What can we learn from McLuhan? Electronic communication technologies and the future of schooling

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Abstract

In the 1960's, Marshall McLuhan predicted that schooling, among other things, would be transformed as society embraced electronic communication technologies. McLuhan and other medium theorists provided an evocative but controversial discussion of the effects of technological development on society and its institutions. McLuhan's ideas were widely criticised by his contemporaries, particularly educationalists; however, his ideas are not so radical today and visions similar to those formulated by McLuhan can now be found in mainstream educational literature. Predictions made by medium theorists about the future of schooling are consistent with both the reforms advocated by current-day educationalists and the speculations of technologists.

In this paper, I revisit McLuhan's predictions for the future of education. I then draw parallels between McLuhan's vision and those espoused by contemporary educationalists. I argue that, although McLuhan's predictions have re-emerged, his analysis of the interaction between new technologies and old ways of doing have not re-emerged to the same extent, with many commentators neglecting to take account of the resilience of the institutionalised practices, structures and roles of traditional schooling.

Introduction

The organisation of modern schooling has a long history which, according to medium theorists (eg., Eisenstein, 1979; McLuhan, 1964; Ong, 1982), has been profoundly affected by, if not founded upon, the invention of the printing press and the proliferation and subsequent dominance of the printed word. Medium theorists have proposed that the growing dominance of electronic communication media will have an equally profound effect on schooling.

One of the most controversial champions of this belief was Marshall McLuhan (1911-1980). McLuhan argued that the growing dominance of electronic communication technologies in the wider society would transform and revitalise formal education (McLuhan & Fiore, 1967; McLuhan & Leonard, 1967; McLuhan & Powers, 1989). McLuhan's ideas were radical in his time and attracted much criticism from his contemporaries (eg., Gambino, 1972; Macdonald, 1968; MacMillan, 1992; Ricks, 1968; Simon, 1968; Tate, 1971). However, many of McLuhan's ideas are now commonly espoused by educationalists. In this paper, I revisit McLuhan's ideas and his predictions for the future of schooling. I demonstrate the relevance of McLuhan's message to current movements in schooling and I propose that the theorising, by McLuhan and others, of the interaction of new technologies with institutionalised practices

provides useful insights into the way teachers and schools respond to the new communication technologies currently being promoted in schools.

Re-visiting McLuhan

Medium theory

Medium theory, a sub-discipline of Communication Studies, focuses on the social effects of the *form*, as opposed to the*content*, of communication media. Medium theory is based on the idea that communication media are not simply means for exchanging information, but that the characteristics of the media themselves have social effects and that dominant media types influence the shapes of societies and what it means to be human in those societies. This focus can be contrasted with more common understandings of the social effects of communication media that focus on the effects of content rather than on the effects of the media themselves. The idea of information having a social effect is a familiar one. Questions about the effects on individuals and on society of, for example, sexual references in *Ulysses*, racial stereotypes on television, violence in the lyrics of Marshall Mathers, and pornography on the Internet, are common. Barry Day (1966) gave the following example to demonstrate the focus of medium theorists:

> It is relatively pointless in a sociological sense to argue at length as to whether there is too much violence on tv, say, when it is the whole nature of the tv medium that is changing people's lives. (p.1)

This shift in focus from the content to the form of the media themselves is encapsulated by Marshall McLuhan's famous pronouncement: *The medium is the message*.

Three phases of human civilization

McLuhan's ideas about the effects of communication technologies were in part inspired by the work of Harold Innis (1894-1952). Innis (1951) argued that communication technologies play a central role in shaping human societies by affecting the flow and control of information. He studied periods of Western civilisation by examining the properties of dominant modes of communication and their effects on human interaction and social power structures.

Innis's (1951) main contention was that the particular qualities of communication technologies encourage particular forms of social organisation, and that the ascendancy of a technological invention can lead to the downfall of one form of social organisation and the ascendancy of another. Innis described many examples of social transformations and their dependence on communication technologies in his essay *Minerva's Owl* (Innis, 1951, Chapter 1).

Innis referred to the particular qualities of a communication medium as *biases*. Two types of bias that he identified as central to the particular effect that communication technologies might have are (1) their ability to communicate over space and (2) their ability to communicate over time. Some communication technologies, for example, the papyrus scroll or the railway, have a *space bias*; that is, they enable communication over a large distance in space. Communication technologies that have a *space bias* enable, for example, the centralised government of large geographical areas. Other communication technologies, for example, rock art or stone tablets, have a *time bias*; that is, they enable communication over a large period in time and, thus, facilitate the preservation of knowledge. All communication technologies can be analysed in this way.

Innis's analyses of human civilisations led him to divide history into epochs based on the communication medium that dominated during particular periods. Many medium theorists have since similarly divided history into stages marked by the dominant mode of communication: the spoken work in *oral cultures*, the written word in *scribal cultures*, the printed word in *print cultures* and the various electronic means of communicating in *electronic*, or more recently,*digital cultures*. Authors usually focus on the transition from one stage to another, noting the differences between the two ways of operating on the world. For example, Ong (1982) and Havelock (1982; 1986) have written on the transition from a primary oral culture to a literate one. Eisenstein (1979) and Ong (1982) have written on the transition from manuscripts to print. McLuhan (1989), Schwartz (1973), Carpenter (1974), Spender (1995) and Ong (1977; 1982) have looked at the significance of the movement from a culture dominated by print to one dominated by electronic communication.

McLuhan's sensory spaces

Unlike Innis, who focused on the effects that dominant modes of communication have on struggles for control over information and social power, McLuhan was more concerned with the ways in which communication technologies extend the human senses and change what it means to be a human being in the world. He argued that new technologies create new ways of perceiving and being. His argument was based on an understanding of technology as an extension of our bodies. McLuhan and Powers (1989) wrote, "All of man's [sic] artefacts, of language, of laws, of ideas and hypotheses, of tools, of clothing and computers, all of these are extensions of the human body" (p.71).

Obvious examples of how technologies extend our connections with the world are those where technologies have been used to supplement the senses of people whose own have been impaired: reading glasses, prosthetics, hearing aids, false teeth, wheel chairs, voice operated computers. Other examples of technologies that extend the human body are microscopes, cars, fur coats, megaphones, goggle and snorkels and space rockets. These examples show how our interaction with and perception of the world can be *enhanced* by the use of technologies.

McLuhan argued that all technologies enhance one or more functions of the human body, while obsolescing others (McLuhan & Powers, 1989). He argued that each of our senses gives us access to a different *space*. For example, sight gives us access to a *visual space*, hearing gives us access to an *acoustic space*, and sense of smell gives us access to an*olfactorial space*, and so on. A seeing person might move through a world that is predominantly a visual space, a blind person might move through a world that is predominantly acoustic, and a beagle might move through a world that is predominantly an olfactorial space. McLuhan used the space metaphor to describe what it means to be a human living in a world that is dominated by a particular type of communication media with a particular sensory bias. By extending one of our senses, technology affects the type of *space* in which we live. McLuhan (1989), Ong (1982) and others saw the most significant change yet in human society as that from an *oral/acoustic* space to a *literate/visual* space.

Acoustic and visual space

According to medium theorists, people who live in oral societies live predominantly in an acoustic space and their modes of thinking, their behaviour and the way their societies were/are organised reflect this. In a primary oral culture, words are only ever spoken, and this speech is a form of action that is grounded in a concrete *now*, and that demands instantaneous reaction in a way that the written/printed word does not. Knowledge in these cultures resides in the memory and belongs to the tribe. In the tribe, knowledge is usually disseminated by the few people whose role it is to remember it. The society of the tribe is

cohesive, depending on proximity to those people who are the custodians of the tribal knowledge. Speech is acoustic and available to all those within *hearing distance*. Acoustic information positions hearers at the centre of the world where sounds travel towards them from every direction.

Carpenter (1974) wrote,

> Self-expression, a product of literacy, is alien to the tribal world. Everyone in a tribe is involved with everybody, simultaneously. Tribal societies are implosive. There is no isolating individualism, no private consciousness, no private point of view. These are products & goals of literacy. (Tribal Artist, np)

In contrast, writing gives the reader a line of view and a point of view. Only those who have the writing in their line of vision can have access to the information. Even when print allows for mass production and dissemination, access is limited to those who are literate. Print (and script) forces us to access information one bit at a time, in a logical, linear order. By allowing thoughts to be stored in writing and disseminated in print, the memory of those who live in a literate culture is freed up. Knowledge stored in print provides a memory upon which individuals can draw as required and make their own assessments, no longer reliant on the tribe or clan. Distinctions between, and identification with, tribes is broken down. Print enables thought to become abstract and separated from action. Print, unlike speech, does not demand immediate action. Instead, it fosters objective analysis and planned action, and the pre-programmed responses of bureaucracies. It encourages staging and specialisation, division and hierarchy. Table 1 contrasts qualities of an acoustic logic with those of a visual logic.

Table 1. Contrasted characteristics of acoustic versus visual space.

oral/speech/acoustic/the ear	**literate/script/print/visual/the eye**
uniqueness	uniformity
circular rhythmic flows	linear
holistic	fragmented, sequential, specialisation
tribalisation	mechanisation
clan/village	individual
appeal to emotion	appeal to rationality
multi-perspective	point of view
acceptance of discontinuity	intolerance of contradiction

Medium theorists (eg., Carpenter, 1974; McLuhan, 1989; Ong, 1982; Schwartz, 1973) have predicted that the advent of electronic communication technologies and their increasing importance in society will lead to a return to the logic of the tribe, except this time, it will be on a global scale. That is, electronic communications bring us into an acoustic space where participation replaces objective analysis and communication is a form of action that demands immediate reaction and involvement. Unlike an oral tribe, however, knowledge is

stored in a global network and can be retrieved instantaneously with no account of geography or *tribal elders*. McLuhan coined the terms *retribalisation* and *global village* to reflect his belief that the processes and structuring of a new electronic society would recall those of the tribal village in which oral communications had predominated. This predicted transition is summarised by Carpenter (1974):

> Beginning with the phonetic alphabet & the Greeks, there came a habit of detachment & noninvolvement, a kind of uncooperative gesture toward the universe. From this refusal to be involved in the world he lived in, literate man [sic] derived detachment & objectivity. He became alienated from his environment, even from his body. He believed there was an elegance in detachment. He valued the isolated, delimited self, especially the mind. He became an island, complete unto himself. Today we've entered a relatively dim, resonating tribal world in which the electronic extensions of everybody's nerves involved him deeply in all other lives. Where writing & print technology tore man out of the group, creating the great misery of psychic alienation, suddenly & without warning the electronic media hasten him back into the embrace of the group. (The Tribe that Swallowed the Private 'I', np)

So how will this predicted transition into a new acoustic space, the global village, affect education? McLuhan was particularly interested in the future of education. He criticised the traditional roles and structures of schooling and anticipated that the diffusion of electronic communication technology and the resurgence of an acoustic logic would revolutionise schooling.

Medium theory and education

McLuhan (1960) described the traditional classroom as "an obsolete detention home, a feudal dungeon" (p.207):

> In an age when even such staid institutions as banks and insurance companies have been altered almost beyond recognition, today's typical classroom - in physical layout, method and content of instruction - still resembles the classroom of 30 or more years ago. (McLuhan & Leonard, 1967, p.23)

Medium theorists attribute the characteristics of modern schooling to the predominance of print-based communication media. The organisation of modern schooling is based on the separation of students (according to age and/or ability) and of knowledge (according to subject area and level of difficulty). This organisation reflects the logic of print (visual logic); it is linear and hierarchical. Some of the structures of modern schooling that might be described as reflecting a visual logic are listed below.

- Students separated according to age-based grouping.
- Knowledge compartmentalised into disciplines or *subjects*.
- Students and periods of time apportioned according to subject matter (timetable).
- Subject matter divided into chunks and sequenced according to *levels of difficulty*. This is reflected in the design of textbooks for particular year/age level.
- School grounds divided according to status of user (teacher or student/student age group), subject and type of use. Discipline-based staffrooms, libraries, equipment.
- Classrooms designed for teacher-led mass instruction.
- Structure of the school day reflects clear distinctions between work and play.

Similarly, the roles that characterise modern schooling reflect the linear logic of division and hierarchy found in print-dominated cultures. In this way, they are compatible with the structures listed above. Qualities of the roles that characterise modern schooling and that might be described as reflecting a visual logic include

- Teachers deliver information to students. A conduit or transport metaphor is used to explain teaching and communication.
- Teachers are masters of specialist fields.
- Student and teacher roles are distinct: students do the learning; teachers do the teaching.
- Students engage in step-by-step mastery of content.
- Students work individually and competitively.
- At higher levels, students begin to specialise and are divided according to discipline.
- The hierarchical structure of knowledge within specialist fields discourages horizontal movement between subjects.
- The movement of students around the classroom and communication between students is limited.

McLuhan and Leonard (1967) predicted that the structures and roles of traditional schooling would be transformed as society increasingly embraced the logic of electronic communication (acoustic logic). This new logic recalls the structures and roles of a tribal village, except that electronic circuitry (instead of voice) encourage the qualities of the tribe on a global scale. Structures of schooling that would reflect a new tribal/global logic include

- Multi-age *classes*. Integration.
- Learning organised around problem posing and solving, and project-based, multi-disciplinary research tasks.
- Flexible organisation of students and time.
- Classrooms designed for student action and interaction.
- Distinctions between work and play and between "in" school and "out" of school are blurred.

On the roles of the new schooling, McLuhan and Leonard (1967, p.24) wrote,

> New educational devices, though important, are not as central to tomorrow's schooling as are new roles for student and teacher. Citizens of the future will find much less need for sameness of function or vision. To the contrary, they will be rewarded for diversity and originality. Therefore, any real or imagined need for standardized classroom presentation may rapidly fade; the very first casualty of the present-day school system may well be the whole business of teacher-led instruction as we know it.

The qualities of the roles of schooling that would reflect a new tribal logic include

- Both students and teachers are learners.
- Teachers facilitate the location and understanding of multi-disciplinary information.
- Distinctions between teachers and administrators are blurred.
- Students are free to move around the school buildings and grounds.
- Communication between students is encouraged.
- Students participate directly in the solving of real problems.
- Students work cooperatively.

There are obvious parallels between these predicted changes and those advocated by educators today. Medium theorists would explain the growing predominance of student-

centred approaches to education and, emerging integrated approaches to curriculum as a result of the embrace of an acoustic logic.

Contemporary views and visions

The reforms implicated by contemporary theories of teaching and learning, the speculations of educational technologists, and many of the second order effects reported by educational researchers, are consistent with the vision of the future of schooling promoted by McLuhan. Many educators working in the area of educational technology have expressed the view that the implementation of new electronic technologies in schools goes hand-in-hand with the reform of the roles and structures of education. For example, Cornu (1995) wrote of the integration of technology as a process that transforms school organisation at all levels, including traditional notions of the pupils' timetable. The US Panel on Educational Technology argued in 1997 that, "the real promise of technology in education lies in its potential to facilitate fundamental, qualitative changes in the nature of teaching and learning" (cited in Becker & Ravitz, 1999, p.357). Duchateau (1995) argued that "the computer provides a wonderful opportunity for inter- or multi-disciplinary activities, which are not limited by the existing subject frontiers" (p.22), predicting that independent subject areas will disappear as the main goal of education becomes "not to learn and master a traditional subject, but only to learn" (p.20). Riel (1999) provided a vision of schools of the future that included increased partnerships between schools and the community, cross-aged learning, a break down of the divide between teachers and administrators and the integration of subject areas.

In his review of the effects of ICT on teaching and learning, Toomey (2001) observed that recent reports identified ICT as a source of whole school reform. He concluded that, "ICT can be a major force in re-engineering schools. The strategic introduction of ICT into a school can seriously challenge its day to day practice" (np). Means (1994) and Riel (1995) describe how reform efforts have been supported by the use of technology.

Although visions of the future of schooling and the role of new technologies are often speculative, educational researchers increasingly report secondary effects of the integration of technology that are consistent with predictions of changes to the organisation of schooling. For example, Cuttance (2001), in a review of twenty schools that sought to integrate the use of computers and communication technology, reported that "in many cases, schools that implemented ICT-based innovations also implemented substantial other changes to the organisation and working environment of the school" (Ch.4, np). Other changes reported included a break down in the distinction between learning at school and learning out-of-class, changes to the school timetable, and changes to the physical environment of the classroom. Similarly, Furlong, Furlong, Facer and Sutherland (2000) compared students' ICT use at home and at school. They found that "schoolwork brought with it a particular sense of time. Yet for many young people, 'computer time' and 'school time' were found to be incompatible" (p.103). Furthermore, "even when there was sufficient time, there were problems with how it was organised at school" (p.104). Cuttance (2001) concluded that, "the experience of schools that have sought to integrate ICT into their learning environments over the last decade clearly indicates the need for other concomitant changes" (Ch.4, np).

These are just a few of the increasing number of publications that question the traditional structures and roles of schooling, that document initiatives that seek to experiment with these structures and roles through the introduction of computer-based technologies, or that document the secondary effects of the integration of computers across the curriculum. Others include Department of Education, Training and Youth Affairs (2000), Beare (1997), Commission of the European Communities (2000), Crawford (1997), EdNA Schools

Advisory Group (2000), Finger and Russell (1999), Hart (1995), Hawkins (1993), Knupfer (1993), Papert (1999), UK Department for Education and Skills (2001), and US Department of Education (1998).

These publications demonstrate the currency of McLuhan's vision. The influence of McLuhan's most publicised views (the nature of the effects of ICT on the organisation of schooling) is evident. However, other important ideas about the interaction of new technologies with institutionalised structures and roles, that are central to the analyses of medium theorists, have received very little attention. Of those publications mentioned above, Furlong, Furlong, Facer and Sutherland (2000) point out that "the way in which technologies are accommodated into every day living has been far more complex than initially predicted" (p.93) and Riel (1999) "intentionally described technology in the background with a focus on the roles of teachers and learners" (p.13), stressing that "real educational change requires changing the relationships among teachers, learners, information and experience" (p.1). However, many publications that speculate about changes to the organisation of schooling, or that report experiments that seek to manipulate the organisation of schooling, present new technologies as unproblematic agents of change, with very little account for interactions between the medium of the new technologies and the medium of schooling.

Rearview mirrors

McLuhan's predictions about the immanent changes to education were made in the late 1950s and 1960s. However, despite the speculations and observations noted above, many would argue that, although schooling has undergone dramatic changes since the 1950s, the full realisation of the new electronic logic has not yet occurred in schools. Medium theorists (eg., Ong, 1982; Schwartz, 1973; McLuhan, 1967; Carpenter, 1974) have described a lag between the adoption of new technologies and the transformation of social structures and roles that results from a "rearview mirror" approach to implementation (McLuhan & Leonard, 1967). McLuhan did not argue that the introduction of electronic media into schools would lead to the creation of a remarkably different environment (although he did think they would help facilitate it). Instead, he argued that the societal level changes resulting from the rediscovery of an acoustic space would be felt gradually in education as they would be across all social institutions.

Medium theorists have argued that the current environment is *invisible* (to use a visual metaphor). These arguments parallel those made by theorists who have written about the invisibility of dominant cultures to dominant cultural groups and those made by those who have investigated institutions and organisational change. Carpenter (1974) quoted John Culkin: "We don't know who discovered water, but we're certain it wasn't a fish" (The Islander) to help explain this point. He wrote, "each new environment makes the old one visible: what is psychic becomes explicit only after it becomes obsolete. The present environment is never seen. We respect its laws without being conscious of them" (Carpenter, 1974, The Visible Past). Rather more graphically, he wrote,

> No environment is perceptible because it saturates the whole field of attention. One can perceive it only after alienation -- after some degree of alienation. I can swallow the saliva in my mouth because it's 'me,' but I can't swallow it if I put it first in a glass. So long as I transact with my environment -- my ecological whole -- I can't perceive it; it doesn't even environ me. It's an extension of me. And I can't smell myself. (Carpenter, 1974, The Name is the Numb, np)

This idea of the *invisible environment* and the *visible past* is used by medium theorists to explain the lag that occurs when new modes of communication are first used. When

describing people's initial responses to writing, Ong pointed out that there was a lag between the invention and embrace of the new technology and the *internalisation* of the new ways of operating on the world that it encouraged. He wrote that,

> Hearing rather than sight had dominated the older noetic world in significant ways, even long after writing was deeply interiorized. Manuscript culture in the west remained always marginally oral. Well after printing was developed, auditory processing continued for some time to dominate the visible, printed text, though it was eventually eroded away by print. (Ong, 1982, p.120)

To demonstrate how script was treated orally, he gives the examples from newly literate societies of how lone individuals read aloud and of how ledgers were read aloud in order to check their correctness.

To demonstrate the lag between print and electronic communication, Schwartz (1973) recounted the following anecdote,

> In my childhood, for example, the telephone was used as a surrogate for a telegram or letter, not as a new medium. If our family was planning to visit relatives in New Jersey, my mother would call long distance from New York to New Jersey to tell them when we expected to arrive. Her messages were short, loudly spoken, and to the point. She used the phone as a vehicle for sending a message across space. Even when the line between New York and New Jersey was clear, she spoke louder than necessary - conscious of the space between them and using the phone as if it were a tunnel through a chasm. She believed that the phone, like a letter, was a low-efficiency vehicle for communication, and she was pushing to get her message across. Today, my daughter often calls her friends to exchange giggles. They relate bits of news, giggle back and forth a few minutes, then say goodbye. My daughter accepts the telephone as a communication system with no resistance and no transformation. Communication for her is what happens when you use a telephone, not something that may occur if your message gets through. (pp.5-6)

McLuhan and Leonard (1967) gave the example of using electronic media for the one-way delivery of information to demonstrate the "rearview mirror" approach, which applies the institutionalised logic of print to the new media:

> That lectures frequently do appear on educational television points up mankind's common practice of driving pell-mell into the future with eyes fixed firmly on the rearview mirror. The content of each brand new medium thus far has always been the ordinary stuff of the past environment. (p.24)

Similarly, Carpenter (1974) explained that,

> In its initial stages, every new medium takes as its content the medium it has just rendered obsolete: scribes recorded oral legends; printers set in type old manuscripts; Hollywood filmed books; radio broadcast concerts & vaudevill; TV showed old movies; magnetic tape was used to copy LP records. (The Visible Past, np)

This interaction between the old and the new is often neglected in the storying that currently surrounds the promotion of new technologies in schools.

Research into educational change: Backward or resistant

Early studies (eg., Carlson, 1965; Gross, Giacquinta & Bernstein, 1971; Miles, 1964; Mort, 1964; Ross, 1958) of attempts to implement change in schools focused on teachers as the source of resistance to change. Teachers were often painted in a negative light as fearful, lazy, insecure, conservative and irrational. On attempts to implement technical innovations in schools, Hodas (1998) wrote,

> each battle is essentially the same battle. The technologists' rhetoric is remarkably consistent regardless of the specifics of the machine at issue. So too is their response when the technologies in question meet with only a lukewarm response: to blame the stubborn backwardness of teachers or the inflexibility and insularity of school culture. (Online Document: The culture of refusal, np)

By the late 1970s and the 1980s, however, studies (eg., Brown & McIntyre, 1982; Plomp, Pelgrum & Steerneman, 1990; Somekh, 1989) of attempts at educational change were increasingly focussed on teachers in the context of schooling. In their review of the literature on computing innovations in schools, Grunberg and Summers (1992) conclude that

> In the last two decades [70s and 80s] a number of increasingly convergent insights into the process of change have developed. The need to study the teacher in the context of the social organisation of the school, rather than as an isolated agent, has been emphasised ... [and] the previous emphasis on the technical characteristics of the proposed innovation has evolved into a more context-sensitive approach focussing on how the proposed innovation fits with the teachers' working conditions and value systems. (p.272)

Doyle and Ponder (1977) argued that teacher decisions are based on an "ethic of practicality" where, to qualify as practical, a proposal must have three features: *instrumentality*, *congruence* and *cost* (return for investment). They wrote, "congruence appears to comprise a cluster of elements all focusing on the perceived 'match' between the change proposal and prevailing conditions" (p.8). That is, congruence refers to the degree to which an innovation *matches* or*disturbs* current practices: routines and procedures, structures and roles. Doyle and Ponder's (1977) article attempted to move the focus of the change literature from teachers' personal qualities to what they call the *ecological* variables shaping the way teachers think about and conduct their work, arguing that many innovations "fail to mesh with existing features established by the structure and flow of real environments" (p.5).

Olson and Eaton (1986) studied the costs and rewards associated with teachers' use of computers. They found that teachers' main concerns were based on the challenges to well established classroom procedures. Cuban (1986) advised that studies of teacher use of new technology should be carried out with an acute sensitivity to the conditions under which teachers work in schools. He argued that the failure of technological innovations in schools is often due to "the high personal cost that teachers have to pay when they try to implement different ways of teaching within current organisational structures and beliefs" (Cuban, 1986, p.221). Similarly, Gillman (1989) explained that many teachers are reluctant to invest the additional time and energy required to incorporate a new technology into their teaching methodology because they have already developed adequate solutions to many of their pedagogical problems within the given organisational structures. Such authors frame

teachers' resistance to change as rational responses to technologies that are incongruent with institutionalised practices and the organisation of schooling.

In a study of the main factors that influenced the way science curriculum innovations were implemented in Scotland, Brown and McIntire (1982) argued that the innovation must make sense in terms of teachers' concerns: "it is entirely rational for teachers ... to give priority to ensuring that they can cope fluently with the practical situations with which they are faced and meet the criteria for which they are accountable" (p.123). Kerr (1996) argued that many technological inventions have failed to be taken up by educators in any permanent or lasting way because they are not accommodated by the already established environment of schooling. Cuban (1986) predicted that teachers' use of computers "will be tailored to fit the [their] perspective and the tight contours of schools and classroom settings" (p.218). Cuban (1986) concluded that, "to those mandates that awkwardly fit the contours of a work setting or are inconsistent with the beliefs of the implementors, token compliance is a common response" (p.55). Schofield (1995) argued that, "to look only at the impact of technology on classroom social processes is to miss half the picture. It has become increasingly apparent that preexisting attitudes and social structures shape the extent to which technology is used as well as the way it is used" (p.94).

In the face of these arguments, teachers' and schools' resistance to many change attempts are not surprising.

Views that technology will act as an agent of change and transform educational environments and practices are open to criticism if they do not adequately account for the power that teachers have, as implementors, to resist innovations which are incongruent with institutionalised practices, or if they fail to account for the resilience of extant structures and roles that support these practices. While medium theory can be criticised as presenting a deterministic view of the effects of technology on society, medium theorists' discussions about the interaction between new technologies and old ways of doing/being offer an explanation of the practices of teachers and their resistance to change. The 'rearview mirror' phenomenon suggests that *second order effects* (in beliefs, structures and roles) are necessary before the medium of new technologies can be fully realised.

Conclusion

Contemporary views of the effect of electronic communication technologies on schooling reflect those espoused by Marshall McLuhan in the 1950s and 1960s. Schooling of the future is often envisaged in ways that reflect the tribal logic of these technologies. However, the realisation of this logic involves practices, structures and roles that are incongruent with the institutions of schooling. The transition from a schooling that reflects the logic of print to one that truly realises the form of new electronic communication technologies involves teacher change, but it also requires changes in the culture and organisation of schooling. During the 1970s and 1980s, much attention was given to the needs of teachers and their power to subvert change strategies that failed to account for their work environment. However, the 1990s brought a resurgence of McLuhanesque pronouncements about the immanent effects of new technologies on teaching and learning and the organisation of schooling with very little attention given to the interaction, described by medium theorists, of the new with the old.

Electronic communication technologies (from radio and television through to the latest Web-based learning environments) have been used to *deliver* the content (message) of modern schooling. That is, new technologies that have been touted as bringing educational reform have at times (arguably, at most times) been used for the purpose of teacher-centred teaching, in what Olson and Eaton (1986) described as "routine" ways, or in what Maddux,

Johnson & Willis (1997) described as *Type I* uses where the learner is passive. More innovative uses that are consistent with contemporary theories of learning have been observed as add-ons to traditional classrooms, or as the products of special projects functioning outside the usual school organisation, but are yet to be integrated into the organisation of schooling on a large scale. If new technologies are to play a role in changing the way we *see* and *do* schooling, then attention must be given to the resilience of schools as institutions and the role of teachers as implementers who construct the technology *in use*.

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