan. Proponents of McLuhan's work, including Paul Levinson, author of *Digital McLuhan: A Guide to the Information Millennium* (2003a), claimed McLuhan foresaw what was to come in the Digital Age because of his attuned sense of the potential that electrified media had to offer the human needs of communication on a global scale. At the time of writing this section, (25 October 2015), Levinson had just hours before, self-published a short digital essay *McLuhan in an Age of Social Media* (2015) via Amazon stating that it 'may be considered as a new chapter' to *Digital McLuhan* which was first published in 1999. As the title suggests, Levinson's essay focuses on social media. This comment draws attention to the role that smartphones and

tablets (the MTSD) have played in changing global communications:

> The digital world today is very different than the way it was then, when there was no Facebook, Twitter, or YouTube, no smartphones or tablets, in short, no social media and the devices we carry in our pockets to be in touch with these media 24 hours a day (Levinson, 2015, p. 3).

Using Mcluhan's ideas Levinson notes human expressions made possible by smartphones and tablets, such as the 'selfie' and even the app, Snapchat, which is only available on the MTSD. But he does not attribute the MTSD (or the smartphone and tablet in his terms) as a medium or mediums that have played a part in world events. Levinson discusses social media as having a role in the Arab Spring but completely overlooks the fact that much, if not most social media in the world today is tasked to the mobile device. On 5 May, 2015, Google confirmed on their advertising blog what marketers had been projecting would occur for several years:

> More Google searches take place on mobile devices than on computers in 10 countries including the US and Japan (Google, 2015).

And Google's figures only take into account smaller MTSD smart phones; they do not count the larger MTSD tablets in this statistic.[8]

Apparently, in 2015 Apple's marketing machine seem to know full well how the MTSD has changed the world—and are clearly making efforts to further capitalise on it with a revised interface—an enhanced MTSD that not only responds to touch, but the *pressure* of the touch:

> The original iPhone introduced the world to Multi-Touch, forever changing the way people experience technology. With 3D Touch, you can do things that were never possible before. It senses how deeply you press the display, letting you do all kinds of essential things more quickly and simply. And it gives you real-time feedback in the form of subtle taps from the all-new Taptic Engine (Apple, 2015b).

The Apple marketing web page (2015a) includes an animation of a hand holding an iPhone 6S; the thumb moves to touch a link on the screen, then appears to apply extra pressure to open a specific type of window for this pressured touch form of interaction. The animation promotes the functionality of the new types of touch events of the interface that respond to pressure - 'peek' and 'pop'. This enhanced MTSD facilitates a new form of interaction that responds to the depth of touch so that the harder one presses, the more is revealed. McLuhan

[8] According to statistics gathered by Dublin based StatCounter, Internet usage by mobile and tablet devices (51.3%) exceeded desktop (48.7%) worldwide for the first time in October 2016 (StatCounter, 2016).

(2002) playfully proposed that the wheel is an extension of the foot; the book an extension of the eye; clothing an extension of the skin; and electric circuitry an extension of the nervous system—now it seems, the MTSD extends the finger, and does so by re-biasing the ratio of the senses towards touch.

The digital media practitioner

With our dependency in this age on digital communications and media, the ideal subject of interest for my research is the "digital media practitioner". In professions such as medicine and law, it is the role of the practitioner to assist patients and clients to better understand an ailment or law that applies to them, to assist in a practical way with advice and treatment. While there are many professions associated with digital media, there are no agnostic digital media practitioner professional standards, code of conduct or ethical standards; and in educational institutions, digital literacy frameworks that might work to address some of the ethical issues involving digital media practices are still emerging.[9]

Adapting the McLuhan concept that content is actually media, we can say in a practical sense that a digital media practitioner uses digital tools to create containers for conveying messages, the expression of an artform or to contain more media containers. My purpose is to associate this ideal subject who uses the MTSD with the archetype of the artist, which I can ascribe to the student research participants. My rationale in this regard is to use the artist archetype to counter balance the metaphor of the ancient tablet in the scholarly context; to this end, I shall develop the facets of the digital media practitioner linked to the artist as my discussion progresses in the following chapter.

Design, human computer interaction and the MTSD

The MTSD as a ubiquitous medium emerged with the introduction of the Apple iPhone in 2007, the mass production of its distinct form and function the result of the industrial design culture at Apple nurtured by its co-founder and chief executive officer, the late Steve Jobs. In his biography, Isaacson (2011) details how Steve Jobs was influenced by industrial design from an early age; Apple's industrial design team are still led by the celebrated industrial designer Sir Jonathan Paul "Jony" Ive who received a 2007 National Design Award (product design category) in the U.S. for his work on the iPhone (Trescott, 2007). The Apple approach is prescriptive, where the designers have much of the control over how products should function

[9]Three different examples of digital literacy frameworks from Open University, University of Queensland and Australian Catholic University illustrate that digital literacy is a relatively new field.

(Isaacson, 2011, pp. 1003,1625). And yet, the MTSD is also the result of human computer interaction (HCI) research and practice that has expanded rapidly since the emergence of the personal computer. According to Myers (1998), HCI together with the world-wide web largely came about from government funded HCI research in universities. This is significant because it distinguishes that while the MTSD owes its ubiquitousness from industrial design, it also owes its existence to HCI in its design – after all, the MTSD is also a computer.

I see that the human necessity to touch, contrasted with the necessity to touch an MTSD for it to operate, are not mutually exclusive. Since the MTSD, human computer interactivity has afforded a closeness with various mediums previously not possible or permitted. To peruse an image gallery on an MTSD, one must touch or swipe the images to navigate. Cultures that value the preservation of paintings or photographs prohibit the touching of these types of mediums. This cultural barrier is removed when the medium artefact is digitised and purposed for use on an MTSD. Within families, small children with soiled hands who are not so careful with a printed photograph can not only use an MTSD to interact with a gallery but they can take their own photographs with just one touch. This example demonstrates the cultural shift that I see the MTSD now facilitates with learning possibilities through interactions via its interface biased to our touch sense. In the next chapter I shall extend this branch of my discussion to consider the implications of touch interactions with the MTSD on the intrinsic flow of the mind.

Touch as a means of accessing, interrogating and negotiating information as it is housed within an MTSD is almost[10] the direct physical meeting between human and media—the icon, image and word—on the touch screen. Gone are the peripherals that constrain movement and mobility; by comparison, the computer with a mouse and keyboard facilitates a more remote, less physically direct interactivity with digital mediums. The peripheral mouse or keyboard in one location must be operated before a result of the operation appears on the screen in another; the MTSD scales down the proximity between the interaction and its result to enhance the directness of the sense of touch. The development since 1984 (The Economist, 2008) of multi-touch event actions that these devices support brings into play a new level of sophistication and intimacy of interaction between human and machine—gestures, pinches and swipes with one, two, three, four or more fingers—all meaning and resulting in something different. At once, the touch screen is the modus operandi and the viewing pane – three dimensions collapsed into and onto the same two dimensional space. It is this space-time warped, multi-touch quality

[10] Almost because the glass is a barrier to digital visual media that we can never touch – unlike an analogue medium such as a painting or sculpture.

that differentiates the MTSD from any other mobile device medium. When connected online, geographical distances between individuals and information collapse, compressing our human experience of the time dimension. The MTSD, as an autonomous media artefact vessel, allows the individual to reach many others and much information in many ways – just by touch. The modes of mass information flows – via email, web pages, text messaging, audio visual media et al bolstered by social media platforms are further compounding and compressing the space-time dimensions that we experience.

The luxury that the touch screen interface has afforded the designer and user is the infinitely re-configurable interface. Every app that is designed for the MTSD screen can start with a blank canvas for the interface and only include what is needed, when it is needed. For example, the controls of the Apple iOS video player become hidden when not used, but can be retrieved by touching the video to activate their visibility. The heat, as McLuhan might argue, is hybridised, biased towards the software (2003, pp. 53-61).

Lev Manovich has made significant observations on the effects of computerisation on the world, the new cultural forms that he discusses in *The Language of New Media* (2001)—where "new media" is what we also know as (interactive) "digital media". Regarding his work as a stage in medium theory that traces back to the work of Harold Innis and Marshall McLuhan (2013, p. 10), Manovich builds on the research and practice of Alan Kay who worked at the research and development company of information technology, Xerox PARC in the 1970s. Manovich covers a lot of ground and perhaps he intends to make up for scholars who have neglected to record the emergence of the computer age:

> Where were the theoreticians at the moment when the icons and buttons of multimedia interfaces were like wet paint on a just-completed painting, before they became universal conventions and thus slipped into invisibility? *(*2001, p. 224).

According to Manovich, Kay was a significant figure among the first at Xerox PARC to recognise and realise the cultural implications and potential of computer technologies at this time, and how to design meaningful human computer interactions with the graphical user interface (GUI) and its use of *metaphors* which facilitated the creation of mediums—especially interactive mediums—that had not previously existed; this has led to digital practices now commonplace – blogging, digital video editing, compositing, interactive multimedia *et al*:

> The evidence is overwhelming. It is Alan Kay and his collaborators at PARC that we must take to task for making computers imitate old media. By developing easy-to-use GUI-based software to create and edit familiar media types, Kay and

> others appear to have locked the computer into being a simulation machine for "old media" (Manovich, 2013, p. 58).

Here, Manovich reminds us that the rise of the computer as a medium—and this includes the MTSD—has been successful because of the way that software has been used to simulate physical mediums through the use of metaphors. Where I diverge from Manovich to begin my enquiry about the MTSD is here – by re-emphasising that the MTSD is a metaphor for the ancient scholastic tablet, whereas the focus of Manovich is on the cultural effects of software and the nature and types of new mediums that software has made possible.

It would be amiss not to mention hybrid mediums among Manovich's new medium types, which McLuhan defined as the cultural effect of two newly combined mediums; for example, the combination of the car and the electric light resulted in vehicles that can be driven all night (2003, p. 57) – think road-train and fresh food or fast food... Manovich on the other hand is specifically talking about new combinations of *digital* mediums represented by software that overlap with multimedia (2013, pp.166-169). Here, he uses two metaphors for hybridization: biological reproduction resulting in a new medium with the 'DNA' of its parents; and *remix* where different medium types are combined to form new combinations – think DJs, VJs and mash-ups. My view is a step back towards McLuhan in that I regard that the hybrid of the iconic tablet and software have been fused to create the MTSD resulting in the release of a great deal of cultural energy. To illustrate involves another example, this time the combination of mediums that are connected within and with-out the MTSD – its camera, software and the social media platforms by which photographs are shared; according to Deloitte Global around 2.5 trillion photos will be shared or stored online in 2016, largely due to 'smartphone capabilities' (2016). These types of observations about the mobile technology are remarkable because the term "smartphone" does not accurately portray the truer and apparently invisible nature of this medium – the five most ubiquitous brands of smartphone in the world today (Gartner, Inc., 2016) Samsung, Apple, Huawei, Oppo and Xiaomi all have touch screens.

Manovich can offer more inspiration: he pinpoints a 1977 article written by Kay and colleague Adele Goldberg, a computer scientist and key collaborator at PARC (2006) in which the future possibilities of the cultural function of computers were conceptualised. To Manovich, the article (possibly still) marks a paradigm change in the way we understand digital media through Kay and Goldberg's arguments that the computer is a *metamedium*, named so because its *content* consists of representations of mediums that already exist and those that have not yet been invented – "new mediums" with new properties. Whereas the MTSD is also a computer, this leads us to conclude, according to this logic, that the MTSD is a metamedium

that houses "content mediums" or "new mediums" with distinct properties; even if the new medium represents a physical artefact, its digital properties allow it to be manipulated in ways that its physical counterpart could never be changed. For example, the multitude of ways that digital photographs can be manipulated with image editing software has led to colloquialisms such as "it's been Photoshopped".

Where my perspective alters from Manovich is by commencing with the quality of our reconfigured sense of touch interactions with the computer medium that defines our relationship with it; in this sense the MTSD with its multi-touch screen interface enhances our physical connection with it, even if software design plays an undeniably dependant role. Our connection with the MTSD starts and ends physically with touch, without which our other senses would not be satiated with vision or sound. It is not yet the case that alternative sensory interfaces, for instance sound driven interfaces made possible by voice command technologies such as Siri challenge the ubiquity and cleverness of the mobile touch screen device interface.

Calm technology

Mark Wieser (1952-1999) was chief scientist at the research and development company of information technology, Xerox PARC. Wieser first proposed ubiquitous computing in his article *The Computer for the Twenty-First Century* (1999), envisaging a world where computer mediums of various sizes are as common as electrical wiring—invisibly integrated into the way we live. The distinct feature of ubiquitous computing (or ubicomp), as Weiser prescribed, was 'to conceive a new way of thinking about computers in the world, one that takes into account the natural human environment and allows the computers themselves to vanish into the background'. He positioned this concept opposite to "virtual reality", which simulates the physical world, rather than to augment it in the way he saw that ubiquitous computing would.

Extending the vision of ubiquitous computing, Weiser and his colleagues, particularly John Seely Brown, saw that a new approach which they called "calm technology" was required to achieve the potential of information technology—one that encalms and informs, not by demanding to be the centre of our attention, but to occupy the periphery of our attention. It is this concept of "periphery" that Weiser likens to Heidegger's readiness-to-hand (1999) that, as I shall soon explicate, results in the invisibility of the medium and the self—only the task and the enjoyment of the task that a person is doing remains.

Weiser and Brown worked to articulate the calm technology approach so that, following the first computer 'mainframe era' and the second 'PC era' that it might be applied to the 'UC era' or what they called the 'third wave' of computers beginning to emerge at that time

(1996a). The MTSD and other mobile technologies are often regarded in research as part of the era of the third wave or ubiquitous computing. Weiser and Brown worked to begin designing calm technology, in that the problem they recognised as being calm technology is to 'encalm and inform' people; and that to solve this problem of the twenty-first century required a dialogue. They saw this as a substantial issue:

> Designs that encalm and inform meet two human needs not usually met together. Information technology is more often the enemy of calm. Pagers, cellphones, newservices, the World-Wide-Web, email, TV, and radio bombard us frenetically. Can we really look to technology itself for a solution (Weiser and Brown, 1996b, p. 1)?

The significance of Weiser and Brown's work to my investigation of the MTSD and its purpose in learning is in their design approach to calm technology. There are common phenomenological underpinnings that recognise the visibility and invisibility of technology that have an effect on how well we might be informed by them—or learn with them. Weiser and Brown's view is that we are best informed when the technology demands the periphery of our perception of the world. But to design for "calm", in which we use ubiquitous computing to optimise the physical environment for people to be informed (or learn), involves designing for both the periphery and the centre of our perception (1996a). I revisit Weiser and Brown's peripheral and central perception in how it applies to my investigation of the MTSD medium and learning in the next chapter.

Flow theory and phenomenology

Flow theory as proposed by Mihaly Csikszentmihalyi (2014b, pp. 230-231) is a means of understanding intrinsic motivation. In Csikszentmihalyi's terms, 'Flow' is a psychological state of optimal experience that he identified by observing and researching the practice of artists, athletes and professionals over more than four decades with his colleagues Nakamura, Rathunde and Whalen. A Flow experience is one in which a person is participating in an activity that is optimally challenged for that person's knowledge and skills; it is also an activity that the individual finds enjoyable. Characteristics of this intrinsic immersion in participation are 'merging of action and awareness', a 'sense of control' and an 'altered sense of time' (Csikszentmihalyi, 2014b, pp. 230-231). Examples of what the activity might be are a social conversation, rock climbing, a game of chess or a learning task in the classroom or online.

Csikszentmihalyi sets out three *conditions of Flow* as: i) clearly stated and understood

goals; ii) the precondition of a balance between the perceived challenges and skills; and iii) clear and instant feedback. The value of set goals serves to enhance experience and focus attention rather than being a means to an end; it has an active purpose. As for the balance between challenges and skills, he highlights that what matters phenomenologically is one's perception, not objectivity; an imbalance biased towards too great a challenge can result in anxiety, a bias towards a weak challenge can easily equate to boredom. Finally, clear and instant feedback serves to assist one to adjust one's actions to maintain the state of Flow with an equipped understanding of what to do next.

A defining facet of Flow theory is Csikszentmihalyi's recognition that how the individual feels and evaluates an experience has a direct effect on the motivation to cease or continue an activity. He writes:

> Our research suggests that the phenomenological experience of flow is a powerful motivating force. When individuals are fully involved in an activity, they tend to find the activity enjoyable and intrinsically rewarding (2014b, p. 233).

All of this is highly relevant to the internal flows of the individual involved in a learning practice that utilises the MTSD. Given the mass uptake of the MTSD, one can induce from a Flow theory perspective the high probability that the MTSD has positively affected the Flow of a great number of individuals. Csikszentmihalyi's perspective on emerging technologies is perhaps a little murky: 'Certain technologies become successful at least in part because they provide flow, thus motivating people to use them' (2014b, p. 234). To build on this remark, I would agree that Flow has something to do with 'success' if this means mass uptake. Furthermore, I would maintain that the mass uptake of a technology medium is due to two reasons: the medium's effect on the senses, which from a McLuhanesque perspective can also cause somnambulism; and that the medium enhances our lives from its design; that is, it solves some problem or makes some aspect of life easier. In this observation emerges the connection between intrinsic motivation (Csikszentmihalyi) and the senses (McLuhan). My interest therefore lies at the intersection and from which I can propose the following principle: a balance or feedback loop or oscillation between the effect of the MTSD medium in how it provides flow and the responses of the individual in maintaining flow sets the ideal conditions in which the individual can learn. We shall see in the next chapter how the individual might exploit this provision of flow while using the MTSD. But first, I shall note a few of the phenomenological aspects of the notion of flow.

The basis for my discussion about *flow*, as I relate this to the work of Csikszentmihalyi, rests on a foundation laid out by Martin Heidegger, known for his work in the domains of

phenomenology and existentialism. According to Wheeler (2015), Heidegger's work was also influential in other fields including psychotherapy and cognitive science. According to Heim (1992, p. 304), Heidegger saw technology as an 'overwhelming force' and yet 'he made it central to metaphysics'. Largely through his reflections on his experience of Nazi Germany, he saw technology to be 'the root evil of the twentieth century'. McLuhan too it seems, held negative views about technology:

> I am resolutely opposed to all innovation, all change, but I am determined to understand what's happening. Because I don't choose just to sit and let the juggernaut roll over me. Many people seem to think that if you talk about something recent, you're in favor of it. The exact opposite is true in my case. Anything I talk about is almost certainly something I'm resolutely against. And it seems to me the best way to oppose it is to understand it. And then you know where to turn off the button (McLuhan *et al.*, 2010, pp. 101-102).

While I empathise with the long lasting negative effects of the ill-use of technology in warfare, I do not share either of these views. For instance, there are benefits that digital communications offers education, health and the arts, particularly in remote communities. I see that the MTSD is an significant component in this regard because of its uptake in many communities. But I should point out at this stage that each of these views including my own are shaped by *individual* experiences of our lives set in different cultures, locations and times. It is not my intention to explore Heidegger's work in the domain of *techne* – involving the definition of "technology" – my interest is to begin to better understand through Heidegger, the individual experience in relation to this enquiry involving the MTSD medium.

As Paul Levinson noted, McLuhan paid tribute to the work of Martin Heidegger as it related to electric media: ' "Heidegger surf-boards along the electronic waves" ' (Levinson, 2003b, p. 295). Even though Levinson uses McLuhan's quote to highlight the 'electronic blurring of boundaries' that access via electronic media facilitates (notable in McLuhan's and Heidegger's time is television), what 'jumps out' at Levinson is McLuhan's metaphorical use of the word 'surf' to traverse information long before the Internet existed. In any case, my interest in intrinsic and extrinsic flow as it relates to the MTSD and Heidegger's work is specifically to the concept of 'Dasein', also known as 'Being-in-the-world' and arguably 'being there' (Wheeler, 2015).

The essential characteristic of Dasein, as I understand its application to my enquiry, is to *re-interpret the practice of existence*. To unravel this notion: existing in the world involves activities that sustain existence and to learn is a survival skill—we must learn to drink, eat, talk,

walk and dress. If we make it this far, then we have learnt to learn; in fact we have developed a practice of learning. But, I have only described the external journey of existence—to sustain existence also requires *internal involvement* in the practice of learning in order to continue to exist. In Heideggerian terms according to Wheeler (2015), 'involvement' or 'Bewandtnis', is concerned with expressing the 'roles that equipmental entities play—the ways in which they are involved—in Dasein's everyday patterns of activity'. And so I am led to ask, what is the role of the MTSD in the everyday pattern flow of learning?

To unpack this question and Dasein a little further, we can examine Heidegger's 'readiness-to-hand', which has a 'distinctive phenomenological signature' (Wheeler, 2015). Readiness-to-hand is significant because it involves the practitioner immersed in activity using a medium, with this producing an effect resembling Csikszentmihalyi's flow experience. Wheeler describes readiness-to-hand:

> Thus, while engaged in trouble-free hammering, the skilled carpenter has no conscious recognition of the hammer, the nails, or the work-bench, in the way that one would if one simply stood back and thought about them. Tools-in-use become phenomenologically transparent. Moreover, Heidegger claims, not only are the hammer, nails, and work-bench in this way not part of the engaged carpenter's phenomenal world, neither, in a sense, is the carpenter. The carpenter becomes absorbed in his activity in such a way that he has no awareness of himself as a subject over and against a world of objects. Crucially, it does not follow from this analysis that Dasein's behaviour in such contexts is automatic, in the sense of there being no awareness present at all, but rather that the awareness that is present (what Heidegger calls circumspection) is non-subject-object in form. Phenomenologically speaking, then, there are no subjects and no objects; there is only the experience of the ongoing task (e.g., hammering) (2015).

We can see in this example of readiness-to-hand, a shift in (flow) experience concerning the medium and the self becoming "transparent" and the significance of the practice in producing this effect. To compare, Csikszentmihalyi defines optimal or flow experiences as those that are accompanied by a *merging* of action and awareness. And so, I have experienced myself, as I have observed in others of all ages, the effect of an intense and entranced involvement when using the MTSD. But what needs to be further unravelled in the readiness-to-hand of the MTSD, is to distinguish any change in the pattern of intrinsic flow that is part of the experience. I make observations about this as it applies to the MTSD and learning in the next chapter.

Summary and conclusions

In this chapter I presented the MTSD from a medium theory perspective to historically contextualise it as yet another ubiquitous medium that has changed the way we live; with the work of Marshall McLuhan and the domain of medium theory as my principal point of reference. My view is that the compressed period of time in which the MTSD has pervaded and changed our lives by reconfiguring us to our surroundings and senses places us too close to the phenomenon in space and time to observe and appreciate the full effects on society and the way we use or might use it to learn. I believe that medium theory offers a way to stand back to observe the visible and invisible effects of the MTSD phenomenon.

The key to understanding the pedagogical qualities of the MTSD is in (the context of) its transitory use in sequence with other mediums across the space, time and places that match or coincide with the intrinsic flow experience of the individual/participant/user. I am talking about the individual's train of thoughts and feelings when using the MTSD and the effects of its use along with other mediums when this internal flow is interrupted, distracted, agitated, inspired, magnified or motivated. To consider a person's practice involving the use of the MTSD in isolation, without considering any mediums that might have been used beforehand or afterwards, misses the point of why and how that individual might choose to use the MTSD to solve the problem of learning in the first place.

In order to travel through this argument the following list summarises my discussion so far with concluding remarks:

- I define learning for the purpose of this study as any change in scale, pace or pattern introduced into the experience and thoughts of the individual, and how this experience and thoughts travel.

- The archetype of the MTSD is the ancient tablet, which has long represented knowledge and learning in the classroom.

- The dynamics between internal cognitive–experiential and external information flows are a focus area of my investigation as these relate to the effect of the MTSD on learning.

- In discussing the history and research of the Toronto School including the (re)application of McLuhan's concepts with the rise of the Internet, I contextualise and critique medium theory to mark its relevance to the MTSD and the new mediums of the digital age.

- From a medium theory viewpoint, I argue that the MTSD re-calibrates our senses, biased towards touch. The significance to this study concerns understanding the implications

of this intrinsic re-calibration effect of the MTSD on learning.

- I revise conventional ways of thinking about content to expose and examine the MTSD as a complex medium comprising and/or configured to many other mediums that we usually think of as 'content'.

- I introduce the digital media practitioner as the ideal subject for my research, noting that there is a shortfall of knowledge about MTSD digital literacy in higher education. This necessitates that my discussion concerning the digital media practitioner must include facets and dimensions of practice beyond the use of the MTSD for learning. In the next chapter I shall expand on this concept and link it to the artist as described by McLuhan.

- I note that the design approach of calm technology, specifically the perceived visibility and invisibility of technology, has common phenomenological underpinnings to this this study concerning the MTSD.

- I draw connections between McLuhan's re-biasing of the senses, Csikszentmihalyi's flow experience and Heidegger's readiness-at-hand as intrinsic motivating factors—motive motif mediums—that become part of the individual's experience in using the MTSD when involved in learning practice. I suggest that optimal learning can be designed for using MTSD affordances to maintain flow experiences.

In concluding this chapter, I note that the distinguishing quality of the MTSD compared to its mobile device predecessors is its interactive touch screen that allows and demands a directness of touch that connects us to flows of information, communications and other mediums in a unique way that did not previously exist. In the following chapter I shall examine the implications of the sense of touch and flow as these relate to the MTSD and learning in greater depth.

3. Learning medium as context

Touching the (MTSD) medium

> If people are inclined to doubt whether the wheel or typography or the plane could change our habits of sense perception, their doubts end with electric lighting. In this domain, the medium is the message, and when the light is on there is a world of sense that disappears when the light is off (McLuhan, 2003, p. 139).

I have begun this chapter with this observation as a reminder that, like all inventions, the MTSD as I call it began as an idea. But I observe that it is the mass acceptance and uptake of that idea that changes the way we live – the technology of the day is the medium that operationalises the idea. In tribute to Walter Ong, I would say it is how we 'interiorize' what we sense when we interact with the (MTSD) medium that matters and can 'enhance life' (2002, p. 82). In this way I think it necessary to discuss the interiorizing of *sensed* interactions with the MTSD as these might relate to learning.

My rationale for looking further into this topic is motivated by comments made by students in my first analysis of their written words—their assignments submissions that form my research data. While I shall provide the full details of the study and methodology in the next chapter, the initial comments that caught my attention and led to this specific enquiry into the literature are worth noting:

> The book has a beginning and end, it is not continuous whereas *the mobile touch screen device is flowing and constant* ...
> *The mobile technology now allows information, constantly updating and changing in real time, flows to us* from every corner of the globe, often overwhelming us.
> There is *no point in having a linear approach* ...
> (Research participants, my italics)

Harold Innis reveals in *The Bias of Communication* (2008) that, in any moment in history, there is a dominant form of media. Marshall McLuhan observed the dominant mediums of his

time and their ability to 'work us over completely' (McLuhan, 2002). Similarly, the ubiquitous MTSD can be regarded as the new domineering medium of our time. My view is that we do not yet fully understand the effects and implications of the MTSD since it emerged as a new medium similar to McLuhan's view about television during the 1960s in *The medium is the massage*:

> The main cause for disappointment in and for criticism of television is the failure in the part of its critics to view it as a totally new technology which demands different sensory responses (2002, p. 128).

I should like to argue that the sensory response that the MTSD medium demands is *touch*, which is pivotal to how the technology compels us. It seems that we are, for the most part, somnambulantly[11] unaware of the MTSD's invisible effects that reconfigure our minds to bias our sense of touch. This is, perhaps, with the exception of the governing authorities of our roads who campaign to reduce the road toll—nowadays flashing signs encountered on freeways warn, 'Don't touch your phone when driving' (VicRoads, 2016). The common behaviours I now observe in public and at universities are people entranced in the activity of touching the screens of devices. My observation and experience is that it is the *directness* of the quality of touch that differentiates the MTSD from any other mobile device medium and alters the learning context, feeding images and sounds to our eyes and ears with the habit forming tactility that we seem to readily observe and adopt. This quality of *directness* concerns the immediate relationship between *exact* touch interactions and the mind.

Touch as communication and the tablet in the classroom

> While in respect of all other senses we fall below many species of animals, in respect to touch we far excel all other species in exactness of discrimination. That is why man is the most intelligent of all animals (Aristotle, 2011).

Aristotle's statement alone is a compelling argument to investigate the effects of our touch interactions with the MTSD on our minds, precisely because the interface of the device does require an *exactness* of touch to operate. Touch is an aspect of (bodily-kinesthetic) intelligence that from infancy we use to communicate with others or learn; we use touch to investigate, create or realise according to Howard Gardner (2011, p. 195). I would think that touch is even more humanly relevant by its very physicality, responsiveness, intimacy, tactile meaning,

[11] McLuhan argued that we self-censor intense experiences that result from a new technology. He described the effect as 'somnambulism' (2003, p. 26)

an expression of love – symbolic across all ages and cultures. The human imprint via touch is thus imbued on the mobile touch screen device—in our minds—yet, before we touch it. In other words, because we have a pre-existing understanding of the language of touch, our minds are therefore attuned to this language and its syntax. We can therefore approach the MTSD with a pre-determined understanding of what we expect to experience. It is the bane of human existence that what we expect technology to do does not always happen.

As we use and experience a complex medium such as the MTSD, each encounter of its content (another medium) within transports us with a varying degree of 'temperature'[12] to a modified, even a new understanding or awareness. When this intrinsic transportation does not occur, I suggest that we are not learning; and somehow, the momentum or flow must continue for the learning process to evolve into a practice. It should prove useful to consider the *Laws of the Media* (1975) proposed by Marshall McLuhan and later developed with his son, Eric McLuhan in contrast to the pedagogical insights of Jean Piaget to consider how a process that takes one from learning flow to learning by practice might take effect.

To begin to better understand the students remarks quoted earlier about flow in the context of their learning practice, I begin by noting that the effect of the (MTSD) medium we should be seeking is an intrinsic flow. I hope to show how thoughts influenced by the use of the MTSD might occur by binding the concept of flow to ideas built on McLuhan's legacy and medium theory. The method I shall employ to construct my argument involves the use of an analytical tool instigated by Marshall Mcluhan, and is known by medium theorists as "the tetrad". Graham Harman (2012) writes in *Some paradoxes of McLuhan's tetrad* of his returning 'over the years' to a theme of the work of father and son, Marshall and Eric McLuhan, highlighting the paradoxical nature of the 'tetrad' of the McLuhans. The ensuing is an application of the tetrad, and describes the specific paradoxical nature of the MTSD.

The tetrad

The tetrad comprises four laws of media that 'describes all human artefacts as composed of a fourfold structure of enhancement, obsolescence, retrieval, and reversal' (Harman, 2012, p.77). According to Harman (2012, pp. 79-85), the tetrad was rapidly developed by the McLuhans over three weeks one summer in the 1970s. Initially, Marshall McLuhan had been asked by his publisher to produce a revised second edition of his formative work *Understanding Media* (2003). He focussed on addressing complaints from critics that his work was 'not scientific',

[12] I am referring to McLuhan's well known concepts about hot and cool media as described in the previous chapter

resulting in the co-developed tetrad and ultimately, the *Laws of Media*, co-authored still with Eric McLuhan, and published in 1988 after Marshall McLuhan's death. I reproduce here a table of the tetrad, with the questions each of its four laws that have been designed to articulate the properties and nature of any human artefact. [13]

Enhancement	'What does the artefact enhance or intensify or make possible or accelerate?'
Obsolescence	Enhancement comes at the expense of other characteristics and properties. What was formerly enhanced that is now obsolete?
Retrieval	What is retrieved by the medium? 'What recurrence or retrieval of earlier actions and services is brought into play simultaneously by the new form? What older, previously obsolesced ground is brought back and inheres in the new form?'
Reversal	'When pushed to the limits of its potential [...], the new form will tend to reverse what had been its original characteristics. What is the reversal potential of the new form?

Table 3.1: Four laws of the tetrad

McLuhan's Laws of the Media

McLuhan's Laws of the Media, was published January 1975 in *Technology and Culture*. In the form of a letter to the editor, the article barely outlines four 'Laws of the Media'. It begins:

> I have been experimenting with developing a series of "Laws of the Media," which I submit herewith for comment and discussion by readers of *Technology and Culture*. My purpose is to invite criticism, directed not at me or at my rhetoric, but rather at the substance and contents of my thoughts. It seems to me that historians of technology—and kindred students of the sociology and philosophy of technology, economists, practising engineers, and the like—might enjoy and profit from attempting to disprove my "laws" (1975, p. 74).

McLuhan is careful to (re)define "media" in relation to the "laws" for his audience and peers:

> You will note that, although these are called Laws of the Media, only a few of them deal with communications media narrowly conceived. Instead, I am talking

[13] Quotations indicate Graham Harman (2012, p.80) citing Marshall and Eric McLuhan. Otherwise, I have paraphrased the laws and questions.

> about "media" in terms of a larger entity of information and perception which forms our thoughts, structures our experience, and determines our views of the world about us. It is this kind of information flow–media–which is responsible for my postulation of a series of insights regarding the impact of certain technological developments. I call them "laws" because they represent, as do scientific "laws," an ordering of thought and experience which has not yet been disproved; I call them "laws of the media" because the channels and impact of today's electronic communication systems provide the informational foundation upon which we order, or structure, these experiential perceptions (1975, pp. 74-75).

Marshall McLuhan does not refer to the term *tetrad* in the article or explain the laws, but he does provide no less than 16 'samples' of his laws, either 'assumed' or 'named': 'the four steps of the process' as sketched in the article are 'Amplifies', 'Obsolesces', 'Retrieves' and 'Reverses'. Having arrived at these laws by a structural approach in considering the problem of form, McLuhan provides a context in which to relate the fourfold structure:

> The Laws of the Media have been shaped by studying the effects of media, so there is always a hidden *ground* upon which these effects stand, and against which they bounce. That is, the law of a medium is a *figure* interplaying with a *ground* (1975, p. 75).

The most relevant sample to the MTSD is the last one:

> XVI. Electric media
> A. Amplification of scope of simultaneity and service environment as information.
> B. Obsolesces the visual, connected, logical.
> C. Retrieves the subliminal-audile-tactile-dialogue.
> D. Etherealization—the sender is sent (1975, pp. 77-78).

I will return to McLuhan's sample further on in my conclusions.

The MTSD and the tetrad

The significance of the tetrad to this investigation involving the MTSD tablet medium and learning is in its practical application. The tetrad was developed as a means to analyse (artificial) mediums such as the MTSD and as a pedagogical tool. In light of this, I should outline some of the possible uses and challenges that using the tetrad presents when used to

analyse the MTSD as such. The first is that the tetrad as a tool can quickly build a snap shot view of the qualities of a medium. However, use of the tetrad can over-simplify the analysis, or perhaps it is rushing it; in any case the results can be superficial. Harman has alluded to this: (Harman, 2012, p. 85): 'as if there was only one possible retrieval or reversal for the iPhone'. There are many examples online – including @McLuhanTetrad on Twitter (James, 2014). Here you can also find the tetrad applied to non-artificial objects the McLuhans have prescribed it shouldn't apply to (Harman, 2012, p.80). This in itself is problematic – the nature of stringent laws is that people tend to bend and break them, wittingly or not. Nevertheless, the tetrad can help to reveal the deeper paradoxical nature of a medium. This deserves attention because the tetrad is a medium itself; it is at once, simple, complex and paradoxical to use the tetrad medium to understand other mediums. I have already outlined 'content' as media within the MTSD, meeting the purpose of the following discourse; and there will be use in applying the tetrad to analyse the mediums within the MTSD further on.

Of the four set laws of the tetrad, Harman (2012, pp. 83-85) notes that others, in particular, the late Frank Zingrone[14] have failed to improve the tetrad. According to Harman, Zingrone was discontent with four laws, and determined to add another law to form a 'pentad'; he also found the laws to be 'rigid', and it seems did not reconcile with this. When applied to the MTSD, which I now set out to do, I can understand the temptation to want to add another law. For the purpose of this enquiry, the tetrad at first consideration seemed limited. The *context* of how a device is being used, for example, has long been noted in mobile web design as being just as significant as its content: 'Your content is of little value to users if it ignores the context in which it is viewed, manipulated and processed' (Moll, 2007, p. 23). However, one can build context into answering questions that the tetrad poses. In the case of using the tetrad to analyse the qualities of the MTSD that facilitate learning by practice, *learning is the context.*

Enhancement

The MTSD time shifts learning. In the context of learning, the MTSD enhances touch as sensory access to information and knowledge, as well as a means to share or publish globally via social media et al. Touch becomes the means of communication to others – peers, educators and other learning collaborators. In contrast to devices with keyboards, it is the augmented touch control of the MTSD, as the dominant sense ratio compared to sight and hearing

[14]Frank Zingrone, a was co-founder of the Communications Department at York University, Toronto and a colleague of Marshall McLuhan.

that accelerates learning access and sharing. And characteristics of the MTSD that facilitate accelerated learning are its multi-dimensional properties and the multi-touch screen[15]. The underlying mediums at the centre of the multi-dimensional MTSD medium are the multi-touch and spatially responsive hardware, computation[16] and online connectivity.

These core mediums bound together with the ability to be mobile can present *perceived affordances*[17] that intensify the MTSD as a learning tool. Obviously, the perceived affordances presented by the MTSD's interface are a significant factor towards its mass uptake. Computational power means the MTSD can run a variety of apps and "content" file types – mediums within the medium. Online connectivity allows access to yet more content mediums and services that can aid learning and learning productivity. And so the optimally used MTSD, creates new space time dimensions – roaming location (or wherever one takes it) and is a quintessential multipurpose learning tool on which one can either complete a learning ask, or defer it to a more convenient time. When the aim is to learn, learning is accelerated—unless the functionality of the MTSD fails—or if one becomes distracted. The paradox of the latter is that even the optimally used and functioning MTSD also interrupts learning, caused by alerts, push notifications, reminders and incoming calls or messages.

A novice to the MTSD can quickly learn how it works just by touching and using "gestures". I remember watching my four year old daughter learn to use the interface of an iPhone in a few moments. She quickly figured out that she could swipe across to look at the different screens of apps, and then tap the app's icon to launch it. Jean Piaget recognised that gestures used as language is ingrained in early childhood development: '... gestures play as important a part as words' (2002, p. 42). With the language of touch and gestures that we learn to communicate with as children[18], I propose that we easily adapt this (derived and synthesised) syntax to operate the MTSD, shifting between the 'syncretistic' gratification of touch that compels us, to 'communicated intelligence' (2002, p. 47-48).

While many of the touch gestures required to operate the MTSD are obvious, such as touch and drag to scroll a web page, others need to be memorised – double-tap to select a word for instance. With an easily established base skill set, one can readily adopt and extend the habit and practice of using the MTSD; although this can only go so far... The full computational capabilities and potential uses of the MTSD are only available when one has unhindered access to the operating system of the device. These are under the control of

[15] Multi-dimensional attributes and multi-touch are also discussed in the Introduction.

[16] I am referring here to the medium of 'computation' as described by (DiSalvo, 2012, pp. 20-25).

[17] 'When people can see what they can do, we sometimes use the term "perceived affordance", to emphasize that the action is not just doable, but also visible in advance' (Budiu and Nielsen, 2012, p. 141).

[18] Pinching and swiping for example.

carriers and the hardware manufacturers and this is where the medium's enhancement qualities become constrained; unless one has a deeper understanding of how to gain full access to their particular MTSD's operating system. The work of "jailbreaking" Apple or "rooting" Android MTSDs allows one to install and use any software that the device is capable of running, rather than only those that are permitted by hegemonic parties. While this would diverge the current discourse with the weighty discussion it requires, Jay Freeman (2013) offers some insights into issues of privacy, data security and hegemony concerning devices such as the iPhone and Google Glass. Similar to transportation mediums like the bicycle or car, competence in getting anywhere needs practice; it leads one to learn how to use it in the way one prefers or needs to. This way of learning, to use the learning medium by doing, is what I mean by *learning by practice*.

Obsolescence

By the dimensionally collapsed properties of the MTSD, [19] distance and the physical need to travel to access information or complete learning tasks become obsolete. Travelling to the library or strolling across to one's computer and work station are no longer necessary when the MTSD is conveniently kept on one's person – touch ready. The space-time continuum shrinks without the physical requirement to move to another place. The paradox in this respect is that a convenient time to use the MTSD is while travelling or commuting; when the need to travel does arise, the head space encountered by an active mind in a stationary body inside a moving vehicle is often conducive to learning. The MTSD becomes the (re)place. Obsolescence thus reveals the tension between physical existence and virtual or digital experiences. It is the interface of the MTSD, via human touch interactions, that facilitates the quality of this tension between existence and experience.

A second paradox arises as the MTSD enhances – the object itself obsolesces and goes to ground, unnoticed by its user absorbed in the content mediums that figure to the fore. The obsolesced MTSD becomes a frame, a reminder of the figure and ground of the self, the mise-en-scene of the theatre that Erving Goffman used to help us better understand the experience of the self in private space ('backstage') and the self expressed 'frontstage' in public (Quan-Haase, 2016, p. 198).[20] *The Haunted Photograph* (2011), by Stefan Schutt and Marsha Berry, 'examines conceptions of framing and context' in relation to photo media and other visual artefacts.

[19] see Introduction: Human computer interaction

[20] The significant work of Quan-Haase draws in references to Goffman as a means to discuss contemporary issues such as cyber bullying and eating disorders.

Their discussion exposes an example of how the MTSD frames (content) mediums from within that come to the fore:

> In this era of increasingly mobile digital media, some interesting projects are emerging that seek to bring the ghosts to the fore. An example is the *StreetMuseum* (2010) application for the Apple iPhone. Produced by the Museum of London, this software program overlays archival photos of London streets, taken from the Museum's archive, onto 200 real locations when viewed via the iPhone camera. Viewers can then delve further into the historical contexts behind the overlaid archival images. Here, the London street is literally framed and haunted by an archival photograph that has been digitised and recontextualised. It sets up a reflexive relation with the beholder, creating a site of postmemory (Hirsch, 1997) that invites an act of the imagination as well as remembrance. We read the contemporary street against the context of World War II and the bombings of London (Schutt and Berry, 2011, p. 38).

The article is also a pertinent example of the MTSD as a pedagogical tool for other reasons: It is a demonstration of the MTSD operating in the real-time space-time manipulation of the present and past to shift the viewers's understanding of what is seen. This touch driven reflexive relation shift of imagination and remembrance becomes the act of travel—paradoxically, this is learning on the obsolesced MTSD in action.

Building on Donald Mitchell's ideas of tonality in music composition, the McLuhans describe using atonality in acoustic space as 'not uniform but rather a multidimensional dynamic of figure and ground' (McLuhan and McLuhan, 1988, p. 52). So it is with the MTSD, whereas each content item activated is thus the figure, leaving the remainder of content to ground.[21] Think of launching an app, web page or PDF that displays on the screen while other apps lay dormant in the background. As each app is also a medium, and its content too, so manifests the multidimensional MTSD medium; while the medium at the fore obsolesces the remaining mediums, including the artefact, any one may yet be retrieved by touch.

Despite the ebb of digital content and mediums becoming figure or ground, none of these mediums including the MTSD are as durable as the ancient tablet. In time, any one mobile touch screen device can not endure as the clay or stone based medium – the dead battery is a case in point – the MTSD may simply be a useless object when not functioning. Thus,

[21] Analogue and digital versions of mediums interchangeably become obsolete; in the case of sound, digital audio must be converted back to an analogue form to be heard by humans. This is a characteristic of all digital devices.

what obsolesces is the durability of the medium and permanence of its content, although this is replaced by the enhanced publishing capability, instant and global in reach. This is the flip side of the ancient tablet utilising but one artificial medium contained, cuneiform that, bonded as a whole with clay or stone, persists in space and time. With a limited life span and the uncertainty of permanence and connectivity to remote repositories and systems (in)forming the content base, the MTSD and the mediums therein shall do anything but persist.

Retrieval

The MTSD medium retrieves two archetypes: the tablet, as the symbol of learning in the class room; and the artist, as the practitioner skilled in the craft of manipulating the figure and ground of content. The most distinguishing quality that the archetypal tablet brings back to the fore is (subliminal) tactile learning. By retrieving the childhood language of touch, there is a symbolic connection between today's student absorbed in tactile interactions with the MTSD in the pursuit of some thing—touching knowledge—and the mind space of the ancient cuneiform scribe, who once 'impressed reed styluses onto damp clay to write the approximately 900 different logographic, syllabic and taxographic signs' (Kumar *et al.*, 2003).

The McLuhans place significant emphasis on the notion of the artist as the 'antennae of the race', skilled in the manipulation of form, responsible for exposing or extending how others perceive: 'It is the role of the artist to keep the community in conscious relation to the changing and hidden ground of its preferred objectives' (McLuhan and McLuhan, 1988, p.114). So, the artist, whom I refer to as the digital media practitioner in relation to the MTSD and learning, can exercise any one of these types of practice:

- The student using the MTSD to learn independently or share knowledge.
- The academic or educator, preparing learning content or mediums for students using the MTSD.
- The learning designer or developer, creating educational mediums such as apps and games. It is the developer (coder) who understands the syntax of the programming languages that control the MTSD, also corresponding with the ancient scribe who understood Sumero/Akkadian cuneiform syntax.
- Support: administration, technical or learning – involving the student connecting with others for these types of support.

Outside the scope of this thesis, I imagine that in the 21st century, we are all in some way digital media practitioners with a diverse range of digital literacies.

The digital media practitioner understands enough about the medium to be able to use the MTSD to educate and learn. And yet, we need to ask how much does one need to understand about the MTSD medium to be able to reach "preferred objectives" if we determine these to be the educational outcomes? What are the MTSD's hidden grounds that need to be revealed? And what are the ethical implications of what is revealed? In the digital age we are ideally, all digital media practitioners. But this calls for digital literacy skills – in this case, understanding how to effectively operate the MTSD and something about the syntax and languages that can control it. The problem is how to keep up our digital literacy skills in the fast evolving digital media landscape – on the MTSD, the software (operating systems and apps) change and update constantly.

Reversal

The learning shifts MTSD time. When the MTSD mal-functions, loses connectivity, or the learner is distracted, learning stops or deccelerates. And with over-saturated access to information and communications via the essential human need to touch, the habit forming lure is to continue touching the MTSD, even when communication, information or learning activities are not necessary. The 'killing time' type of 'user' behaviour, much analysed by consumer research, is also labelled as the 'time waster'.[22] Budiu and Nielsen (2012, pp. 108-109) uncover yet another paradox in their observation that 'people want to kill time and get angry when their time is being wasted'. Their explanation is that 'relaxation is purposeful behaviour'. I propose to take this further, specifically about people learning using the MTSD, to say that purpose is lost – and learning stops, when we lose the focus or propensity to shift between syncretistic and logical modes of thinking.

When pushed to the limits of its capacity, the MTSD is loaded and saturated with a multitude of other content mediums – websites, apps, music, video *et al* – the experience reverses into a slow, time-consuming space – frustrating and confusing when mis-matched to the momentum in one's mind when easily shifting between the syncretistic and logical thinking modes that Piaget defined in *The Language and Thought of the Child* (2002).

[22] The 'time waster' is also regarded among app developers and consumers as a category of app (Whitworth, 2011).

Conclusions about the learning medium as context

As a medium, the MTSD compels us to touch and yet as I have discussed, when the mind remains fixed, touch becomes habitual and serves no purpose to learning. While ego-centric thought driving gratification is needed to touch and operate the MTSD, communicable intelligence is needed to make sense of aural and visual information or communications encountered. Any such shift between such distinct logics transports the mind and oscillating between suggests the occurrence of learning. I shall refer to this oscillation between syncretistic and logical modes of thinking as *oscillating logic*, and return to it in my concluding chapter. I note a resemblance between *oscillating logic*, Weiser and Brown's *encalmimg* peripheral-central perception and the *merging of action and awareness* that Csikszentmihalyi's Flow state shares with Heidegger's readiness-to-hand. The similarities I see are in the participatory qualities of these experiences in which the mind is absorped but what distinguishes *oscillating logic* from the others is an emphasis on the perceptual effect of (sensory) touch interactions and my suggestion that it is a state of learning.

I now return to the sixteenth of Marshall McLuhan's samples, I have added my own, corresponding, albeit cruder notes on what McLuhan pre-described as "electric media", as applies to the MTSD and the context of learning. Adapting the tetrad in this way to examine the MTSD medium binds various elements that might otherwise be regarded apart—context and learning—the *context* in which we are examining the MTSD medium is *learning*.

Electric media – the MTSD

A. Amplification of scope of simultaneity and service environment as information.

On the MTSD, it is the simultaneous touch connection to multiple web services that provides access to big data information and communications resources for learning.

B. Obsolesces the visual, connected, logical.

The linear visual human experience of the physical world gives way to a non-linear touch-interactive and 'virtual' space time environment. The MTSD becomes an effective learning tool when its content mediums figure to the fore and the device itself is unnoticed. Learning only occurs when this Flow state effect is accompanied by any *change of scale or pace or pattern* that is introduced into the experience and thoughts of the user of the MTSD.

C. Retrieves the subliminal-audile-tactile-dialogue.

The tactile responses that the MTSD demands are subliminal according to its corresponding archetypes and the shift responses of the mind. [23]

D. Etherealization-the sender is sent.

In digital space-time, the immediacy of touch witnessing virtual identities and their content mediums, transports one's mind experience to other worlds and new understandings. It seems to me that McLuhan did not consider that pushing a medium, at least 'electric media' to its limits, might also break and reverse its effect on its user(s).

The focus on Marshall McLuhan, medium theory and the tetrad has worked to simplify the process of analysis; essential because the MTSD is multi-purpose of which learning is just but one. Paradoxically again, complexity succumbs to simplicity—the significance of travelling to learning is found through the analysis of the multi-dimensional MTSD through the medium of the tetrad.

The MTSD demands the sensory response of touch, and its mass uptake alone is evidence that the medium is easily used and adopted—after all, it was designed for consumerism. But to employ the MTSD for or with the intent of learning is a specific practice. And practice as the means of mastery over the medium to coerce the learning journey is also a hegemonic question: to choose or lose one's level of mastery over the medium is directly related to the control and power one has over the learning journey while using the medium. What one can learn is contained to what one can access—also what can or may be done with the medium. This is the terrain of the digital media practitioner using the MTSD.

And so, from these deliberations of the MTSD medium to ourselves, it is by practice, that the student becomes the artist who informs the student. In this chapter, I have displayed and explained a new application of medium theory. I have shown how the Laws of the Media—the Tetrad—can uncover new ways for us to think about the intrinsic processes in the mind of the individual. This new approach concerning the individual's interactions with the MTSD can also apply to human interactions with other mediums – when the individual is performing, participating and involved in learning flow experiences that make up their learning by practice.

[23] It is likely McLuhan is alluding to TV. We "watch" TV and so all else is the background.

5. Analysis: The flow and simultaneousness of practice

Introduction

For the purposes of my analysis, I revisit the research question that I posed to the student participants: What are the qualities of the MTSD medium that facilitate learning by practice? It is to this question that they have offered their thoughts, discussion and dialogue; it is to this question that they have shared their experiences with me, primarily and consensually as the researcher, but also as a fellow student and colleague. My initial observations of these expressed experiences were verified in a group social setting with the students which I have described previously and will elaborate on later. However, it is the experience of each individual captured in that individual's own written words that I now turn and focus my attention to as the richest source of insight into the tandem phenomena of the MTSD with learning practice. What this means is that in this analysis, when I refer to the MTSD, learning practice is involved and *vice versa*. When I discuss other mediums or content, or their patterning and information flow, it is in the context that the MTSD is involved as one of the external essentials for learning practice to occur. When I discuss internal or inner flow, motivation and the concepts of figure and ground and how these relate to what is, and what isn't noticed, and how these are patterned, it is in the context that these are the intrinsics of learning practice. I discuss qualities of the MTSD that facilitate learning by practice by examining the effects of the MTSD on flow when the context is learning by practice; learning by doing and reflecting. I identify a quality as any part, attribute, property or function of the MTSD that has a perceived effect on learning by practice, as experienced by the participants and in my own analysis of the data. In this context, qualities are both physical, such as the screen of the MTSD and digital entities such as the applications and functions or protocols that enable connections to communications or information not locally stored on the MTSD; that is, on remote databases and cloud storage or services. I have listed the steps of my methodology in the previous chapter and I shall now

begin to systematically extend the depth of my analysis via each of these methods for the remainder of this chapter and into my concluding chapter.

My analysis works through the methods that I listed in the section *Moustakas*, in the previous chapter, *Methodology*. For convenience, I reproduce here a briefer version of the ten step process as a reminder:

1. Create and organise files for data.
2. Read through text (assignment data).
3. Verify initial findings.
4. Reflect on the initial findings.
5. Develop significant statements: about the effects of the MTSD on learning practice based on what the students had written and my field notes.
6. Group the significant statements into meaning units (or themes).
7. Develop a textual description.
8. Develop a structural description: the locations, environments and contexts of how the MTSD and learning practice were experienced by the participants.
9. Develop the essence (of the phenomena).
10. Present narration of the "essence" of the experience.

This chapter is concerned with steps 1 to 8 of the above process. Steps 9 and 10 that describe the essence and a narration of the MTSD phenomenon and its effects on learning experience and practice form part of my conclusions in Chapter 6.

First impressions

This section describes what happened during the first three steps of the process: i) to create and organise the (assignment) files for data; ii) read the assignments to identify common terms and emerging themes; and iii) verify what is found with the student participants. The assessment submissions of students who had consented to participate were stored in electronic format as PDF files in a directory on a secure drive at Victoria University, specifically set up for research data storage. I could access the data files with a secure VPN connection to the research drive. For the specific purpose of arranging the texts to compare, contrast and

make notes I used a note taking application running on my dated laptop computer and its operating system.[24] I read the assignments as I uploaded each file to the research drive. After trying the alternative software noted, I used the note taking software to collate my impressions and observations into categories that I changed and refined as I read through the ideas and experiences of the students. This all took place between weeks six and eleven while I continued to work in my full-time professional role. The challenge in this context was to pattern this analytical process into an efficient rhythm—or *flow*—it seemed as if my time doing this work was dis-jointed and limited. Still it was apparent to me that the data was rich with insights from the students about their experiences using the MTSD to complete the assignment. I managed to read, check and re-read through the assignment submissions before I presented my observations to the students in the form of presentation slides during the week eleven seminar. This first analysis consisted of my immediate impressions and observations which I segmented into a list categorised as:

- Your observations
- Common themes and terms
- McLuhan's terms and ideas used
- Learning preferences
- My learning preferences
- MTSD qualities and affordances
- Other qualities and affordances
- Article observations – broken down into the elements of the article about which the students had written their medium theory critical analysis

My means of verification was a conversation with the students to check my observations with them. We discussed these observations that I had compiled into lists. This took place during the Week 11 seminar after the lecture entitled *Data privacy and data motility*. At this stage of the semester, this conversation with the students also served to reflect on their first assessment; that is, the assignment that is also the data source of this study. The focus of

[24] Both the hardware (MacBook) and software (Mac OS X 10.6.8 "Snow Leopard") are outdated; after trying several other software options including qualitative analysis tools such as TAMS Analyzer and R, I settled with Notepad Deluxe simply because I found it to be the solution that best suited my workflow at the time I commenced the study.

the conversation concerned the students' use of the MTSD to complete the first assignment and their learning practices in relation to medium theory concepts. A significant discussion point was that each and every student used a number of mediums or tools to complete the assignment and more generally in their learning practice, rather than just one computer (or an MTSD which they had been asked to do). For example, the students confirmed from what I had read in their essays that when they found a learning resource online using an MTSD, they would often email themselves a link to the resource. Often, they preferred to view the resource at a later time – when it was a more convenient place, a better time or if they wanted to view the resource using a computer for its larger screen or to print it out; that is, using a different medium to consume the resource. In terms of learning practice, the discussion also covered details about the specific MTSD devices and apps that the students preferred, and how they would use them in sequence with other digital and analogue mediums, like computers and books for example. At the time, most of these details didn't seem to resonate with insights except for the *Common themes and terms* from which I thought I could begin to recognise a repetition of terms/themes. Later, I would continue to return to one of these themes, *free flow of information*, to delve deeper into relevant texts from which I could learn from and apply in my ongoing analysis of the data as well as to my own learning practice. A complete set of presentation slides comprising my list of initial findings presented in this conversation with the students are included as *Appendix D: Researcher notes*.

For the main part, the student participants concurred on what I presented to them as their observations and our discussion around that. There were only two feedback items that the students asked me to note down: one student suggested the significance of cloud storage as a platform that enhances mobile access (iCloud in particular), and the assertion from another student that Australia is the "pilot ground for new technologies" although without a clear rationale as to how this was related to the assignment or medium theory.[25]

Reflect on the initial findings

My first impressions reading the students' assignments and the ensuing discussion with the students seemed significant to me but at the same time myopic. Rather than focus on details such as which MTSD or which app students were using I began to think it was more important to see beyond these elements that would soon change or obsolesce and attempt to find the

[25]It is clear to me that cloud storage is a significant aspect of the MTSD experience in terms of providing more seamless access to information. I often return to the last point but cannot find any further information about the claim or glean any further insight apart from my own speculation.

qualities and principles that would persist in time, yet were still the "voices" of the students. This was a decision point in my thinking for this project. With this in mind, I offer in this fourth step, the original summary of my conclusions drawn from the initial analysis.

- In the context of learning, students' (deliberate) use of the MTSD is transitory, even when the location of learning remains the same. This student remark describes such a scenario: 'I took notes on the ipad's Notes app at the kitchen table then emailed them to myself to paste into a Word document on a computer in the home office'.
- Students using MTSDs perform learning activities across multiple learning aids or devices.
- Students adapt to the learning context by using the MTSD to control their learning journey; by using the device to continue learning activities or deferring learning to a more convenient time/space, learning medium or place.
- As a potential pedagogical method, McLuhan's concept of hot and cool media is problematic. Students had differing opinions of what the "temperature" was of the mediums they were asked to evaluate, based on the context and what they already knew. This data differed too much for it to be useful.

I have reproduced the above list *ad verbatim* from my original notes taken after my last meeting with the students to provide context and also mark a shift in my understanding of the learning qualities of the MTSD and similar technologies from a medium theory perspective. What is clear to me now is that McLuhan's concept of hot and cool media is *not* problematic when applied and understood in relation to the figure and ground of a complex medium such as the MTSD which can be both hot and cool simultaneously. I shall expand on this further on in my analysis of the data to involve the concept of figure and ground in the context of examining the paradoxical effects of the MTSD on learning practice.

The Epoche: Personal learning interaction experiences with the MTSD

Although I have described some of my observations about the mass uptake of the MTSD, I have yet to note my personal experience of using the medium in my own learning practice. Creswell (2007, p. 150) describes that the qualitative researchers often learn by doing which is precisely what I mean by learning by practice when it comes to research. The purpose of this exercise is to defer judgement or 'set aside' the experiences of the researcher by describing my own 'experience of the phenomenon' in order to focus the analysis on the experiences of the participants (Creswell, 2007, p. 159). However, I find the effect of this practice is paradoxical

because my *experiences* are not independent from what I analyse and write about. For me, finding and accepting each paradoxical effect of the MTSD has shifted my understanding of the nature of the medium and changed the way that I make use of the device in everyday learning.

In using the MTSD, the very thing I set out to do can be undermined. I shall start by describing my own experience and observations of the presence of the phenomenon of paradox as an effect of the MTSD on my learning practice [26]. For instance, when commuting, I often recall something to do with this research which I find I want to investigate further. I use my iPhone to instantly put this motivation to action but other impulses can just as easily interrupt this flow of activity. It may be that I notice an unread message [27] or a previously written note or have an impulse to check the news, never-the-less, my attention and the activity drifts to another course from what I intended; it may continue to be a task that has something to do with the research but it can just as easily become a seemingly endless surf through social media, current affairs or virtual shop fronts. It seems that the noise around what I originally intended to pursue has smothered my motivation; the qualities of the MTSD that have facilitated my passage to complete a research task—convenience, access to digital "content" and productivity tools—notes, camera, screen captures—have also overturned it.

The distraction can be work

However, it occurs that after I have left the activity and am in a different physical location, that I find my mind often *drifts* back to the original task and I can pick up again where I left off using the MTSD. Having observed this a number of times I now accept that at least for me, this *drift* for the most part does occur when I set out on a task using the MTSD. What I now tend to do when I observe that this *drift* does not support my flow of thoughts is to stop, knowing from experience that I can pick up later when the quality of my thinking has re-calibrated—usually after travelling to a different physical place—and with the passing of time which seems to allow space for my mind to refocus. I regard this *drift* as one of the paradoxical effects of the MTSD—a quality that both aids and hinders the task at hand. When aided, my time using the MTSD is spent either initiating tasks or filling in tasks; that is, continuing tasks that are later picked up again on the MTSD or using another medium.

At work I use the MTSD at my workstation positioned next to my computer. While working,

[26] See the chapter titled *Medium: Learning as context* in which I examined the MTSD through the laws of the media which when applied, determine the qualities that figure to the foreground and fall to the (back)ground.

[27] This might consist of an email, text message or app notification.

I use the MTSD as a continuation of my thoughts so that I do not interrupt the workflow that I have set up on my computer. I use the MTSD if an idea pops into my head that is not related to my computer workflow. This practice helps me to perpetuate the flow of several tasks and is how I involve my professional work, research studies and personal development in the combined physical and virtual environments. So I use the MTSD as a tool to bind the other mediums of these environments to better support my activities which includes what I might learn throughout the day—through investigation, discovery and analysis.

Having made the aforesaid reflections about my learning practice using the MTSD, I have experimented with the effort of keeping my cognitive processes flowing when I have had time to use the device, both at home and away from home. The following notes are my accounts of various ways I modified my use of the MTSD to write and think during the later phases of this project. It is an account of a way to write or take notes using the MTSD that came about after the relationship between McLuhan's and Csikszentmihalyi's ideas about flow came to my attention. Its central concern is with reflections I make about my learning practice while using the MTSD. It started when I was drafting a postulation that I have kept here to provide context and in case a deeper relevance emerges later.

Note taking exercises July 2015

The following notes were captured using my smartphone when commuting during the week, at home and on the weekend at *ad hoc* times and locations when the opportunity arose. I have attempted to modify the notes so that it reads as an account of the exercise. I have made spelling and grammar corrections apart for phrases that I sense convey a "non-linear" logic I cannot reproduce with correct grammar. These phrases, emphasised in italics, remain as an *ad verbatim* capture of my own flow of perceptual experience while using an MTSD. I use parentheses where I have deleted words that do not make sense or where I have added words to provide context.

Postulation: Version 1. The altered sense ratio of a medium has an effect on a student's ability to learn.

I am writing this on an MTSD in a train commuting, tap typing, and am finding it difficult to reflect on this proposition. I am thinking to keep my thoughts flowing and that recording these thoughts is the right strategy to articulate this idea (about the postulation). Read, reflect, type, read again. There are four of us all men seated together on the train, tapping our MTSDs. I do not know the others. I am wondering if their thoughts are flowing, inquiring or if the interactions of the others with their devices are trance like. Reflect now. I have left

the train to now catch a bus or tram. It just occurred to me that Jack Kerouac's "stream of consciousness" is linked to what I am doing. His practice was to type and keep on typing to keep his ideas flowing. *This now shows to me how I might write my thesis while physically moving with my thoughts flowing while using the MTSD hence demonstrating how the medium might be used for effective research and learning.* I didn't link Kerouac's idea to this concept until I was in this context and tried this technique. Reflect on the postulation. I rewrite a second version of the postulation based on this reflection.

Postulation: Version 2. The altered sense ratio of touch that a person employs with a medium has an effect on a student's ability to think, reflect and write—converting flowing thought into written words—an effect on one's practice—learning by practice.

Keep going. Moving. First touch. Then stop to think for a moment. (...) I approach my destination and stop taking notes. (I disembark from the train and start to walk.)

Now it occurs to me that I can continue to take notes using the voice to text function as I walk. I am trying to keep my thoughts flowing while walking. But utilising the voice recorder is slightly more difficult; when I touch the screen to stop recording it also interrupts my Flow and I lose my train of thought. I am thinking that it is our inclination to move and travel—transportation—that is just as important as touch, in how the kinesthetic sense can keep one's thoughts flowing. A narrative is important but the quality of flow in our minds is just as important as the narrative. Writing through the voice recorder this way on the MTSD does not seem to be as effective as typing while being silent. It is harder to reflect and I am conscious of my voice in a public space. I am more conscious of my voice even now that I am at home.

Employing our senses in this way is actually what it is to practice, it is part of one's practice to employ one's senses to alter our ratio of senses. What I mean by this is the deliberate act of typing, tap typing in my case as part of my practice, has allowed my thoughts to flow the same way that Kerouac realised using the typewriter. (...) *To keep on physically moving affects the mind, physically doing something, even typing keeps the mind moving. (...) Within this motion and the words that I am typing I find the way to articulate what it is that allows this to happen.*

I now go back to a thought I had while walking which is that the practice of McLuhan is that of an artist as much as it was Kerouac's. In his practice as an artist McLuhan was a performer, the clown as he had confessed, but nonetheless an artist. He wore the mask of a clown to lob his cultural probes, to see what effect they might have. The effect of his probes was to stimulate the flow of thoughts of others whether they were agitated by his propositions

or whether they were inspired by his ideas. McLuhan was then a master of employing flow to educate and to stimulate further knowledge and research.

My mode of transport has over this week included public transport. (Last week I rode to work and therefore did not have the opportunity to study or take notes.) I realise now that some of the dormant thoughts from last week have now arisen because of the opportunity presented by employing this flow technique using the mobile touchscreen device.

It is the next day and I am trying this mind flow technique again while waiting for my partner. (...) I have been reading a JavaScript programming email, a learning resource distribution and bookmarking which articles I would like to return to later. I attempt to quickly learn something about JavaScript from one of the articles and realise my mind is not in the same state of flow as it was yesterday while trying the technique—until now as I write. How can I apply this technique to reading; that is, comprehending or does it only apply to writing or producing words or the creation of knowledge?

I realise now that this practice of mind flow learning is part of everyday life. But how do we identify when we are practising mind flow from other aspects of our lives? How can we make better use of it? *In this instance, the MTSD aids me to capture these moments of mind flow to more easily convert thoughts into words—more or less as I think and before I forget.*

I think this mind flow technique is something I can develop, something that builds on both McLuhan's ideas of (information) flows, Flow theory and learning by practice. It is a reflective pedagogical technique that utilises the MTSD.

Time and space

If I compare my reflections to the reflections of the students, that is the data, it is obvious that I have had advantages to develop my learning practice using the MTSD—because I have had the opportunity to spend time to iterate and develop the practice—with access to the reflections of the students which have informed my own observations. If I am moving physically in a space such as my home it seems easier for me to catch my thoughts. For example I can pace up and down (in my home) as I am now while taking notes on my mobile touchscreen device using my voice.

The paradox for me in writing about my learning practice with the MTSD while using the MTSD is that, when I observe that I am no longer capturing my thoughts about this (experience), I will stop and yet the action of stopping triggers reflection and a further or new flow of ideas. Attempting to restart capturing my ideas using the MTSD can reverse the intended effect and stop my intrinsic flow.

Again, I am trying to employ the stream of consciousness technique using the MTSD. (...) The point of the technique, (to capture ideas before they are forgotten), is to keep going and not interrupt oneself and one's pattern of thoughts or the pace of one's thoughts.

The difficulty is in trying to avoid "reflective-editing" for the sake of capturing the ideas—the impulse is to edit what I have written immediately because I know I can. *However the balance seems to be to strike a harmony between capturing one's ideas before the thoughts escape one's mind and the accurate tactile use of the MTSD tool; in ensuring that those ideas make sense when read back.* I can only assume that this must become easier with practice.

My last observation is about the paradox of time and space and understanding it as it relates to learning practice, the MTSD and this whole topic. *In the practice as I capture my spoken words with the tool and then stop capturing my words to then go back and edit what I have done it becomes very difficult to make sense of the written words because at the time of capturing them as I am doing now it is in the present tense but when I edit the words what has happened is in the past.*

Existing at once in the past, present and future

The experience of attempting this modified practice becomes about simultaneously thinking and acting in the past when reflecting, the present when one is writing, as well as in the future when one is editing what one wrote in the present which all together seems impossible when reflecting and yet isn't when doing.

End of the note taking exercise.

The note taking exercise involved a sense of immediacy in the reflective self-observations that resembles the concept of the practice of *reflection-in-action* (Schön, 1995). The experience had aspects of the reflective practice that Schön described as a type of artistic performance involving, responding to complexity, spontaneity and improvisation in the endeavour to keep the momentum of the flow of inquiry (Schön, 1995; Schön, 1998). Another feature of Schön's work, *reflection on reflection-in-action*, resembles the reflections that I am making here about the note taking exercise.

I found the speech recognition software on my MTSD effective in certain scenarios but the inaccuracy of the voice to text function meant that I also spent time "on the fly" correcting my words incomprehensibly captured in jumbled text, a process which interrupted my intrinsic flow state. The voice to text function was less reliable when noise from traffic, crowds or wind affected its accuracy. I felt less inhibited when using the touch screen keyboard in public spaces and could capture thoughts and reflections efficiently.

Significant statements

Following Creswell's prescription, the significant statements listed here are selected quotes from their students' assignments. I make this selection by considering which excerpts might have the potential to offer enduring insights about the MTSD. The process I have followed is to regard each quote with equal worth or merit (horizontalisation) and then break each quote up into segments in an attempt to identify and eliminate any repetition or overlapping of the meaning and substance of each segment with another; each segment should represent a different idea to another.

I therefore reproduce here a table consisting of statements made by the students *ad verbatim* (the left column) which I have segmented into non-overlapping statements (the right column). The statements either directly describe a personal experience or represent the individual's perception and ideas about the experiences of that individual's learning practice using the MTSD from a medium theory perspective. This is to be expected as it was the topic of the assignment and what the students were asked to write about.[28]. I shall re-use the segment interpretations again further on when I group them into themes.

	Statement by student	**Segment interpretation**
1.	'The book has a beginning and end, it is not continuous whereas the mobile touch screen device is flowing and constant, we have the control'.	a) Compared to the book, the mobile touch screen device is continuous and non-linear. b) The mobile touch screen device is a flowing and constant medium. c) Users of the MTSD have the experience of being in control.
2.	'the mobile technology now allows information, constantly updating and changing in real time, flows to us from every corner of the globe, often overwhelming us. There is no point in having a linear approach to education any more we cannot stay detached as learners..'	a) Mobile technology allows information, constantly updating and changing in real time, to flow to us from anywhere in the world. b) The experience of accessing information using mobile technology can be overwhelming. c) Learning using the MTSD requires a non-linear approach.

[28]Refer to Appendix A: Mobile phone-Tablet Assignment (20%)

3.	'We can no longer remain mute spectators either, mobile learning demands we engage the medium as well, contributing ourselves to swill of information'.	a) People can no longer remain mute spectators (an effect of MTSD medium). b) The MTSD medium demands that we engage with it when using it to learn. c) People using the MTSD contribute themselves to a "swill" of online information.[29]
4.	'Can learning become a personalised thing?'	a) Can learning become a personalised thing (for the user of the MTSD)?
5.	'Will education cease to be standardised?'	a) Will education cease to be standardised as an effect of the MTSD and mobile technologies?
6.	'I especially enjoy the thought the learning has now become a truly social affair, at the same feels personalized'	a) I enjoy the thought that learning has become a truly social affair using the MTSD. b) Learning feels personalised using the MTSD.
7.	'Our patterns of perception have undoubtedly been altered by the introduction and subsequent mass adoption of this medium'.	a) Our patterns of perception have been altered by the introduction and subsequent mass adoption of the MTSD medium.
8.	'Unlike the mediums analysed by McLuhan, contemporary mediums do not fit neatly within a continuum. Mobile technologies are simultaneously hot and cool, information can be distributed and accessed in a multitude of different ways, and how the audience engages with the content of the medium is often dictated by the user'.	a) Contemporary mediums do not fit neatly within a continuum. b) Mobile technologies are simultaneously hot and cool, information can be distributed and accessed in a multitude of different ways. c) How the audience engages with the content of the MTSD medium is often dictated by the user.

[29] I am uncertain whether the word "swill" is intentional. I have considered that it might be a typographical error or a mis-interpreted word used by a student who speaks and writes English as a second language. In considering my approach to trust the voices of the students, I have decided to display the word in the context I found it—its meaning suggests to me that our consumption of information is excessive. I find this an interesting perspective in terms of what the MTSD might signify.

9.	The ways in which I did not use the MTSD provoked more consideration and analysis of medium theory than the ways in which I did use it. The resistance to the new technology, and the repackaging of content highlighted that as a member of modern society I have been shaped by the nature of the medium in which we communicate. The content of the new medium – the MTSD – is the one it is succeeding – books and printed word – and highlights the possibilities of unrealised potential of the new medium. There is room for more formats of content to be developed and delivered that we possibly have not even thought of. Although I felt that my physical senses were restricted or amputated by the new medium, space and time were extended. Being challenged to utilise the MTSD to actively engage with and analyse media led to the consideration of my own methods of consumption and my own internal resistance to technology.	a) The ways in which I did not use the MTSD provoked more consideration and analysis of medium theory than the ways in which I did use it. b) The resistance to the new technology, and the repackaging of content highlighted that as a member of modern society I have been shaped by the nature of the medium in which we communicate. c) The content of the new medium - the MTSD - is the one it is succeeding - books and printed word - and highlights the possibilities of unrealised potential of the new medium. d) There is room for more formats of content to be developed and delivered that we possibly have not even thought of. e) I felt that my physical senses were restricted or amputated by the new medium, space and time were extended. f) Being challenged to utilise the MTSD to actively engage with and analyse media led to the consideration of my own methods of consumption and my own internal resistance to technology.

10.	'I have found in my experience that thanks to my MTSD it is now possible to think and act in a stream of consciousness; to think in links; or more literally, hyperlinks. By this I mean that due to instant communication - the instant ability to retrieve information on demand as soon as a thought enters my consciousness, my experience of learning is now based on access to information as opposed to storage of information'	a) The experience of using the MTSD makes it possible to think and act in a stream of consciousness. b) The MTSD facilitates the instant ability to retrieve information on demand as soon as a thought enters one's consciousness. c) The experience of learning is now based on access to information as opposed to storage of information.

Table 5.2: Significant statements by students

Themes that have emerged from the data

The text in this table consists of the significant statement segments from the right column in the previous table. Here, I have grouped these statements into four themes: i) Hegemony: Experience of control; ii) Flow qualities of the MTSD; iii) Learning and teaching implications; and iv) Paradoxical effects of the MTSD and mobile technologies.

Significant statement segments grouped into themes

I.	**Hegemony: Experience of control**
	1c) Users of the MTSD have the experience of being in control. 2b) The experience of accessing information using mobile technology can be overwhelming. 2b - version 2) Exposure to the vast amount of information available via the MTSD can be overwhelming. 8c) How the audience engages with the content of the MTSD medium is often dictated by the user. 9b) The resistance to the new technology, and the repackaging of content highlighted that as a member of modern society I have been shaped by the nature of the medium in which we communicate.

II.	**Flow qualities of the MTSD**
	1a) Compared to the book, the mobile touch screen device is continuous and non-linear. 1b) The mobile touch screen device is a flowing and constant medium. 2a) Mobile technology allows information, constantly updating and changing in real time, to flow to us from anywhere in the world. 2c) Learning using the MTSD requires a non-linear approach. 3a) People can no longer remain mute spectators (an effect of MTSD medium). 3b) The MTSD medium demands that we engage with it when using it to learn. 3c) People using the MTSD contribute themselves to a swill of online information. 7a) Our patterns of perception have been altered by the introduction and subsequent mass adoption of the MTSD medium. 8a) Contemporary mediums do not fit neatly within a continuum. 9e) I felt that my physical senses were restricted or amputated by the new medium, space and time were extended. 9f) Being challenged to utilise the MTSD to actively engage with and analyse media led to the consideration of my own methods of consumption and my own internal resistance to technology. 10a) The experience of using the MTSD makes it possible to think and act in a stream of consciousness. 10b) The MTSD facilitates the instant ability to retrieve information on demand as soon as a thought enters one's consciousness.

III.	**Learning and teaching implications**
	2c) Learning using the MTSD requires a non-linear approach. 4a) Can learning become a personalised thing (for the user of the MTSD)? 5a) Will education cease to be standardised as an effect of the MTSD and mobile technologies? 6a) I enjoy the thought that learning has become a truly social affair using the MTSD. 6b) Learning feels personalised using the MTSD. 7a) Our patterns of perception have been altered by the introduction and subsequent mass adoption of the MTSD medium. 9c) The content of the new medium - the MTSD - is the one it is succeeding - books and printed word - and highlights the possibilities of unrealised potential of the new medium. 9d) There is room for more formats of content to be developed and delivered that we possibly have not even thought of. 10c) The experience of learning is now based on access to information as opposed to storage of information.
IV.	**Paradoxical effects of the MTSD and mobile technologies**
	1c) Users of the MTSD have the experience of being in control. 2b) The experience of accessing information using mobile technology can be overwhelming.
	6a) I enjoy the thought that learning has become a truly social affair using the MTSD. 6b) Learning feels personalised using the MTSD.
	8b) Mobile technologies are simultaneously hot and cool, information can be distributed and accessed in a multitude of different ways.
	9a) The ways in which I did not use the MTSD provoked more consideration and analysis of medium theory than the ways in which I did use it.

Table 5.3: Themes

Textural description of what happened

Hegemony and flow qualities of the MTSD

As stated in Chapter 1 (Operational definitions), it is from an individual's perceptual experience of his/her own control in a specific context by which I refer to "hegemony"; in this case, how

an individual experiences and describes what sense of control is perceived in the use of the MTSD medium. In regards to the research question, my analysis is focussed on how the research participants' sense of individual control, as affected by the MTSD, correlates with their learning practices.

The student participants asserted that they either had or liked to have control of the MTSD and other mediums that they learn with and use in their everyday lives. At the same time they expressed a fear and mistrust of technology, when overwhelmed by being exposed to a massive volume of information and the idea of having been changed by newly introduced technologies. This is what the significant statements tell us when grouped into the themes of hegemony and flow qualities of the MTSD.

Turning to a description in an assignment submitted by one of the students provides a picture of how the MTSD was placed within the learning context:

> I took notes on the iPad's Notes app at the kitchen table then emailed them to myself to paste into a Word document on a computer in the home office (Research participant).

There were no exceptions to this scenario showing that the students' deliberate use of the MTSD is transitory, even when the location of learning remains the same. Neither were there exceptions to students using MTSDs to perform learning activities in sequence with other digital or analogue mediums – computers, laptops, books, pen and paper etc. Students who seemed to be working productively reported using the MTSD in this way.

Flow control and interruption

One student mapped several of her own learning tasks, performed using the MTSD; a tablet. She made use of a mindmap including a colour key, using green to represent 'a process involving technology, that has an uninterrupted flow' (Research participant). (If only every student mapped the flow of their own learning tasks, what might be learnt!) The student noted a preference in how the iPad was used in different home locations – she used a keyboard with the MTSD in the study but removed the keyboard to move to the lounge. Whatever the motivation, it is clear that there is a link between the motive, the choice of medium and how it is used for the learning task. Hence, we can see that how students adapt to the learning context by using the MTSD to control their learning journey, by using the device to continue learning activities or deferring learning to a more convenient time/space, learning medium or place. This excerpt from another assignment explains how the student controlled her own

learning context across locations, settings and time by choosing when and when not to use an MTSD:

Where these devices were utilised

- At work, at home, at the airport, on the airplane and on public transport

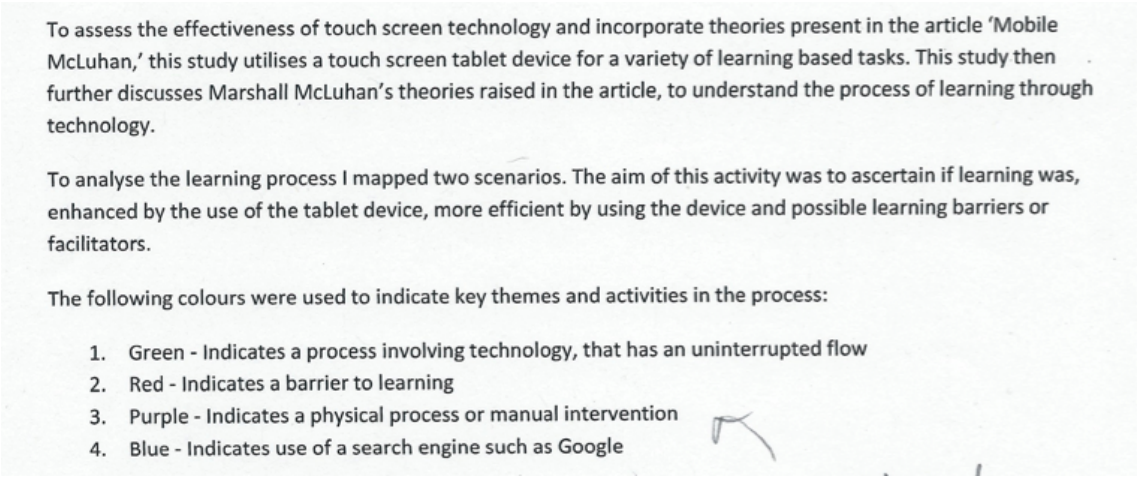
Way in which these devices were not used

- To perform further, more in depth research

- To type and complete the assignment

Use of alternate technology

The assignment tasked us to use a MTSD however, the majority of the assignment was completed on my personal laptop. I engaged with the article on both my iPhone and iPad but only briefly, for the purposes of the review, and often whilst on the move, in transit or on breaks at work (Research participant).



To assess the effectiveness of touch screen technology and incorporate theories present in the article 'Mobile McLuhan,' this study utilises a touch screen tablet device for a variety of learning based tasks. This study then further discusses Marshall McLuhan's theories raised in the article, to understand the process of learning through technology.

To analyse the learning process I mapped two scenarios. The aim of this activity was to ascertain if learning was, enhanced by the use of the tablet device, more efficient by using the device and possible learning barriers or facilitators.

The following colours were used to indicate key themes and activities in the process:

1. Green - Indicates a process involving technology, that has an uninterrupted flow
2. Red - Indicates a barrier to learning
3. Purple - Indicates a physical process or manual intervention
4. Blue - Indicates use of a search engine such as Google

Figure 5.2: Student description of mindmap

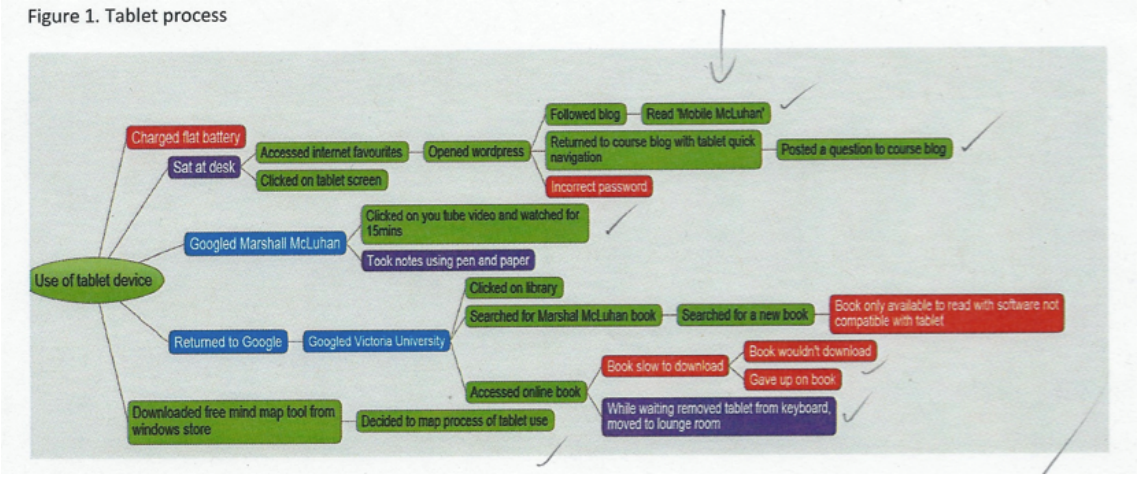


Figure 5.3: Student mindmap of two learning processes using a tablet

Learning and teaching implications

The student testimonies highlight that to be in control of their learning (when using the MTSD) is a central concern. The students questioned the direction and future of education. They noted this in our discussion and I observe the development of this theme in their essays that learning whilst using the MTSD involves access to information in formal and informal educational contexts, encapsulated in this student's comment: 'I especially enjoy the thought that learning has now become a truly social affair, at the same feels personalized'. This again reflects the significance of the student participants placing themselves in a position of control.

The student observation that learning using the MTSD requires a non-linear approach is a proposition that might be tested and explored further.

In respect to learning design, it will be useful to provide examples from the students' assignments. In the first, the student is using a smartphone MTSD to read and describes a specific interaction:

> I was able to touch any word I was unfamiliar with and instantly look up its definition so I could better understand the context and main idea that was being presented to me (Research participant).

In this quote, we have a clear micro example of learning practice flow where thoughts and the sense of touch take turns in following one other. The task *reading*, prompts the motive to *look up*, prompts the interaction *touch*, provides desired information that prompts further *reading*, and results in a *better understanding*. In this micro-model of learning practice, the effect of the MTSD on the thought—interaction—sense pattern results in *learning*. The reduced scale of time between seeing an unfamiliar word and understanding it in context is triggered by touch. The pace at which this flow happens is accelerated, and the order in which it has occurred—its pattern—has been changed by the way the device works.

In the second example, the same student provides a specific reason to stop using the MTSD in favour of a laptop computer:

> I discontinued use of my smart phone when I decided to write this essay in order to have more space, to utilize a bigger screen that my MacBook Pro can provide (Research participant).

The motivation to discontinue using the MTSD for the laptop is prompted by the *decision* that is based on the student's evaluation of both mediums' affordances to understand which medium will better support the flow of the task. It follows that this type of evaluation can

only exist from the familiarity and understanding about the tools that comes with practice. Here is an example of the digitally literate digital media practitioner using more than one tool in a learning practice.

In another example, a different student describes the process of using two MTSDs at once for the task of finding books online at the Victoria University library and then finding the books in their physical location:

> I also took screen capture photos when I was on the VU Library website of the books I wanted to borrow, and when my iPad synced with my iPhone I was able to walk around the library and use the photos on my iPhone to check the call numbers of the books I wanted to borrow (Research participant).

The use of two MTSDs at once in this way to find books in the library online is a notable change in learning practice. The first aspect of this scenario worth noting is that the student employed the use of a media production affordance of the MTSD, the camera, a tool not traditionally used for the task of writing an essay. But this example is perhaps an indicator of the way learning practices are evolving with the uptake of new mediums such as the MTSD. The process describes more how the MTSD *supports* the extrinsic flow of learning rather than describing aspects of the intrinsic flow of thoughts in the learning process. Still, the description notes a different pattern in the way this student interacted with the MTSDs to perform a learning support process. The difference in the pattern that I should like to highlight, is the use of multiple devices, specifically the use of more than one MTSD. Five of the eleven students who participated in the study used two MTSDs to complete the assignment. In each case, one was a smartphone and the other a tablet.

The research data emphasises that in higher education, we already live in a multi device world. The challenges we face to facilitate appropriate digital literacies are perhaps best described by an essay quote from another student:

> Teaching people how to use multiple devices, manage software applications and recover quickly from set-backs are all important areas to focus on, whilst learners adapt to the use of these devices in education (Research participant).

Paradoxical effects of the MTSD and mobile technologies

The hegemonic narrative of the MTSD manifests in the seemingly contradictory effects it has on the individual. For instance, the factors that affect the individual's sense of control via the Tetrad are access to a 'free flow of information' that *enhances* learning, and 'information

overload' that hampers learning;[30] that is, when the medium is overladen with information and content, this extremity in effect *reverses* the ability—the lack of control—of the (overwhelmed) individual to learn. In this context, "information overload" encompasses more than an overburdened 'cognitive load' (Sweller, 1988) because it includes (intrinsic) emotion and systems external to the individual. This leads to the question of how much control an individual actually has of the MTSD when using the device to learn? And what are the controlling factors and elements that interplay between the figure of enhanced learning and the reverse effect of learning going to ground?

The following student comment[31] offers more insight into how the hegemonic interplay between the figure and ground of learning works in one of the student participant's learning practice using the MTSD, and how the travelling and motivational flow qualities of the MTSD amplify its purpose as a pedagogical medium:

> As I read Woodhill's blog article from the comfort of my bed I was able to conveniently turn to my partner and ask for his opinion on the blog article which I was able to email to him instantaneously from my MTSD. Upon receiving the article link on his own MTSD he was able to read it himself and propose his thoughts on the subject matter – and all within a matter of moments. Further, he emailed me some links to other online articles of relevance to aid in supplementing my studies. Had it not been for each of us owning an MTSD the incentive to action the immediate sharing of learning would not have been possible; more realistically, it would have been postponed (Research participant).

Here, the disruption of momentum to perform the learning task is avoided – rather than simply pass the MTSD to her partner to read the article, email is employed so that the student's reading activity (and the motivation to read) can continue. The object of learning is shared – emailing a link to the article results in the partner becoming a learning collaborator or personal librarian. This sets up a feedback loop – a prompt that propels the learning momentum – he sends back access points to extra resources relevant to the article in the real time of the reading learning activity taking place – further spring boards from which the flows of intrinsic motivation and information can continue.

It is also clear from this example that the student's control of the MTSD is relational to the flow of her internal cognitive journey that the device enabled. For example, had her

[30] 'Free flow of information' and 'information overload' are significant terms reproduced here from the assignments.

[31] The quote is from a different assignment to the examples in the previous section.

partner somehow obtained her MTSD to read the article, her internal flow would have been interrupted; and so emailing her partner the link to the article to maintain her (internal) flow state includes that she also exercised her possession, ownership and control of the MTSD. And so this scenario represents a micro example of the hegemonic environment that the participants negotiated in their use of the MTSD for their learning practices.

The student participants drew reflective observations [32] about the use of the MTSD as it applies to their learning practice: having access to a 'free flow of information'; 'information overload'; resistance to new technologies such as the MTSD; finding 'reputable sources of information' in the vast amount of free and instantly available online content; students questioning and re-contextualising the definition of learning and the future of formal education with questions such as 'what is learning' and 'will education be de-regulated?'; and that using the MTSD can be distracting – games, social media, incoming calls and text messages.

Structural description: How the experience happened

Reflections on the setting and context

The intervention actually comprised two collaborations of practice. The first was in teaching practice by collaborating with the unit lecturer and both supervisors to design and execute the assessment. The second was to initiate and participate in a discussion with students on the topic of the MTSD and how they used it to learn. The topic was explicated via the assessment and research handouts provided before the first discussion, which was conducted as part of a first seminar that I delivered. After the students who opted in (to the research project) submitted their assessments, I was provided access to these and then collated my first impression of their reflections about the MTSD and (mobile) learning which formed the basis of a discussion with them in class.

While the discussion about the MTSD and learning was insightful about the breadth of this practice amongst the group, I came to see that a deeper analysis and understanding of the data could be obtained with the addition of more detailed analysis methods that I could apply in my (individual) practice as a researcher; by using my interpretations of the data to lead my interest and (re)analysis of the relevant texts. The field study as designed necessitated that I interact with the research participants' class in three roles: as the researcher, the teacher and as a fellow student. To a few, I was also a professional peer working in a similar field, adding another social dimension and dynamic.

The limitation that I faced during the execution of the field study was that even with

[32] I have paraphrased here except where quoted.

several points of contact with the students, I had no way of monitoring any improvement or change in what they were learning compared to if I had not intervened; this is problematic in terms of objectively verifying any improvement for the subject matter of the unit. What I did find though, was that I had rich accounts of the learning experiences of individual students using the MTSD and their opinions about it, of which a significant proportion was from the student's own medium theory perspective. This should hardly have surprised me because this was the intention behind the experiment design and intervention—but it still did.

Impact of the initial findings

My early analysis of the data was in the form of several readings and re-presenting to the student participants for discussion, my summary of their observations and the key themes and terms that I found most prominent, including those about medium theory. I had noted by this time that there were several students present who were also professionals—one worked as a journalist for Fairfax. And so it was relatively straight forward for us all to fall at times into a pattern of conversation similar to a role play where I might have been a consultant checking with colleagues and/or clients that my observations and reasoning were sound. This role play like context in the way I asked for feedback was not contrived in that we did not need to pretend or act the roles because the roles were just different aspects of who we were as professionals compared to the teacher/student roles we had adopted earlier during the lecture section of the seminar.

The initial analysis and consultation with the students left two strong impressions: the simple fact that all participants utilised the MTSD as one of several tools to complete the assessment (rather than use the MTSD "as much as possible", which was the assessment instruction); and the emerging theme of what I described at the time as the travelling, motivational and disruptive/interruptive properties of the MTSD that, combined as a quality, influence learning in the context of the field study; that is, the students' brief to use the MTSD as an assignment completion tool.

Conclusions

In the analysis, my ideas have formulated not by just observing others but by participating in (individual) practice—joining in and doing as the others did—forming a deeper connection and common understanding with the students whom I designed the study for. This is a design spiral paradox: solving the problem of how to use the MTSD to study – how students use the MTSD to solve the problem of learning.

Students exercised control of their learning practice by using the MTSD to engage with information formatted by mediums that motivated them – text, images, podcast, video, social media. They did this by interacting with the MTSD to arrange (or personalise if you like) the way external flows are patterned; that is, their use of other useful mediums in conjunction with the MTSD and how they traversed these in different locations, times and spaces (physical and virtual), as they worked to complete the assignment. For this task, the content production and publishing capabilities of the MTSD were mostly unused.[33] Apart from using the MTSD to read and consume audio visual media, its active use for the assignment was primarily as a note taking tool. As one student wrote about the iPad: it was 'used for relatively passive consumption'. Whether this was a general preference for the participants completing a text biased written assignment or an indication that students may have used the MTSD more if they had the digital literacy required is a question that would require further investigation of a different design. The study and the data here do not reveal any further insights than I see in this regard.

My own reflections on learning practice (also text biased) involving the MTSD came to be informed, first by the initial analysis and discussion with the student participants, and then by my observations during the analysis, as the reader can observe whilst reading the techniques I deployed for that section of the analysis. My practice was complemented through the technique of using the voice-to-text function. However, the inaccuracy of the voice-to-text function on the MTSD meant that I also spent time "on the fly" using the touch screen to correct my words incomprehensibly captured in jumbled text, a process which interrupted my flow of thoughts from interchanging between the touch screen and voice-to-text interfaces.

I consider that the most significant technique common to the students' learning practice and my own involved using the MTSD in a specific way; participating with and/or acting on a stream of consciousness while using the MTSD. From my own experience, I can describe this technique as the simultaneous participation with one's flow of thoughts and the MTSD medium; this is a non-linear experience. To describe it as quoted from the assignment in one of the student's voices:

> I have found in my experience that thanks to my MTSD it is now possible to think and act in a stream of consciousness; to think in links; or more literally, hyperlinks (Research participant).

The students' interrupted learning experiences with the MTSD involved the mind being over-

[33] Apart from the student who used the camera to find library books, one other student published a Facebook post, and another published a comment on the blog that the assignment was about.

whelmed with information. But when students took charge by using the MTSD with, what seems, adequate skills required for the task and a sense of purpose, a pattern (or feedback loop) would form in their *stream of consciousness* thinking that fed their intrinsic motivation to perpetuate the sense of control experience. This has all the hallmarks of a flow experience as described by Csikszentmihalyi, albeit self-directed by the students' learning practices. This is the result of what can happen if students are left in charge of their own learning with the MTSD but, as I have highlighted, the necessary skills and digital literacies are required for this type of learning practice to occur.

There is a distinct quality to the students' and my own "stream of consciousness" experiences. It is a *simultaneous participation with the medium* that is not quite Heidegger's *readiness-to-hand* because the qualities of experiencing participatory non-linear thought and/or interruption as effects of the MTSD are present in any given moment. This is the telling difference that distinguishes *simultaneous participation* with the MTSD to *readiness-to-hand* represented by Heidegger's hammer which by contrast is a linear, analogue tool.

The final words in this chapter are aptly attuned to the author Jack Kerouac,[34] most significantly, that the stream of consciousness technique/thinking/participation used in his practice which existed before the digital age, as we can see how it applies in our use of the MTSD, is still relevant and applicable today.

[34]Kerouac wrote using an analogue typewriter fed by sheets of paper joined together so that he could write an uninterrupted 'stream of consciousness'.

6. Conclusions: The MTSD and flow as medium

Introduction

> The book has a beginning and end, it is not continuous whereas the mobile touch screen device is flowing and constant, we have the control. (Research participant)

This chapter begins by answering the central research question of the thesis, *What are the qualities of the MTSD medium that facilitate learning by practice?* The singular term common to all of the students is control—either explicit, such as in the previous quote, or implied, such as the example of the student who emailed her partner a link to the assessment article so that she could continue to read it herself. Speaking through their written critical analyses, the student participants described how they sought to control the flow and pace of their learning to suit the social, physical and virtual environments in which they were working and contexts in which they were trying to learn. The MTSD provided that control yet at the same time undermined it when students were overwhelmed by the technology and/or information, or when unchecked distractive and interruptive affordances of the device intersected flow and pace.

The pervading effect of the use of the MTSD is an *amplified sense of control*; paradoxically, the effect is both positive and negative. Individuals positively motivated by this effect are more likely to attain and maintain Flow experiences when learning and interacting with the MTSD. The unique quality of the MTSD is in its facility to reconfigure the patterns of individuals' learning experiences in their everyday lives. This works in two interplaying and inseparable parts. *Extrinsic re-patterning* works in that the MTSD enables individuals to design and improvise their own learning practices in varying contexts across locations, places, spaces and time. *Intrinsic re-patterning* results from the feedback loop between the individual's perception and touch interactions with the MTSD, a condition that can enhance flows of thoughts, creative

thinking, intrinsic motivation and facilitates reflective learning practices.

Essence of the phenomena: Using the MTSD for learning practice

The effect of the MTSD on the individual (learning) is an engagement that is transitory, leading and following the flow of the thoughts and intentions of that individual. There is the distinct and clear sense of a travelling (inner) experiential journey that moves parallel to the MTSD medium as it is used in sequence with other mediums, both digital and analogue, as they are used in the practice of learning. The essence is the tension between the inner journey and external transitory use of the MTSD—a subset of a set of interactions with the range of mediums, information and communications negotiated and traversed.

Individuals use the MTSD to control the pace (sense of urgency), pattern (where, when and how to use) and scale (duration and magnitude) of learning activities. They either continue with a task when the environment, conditions and context match their internal flow or defer that task to resume it in a different time, place, space (virtual or physical) or via a different medium. While the journey may involve encounters with others, the practice of learning using the MTSD is propelled (motivated) intrinsically by the individual, fuelled by the flow state inducing *oscillating logic* effect of the MTSD and or with the control over the device that the individual experiences.

The conclusions

At the outset, I defined learning from a medium theory standpoint that rests on Marshall McLuhan's ideas as any *change of scale or pace or pattern* introduced into the affairs of the thoughts of the individual, and how these thoughts travel. And I said that it would involve the dynamics of the tension between *external* flows of information that the individual is exposed to and the *internal* experiential flows of the individual, specific to performing a learning task. I have used this measure of pace, scale and pattern as markers of *learning* where the data shows that of their own accord, participants used the MTSD to control: their learning participation in its pace (do now or defer); its scale (how much and with whom); and its pattern (where and when).

The way I have answered how the student participants used the MTSD to solve the problem of learning goes beyond the types of content mediums—apps, tools, utilities—they chose to use. My reflections about this are that each individual participant solved the problem of learning by using the MTSD in sequence with other mediums to extrinsically *design* and *improvise* their

own learning patterns in the ways they accessed and produced knowledge/artefacts; and that this pattern both informs and is informed by following and leading flows of thought; that is *oscillating logic*. These intrinsic and extrinsic flows are involved in a continual friction that itself ebbs and flows as the student uses the MTSD.

In my discussion about oscillating logic, I have detailed how the mind can be motivated, leading and following the individual's sense of touch enhanced by the MTSD. I was intrinsically motivated by the words of the student participants writing about 'steam of consciousness' and 'flowing' qualities of the MTSD to investigate this in my own learning practice using the MTSD. In my reflections I have discussed how the mind can drift away from and back to the task of writing—a (re)minding drift—at odds or in harmony with a kinesthetic tension. I have described how a deliberate awareness of the senses at the time of putting words to thoughts creates a participation with the mind at once with the body in motion – the grosser the body movement, the clearer the quality of the mind is amplified – and dormant thoughts can surface to be articulated. The experience of this flow thinking technique in tandem with sensing the kinesthetic motion of the body is as instantly enhanced reflections – present and amplified.

The point of developing my own technique in writing this thesis has become to continue the pattern and the pace of thoughts that enhance the learning activity using the MTSD to capture my ideas that would otherwise not be captured ... as I am writing now. It requires the discipline to avoid impulses—in my case the urge to edit—but it can just as easily be succumbing to a distraction or urge to touch and check or do something else on the MTSD which has nothing to do with the task at hand. When experiencing enhanced learning experiences through practising this technique, it is sensing the collapsing of time that results in expressions of learning, as I have emphasised in Chapter 4, *The Epoche: Personal learning interaction experiences with the MTSD*. I have both found and experienced that the MTSD binds other mediums in the same or other environments (through its connective qualities), as it enhances and extends the ability of the individual to investigate, discover and analyse. In terms of learning practice, techniques that draw on the awareness of the touch and kinesthetic senses evidently work in self-directed learning contexts as they have in my case.

Hegemony

The MTSD is ubiquitous and provides the individual with an unprecedented control to access, produce and publish digital media. Yet most of the student participants did not, or chose not to use the MTSD to its full capacity, especially the producing and publishing capabilities of the device beyond text; although as the assignment was a written task this for me comes as

no surprise. In my observation that students place significance on the experience of being in control (of the MTSD) and Csikszentmihalyi's observation that the individual's experience has a direct effect on the motivation to cease or continue an activity, it follows that augmenting this sense of control with equitable access to the device, the associated learning resources and support is a key consideration towards creating enhanced student learning experiences involving the MTSD.

I have raised ethical considerations about the use of the term "user" in the fields of HCI/UX to describe and address groups of individuals, who are observed and treated as the other; that is, people objectified for the purpose of enhancing their experiences. We can no longer expect this objectification to persist when the student becomes a designer with the MTSD by using it to solve the problem of learning; the paradox then becomes that the designer (UX *et al*) is designing for the designer – this is indeed (popular) contemporary culture eating itself.[35] Yet, control of the MTSD is primarily set in its design by its creators, and as I touched on in the second chapter, the industrial designers and software developers of the medium have the upperhand in who controls the medium in the current age; perhaps this is the root cause of why they can be so prized and revered[36] with high salaries and a celebrity like status.

Paradox

The paradox has become the centrepiece theme through the course of my review of medium theory literature and my analysis of the research data. Identifying paradox (or seemingly contradictory statements), by applying medium theoretical thinking through the use of the tetrad and the concept of figure and ground has worked to unravel how the enhancing learning qualities of the complex MTSD medium are hidden and revealed. It is through the consideration of the MTSD in space and time, in which the simultaneous model of the medium can be regarded, that the ebb and flow of its visible (and invisible) qualities is understood by the contradictions that at first glance make no sense. The ultimate paradox is that the MTSD is such an effective medium that its effects on society have until now been largely invisible, even to medium theorists. The MTSD at every moment completely re-configures us to: our senses; each other through communications; information; our physical surroundings; and in the way we create to completely transform how we now conduct our lives – and can learn.

[35] I have always thought that the well used saying "pop will eat itself" was a quote of Andy Warhol but there seems to be no record that he actually said that.

[36] Jonathan Ive was knighted in 2012 for his services to design.

Flows

From the experiences of the students I have identified three distinct flows involving the MTSD and learning that span their structural, social and contextual settings (environments): the flows of information that McLuhan identified that can inform or overwhelm; the *stream of consciousness* aspect of flow state that Csikszentmihalyi identified as motivational; and the presence of what I call the medium flow, or the flow of mediums—the sequential use of (physical and virtual) artefacts over space and time—that each student traversed (paced, patterned and scaled to their learning) in describing their learning process. In general terms, I have attempted here to visually depict the characteristics of the three flows in the following diagram of an individual student in a learning context involving the MTSD. Information flows that generally enhance a student's learning are shown to intersect the flow of thoughts when the student experiences an information overload. I indicate when a student's thoughts are altered by interacting with each medium: an upwards movement indicates thoughts are becoming/reaching higher order thinking or a stream of consciousness; a downwards movement indicates, for instance, thoughts involving a distraction or information overload. In my sample, each (learning) medium is set apart in time, although we know from the data that sometimes the students used another one or more mediums with the MTSD at the same time or in close sequence with another medium.

Simultaneous model

The ingenuity of the MTSD is in its simplicity as a physical object and its complexity as a personal, portable, multi-purpose tool that demands interaction. I have explained earlier that my analytical methods were constructed by drawing on Phenomenological Reduction built on the structuralists and McLuhan's work so that I might (simultaneously) examine the MTSD as both a medium and a phenomenon. As I have demonstrated, there is clarity to be gained about how the qualities of complex mediums like the MTSD work by regarding them as a simultaneous construct in which all of its elements and qualities are present at any given time. From the phenomenological understanding that I can never completely detach myself from the world I study, my discovery is that simultaneously observing and *acting* with the MTSD artefact in *practice*, produces a deeper learning experience and understanding of the mediums that make up the world I encounter—as an individual—with others.

As a complex medium the MTSD is the perfect simultaneous model to examine: it is a singular portable object that can easily be held and carried; but for the most part, its elements and capabilities are invisible or hidden at any one time. In physical space it is an

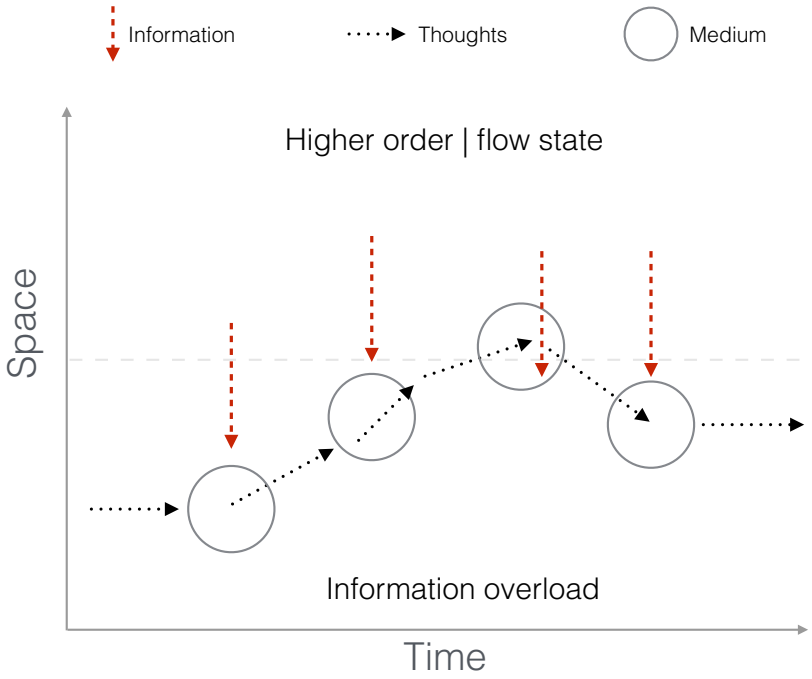


Figure 6.4: Flows: Information, thoughts — stream of consciousness — flow state, and mediums

autonomous object but its inner (software) and outer (connective) workings that are totally (inter) dependant reverse that autonomy. The MTSD has emerged from the tetrad as a paradox – an object that operates with the quality of *autonomy* that is simultaneously enhanced and reversed as *dependency*. So it should come as no surprise to us that its effect on us is to push and pull our thoughts but when, through deliberation, we have the experience of being in control, these thoughts find an equilibrium resulting in oscillating logic. The MTSD with its apps and other interface elements *et al* made visible and invisible through our interactions provide us with experiential examples that we are all familiar with, not just as a simultaneous model for research but as a model that can be used in arts and design practices – or both. The discovery of this study is that the MTSD medium is the perfect simultaneous vehicle and model for examining nonlinear thinking practices that can enhance learning.

Simultaneous model implications

The examination of a simultaneous model—figure and ground—the tetrad—is a key to unlock an even deeper understanding of the pedagogical qualities of the MTSD (as well as other complex mediums) and how they might be used to enhance the learning experiences of individual students. The further investigation of the oscillating flow between figure and ground of syn-

cretistic and logical thinking modes, against the conflicting or contradicting content mediums and themes within a complex medium may yet explore uncovered ground in the medium of collective knowledge.

The paradox of flows

I have defined that a *medium flow* is the sequential use of (physical and virtual) artefacts over space and time and yet there is more to consider; because each of the transitions *between* the use of each individual artefact also forms its own pattern or flow, that can be regarded as a distinct sub-set, a sub-medium flow of the medium flow. If we further consider a flow state (Csikszentmihalyi) that is induced by oscillating logic, we might see that it is a fragile condition that might be interrupted or broken at any time. The effort and concentration to attain a flow state in this way needs to be attained and maintained to have form—a medium for there to be be learning—without coherence it dissipates into fragmented experiences without form; it becomes practice without a medium.

Implications in society

The field study and the literature have shown that the most effective enhancer of intrinsic motivation is when the student has the control to design their own extrinsic learning patterns. My conclusion is that the overall effect on society is that the mass adoption of the MTSD has changed the intrinsic conditions in which learning can take place. In the least, the study demonstrates that when an individual is intrinsically motivated, then attention to the task at hand is maintained and so in turn is the pursuit of interest in the topic. I need only draw the attention of the reader back to the particular scenario of the student studying in bed, maintaining a learning flow state with a distinct reconfiguration of her intrinsic connection to her partner and information that she controlled with her MTSD. Such an intrinsic condition made general can only lead to the conclusion that the internal (re)wiring of our thinking and learning in society is now forever changed.

In this new state of affairs, it would be useful to think about what the desired effects of the MTSD on our learning practice might or could be. As we move throughout the day in space, place and time, at each moment the MTSD reconfigures us in how it can connect us to our surroundings—the pace, pattern and scale of communications, information, geolocation *et al*—is adjustable in every moment depending on our thoughts and how we act upon them, how we participate as a result of our re-patterned cognitive flows with feedback loops fuelled by our touch interactions with the MTSD.

We have more control than ever before in our learning because, given the right circumstances, we can now shape—design or improvise—each moment and place to be a learning context; this is a new learning practice and being able to learn in this way involves a new digital literacy. The digital literacy I speak of is more than how to operate the MTSD or which apps might be of use – it is more about understanding the controls of choices we have available in how the MTSD reconnects us to the virtual and analogue worlds that enable us to "touch knowledge".

The role of the artist

Marshall McLuhan might agree that the artist archetype shows us the way to a higher and finer control of the medium. It is the innovation of the artist that illuminates new ways to use mediums such as Kerouac joining sheets of paper to directly capture the stream of words that formed from his thoughts (Kerouac, 1957). It is the discipline of the artist who continually practices using the languages and techniques that control the mediums for the purposes of the (isolated) artist who is sometimes the first or only person to understand the merits of their work that others—future generations—might benefit from; and it is the dedication of the artist to humanity that prevails beyond the medium and mortality in the legacy that remains.

The creative practice of David Bowie (Victoria and Albert Museum, 2015) included non-linear approaches: techniques such as "cut-ups" (also practiced by William Burroughs), in which sentences written on paper are cut into word segments, then re-arranged; and the 'Verbisizer', an app Bowie designed which dissects sentences and randomises the words into new sentences. The purpose of these techniques seems to be to manipulate one's own ideas into a higher order thinking, as Bowie puts it to 'empathise' with new randomised meanings, which one can choose to interpret or take literally in the creative process.[37] With these non-linear approaches Bowie sought 'access to areas that I otherwise wouldn't be thinking about during the day, that in the natural course of events I would have skirted around or just not have been involved in'. When he worked in this way, the new meanings in his lyrics would follow a form that was initiated from the process, then assimilated and applied further if Bowie found that it 'felt like that kind of patterning'. In contrast, the research participants reporting that the result of the mass adoption of the MTSD is 'our patterns of perception have been altered' as well as deploying the stream of consciousness technique display a similar scenario in which the individual controls the medium to attain higher order thinking through creativity. In

[37] I refer here to the cognitive domain of the revised Bloom's Taxonomy (Huitt, 2011), specifically to the aspects of higher order thinking involving the verbs 'apply', 'solve', 'experiment' and 'reflect' (Collins, 2014).

this way, non-linear design approaches have potential as a pedagogical technique to encourage higher order thinking involving the MTSD.

Recommendations

This study has made visible, the ways that the MTSD is used and might be used by students in higher education that offers enhanced access to higher order thinking. However, much more work is needed to understand the fuller implications and the potential of what I have discovered. The findings call for action in four areas—research, learning design, digital literacy support and systems:

1. Further research is needed to substantiate what I have defined as *oscillating logic* and altered patterns associated with learning that we experience arising from our interactions with mediums such as the MTSD. A better understanding of how the dynamics of intrinsic and extrinsic flow patterns affect learning will serve to enhance learning experiences. Projects that seek to understand how ubiquitous mediums such as the MTSD can enhance higher order thinking should be supported.

2. Learning design and practices must take into account that the perception of having control is a significant enhancer/inhibitor to students' learning when they use digital technologies, especially concerning the MTSD. Learning designs should also facilitate the enhanced intrinsic and extrinsic flow learning patterns of students; and this is also dependent on further research to find out how it can be done.

3. On the assumption that the issue of control is just as important to teaching staff as it is to students, professional development programs for staff should offer digital literacy components that result in improved proficiency and confidence in the use of the MTSD and other related technologies used in pedagogical contexts. Students should have access to ongoing digital literacy development resources.

4. Systems: Technology infrastructures and platforms, policies concerning MTSDs,[38] and procedures or processes (content management, publishing) that support the use of technology in higher education should also support the MTSD. The first step is to revise or establish enduring principles that will guide the more effective use of the MTSD in higher education by asking students how they already use it.

[38] One example would be an institution's "bring your own device" or BYOD policy.

I now offer further notes to supplement and expand on this recommendation summary concerning the subject of the MTSD, particularly concerning learning design, the broader pedagogical implications and the role that medium theory can play to inform the challenges we now face in society with the rapid rise of new technologies.

Between design

The new dimension that the MTSD brings to design practices involves something aside from designing for one or more contexts—it involves designing for *between* these contexts following paths led by the extrinsic flows of students in their everyday lives at university, the workplace, at home and everywhere in between. Therefore higher education now faces the new task for learning design to establish approaches to solve how students might continue learning between learning contexts. By this I mean both formal and informal learning contexts including face-to-face, digital learning and blended learning, essentially all of the learning contexts that a student might be involved in during the course the day.

Rather than a snapshot fragment of time in which one context involving "mobile learning" is regarded, what is needed is a wider view of the (space) time spectrum over which learning activities take place, a day, or even a week;[39] the designer of the activity should know the amount of time appropriate. It needs to be kept in mind that the use of the MTSD is transitory, but this thinking should also be applied to other mediums – computers, books *et al*. The use of each medium used for a learning purpose is transitory but as the data has shown, the ways students employ the MTSD make it the medium that can bind the learning experience together across locations, contexts, spaces and time. With this insight, we must now devise a holistic design approach to enhance the flow of these learning experiences. There are technical challenges in executing such a design that must also be considered, such as facilitating the continuation of a learning experience from one platform to another.

Design for the designer: Between non-linear thinking practice

Learning design must take into account that the perception of having control is important to students. The main challenge is designing learning for students who can now design and improvise their own learning patterns while also controlling its pace and the scale in which they (intrinsically) engage themselves or participate, all bound together with the MTSD. This is the new learning practice that permeates society on all levels and in all domains. So, while the use of the MTSD and other resources is transitory, the designer should solve what type

[39] Essentially, the expected period of time it would take a student to complete the activity being designed.

of intrinsic motivation is needed between the use of each resource. Design questions that will help here are:

- How can I make it easier for a student to leave, continue or complete a task through the course of the day?
- On what note or with what thoughts might the student leave an activity when interrupted?
- How easy will it be to pick up from where they left off? How can I suggest the appropriate place to start or perform an activity appropriate for the attention (cognitive load) it requires? For example, it could be suggested that a quiet environment such as the library or at home is the best place to read a dense text provided; or it could be suggested to "try this when you have 5 or 10 minutes" if the task is relatively less demanding. This approach complements time indicators that are often now used to let students know how much time an activity might take.

Scale: Minimal design for maximum effect

What is the magnitude of the task – is it challenging enough or too challenging? From a Flow theory viewpoint, the scale of the task must not be too difficult so that the student is discouraged or cannot solve the problem and at the same time should not be too easy so that interest in the activity is lost. Given that students might be using one or more MTSDs in various contexts, is the task best suited for the individual or does it necessitate a group activity? In what type of environments or spaces might the activity take place? Will the student have the right level and appropriateness of support, ranging from whether the activity requires one-to-one assistance to the overall technology infrastructure required to provide access with equity?

Pattern: From non-linear to critical thinking

What are the different locations in which the activity might take place? What effect might this have on the ability of the student to perform the activity to the expected standard? Therefore recommend locations and environments best suited for the task. Recommend the right mediums; the MTSD might help to continue a task but might not be the best main tool for it. Use the affordances of the MTSD to stimulate non-linear thinking by capturing students' thoughts at the time they might occur – via text input, the camera, drawing and any other (enhancing, augmenting, amplifying) tactile activity that might keep the mind shifting.

Consider anything that might induce higher order thinking in the way that new information might present itself to students, how they need to negotiate that information, problem-solve in obtaining it, and then collate it so that when presented it makes sense. Students can enhance this design with their own techniques and by using other mediums whether that might be an app or pen and paper etc.

Pace: (In)form thoughts with medium form

The pace and momentum of learning need a clear direction. At any moment the student using the MTSD can be distracted and so needs intrinsic motivators to carry the momentum of the sense of learning onwards, to know and to remember what the task is and what needs to be done now for the activity to be carried out in full. Gamification techniques used in flow practices can be beneficial but should apply across the sequence or pattern of mediums; whereas the MTSD shapes the pace of engagement in how we act on the impulse to touch it. Perhaps the obvious approach to enhance the intrinsic pace of students are the techniques of gamification, for example the use of an external timer to create a sense of urgency. But this must be done with regards to the other extrinsic physical patterns of student interactions and events that might be taking place. At the same time each student should be able to control the pace to negotiate mobile learning contexts. So, as much as possible, students should be able to defer an activity that is in progress and be able to easily continue it in a more convenient time and place. In this regard, asynchronous communications will provide greater flexibility than synchronous communications for students – more opportunities in time for learning interactions.

Wider pedagogical implications

What emerges with the ubiquity of the MTSD is a reconfigured human—medium—information—communications environment that calls for new pedagogical models and approaches to digital (including online and mobile), blended and face-to-face learning. Here, I am discussing some of the broader pedagogical implications than those that just involve the MTSD. We could see a turning to the examination and application of medium theory for de-constructing other complex mediums used in education such as the well established learning management system (LMS) for example, along with other emerging mobile technologies such as smart watches and wearables. As I have already noted, the tetrad is a pedagogical tool constructed for the purpose of analysing mediums, the second chapter of this thesis is but one example of how the tetrad might be used to de-construct a pedagogical context – others may also see the potential

pedagogical clarity involving complex mediums and benefits of similar approaches to the one I have used and that various medium theory practices might be established within the broader practice of educational design.

In *learning design*, we could see a more deeply informed emphasis on the effects of interactions with learning mediums – how the re-configured senses might be employed to shift the mind. For example, when designing learning specifically for the MTSD, touch interactions could be balanced with other physical activity (using geolocation as an interface to content) that altogether, would aim to help students to internally process information – the data gathered or produced.

What has recently emerged in the observations of educators are students in low-income situations whose main access to information and communications is the MTSD, that is "smartphone-only" (Martin, 2017). This is shaping the digital literacy that learning designers and educators need to design for to most effectively engage with their students. But as I have demonstrated, it is not just a narrow focus in time on the MTSD (smartphone and tablet) that will provide the answers that educators need to design and develop learning experiences effectively. More research is required to understand the new extrinsic learning patterns of students brought about by the MTSD that inform their intrinsic motivation, more so about how they themselves design and improvise these patterns.

I can see that new pedagogical approaches are required or at least a new principle that is relevant and applicable in every learning scenario. I offer this heuristic posed as a question:

- *What will support the continuity of the learning activity to carry it through to completion*?

Medium theory

There is much to benefit from a more consistent and concentrated effort in returning to the initiating medium theorists such as Harold Innis and Marshall McLuhan: by discerning in greater detail the concepts that have more light to shed on the changes and challenges we now face in society with the rapid rise of new technologies – not only artificial intelligence (AI) robots *et al* but also the re-emerging analogue biased mediums/technologies such as the LP record and record player, film and arguably the electric vehicle (EV) to name a few. The MTSD continues to be a useful subject to scrutinise because of the relatively short time span its uptake has pervaded society compared to other medium precedents that have shaped the way we live. The correlation between intrinsic thought, extrinsic mediums and events are now clearer as a result.

Contribution to knowledge

In this thesis, my original contribution to knowledge is to use medium theory to examine the effects of the mobile touch screen device (MTSD) on the learning experiences and practices of adult individuals. But the work of my practice that has resulted in this thesis makes two further contributions to the medium of knowledge: the *theory of oscillating logic* and *between design*.

Theory of oscillating logic

I have argued that the senses of an individual using the MTSD are re-calibrated to bias the sense of touch from my interpretations of the literature; predominantly medium theory and pedagogy stemming from the ideas of McLuhan and Piaget respectively. It is from these ideas that I have arrived at the theory of oscillating logic: *Oscillating logic is a cognitive condition that occurs when an individual is involved in participatory tactile learning with a medium and can be described as the oscillation between the syncretistic and logical modes of thinking identified by Piaget.*

Between design

From the data, I have made observations and reflections about intrinsic and extrinsic non-linear flow practices: intrinsically the practice of non-linear and stream of consciousness thinking that aid learning and creativity; and extrinsically the recognition of new patterns of medium usage for learning and creative practices that can only and should be observed or seen through a wider gamut of space, place and time. This has resulted in a new approach to interactive design whether that be for communications or learning that I prescribe as *between design*. *Between design recognises that the use of a medium for any given human endeavour is transitory and should allow for an individual to be able to start, continue or leave the experience involving interactions with a medium seamlessly with the other mediums required for the experience designed to be complete.*

Epilogue

When I was quite young—four or five years old—I observed my father reading a newspaper; he seemed to read its entire contents turning quickly through the pages to then suddenly turn the last one before sliding the closed paper away on the table. Impressed, I enquired how he had read the entire newspaper so quickly because I was convinced he had read it front to back. He casually told me that the newspaper consisted of very little substance and he therefore only read the parts that he thought were important or interesting. It was mind shattering at that age to suddenly understand that you could actually choose how much of the newspaper you wanted to read, that people could have this kind of control over the experience that they wanted to have. This is my earliest memory of cognitively processing what is now widely regarded as UX. To me, this example from a childhood memory resembles the current scenario and new status quo brought about with the ubiquity of the MTSD, where the people have the experience of using an everyday medium in a practical way where the user is very much in control.

Expanding on this notion, I think in a variety of practices we are still coming to terms with the MTSD and how it has changed society: the web, the ways we communicate, produce, publish, access information and the way we trade; the emphasis on UX for marketing agendas and commodification, monetisation often leaves scant room for investigating the richer experiences of learning. My investigation and interest about the effects of the MTSD medium on the way we learn has hopefully provided the reader new perspectives (and contextualised) the ways the MTSD has changed the way we live, opening new ways of thinking whereby or from which we might learn and design to learn.

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Appendices

Appendix A: Mobile phone-Tablet Assignment (20%)

Medium theory and critical analysis of a blog article 'Mobile McLuhan'

Using a mobile touch screen device (MTSD) smart phone or tablet, students are required to provide a critical analysis of the blog article 'Mobile McLuhan' at http://floatlearning.com/2012/08/mobile-mcluhan/

Your analysis should identify and critique at least two ideas by media theorist Marshall McLuhan (1911-1980) that are presented in the article. Use the device to find out more about these ideas and discuss how you did this. Follow the tasks below as a guide.

How did you use a mobile touch screen device (MTSD) to complete this assessment? Try to identify specific characteristics of the MTSD that are conducive to learning. Complete the following tasks:
Write down the type of device/s you used smart phone or tablet and how it was used. For example, did you use it to:
- read the article
- search the Internet for more information
- exchange SMS messages with someone about the blog or assessment
- use email in any way
- call someone to discuss
- write the assessment if so, using which app?
- use another productivity app such as a calendar, a to do app, a voice to text app etc.
- post to Facebook, Twitter or any other social media (including the blog)?

If you used a computer, laptop or even pen and paper to complete any tasks, write the reasons why and identify which tasks you completed this way.

Consider and comment on how well the title, article and image communicate when viewed with an MTSD.

One of McLuhans concepts is on hot and cool media. We engage passively with hot media because it is high definition, not relating to screen pixels rather, it is saturated with information and requires little interpretation to make sense. Cool media requires active engagement and a high level of interpretation for us to make meaning of it. Comment on the temperature you would assign to the title, article and image when viewed with an MTSD and the reason why.

Comment on the authors purpose of writing this post, the intended audience and any responses by the audience.

VICTORIA UNIVERSITY
MELBOURNE AUSTRALIA

INFORMATION TO PARTICIPANTS INVOLVED IN RESEARCH

You are invited to participate

You are invited to participate in a research project entitled *Touching knowledge: Digital media practice and medium theory informing learning on mobile touch screen devices.*

This project is being conducted by a student researcher Victor Renolds as part of a Master of Arts at Victoria University under the supervision of Dr Tom Clark from the College of Arts.

Project explanation

Hello, my name is Victor Renolds. My research aim is to understand how you use your mobile device as a study aid and how it supports your learning. My specific research interest is in the mobile touch screen device as a medium.

The MTSD or mobile touch screen device is an iPhone, iPad and other various sized touch screen device (e.g. Android, Blackberry). My research question is: What are the qualities of the MTSD medium that facilitate learning by practice?

The aim of this project is to investigate the qualities of the MTSD medium, that aid the learning of post-graduate communications students. My investigation shall employ medium theory as the main methodology, combined with systems, design and cultural analysis methodologies to gain a greater understanding of how the MTSD aids learning.

What will I be asked to do?

One of the assessment items for this unit, *Medium theory and critical analysis of a blog article 'Mobile McLuhan',* involves using a mobile touch screen device. I am asking for your permission to use your assessment submission as data for my research. Apart from submitting a consent form and completing your assignment, you do not need to do anything extra to participate in this research project. Your assessment will be marked without prejudice or disadvantage if you choose to opt out. If you do have access to a mobile touch screen device, you can still participate in the research project by completing the assignment without one - this will also be valuable data towards the research.

What will I gain from participating?

Possible benefits from participating are that you will also gain a deeper understanding of your own learning using a mobile touch screen device, as well as communication and medium theory concepts as these relate to the ACG5214 Media 2.0 unit subject matter.

How will the information I give be used?

Your assessment answers will help me identify and analyse the qualities of the MTSD that support learning. This will be used towards my thesis and publications. Participants will not be named or identified in the research findings.

What are the potential risks of participating in this project?

There are no perceived risks in participating other than what you would usually encounter using your mobile device or completing an assignment.

How will this project be conducted?

I will be attending the week one lecture for ten minutes to go over the information in this form and answer any questions. Your lecturer will provide the assessment details along with your other assessments and will also answer any questions

you may have about how the research relates to your studies. All students attending will be provided with the consent form. If you choose to participate, the completed and signed consent form can be returned in week two.

Who is conducting the study?

College of Arts, Victoria University

Chief Investigator: Dr Tom Clark, College of Arts, Victoria University
Email: tom.clark@vu.edu.au

Investigator: Victor Renolds, Virtual Learning Executive, CPA Australia
Email: victor.renolds@cpaaustralia.com.au

Any queries about your participation in this project may be directed to the Chief Investigators listed above.
If you have any queries or complaints about the way you have been treated, you may contact the Ethics Secretary, Victoria University Human Research Ethics Committee, Office for Research, Victoria University, PO Box 14428, Melbourne, VIC, 8001 or phone (03) 9919 4781.

CONSENT FORM FOR PARTICIPANTS INVOLVED IN RESEARCH

INFORMATION TO PARTICIPANTS:
We would like to invite you to be a part of a study into…

Touching knowledge: Digital media practice and medium theory informing learning on mobile touch screen devices

The MTSD or mobile touch screen device is an iPhone, iPad and other various sized touch screen device (e.g. Android, Blackberry). My research question is: What are the qualities of the MTSD medium that facilitate learning by practice?

The aim of this project is to investigate the qualities of the MTSD medium, that aid the learning of post-graduate communications students. The investigation shall employ medium theory as the main methodology, combined with systems, design and cultural analysis methodologies to gain a greater understanding of how the MTSD aids learning.

A possible benefit is that by participating, you will also gain a deeper understanding of communication and medium theory concepts as these relate to the ACG5201 Social Media 2.0 unit subject matter.

There are no perceived risks in participating other than what you would usually encounter using your mobile device or completing an assignment.

CERTIFICATION BY SUBJECT

I, [Click here & type participant's name]
of [Click here & type participant's suburb]

certify that I am at least 18 years old* and that I am voluntarily giving my consent to participate in the study:
Touching knowledge: Digital media practice and medium theory informing learning on mobile touch screen devices being conducted at Victoria University by: Dr Tom Clark

I certify that the objectives of the study, together with any risks and safeguards associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by:

Victor Renolds

and that I freely consent to participation involving the below mentioned procedures:

- Allowing my assessment submission *Medium theory and critical analysis of a blog article 'Mobile McLuhan'* to be used as research data

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise me in any way.

I have been informed that the information I provide will be kept confidential.

Signed:

Date:

Any queries about your participation in this project may be directed to the researcher
Dr Tom Clark

9919 2196

If you have any queries or complaints about the way you have been treated, you may contact the Ethics Secretary, Victoria University Human Research Ethics Committee, Office for Research, Victoria University, PO Box 14428, Melbourne, VIC, 8001 or phone (03) 9919 4781.

Touching knowledge

Digital media practice and medium theory informing learning on mobile touch screen devices

Researcher notes

- Victor Renolds
- Medium theory
- Mobile Touch Screen Device – MTSD
- What are the qualities of the MTSD that facilitate learning by practice?

Your observations

- Awareness of a medium containing other mediums
- how media working together affects us
- MTSD is a dominant mode of communication
- awareness of the adoption (or uptake) of the MTSD as a new medium
- affect on choices made because of connection speed
- connected while location can be remote
- www is part of the MTSD medium
- mobile learning demands we engage
- non-linear, dynamic information and comms in real time
- with vast information freely available can mobile learning actually be personalised?
- will education be de-regulated?

Your observations

- the resistance to new technologies
- instant communication - experience of learning is now based on access to information, now that access to information is instant (with an MTSD)
- what is real learning?
- '... the ability to use apps via my MTSD gave me the ability to personalise my learning content during my preliminary research stage. Being able to assemble, carry around and have on-demand access to personally useful quotes and links is a modern-day privilege and expectation that challenges the traditional conventions of accessing content'
- choosing solitary exploration above social for learning
- need for reputable information sources - esp. online
- employing a contemplative approach (Pang) to learning on the MTSD to avoid distractions
- faster and easier communication

Common themes > terms

- information overload
- access information at any time in any place
- instant - anytime, anywhere
- convenient
- new technologies & how we adopt
- Literacy
- free flow of information
- digital divide

McLuhan's terms & ideas used

- extensions and amputations
- ratio of senses
- the medium is the message
- attempting to make new media do the work of the old
- hot and cool media

Learning preferences

- multi-tasking using MTSD
- Google seach
- browser favourites, apps, RSS
- pen and paper for note taking, print out and reference while on computer
- Skype
- **email links** - esp. to the student blog
- student blog, student blog post
- Facebook (two way)
- text on mobile responsive websites for reading on iPhone with slow connection
-

Learning preferences

- less assignment research done on small MTSDs like iPhone
- much assignment research done on small MTSDs like iPhone - Notes
- Safari, student blog
- Wikipedia
- Laptop for writing
- tablet to do research
- Reminders to do app
- iPad mini and iPhone - Evernote, chrome browser, email, iPad mini as reference while typing on a laptop
- briefer usage of MTSDs whilst on the move
-

Learning preferences

- Dictionary app
- iPhone 5 and iPad 2 - iPhone on the go, iPad for long-form relaxed content.
- During lecture, used iPad for taking notes with Evernote
- Safari to read course blog and Woodill article (bookmarked it by adding to home screen),
- iPhone 5 to:
- - download and listen to a podcast on McLuhan from Monash Uni School of Comms
- - Watch YouTube video on McLuhan 'The world is a global village' (Canadian TV)
- - Read Woodill article

Learning preferences

- Pen and paper to write notes for assessment
- Used iPad while bedridden for further reading for assignment, student email and entertainment
- Laptop for writing report
- Author research: linkedin.com, Twitter,
- Reading - hard copy, smart phone, tablet, library resources (e copy and hard copy), librarian, PDFs,

My learning preferences

- read article multiple times on iPhone
- iPad – writing, reading
- LED screen attached to Macbook
- read student hard copies of assignment
- use Notepad Deluxe on Macbook computer to take notes, prefer electronic notes - easy to develop ideas further
- dual screen
- send emails to myself
- Delicious social media bookmarking and tags (less and less),

MTSD qualities & affordances

- The MTSD: is hot when reading, cool when accessing different media together
- fast, zoom is useful
- easily look up word definition
- notifications (e.g. Reminder app)
- physical world characteristics of apps can be compelling
- convenience and comfort (laziness)
- private and personal
- 'able to assemble, carry around and have on-demand access to personally useful quotes and links'
- immediate sharing, spontaineous
- able to engage the senses - sight, sound and touch
- access to news/information

MTSD qualities & affordances

- MTSD weaknesses:
- cut and paste cumbersome
- distracting e.g. notifications
- mobile phone a distraction more than a tool

Other qualities & affordances

- Pen and paper - good for note taking
- Laptop:
- - used for research
- - writing assessment
- - quick access to multiple screens for writing and cross-referencing much faster than an MTSD

Woodhill: Article title temp?

- cool if you didn't know who McLuhan was
- hot if you did

The article temp?

- cool medium on an iPhone because it involves much touch interaction to get through it
- text and image - simple in font colour hardly 'rich' therefore cold
- hot - information rich and easy to understand
- cold - requires significant engagement

Article image temp?

- cool - had to make out what the image was
- hot - when clear
- simplistic - therefore cold

Article comment comments

- positive
- new learning culture
- thirst for information

The article audience

- written for academics/educators and researchers
- written for the educated or with an interest in the subject matter and McLuhan
- Woodhill is an eLearning industry professional – article for clients and potential clients
- - one comment is written by an industry peer and colleague

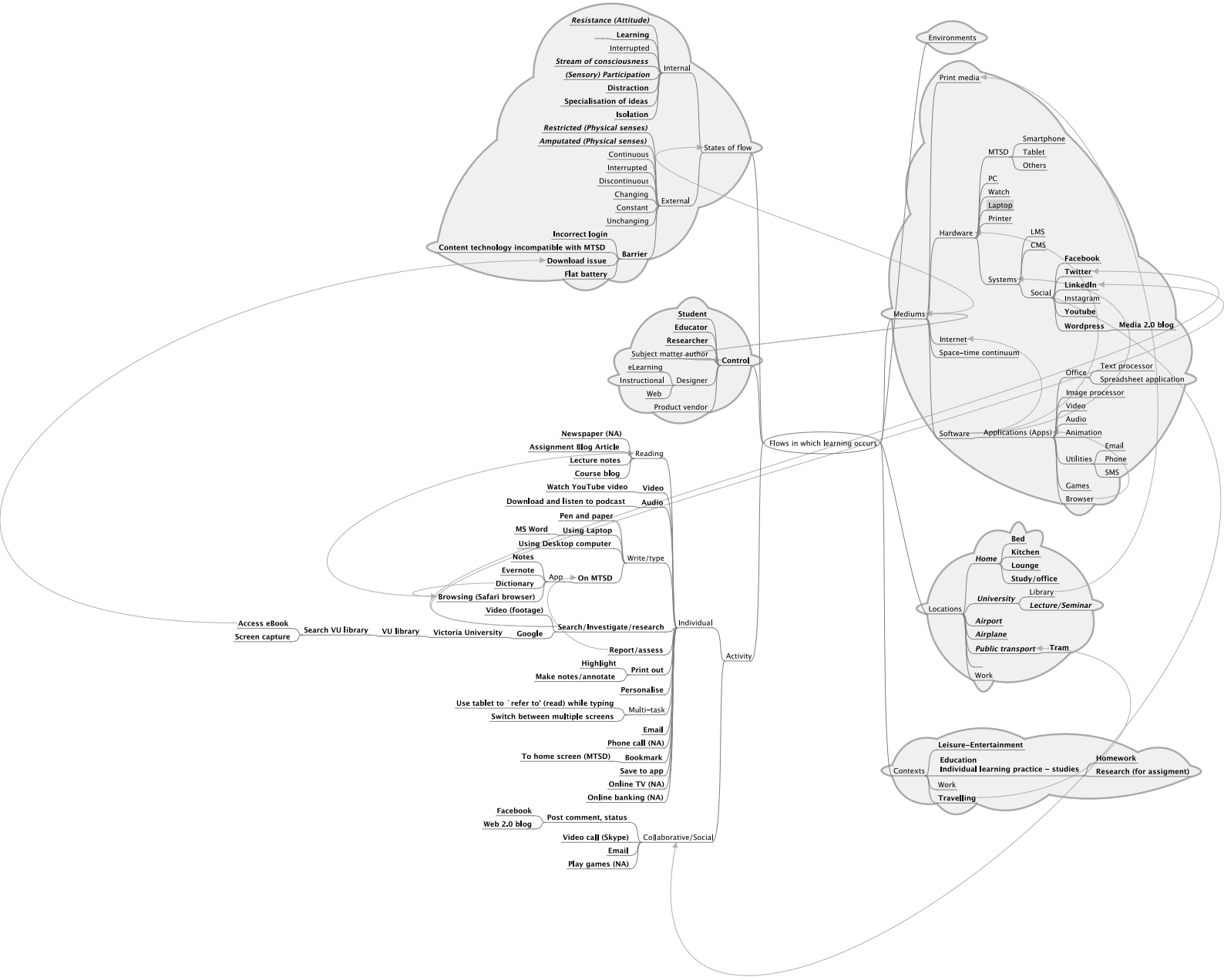
Thank you!

What else did you learn about medium theory from completing the assessment?

What did you discover about your own learning processes?

How significant is the MTSD to your learning?

Feedback: victor.renolds@live.vu.edu.au


Resistance (Attitude)
Learning
Interrupted
Stream of consciousness
(Sensory) Participation
Distraction
Specialisation of ideas
Isolation
Internal
Restricted (Physical senses)
Amputated (Physical senses)
Continuous
Interrupted
Discontinuous
Changing
Constant
Unchanging
External
States of flow
Incorrect login
Content technology incompatible with MTSD
Download issue
Flat battery
Barrier
Environments
Print media
Smartphone
MTSD
Tablet
Others
PC
Watch
Laptop
Printer
Hardware
LMS
CMS
Facebook
Twitter
LinkedIn
Systems
Social
Instagram
Youtube
Wordpress
Media 2.0 blog
Mediums
Internet
Space-time continuum
Student
Educator
Researcher
Subject matter author
eLearning
Instructional
Designer
Web
Product vendor
Control
Office
Text processor
Spreadsheet application
Image processor
Video
Audio
Animation
Software
Applications (Apps)
Email
Utilities
Phone
SMS
Games
Browser
Flows in which learning occurs
Newspaper (NA)
Assignment Blog Article
Lecture notes
Course blog
Reading
Watch YouTube video
Video
Download and listen to podcast
Audio
Pen and paper
MS Word
Using Laptop
Using Desktop computer
Write/type
Notes
Evernote
Dictionary
App
On MTSD
Browsing (Safari browser)
Video (footage)
Access eBook
Screen capture
Search VU library
VU library
Victoria University
Google
Search/Investigate/research
Report/assess
Highlight
Print out
Make notes/annotate
Personalise
Use tablet to `refer to' (read) while typing
Multi-task
Switch between multiple screens
Email
Phone call (NA)
To home screen (MTSD)
Bookmark
Save to app
Online TV (NA)
Online banking (NA)
Individual
Facebook
Web 2.0 blog
Post comment, status
Video call (Skype)
Email
Play games (NA)
Collaborative/Social
Activity
Bed
Kitchen
Home
Lounge
Study/office
Library
University
Lecture/Seminar
Locations
Airport
Airplane
Public transport
Tram
Work
Leisure-Entertainment
Education
Homework
Individual learning practice - studies
Research (for assigment)
Contexts
Work
Travelling