

Innovation, Change Theory
and the Acceptance of New Technologies:
A Literature Review

By Alec Couros
For Dr. Cyril Kesten
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Introduction to Innovation Theory

Ralph Waldo Emerson is reported to have once said, “Make a better mousetrap, and the world will beat a path to our door.” This principle that may have held merit in the early 1800’s, can be easily dismissed in the post-industrial world. Theoretically superior technologies such as Betamax recorders, the Dvorak keyboard and the early Apple operating system have succumbed to the VHS standard, QWERTY and the Wintel¹ monopoly, respectively. It is in general agreement that the adoption of technology is a more complex process than the technical superiority of a product (Abrahamson & Rosenkopf, 1997; Rogers, 1995; Ryan & Gross, 1943; Valente, 1995).

The common lens through which theorists study the adoption and development of new ideas is commonly known as Innovation Theory or Diffusion Theory. In its basic form, Diffusion is defined as the process by which an innovation is adopted and gains acceptance by individuals or members of a community. Diffusion Theory represents a complex number of sub-theories that collectively study the processes of adoption. Perhaps the first famous account of Diffusion research was done in 1903 by French sociologist Gabriel Tarde (1903). Tarde plotted the original S-shaped innovation curve (see Appendix A) as he believed that most innovations have an S-shaped rate of adoption. Through the slope of the S-curve, Tarde could identify those innovations with a relatively fast rate of adoption (steep slope) versus those with a slower rate (gradual slope).

¹ Wintel is the common trade term used to describe personal computers based on the Intel architecture and the Windows Operating system. This has by far become the prevalent configuration for standard personal computers.

Since Tarde, the S-slope has become important for those studying the adoption of ideas, especially those found in business.

Several decades later, Ryan and Gross (1943) published their seminal study which described the diffusion of hybrid seed among a group of Iowa farmers. At the time of the study, U.S. farms were slowly becoming business enterprises rather than family subsistence units. As corporations entered into the business of agriculture, so did the concerns of higher productivity, efficiency, competitiveness and agricultural innovations. Ryan & Gross wanted to study the process in which innovations in agriculture were adopted. They discovered that diffusion was “a social process through which subjective evaluations of an innovation spread from earlier to later adopters rather than one of rational, economic decision making.” (Valente, 1995) At the time, this was a novel perspective on the diffusion process and emphasized the effect of social factors on adoption.

Ryan & Gross (1943) also noted that the rate of adoption among those studied followed an S-curve when plotted on a cumulative basis over time. This supported the work of Tarde reported 40 years previously, and renewed interest in Diffusion Theory. Additionally, Ryan and Gross (1943) classified the Iowa farmers into five adopter categories. These categories included: innovators, early adopters, early majority, late majority and laggards. Theorists since (Abrahamson & Rosenkopf, 1997; Gladwell, 2000; Midgley & Dowling, 1978; Rogers, 1995) have used and modified these basic categories to build upon the work of Ryan and Gross. What is also important from this work are the

distinctive characteristics of each adopter level. For instance, Ryan & Gross (1943) identified that those farmers most likely to adopt (innovator category) were more cosmopolite and belonged to a higher socioeconomic status than members of the other categories (later adopters). While the work of Ryan & Gross (1943) began the next wave of Diffusion research, the next seminal work in the area would appear almost two decades later with the work of Everett Rogers (1962).

Everett Rogers and the Diffusion of Innovations

Everett Rogers' work is very important as he claims in his 1995 text, *Diffusion of Innovations*, as a synthesis of over 3800 diffusion theory publications. While much of his theory emanates from rural sociology, his established framework has been used in diverse areas such as business and marketing, anthropology, public health, and of course, education. Rogers defines diffusion as "the process by which an innovation is communicated through certain channels over time among members of a social system" (1995, p. 5). Diffusion theory, in this light, is very much a communication based model. The process Rogers (1995) refers to is mediated through the two-process of communication convergence (Rogers & Kincaid, 1981), rather than a one-way linear act. Additionally, diffusion is a special type of communication in which the messages pertain to a *new* idea. This is important in that the diffusion process is inherently uncertain due to the *newness* of the idea and how it will be accepted as a message.

Another important point is that Rogers does not make a fundamental distinction between spontaneous and planned diffusion. Where Rogers (1995)

reports that some (unnamed) authors may classify the *spontaneous* spread of new ideas as diffusion, and the *planned* spread of new ideas as dissemination, Rogers does not make the distinction between the two. Perhaps a moot point at this stage of this literature review, the idea may gain relevance as one studies the process of diffusion as it pertains to formal and informal communities of practice (CoP's) and communities of learners (CoL's). In particular, Wilson & Ryder (1996) mark the differences between the communication and learning processes found in self-organizing or emergent CoL's (particularly *virtual* learning communities) versus the processes in what they described as *bounded* learning communities (found in most educational institutions). In relation to this, and to the idea of self-forming communication processes, Hargreaves and Fullan (1996) present the idea of "comfortable collaboration" in which they describe the type of constrained communication that often occurs amongst teachers. The authors suggest that such "typical communication" often does not move beyond "sharing bags of tricks" and will often exclude deep investigations into issues of teaching, learning and the profession. In other words, teachers do seem to share "tips" concerning the improvement of practice, however, often do not delve into deeper conversations that investigate the hidden assumptions concerning the teaching profession.

Key to Rogers' (1995) definition of diffusion is the presence of four elements in the diffusion of innovation process. These elements include the following:

- 1) The Innovation: an idea, practice(s) or objects that is perceived as new by individuals or a group of adopters.
- 2) Communication Channels: the means by which innovations move from individual to individual, or group to group.
- 3) Time: the non-spatial interval through which the diffusion events occur. These events include the innovation-decision process, the relative span of time for the individual or group to adopt the innovation and the innovations' rate of adoption in a system.
- 4) A Social System: a set of interrelated units that are engaged in joint problem solving activities to accomplish a goal or goals.

These components are a bit simplistic and follow a basic information-processing model. However, I find it useful in separating out the message from the channels and the potential adopters. As Rogers' (1995) work represents a compilation of the majority of the previous Diffusion Theory research, this model could be helpful in studying any type of innovation.

Related to the first element, Rogers (1995) identifies important characteristics of innovations as perceived by individuals. These are important as they are constructed as to the way in which potential adopters may view the innovation. The characteristics, which forms the basis for what is regarded as perceived attributes theory, include:

- 1) Relative advantage: the degree in which an advantage is perceived as better than the idea it supersedes.

- 2) Compatibility: the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters.
- 3) Complexity: the degree to which an innovation is perceived as difficult to understand and use.
- 4) Trialability: is the degree to which an innovation may be experimented with on a limited basis.
- 5) Observability: the degree to which the results of an innovation are viable to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt it. (Rogers, 1995, pp. 15-16)

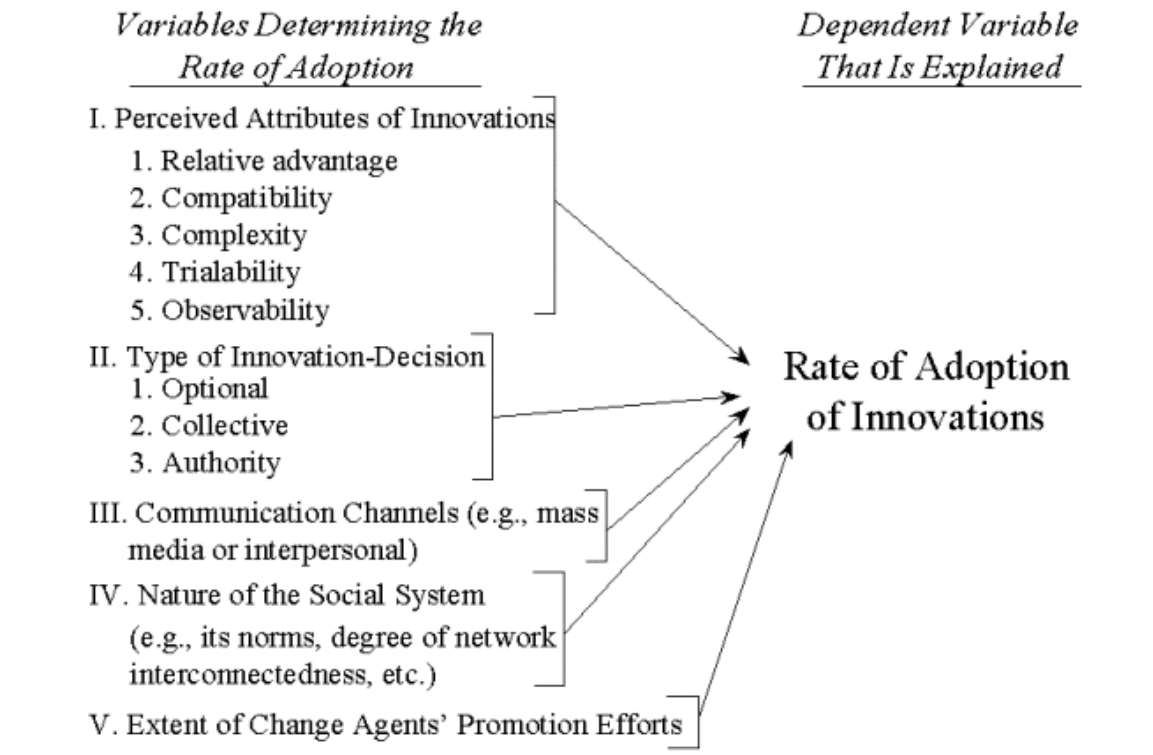
Although, I don't feel that the adoption process is limited to these perceived attributes, I feel that these elements would be helpful in formulating questions for potential adopters in better understanding what factors make adoption possible or desirable. Additionally, although Rogers brings up the idea of reinventing innovation (e.g., an adopter adapting an innovation to a specific need), these characteristics do not fully account for this process. The idea of reinvention and what I would call personalization of innovation, especially in regards to a teacher's use of technology, would be an important feature for consideration. If I were to consider these characteristics in future research, I would pay special attention to the idea of reinvention as it seems to be an element missing in the current research.

Rogers (1995) distinctly separates the diffusion process from the adoption process. While the diffusion process permeates through society and groups, the

adoption process is most relevant to the individual. Rogers (1995) defines the adoption process as “the mental process through which an individual passes from first hearing about an innovation to final adoption” (p. 35). The five steps in this process are regarded as 1) knowledge (awareness), 2) persuasion (interest), 3) decision (evaluation), 4) implementation (trial) and; 5) confirmation (adoption). Throughout the adoption process, the individual seeks knowledge of and skills which will ultimately affect the adoption process. For a potential adopter, the process will proceed through the various steps and lead to adoption, or alternately, lead to rejection of the innovation. (Rogers, 1995)

Rogers also offers a very scientific approach to understanding the rate of adoption. Rogers (1995) has developed five variables which affect the adoption rate of any particular innovation. These include 1) perceived attributes of innovations (discussed earlier), 2) type of innovation-decision, 3) communication channels, 4) nature of the social system, and; 5) extent of change agents' promotion efforts. Rogers' model could help a researcher to consider the basic forces which affect both adoption rates, and the factors which may lead to the rejection of an innovation. However, in its own simplicity, which may be ironically its strength, it is limited in explaining complex human systems. A schematic description of this model is shown below in Figure 1.

Figure 1: Variables Determining the Rate of Adoption of Innovations



(Rogers, 1995, p. 207)

Technological Determinism Versus Technological Instrumentalism

As an observation of Rogers' work, I believe that the models created here could help to describe both top-down (macro-level) and bottom-up (micro-level) change models. As Rogers' (1995) work seem to be really a comprehensive meta-theory, the focus could possibly allow for the study of both systemic and individual change. However, what seems missing is the attention to another important dichotomy. This is the issue of technological determinism versus technological instrumentalism. In other words, is it the assumption of the

research that technology can *itself* drive the change process? Or alternatively, is the change process guided merely *by those that use it*? To understand this distinction better, it may be useful to give examples of questions that may be asked of an individual in either mindset. Consider the following simplification:

Technological Determinists May Ask Questions Such As:

- What was the effect of the automobile on society?
- What did the typewriter do to the balance of gender power in the office?
- How has television affected school violence?

The assumption here? Technological innovation can directly cause social change. More so, technological innovation (itself) can be attributed as a determining factor for adoption.

Technological Instrumentalists May Ask Questions Such As:

- How do we encourage people to be more conscious about the environmental affects of purchasing sport utility vehicles?
- How do we convince the major television networks to produce less violent programming?

The assumption here? It is understood that the adoption of an innovation depends strongly on the context (the people, organization etc) in which it might be used.

This is an important issue because there is often a common perception that with technology, positive change will commence, and that it is in fact technology itself driving this change. This is often a prevailing thought in educational systems especially. Postman criticizes this mindset and writes, “school boards are now preparing to spend, in aggregate, billions of dollars to wire schools in order to accommodate computer technology; and for reasons that are by no means clear” (1999, p. 46). Richard Stoll (2000) also stabs at the assumptions some educators and administrators make toward the implementation of technology into schools. In refuting the famous McLuhian

cliché “information is power”, Stoll writes, “Information isn’t power. Who’s got the most information in your neighbourhood? Librarians, and they’re famous for having no power at all. Who has the most power in your community? Politicians, of course. And they’re notorious for being ill-informed” (2000, p. 142).

In fact, McLuhan was one of the first philosophers to be noted as a technological determinist ²(and advocate of the determinist philosophy). Some of McLuhan’s basic theories argue that technologies change the way humans communicate, and in essence, are what shape our existence. McLuhan felt that our collective culture is moulded particularly by communication technologies and by the technologies that are embraced. To elaborate, McLuhan constructed three simple points. First, inventions in communication technology cause cultural change. Secondly, changes in modes of communication shape human life. Thirdly, as McLuhan once stated prophetically, “we shape our tools and they in turn shape us” (quoted in Griffin, 1997, p. 294). These simple points should be considered if one is to look at change beyond diffusion theories such as developed by Rogers (1995).

Mirroring similar ideas, Ellen Rose (2000) writes of the “IT Dream” that suggests that information technology is a “primary source of the images and aspirations which inform discourse and practice in all walks of life today” (p. 16). Rose suggest that the “IT Dream” helps to shape our images of society as stories that are told in terms of vast networks connected by digital devices and fibre optic

² Technological determinists interpret general technology, and communications technologies in particular, as the basis of society in the past, present and future. Technological determinists view particular technical developments as the sole or prime antecedent causes of changes in society. Technology is seen as the fundamental condition underlying the pattern of social organization.

cables. Rose identifies society's tendency to become techno-utopian and explains, "when we tell stories about our society's future, they are often told in terms of what human beings will become by means of technology" (p. 34). Information technology often gives worth and direction to the "products" of humanity.

An early example of techno-utopian literature comes from Seymour Papert (1980), one of the earliest proponents of educational technology and an influential innovator in the field. Here is a short narrative, representative of Papert's conviction to the potential of computers in the classroom.

Well into a year-long study that put powerful computers in the classrooms of a group of "average" seventh graders, the students were at work on what they called "computer poetry".... One of the students, a thirteen year-old named Jenny, had deeply touched the project's staff by asking on the first day of her computer work, "Why were we chosen for this? We're not the brains."... One day Jenny came in very excited. She had made a discovery. "Now I know why we have nouns and verbs," she said. For many years in school Jenny had been drilled in grammatical categories. She had never understood the differences between nouns and verbs and adverbs. But now as she tried to get her computer to generate poetry, something remarkable "happened".... Her learning was deep and meaningful.... She not only "understood" grammar, she changed her relationship to it. It was "hers," and during her year with the computer, incidents like this helped Jenny change her image of herself. Her performance changed too; her previously low to average grades became "straight A's" for her remaining years of school. She learned that she could be "a brain" after all. (pp. 48-50)

Papert's inspiring, yet likely embellished, narrative gives readers a brief glimpse of what might be possible for learners when microcomputers have become a ubiquitous part of the learning process. This seductive, yet likely extreme glimpse of personal transformation is an example of the types of fiction that

permeate relentlessly through educational thought. Yet absent from this account are the details of how human relationships (e.g., teacher-student) may have contributed to this seeming transformation; rather the student's relationships with the microcomputer itself has been glorified.

Opposed to the determinist view of technology, lie the instrumentalists. Instrumentalists view technology as a tool, and humans as masters of the tool. In some cases, Instrumentalists cite the knife as an example of their philosophy. For instance, a knife is a tool that can be used for good or evil depending on an individual's desires (Levinson, 1996). Also, "while determinists see technology as the most powerful force for change, instrumentalists see social conditions and human aspiration as the primary causes of change" (Surry, 1997). While the determinist/instrumentalist debate can go on forever with likely no winner, it's important to consider one's stance on the affect of technology itself on the change process. Further reading in literature from utopian determinists (e.g., McLuhan, Toffler), dystopian determinists (e.g., Ellul, Orwell) and instrumentalists (e.g., Chandler, Levinson, D. McKenzie) could help to establish further grounding on this relevant topic.

Practically, the distinction between determinists and instrumentalists does not appear so "black and white". This is where theories of social constructivism related to development and adoption of technology may be beneficial for better understanding. While social constructivist theories vary, some key characteristics and commonalities are represented in Brey (1997):

(S)ocial constructivism includes a conception of technological development as a contingent process, involving heterogeneous

factors. Accordingly, technological change cannot be analyzed as following a fixed, unidirectional path, and cannot be explained by reference to economic laws or some inner technological "logic." Rather, technological change is best explained by reference to a number of technological controversies, disagreements, and difficulties, that involve different *actors* (individuals or groups that are capable of acting) or *relevant social groups*, which are groups of actors that share a common conceptual framework and common interests. These actors or groups engage in strategies to win from the opposition and to shape technology according to their own plan. (Brey, 1997, p. 5)

For traditional understandings of technological invention, it may be sufficient to state that "Edison invented the light bulb" or "Ford invented the Model T". The notion here is that inventions occur when brilliant individuals create new technologies, ready-formed and market ready. However, in social constructivist theories, there is a tendency to shift away from the idea of *invention* toward the idea of *technological development* which occurs over time and is subject to many forces. Thus, social constructivism moves away from "heroes" or a few key historical names toward a complex and seamless web of interests that may include economic, political and social change factors.

The Tipping Point

Diffusion Theory has become incredibly popular in business and marketing literature. Perhaps one of the prominent writers from this venue is Malcolm Gladwell, a writer for the *New Yorker*. Gladwell has been credited for popularizing the phrase "tipping point", first in a 1996 *New Yorker* article and, later in his subsequent book titled *The Tipping Point: How Little Things Can Make a Big Difference* (2002). The concept of the tipping point is described as the "culmination of a build-up of small changes that effects a big change"

(Gladwell, 2000, p. 17). Gladwell derives the term from the health science study of epidemics, particularly in describing “that point when a virus reaches a critical mass” (p. 18). For instance, he notes that “AIDS tipped in 1982” (p. 20) as it went from a rare disease affecting a select community, into becoming a worldwide epidemic. However, the author then progresses toward his intentional frame of meaning in using the term to describe the phenomenon in which an innovation or idea (e.g., newly introduced business product) moves from relative obscurity into becoming an extremely popular article in a relatively short span of time.

In *Tipping Point* (2000), Gladwell focuses specifically in studying the growth and acceptance cycles of trends and ideas. In this, Gladwell develops three general themes which, he posits, can be directly attributed to affecting the development of trends. The three themes include The Law of the Few, The Stickiness Factor and the Power of Context. Through these ideas, Gladwell begins to explore the creation, spread and control of intellectual and socio-cultural epidemics.

The Law of the Few, describes the formation of self-organizing networks which foster the spread of ideas through the work of key individuals, The author goes on to identify various players within such networks and he identifies three important roles: the Connectors, the Mavens and the Salesmen. The Connectors are defined as those individuals who are typically very social and outgoing, have access to diverse social networks and possess a significant ability to spread information. For instance, Gladwell uses Paul Revere as an example of a

Connector, as Revere's large number of social contacts and his relative position in the social network of colonial America was critical in raising the resistance against the British colonizers. Mavens, who likewise possess a great number of social contacts, are more significant in their early acceptance of new ideas or trends, and their willingness to spread such ideas through working with others who may be less likely to adopt without persuasion. And finally, Salesmen work within the network to explain to potential adopters why they must/should participate.

Gladwell's theories of self-organizing networks seems to have foundational roots in the work of Stanley Milgram. Milgram was a social psychologist at Harvard who established the hypothesis that members of any large social network are connected to each other through short chains of intermediate acquaintances. Eventually Milgram developed his hypothesis into what would be known to the scientific community as the Small World Phenomenon (1967). Additionally, Milgram's research spawned the foundational ideas behind the now famous phrase "six degrees of separation" (Milgram, Sabini, & Silver, 1992), implying that in most cases, any one individual is connected to another individual, through a chain of acquaintances which is usually no longer than six links. Although Milgram's (1967) research found acclaim in the decades to follow, remarkably very little work has been done to either refute or support his findings. Additionally, the hypothesis was never tested for individuals of different race.

The second trend which Gladwell identifies is known simply as the “stickiness” factor. Gladwell suggests that “stickiness” is the premise that for an idea to gain prominence, it must have staying power, must be generally easy to understand and, most importantly, must be packaged in a format that is appealing to the intended recipients³. In explaining this premise, Gladwell discusses children’s television including the classic Sesame Street, and the more recent Blues Clues. Such shows were designed with (the idea of) stickiness in mind. Research with young viewers was performed with the focus on identifying what children pay attention to through their viewing of short skits. Gladwell suggests that if you can find that “certain something” that one will pay attention to most, you may have found that stickiness factor. Of course the notion of revealing what people pay attention to, is certainly not as simple as Gladwell attempts to make it seem. With similar notions, Goldhaber, in *The Attention Economy* (1997) proclaims “Attention, at least the kind we care about, is an intrinsically scarce resource” (p. 4). He continues to hypothesize that the term “Information Economy” is inaccurate, and that the Internet economy’s greatest commodity is in fact, attention.

Gladwell’s second theme, Stickiness, is in some ways a more accessible approach to the rather complex world of Memetics, Meme Theory and Thought Contagion (Lynch, 1996). Richard Dawkins (Dawkins, 1976), a zoologist, sought

³ In describing ‘stickiness’ Gladwell goes back to the health science analogies and refers to the spread of colds or flu. On occasion the rate of viral infection is balanced with the rate of recovery and the disease does not spread rapidly. For example, during the Christmas shopping season in New York the density of people on the street, in the subways and in the stores increases. Now, the disease spreads a little faster yet only slightly faster than the recovery rate. Yet even with this small change., The virus moves from equilibrium toward epidemic.

out to describe cultural evolution using biological terms through his invention of the word meme. The meme⁴, the metaphorical equivalent of the gene, is an information particle that replicates itself as individuals exchange information. In fact, a meme can be transferred through individuals in a number of possible of ways: inventions, fashion, recipes, songs, art, literature, etc. In reflecting a social Darwinist twist, that information which is naturally selected by our brains as most relevant (or as Gladwell may suggest, most “sticky”) is replicated and passed along, while other information or behaviours may be lost. Dawkins (1976) ideas are furthered by the work of Susan Blackmore in *The Meme Machine* (1999) where the author continues to hypothesize on cultural replication and strongly ties memes to the acts of mimicry and imitation of ideas and behaviours.

Gladwell’s third theme is known as *The Power of Context*. This is a fairly simple and obvious notion, but Gladwell’s treatment of the topic is insightful. For example, Gladwell refers to the New York subways in the late 1980’s that had become chaotic, crime-infested systems of transportation. George Kelling, a consultant with the New York Transit Authority at the time, set out to change the subway environment. He cleaned the subways and stopped minor crimes that had been previously thought as too insignificant to deal with. The resulting order and the subway cleanliness established a new context. The power of context, in this case, helped to establish the “tipping point” which apparently led to a dramatic decrease in crime.

⁴ The most accepted definition of the meme is “a unit of information residing in the brain” (Milgram et al., 1992)

General Educational Change Theory

Getting Reform Right – Fullan & Miles

One of the most acclaimed authors regarding school change and reform is Michael Fullan. Fullan has many books and articles over the past decade and has become a popular voice and renowned expert on the topic. In this section, I will try to capture some of the most common ideas from Fullan, particularly those that will further my knowledge on the subject.

While much of the Diffusion and Innovation Theory I have covered thus far have helped to establish what conditions allow for change to occur (e.g., perceived attributes of an innovation, stickiness, context), Fullan and Miles (1992) work to reveal the conditions in which reform (change) fails. The following is a summary of the seven basic reasons for reform failure:

- 1) **Faulty Maps of Change:** The authors make the point that institutions may inaccurately represent themselves by postulating inaccurate or limiting “maps” of their situations. For instance, a “map” such as “every school is unique” is true in the abstract, but not enough to provide guidance for change. Or, a “map” like “keep it simple, stupid: go for small, easy changes rather than big demanding ones” seems to be obvious, but studies have shown that multiple problem change efforts are actually more likely to succeed. (see full list of “maps” in Appendix B).
- 2) **Complex Problems:** Here, the authors identify that there are many complex problems involved in schools, and as many of them have never

been solved before, it is destructive and folly to think that problems of such magnitude can be solved in short order.

- 3) Symbols Over Substance: Fullan & Miles identify that in many cases, educational institutions will adopt external innovations with only symbolic benefit. While the authors believe that, “symbols are essential for success” (p. 4), they will often fail if there is not enough grassroots support for change. Symbols, in many cases are provided only to achieve political success, and less so to achieve reform.
- 4) Impatient and Superficial Solutions: The authors argue that many solutions are introduced with little thought, may be the result of faddism and then implemented too quickly. An example of this could be when a school board purchases computers for every classroom. While it may seem that connectedness is an excellent idea, it almost always creates more problems than it solves. (Fullan & Miles later write “Change is resource-hungry, p. 9).
- 5) Misunderstanding Resistance: The authors suggest that administrators may be misreading what they equate to being resistance. In fact, what may seem like resistance from individuals is more likely their natural responses to the recent transitions. If we misread these responses as resistance, reformers may run the risk of providing inadequate support to those that are having difficulty with change.
- 6) Attrition of Pockets of Success: Fullan & Miles suggest that there are many examples of innovation success in classrooms, but these examples

often become difficult to sustain as receive little support from the institution. In order for such changes to become sustained, they need to be brought to attention and supported through the school culture. “Reform fails unless we can demonstrate that pockets of success add up to new structures, procedures, and school cultures that press for continuous improvement” (p. 7).

- 7) Misuse of Knowledge About the Change Process: This statement refers generally to point #1. Many of the initial propositions can be viewed as only half-truths, and unless more is understood about the change process, there can be little progress expected.

The previous points are fairly general and often intended for the institutional level, but can be used as guiding principles in helping to understand some of the key reasons why a particular reform may fail.

Also, within this article, Fullan & Miles (1992) developed seven propositions for success. They present these as the “seven basic themes or lessons derived from current knowledge of successful change” (p. 7) and in some ways, are presented as a foil to the previous points discussed (reasons for failure). I have paraphrased the propositions for success below:

- 1) Change is Learning: Change is a process of finding and adjusting to personal meaning, and therefore is a learning process. As it is a learning process, it needs to be approached with this light.
- 2) Change is a Journey, Not a Blueprint: Fullan & Miles admit that rational planning models for change cannot address complex human processes.

- The message here is basically that reformers can plan, but more than likely, they will have to plan again for the unexpected (planning is continuous).
- 3) **Problems Are Our Friends:** Problems arise from the change process and these are natural and expected. Reformers must be assertive in identifying, discovering and solving problems (or attempting to solve problems).
 - 4) **Change is Resource-Hungry:** Reformers must be prepared to the growing costs of the change process. Fullan & Miles warn that to sustain a large-scale change process, often much time is spent on identifying and acquiring additional resources to feed the engine of change.
 - 5) **Change Requires Power to Manage It:** Here, the authors put forth the idea that change (specifically what they refer to second-order change) in the culture of schools requires a local body to manage it. Fullan & Miles advocate putting school boards and schools in the position of negotiation for the management of change as complex problems often cannot be solved at a distance.
 - 6) **Change is Systemic:** In understanding systemic change, one must focus on two primary aspects. First, one must look at reform in the development of the many interrelationships within a complex system (curriculum, teachers, students, community, etc.). Second, reform must not focus simply on “structure, policy, and regulations, but on deeper issues of the culture of the system (p. 11). While Fullan & Miles do not explicitly explain

how this is done, they emphasize the importance of this complex undertaking.

- 7) All Large-Scale Change is Implemented Locally: The authors here conclude saying that the six previous postulates cannot be served by bureaucratic decisions made from a distance. They conclude, “any interest in system-wide reform must be accompanied by a preoccupation with how it plays itself out locally” (p. 12).

The Stages of Systemic Change – Anderson

Fullan & Miles (1992) are clearly most interested in systemic change: the process of understanding one’s current system, identifying and understanding problems, identifying and managing change relevant resources and embarking towards a newly reformed system. A year after this article, Anderson (1993) developed a useful continuum of system change. The continuum highlights the stages of change which include: maintenance of old system, awareness, exploration, transition, emergence of new infrastructure and predominance of new system. Additionally, Anderson describes how several “elements of change” (e.g., vision, public and political support, teaching and learning changes, etc.) are affected as they move through this continuum.

Anderson (1993) also identifies three specific ways in which this continuum is useful for educators involved in the reform process. First, the continuum can help to establish a common language or conceptual picture of the process of change and the shared goals. Anderson suggest that this will help multiple stakeholders to understand and participate in the reform process.

Second, the continuum will help to outline and develop a strategic plan. The continuum is generic enough for administrators to “cut-and-paste” their own goals for change, and therefore, allows for a simplistic outline for a better understanding of the next steps to take. Third, the continuum assists in helping to develop an assessment tool for the reform process. Anderson believes “the matrix can provide the basis for deciding the focus of an evaluation, the type of data to collect, and the modes of analysis for reporting.”

While I see merit in the matrix and the continuum described by the author, I am sceptical in believing this relatively simplistic, generic approach will always lead to “encourage deep, quality change” (p. 6) as Anderson advocates.

Nevertheless, the continuum does help to “snapshot” factors to consider in both the movement of change and those elements involved in the change process.

The article, including the continuum is available at:

http://www.ascd.org/publications/ed_lead/199309/anderson.html

The New Meaning of Educational Change – Fullan

One of Michael Fullan’s (2001) newer books, *The New Meaning of Educational Change*, is not a significant departure from his early writings, however, the author has brought the idea of school culture to a greater priority. Additionally, the main premise in this book is Fullan’s insistence that all learning, organizational or individual, is a continual negotiation of “meaning-making”. This updated understanding of organizational learning is in line with contemporary constructivist theory. With this in mind, Fullan also recognizes that for “meaning-making” to occur, the relationships must be improved to create the conditions for

change to occur. In a sense, the shift here moves away from linear structural change to the idea of cultural change, and a focus on relationships and values in the smallest of units, in schools and in classrooms.

Through the premise of “meaning-making”, Fullan (2001) goes on to develop key ideas throughout this book. Four of these ideas (most relevant to this review) are summarized below:

- 1) Existing strategies for reform fall short: Fullan criticizes the reformer practice of imitating “best practice” of schools moving forward. He argues that the existing conditions and relationships in each school must change or be addressed in order to move toward reform.
- 2) The learning organization must serve as a model, not as a cliché: Fullan calls for the creation of authentic learning communities which continually convert tacit knowledge into explicitly shared ideas. Here Fullan builds on the ideas of Polyani (1983)⁵, Nonaka & Takeuchi (1995) and Von Krogh, Ichijo & Nonaka (2000) as he writes not only about the release of tacit knowledge, but also of the creation of energy in organizations.
- 3) Education must reemphasize it’s strong moral component: Fullan criticizes reform attempts of the 1990’s which were focused primarily on efficiencies. Fullan advises reformers to focus on the collective good, to rediscover the close ties that education has with democracy and to understand that reform will happen through the sharing of successes and failures. Schools should share such ideas pertaining to reform for the

⁵ Nonaka and Takeuchi may have been the first to distinguish between explicit knowledge (words and data that can be communicated in the form of data and information) and tacit knowledge (skills and beliefs that are difficult to communicate as they lie below the level of awareness).

benefit of all students. Not only should schools share their efforts with other schools, they must also work to improve the larger communities in which the school resides.

- 4) Change is inevitable, and we must learn to live with it: Change is not going away, thus the best strategy for sustainable change is the formation of professional communities that are able to deal with issues (both minor and major) as they occur.

Educational Technology and Change

Diffusion theories can provide a powerful lens for the study of the adoption of educational technologies into school systems. As the processes for adoption of technology into such systems can vary tremendously, it is beneficial to breakdown the application of diffusion theories into more easily managed categories. For this, I will first divide such efforts into macro and micro theories.

Macro theories are those concerned with wide-scale reform and the restructuring of educational institutions. Macro theories related to technology adoption are concerned with complete organizational and structural change and less interest is given to change of the individual components. Generally, macro theories represent reform as a top-down process. The integration of educational technology usually subsists as a major component of institutional change or as a catalyst for other changes within these systems. In Canada, a wide-scale example of envisioned change policy comes from Industry Canada's "Connecting

Canadians” initiative.⁶ The initiative is actually made up of several large initiatives including SchoolNet⁷ and the Smart Communities program⁸. The essence of these programs is to promote and provide the technical infrastructure (e.g., networks, community access points, connected schools and libraries) to enable Canada to become the most connected country in the world. In the SchoolNet report *Vision of Learners in the 21st Century* (1996), two metaphors, the global learning village and the information highway, are blended in describing the future context for learning.

the global learning village ... fosters local community support, stimulation and collaboration, making use of institutions and teachers (both broadly defined) to provide identity and meaning, caring and belonging;

the information highway ... links learners and communities through affordable technologies with other learning villages and resources around the world, providing variety and scope, possibilities and choices. (SchoolNet, 1997)

Seven years later, these metaphors have become cliché. However, macro theories for change such as these, often depend upon the use of a grand metaphor for developing visionary outcomes

At the institutional level, Bates (2000) has developed several macro theories regarding the integration of technology into higher education in *Managing Technological Change: Strategies for College and University Leaders*.

⁶ “Connecting Canadians is the federal government’s vision and plan to make Canada the most connected country in the world. In an increasingly competitive and knowledge-based global economy, Canada can benefit by becoming a world leader in the development and use of advanced information and communications technologies.” – (<http://www.connect.gc.ca/>)

⁷ <http://www.schoolnet.ca/>

⁸ <http://smartcommunities.ic.gc.ca/>

In this work, Bates focuses much upon strategic planning and has identified the traditional elements of contemporary strategic plans. These include:

- **Mission:** What the institution or department does, for whom, and how.
- **Environmental scan:** Jargon for describing what is happening in the world around you and its likely impact on your activities; another term used for current reality.
- **Vision:** Often confused with mission statement; used here in a specific sense to mean a concrete description of what it would look like if you fully achieved what you would really like to do (no definite time scale).
- **Objective-goals:** What you are trying to achieve, in observable terms, over the next three to five years; achievement of these goals would move you closer to the state described in the vision.
- **Strategies:** Actions to achieve these goals (implementation plan)
- **Monitoring:** Ways of measuring achievements and adjusting strategies during implementation to keep on track for implementing the objectives-goals. (p. 47)

While Bates (2000) emphasizes the importance of strategic planning, he admits that such large efforts are often more than managers or department heads have time and resources to undertake completely. However, Bates goes on to write that it is of utmost importance to for administrative bodies to develop a clear vision for teaching and learning at various levels throughout educational institutions irregardless of whatever commitments these bodies may have to the other components of a strategic plan.

Other examples of Macro-type models include Reigeluth's (1987) Third Wave Educational System, The SchoolYear 2000 Project ⁹ and the New American Schools Development Corporation (NASDC) ¹⁰. Such programs are quite similar in their approaches to school reform, however for the purpose of this review, I will not move further into describing the specific characteristics of each.

⁹ Originates from the Centre for Performance Technologies, Florida State University, <http://cpt.fsu.edu/4stage.html>

¹⁰ A non-profit organization which promotes a systemic school reform model: <http://www.successforall.net>

Micro level theories related to educational technology adoption are characterized by focusing on strategies that will lead to an increase of technological adoption and a change on an individual's instructional strategies. Rather than focusing on systemic change, micro level theories are characterized by focusing on smaller units of change (e.g., teachers, principals, students, etc.).

Surrey (1997) developed a useful framework for understanding the variance of theories related to the adoption of educational technologies. Surrey constructed a grid aligning general goals (systemic change vs. product utilization) against a diffusion philosophy (developer based vs. adopter based goals). Within the grid, Surrey places specific innovation adoption theories within the appropriate quadrants. The complete grid is found below.

		GOAL	
		Systemic Change (Macro)	Product Utilization (Micro)
P H I L O S O P H Y	Developer (Determinist)	Top Down Reform NASDC Goals 2000	ID Models Needs Assessment Formative Evaluation Summative Evaluation
	Adopter (Instrumentalist)	Bottom Up Reform CBAM Coalition of Essential Schools	Burkman's UOID Environment Analysis Adoption Analysis Stockhill & Morehouse

(Surrey, 1997)

Surrey's (1997) distinction between adopter vs. developer-based philosophies is important here. The author explains:

The goal of a developer based theory is to increase diffusion by maximizing the efficiency, effectiveness and elegance of an innovation. The developer, or architect, of superior technology is seen as the primary force for change. (Surrey, 1997, online).

Adopter based theories focus on the human and interpersonal aspects of innovation. Adopter based theories are inherently instrumental in philosophy because they view the end user – the

individual who will ultimately implement the innovation in a practical setting, as the primary force for change. (Surrey, 1997, online).

When understanding change and diffusion theory, this differentiation could be an important consideration as it draws a line between the developer of an innovation and the intended adopter. Additionally, the tones of determinist vs. instrumentalist tie well into the previously discussed literature.

Burkman and UOID

Burkman's (In Gagné, 1987) theory of user-oriented instructional development (UOID) is a relevant model for consideration. Although, Burkman developed the model with instructional designers (ID's) in mind, the developed theory could be useful in other contexts. Burkman's model, which is incidentally influenced by Rogers' (1962) diffusion of innovation theory, is paraphrased below as a series of steps.

- Step 1: Identify the potential adopter.
- Step 2: Measure the potential adopter perceptions.
- Step 3: Design and develop a user-friendly product.
- Step 4: Inform the potential adopter.
- Step 5: Provide post adoption support. (Burkman in Gagné, 1987, pp. 440-1)

While it may not be apparent from the previous description (i.e., the steps), Burkman's model provided a break in the standard practice of instructional design. Burkman describes three major differences between standard ID practice and that practice represented by the UOID model.

First, designers do not normally measure potential adopters' perceptions of their products or try to use them in establishing product attributes. Second, it is not usual for designers to formulate messages about their products or to select communication channels with the objective of creating favourable potential adopter

perceptions. And third, designers do often use adoption and implementation success rates as criteria for evaluating their products. (Burkman in Gagné, 1987, p. 441)

Perhaps what is most important about this break is that Burkman rejects the idea that the technical superiority of a product is a sufficient condition for its adoption. While product quality is important, the relationships between the developer and adopter become much more relevant. And ultimately, potential adopters are seen as the primary forces that influence adoption.

Differentiation of Technology Adopters

Earlier in this paper, Rogers' (1962, 1995) adopter categories were explored. These categories included the innovators, early adopters, early majority, late majority and laggards. Moore (1991) examined these categories in relation to the adoption of technological products in business. He came to the conclusion that the critical region between adopters, which will most likely determine whether or not a product is adopted, lies in the gap between the early adopters and the early majority. Expanding on this theory, Geoghegan (1994) studied technological adoption in reference to university faculty. In his study, Geoghegan developed specific characteristics in helping to interpret these two categories of adopters (i.e., early adopters, early majority) within the context of higher education. The table below summarizes these characteristics:

Early Adopters	Early Majority
<ul style="list-style-type: none"> - Technology focused - Proponents of revolutionary change - Visionary users - Project oriented - Willing to take risks - Willing to experiment - Individually self-sufficient - Tend to communicate horizontally (focused across disciplines) 	<ul style="list-style-type: none"> - Not technically focused - Proponents of evolutionary change - Pragmatic users - Process oriented - Averse to taking risks - Looking for proven applications - May require support - Tend to communicate vertically (focused within a discipline)

(Geoghegan, 1994)

Concerns and Needs Based Diffusion Models

The Concerns-Based Adoption Model (CBAM) may also be an important regarding the adoption of innovation. The model, originally developed by Hall & Hord (1987), is a macro level theory of diffusion. However, the idea behind CBAM is to allow those facilitating change to better understand the process from the point-of-view of potential adopters. Therefore, CBAM is an example of a systemic change model, however the processes it utilizes are primarily bottom-up strategies.

The basic framework behind CBAM includes what is known as the “stages of concern”. The following chart outlines the seven stages of concern and utilizes contextual comments to emphasize the personal approach.

I may be “stuck” if I am saying ...	Stages of Concern	I’m ready for change and focused on ...
Everything is fine, so I am not interested	AWARENESS	What is it? (reactive)
I don’t want to do it.	INFORMATION	How does it work?
I can’t do all that!	PERSONAL	How does that impact me? What’s my role in it?
I’ll try, but I’m not a believer	MANAGEMENT	How can I master this? How can I fit it all in? What’s the minimum I must do?
I am not convinced that it’s worth it.	CONSEQUENCE	Is it worth it?
I have my own way of doing this.	COLLABORATION	How do others do this? What’s the maximum potential of this?
Everything is fine.	RE-FOCUSING	Is there a better way? (proactive)

(Adapted from Sweeny, 1997)

In analyzing the stages, you will notice that the first three are concerned primarily with individual discovery of the specific innovation or idea. These first three steps are generally exploratory. The middle stage, management, focuses on mastery, but there still may not have been a “buy-in” at this point. The final three stages focus primarily on the results or impact of the idea or innovation. Here, the potential adopter will accept or abandon the idea or innovation, or possibly reinvent its use.

Note: Another visual representation of CBAM is available in Appendix C.

Conclusion and Further Explorations

There are numerous theories around innovation and change. I have visited several theories relating to the diffusion of innovations, general change theory and the acceptance of technological innovations in education. As well, I have analyzed specific philosophies of thought regarding change, particularly

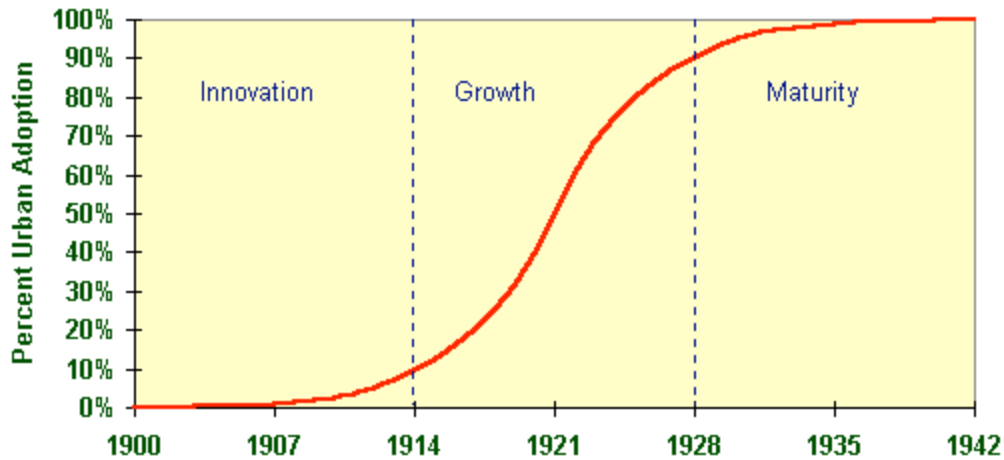
instrumentalist, determinist and social constructivist theories. And still, the journey does not seem to end. I've only scratched the surface.

Two areas of change which, I believe, warrant further discovery include the following. First, change literature relating to intellectual property of ideas would be a relevant area for study. Works from Lessig (2001), Koepsell (2000) and Noble (1998) would be of specific interest. Second, exploration into the idea of "emerging" pedagogy would be important. Specifically, theories of the impact of technology on pedagogy would be beneficial for my intended future study. Loveless and Ellis (2001) provide insight into the relationship of pedagogy and technology, and provide excellent analysis. Exploration in the two specific areas , mentioned above, would certainly allow for further understanding of the literature around change, and would provide sufficient scaffolding for a study which focuses on the implementation and adoption of technological innovation.

Appendix A

S-Curve of the Automobile

An example of an S-Curve is shown below:



At the beginning of the 20th century, only the very rich owned an automobile. Following this S-Curve, between 1900 and 1914, the automobile went through the innovation phase. At the end of this phase, Henry Ford introduced the assembly line which helped the automobile become affordable for the middle class. From 1914-1928, the automobile went through its growth phase as 90% of urban families now owned one, up drastically from 10%, only 14 years earlier. After 1928, the automobile market grew slowly as it reached the maturity stage.

(Paraphrased from Dent, 1994, pp. 106-8)

Appendix B

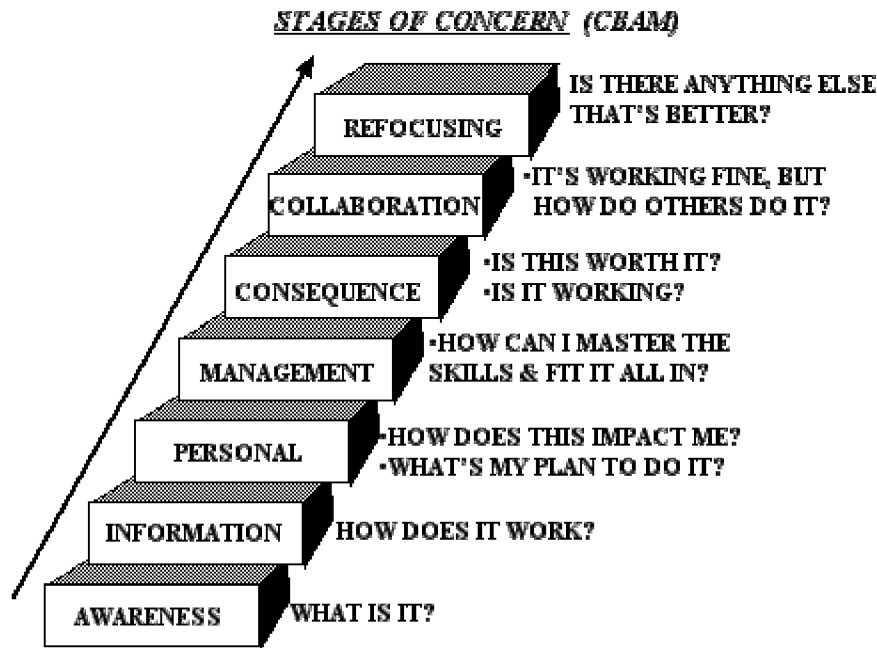
Faulty Maps of Change

- 1) Resistance is inevitable, because people resistance change.
- 2) Every school is unique.
- 3) Plus ca change, plus c'est la meme chose.
- 4) Schools are essentially conservative institutions, harder to change than other organizations.
- 5) You just have to live reform one day at a time.
- 6) You need a mission, objectives, and a series of tasks laid well in advance.
- 7) You can never please everyone, so just push ahead with reforms.
- 8) Full participation of everyone involved in a change is essential.
- 9) Keep it simple stupid: go for small, easy changes rather than big, demanding ones.
- 10)Mandate change, because people won't do it otherwise.

(Fullan & Miles, 1992)

Appendix C

CBAM Model



(Hall and Hord, 1987)

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