# Diffusion of persuasive technology: applying the even less developed concept

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**ABSTRACT**

This manuscript discusses a qualitative model of diffusion that is different from the pro-diffusion models that are usually of interest to marketers. The present model proposes a set of infrastructures that can enable or inhibit the diffusion of, in this case, a technology that could be used in persuasive technology. These infrastructures include a technological infrastructure, a competitive infrastructure, a political infrastructure, and a social infrastructure. This qualitative model could be of value in assessing whether or not a technology could diffuse or has diffused to the point of being viable for use as a persuasive technology.

Keywords: Persuasive technology, persuasion, diffusion of innovation, Internet of Things, Even Less Developed Concept, ELDC

## INTRODUCTION

### What is Persuasive Technology?

Persuasive Technology is a relatively new field of study in consumer behavior. In an early article about the concept of Persuasive Technology, Fogg (2002, p. 89) describes computers as having the capability to "persuade by giving a variety of social cues that elicit social responses from their human users.". The author illustrates this with an example from a police log: A resident heard a man in another house screaming, "I'm going to kill you!" and called the police. The police arrived to find a man who had been yelling at his computer. Many of us can recall having had similar conversations with malfunctioning computers, applications, automobiles, or lawnmowers. Technology can, no doubt, elicit social responses from their human users.

More recently, Fogg (2009) has lamented that attempts to create persuasive technologies often result in failure. He goes on to propose eight steps to minimize the chances of failure: 1) choose a simple user behavior to target, 2) choose a receptive audience, 3) find what prevents the target behavior, 4) choose a familiar technology channel, 5) find relevant examples of persuasive technologies, 6) imitate successful examples, 7) test and iterate quickly, and 8) expand on success. The present manuscript argues, however, that whether or not a persuasive technology will work depends on a much wider set of issues than choosing an audience and choosing a "technology channel".

### An Alternative Model of Diffusion

Owen (2008; Owen et al. 2002; Owen & Humphrey 2009) has proposed a qualitative model of diffusion (ELDC) that has been used to explain when a technology - such as persuasive technology - is ready to diffuse into the marketplace. Automated teaching machines for dispensing and implanting information are coming into common use on the World Wide Web, but teaching machines had been abandoned in the 1960s because the technology wasn't yet ready. Owen (1999) described some relatively simple html techniques that could easily be used on the fledgling World Wide Web to mimic failed attempts a half century earlier to produce practical teaching machines and automatic tutoring devices. Skinner (e.g., 1954, 1958) had been experimenting with operant conditioning and reinforcement in technology that used a method called programmed instruction. Critical of Skinner's approach to learning, Crowder (e.g., 1959, 1963) had been experimenting in a different direction with automatic tutoring machines that, instead of reinforcement for a correct answer, provided an explanation to the student when a mistake was made. The problem with these innovative and effective learning methods at the time was that the modes (technology) of delivery, including Skinner's programmed books, were too cumbersome to diffuse into common use.

In the cases of Skinner's teaching machines and Crowder's automatic tutoring devices, theoretical development had advanced to a point where such machinery seemed to be a good idea for effectively implanting information and skills into the learner. But available contemporary technology was difficult to use by both the developer (human teacher) and the end user (student). There was plenty of information to be learned, but if nobody is developing applications to distribute that information and if nobody wants to use existing technology that distributes that information, end learners are not exposed to that information and nothing gets learned, at least by that means.

And so the same could be said for any new technology that has the potential to communicate information, whether that information is intended for learning or persuasion. Travelers on foot and on horseback once stopped at eateries because they not only saw signage that communicated information such as "Eat at Joe's," but also because eateries persuaded people to stop by transporting the aroma of a sizzling steak out to the road. If Joe's Eatery is now forced to promote to travelers who use mobile devices to find a place to eat, how can the eatery use the aroma of the sizzle to persuade? If the technology existed to equip mobile devices with aroma transducers, would consumers desire such a feature?

There are several issues that the marketer would have to overcome if an aroma transducer was ever invented for use on interactive Internet-capable mobile devices. One obvious issue is the physical size and the financial cost of such a transducer. Even if very small and very low in cost, there are other hurdles. One is a competitive factor; the device and applications for it might not diffuse if there were no competitive pressures to develop and market it. Even if competitive pressures forced it to be developed and improved into a practical device, consumers would have to want it. How many people would want to be in a room full of mobile-phone users who are emitting various smells? Might public policy begin to restrict people from using aroma-equipped tablet computers in libraries or aroma-equipped mobile phones in bars, restaurants, and theaters just as cigarettes are banned in public places?

The objective of this manuscript is to outline a set of particular infrastructures that can indicate when a new technology might or might not yet be useful. This implies that if we understand what is missing, we can make decisions as to whether or not we can or cannot create missing elements. The diffusion model that is proposed goes beyond factors of the technology itself and beyond pro-diffusion concerns of pushing innovators or early adopters to use a technology. (An "adopter" refers to someone who has begun to use a technology to do new things or to replace an old way of doing things, such as a person replacing a hard-wired landline phone with a wireless mobile phone, or a person giving up a mobile phone for a smart phone to communicate through social media.)

The diffusion model proposed here is based on a question raised several decades ago by Sheth (1981): Why do a majority of consumers fail to adopt a technology? Sheth's model suggests that we should not be so interested in why many people adopt a new technology, but we should instead focus our interest on why many people do not adopt a technology. The model in the present manuscript proposes four basic infrastructures that must be considered in enabling (or

inhibiting) the diffusion of a technology: the core/technological infrastructure, a social infrastructure, a competitive/commercial infrastructure, and a political/regulatory infrastructure. These are proposed as qualitative influences that can tell us why people have not yet adopted a new technology.

## BACKGROUND

Perhaps the largest influence on the concept of diffusion of innovation in the marketing discipline is the original book by Everett Rogers (1962) and continuing editions across the next few decades. One of the problems with the way that marketers have used the ideas of Rogers is in the focus of marketers on using consumers as the main unit of analysis - issues such as adopter categories and of opinion leadership in diffusion (cf., Rogers 1995, Table 2-1). In attempting to penetrate a market with a new product using a new technology, it is perhaps useful to understand the psychographic characteristics of innovators, early adopters, and such in order to sequentially penetrate those market segments.

However, sequentially penetrating segments of technology adopters is of limited value with persuasive technology if the goal is to reach a majority of people, not just some small subset who are using a particular technology. Consider the following hype about the promise of Videotex as a technology that was promoted be used for the distribution of text information on the (now obsolete) NTSC TV signal: "People still don't know just what they're missing . . . Videotex promoters continue to believe that consumers somewhere have a sweet tooth for the services that technology will bring home. If things don't work out in 1988, well, there's always 1989" (Arlen 1988, p. 123, as quoted in Owen 1991). Although the technology and distribution system existed for a medium that had capabilities that bore similarities to what became the World Wide Web a few years later, videotex diffused to only a small percentage of the potential market before it died. As Fogg (2009) said, most attempts to create persuasive technologies have failed.

The videotex experience illustrates that diffusion to the majority of a market requires more than just the technical viability of a technology. It was a two-way, interactive means of transmitting text and graphics, something like the capabilities of the current World Wide Web, but there were several competing proprietary standards with no standardized global policy and generally no alternative competitors within a proprietary standard. Importantly, for all of the hype and hope of marketers, videotex wasn't supported by any sort of social infrastructure. Users didn't react and interact as a universal group in the ways that we now see happening with the World Wide Web.

The remainder of this manuscript outlines the four basic elements of a diffusion model that might be useful in evaluating issues of persuasive technology. This model departs from the more common marketing view of diffusion in focusing on the traits of innovators, laggards, opinion leaders, and such, by considering what Sheth (1981) proposed as the "Less Developed Concept," or "LDC", of diffusion of innovation. Sheth proposed that instead of focusing on how

a minority of people first adopts an innovation, we should instead look at why a majority of people fails to adopt an innovation. The model proposed below considers not only a technological element in diffusion, but also social, competitive, and regulatory elements that are important to the diffusion of a technology into the marketplace.

## ELDC: THE EVEN LESS DEVELOPED CONCEPT OF DIFFUSION

### Diffusion in a Social Infrastructure

Diffusion of anything -- a new kind of product, a new kind of technology, a rumor about the health of a company CEO, an urban legend about unwholesome ingredients in a fast-food sandwich -- occurs through some sort of social infrastructure. Rogers (1976) asserted that an innovation (the idea or thing being diffused) is communicated through a channel among members of a social system. In borrowing the idea of diffusion from Rogers, marketers have similarly viewed diffusion as taking place in a communication channel or social system (e.g., Gatignon and Robertson 1985; Mahajan et al., 1990). An initial interest of marketers in Rogers' concept of diffusion was the categorizing of a consumer market into innovators, early adopters, laggards, and such. An expectation from this perspective is that if we could figure out how to reach innovators and then early adopters of a new technology or product, we could eventually penetrate the market to reach the mainstream majority of people.

Note Rogers' idea of a social system and a communication channel. Diffusion can occur in some social systems, such as teens sharing information with other teens, without much overlap into other social systems, such as teens sharing the same information with parents. These social systems are enabled by the existence of communication channels - teens having opportunities to share rumors and urban legends when meeting with peers at school, bicyclists being able to talk shop about new products while riding with members of a recreational riding club, teens having increased opportunities to chat with the invention of low-priced mobile phones, members of a recreational cycling club being able to post ride calendars on a club website, teens and parents and members of a cycling club being able to chat and broadcast information via social networking websites.

These smaller social systems - groups of teens, groups of parents, groups of bicycle riders - are enabled by the existence of communication channels. Those communication channels are all enabled by some sort of technology infrastructure. In modern times - not for all of history - teens have been able to meet in large groups due to the ability to construct large schools and to carry those children long distances on school buses. Only the most recent generations of teens have had access to mobile phones and mobile Internet devices, enabling 24/7 exposure to social influences beyond their parents - accompanied, perhaps, by a permanent change in culture in almost every developed part of the planet.

**Influences of a Core/Technological Infrastructure**

New innovations about which we might have a concern for diffusion would usually be associated with some new sort of technology infrastructure. The diffusion of new social networking sites on the World Wide Web have relied on the World Wide Web as an technological infrastructure on which the networking applications can be built. And the World Wide Web itself owes its existence on other technological infrastructures, such as the physical network of wires and servers. Diffusion of the technological infrastructure had to occur before diffusion of the Internet that used that infrastructure; diffusion of the Internet had to occur before diffusion of the World Wide Web; diffusion of the World Wide Web had to occur before diffusion of social networking applications (Twitter, Facebook, etc.) could occur. And diffusion of social networking applications into common usage by a mass of users had to occur before communications through them would become commonplace.

Diffusion of many innovations can be inhibited by issues the technological infrastructure. Guerilla marketing, terrorism, or cyberwarfare can operate by exploiting weaknesses in the technological infrastructure. When the Colorado Rockies baseball team launched online-only sales of World Series tickets, it was immediately attacked with a large number of automated "hits" that swamped its system and forced it to close sales after two hours with very few tickets sold (Associated Press 2007). The experience of both frustrated buyers and sellers could persuade them not to use this mode of distribution in the future.

**Influences Through a Competitive/Commercial Infrastructure**

Some marketers (Gatignon and Robertson 1985; Framback 1993; Robertson and Gatignon 1986) suggested that the basic elements of an innovation, communication channels, and a social system be extended to include marketing and competitive actions. A year after Netscape was offered for sale as a Web browser in 1995, Microsoft began bundling its new Internet Explorer browser for free with the Windows operating system. Netscape then started offering its operating system for free. At the same time, America Online was heavily promoting its Internet connection service (ISP). Such competitive actions probably assisted the diffusion of the Internet and the World Wide Web from back room university labs into the homes of mainstream household consumers.

While the competitive and commercial infrastructure surrounding the diffusion of the Internet and the World Wide Web probably enabled these to diffuse rapidly into a mainstream market, competitive effects could also inhibit the diffusion of some technologies. Computer manufacturers and distributors who install the Microsoft operating system on their hardware usually will not want to install applications that compete with a Microsoft suite of applications (Grimaldi 1998; Wolffe & Kehoe 1998). This commercial/competitive relationship in that industry has probably helped to inhibit the development of improvements through non-Microsoft browsers, word processors, spreadsheet applications, and such.

**Influences Through a Political/Regulatory Infrastructure**

A result of the dominance of Microsoft in computer operating systems and applications that run on those systems was talk that Microsoft's dominance had stifled the industry. The cost of attempting to compete with the high market share dominance of one competitor provided a dis-incentive for third-parties to develop competing applications. This essentially provided an "applications barrier to entry" that quashed cross-platform applications development, further inhibiting the development of competing operating systems (United States v. Microsoft 2007). Trade industry or government actions or inactions can affect the development of infrastructures surrounding an innovation. Because of its near monopoly position and resulting stifling effects on the industry, Microsoft, was the target of US and EU antitrust proceedings (cf., O'Brien 2009).

Increased government regulation on landline telephone use is increasing the cost and pushing consumers to use lower cost alternatives such as VoIP Internet telephone, audio messenger services, text email, and social networking applications (cf., Bennahum 2004). While this is currently enabling one group of technologies, new government regulations could stifle those technologies in some places. One unintended side effect of VoIP and other Internet audio communication is that audio isn't transmitted as an audio signal, but as a series of smaller digitized packages that are re-assembled on the receiving side, making audio conversations difficult to intercept by law enforcement agencies as well as by bad guys. The US Federal Bureau of Investigation (FBI) has appealed for legislation and other assistance that would enable it to "wiretap" Internet and smart-phone communications (Halpern, 2015; McCullagh 2011; Toor 2012). A concern is that this could cause some communications service providers to pull out of the US because they do not want to incur the expense and loss of privacy to comply with proposed new legislation.

**IMPLICATIONS FOR PERSUASIVE TECHNOLOGY**

Persuasive technology relies on more than just the technology itself. This manuscript has proposed that in order to assess the viability of a promising new technology or existing technology for use in persuasive technology, one should look beyond the infrastructure of the technology. Other infrastructures that can affect diffusion include a social infrastructure, a competitive/commercial infrastructure, and a political/regulatory infrastructure.

RFID technology, for example, is currently viable and has been in use for many years, but it will be years before it diffuses into household end-user domains for use in persuasive technology. RFID allows a tiny electronic "chip" to respond by radio signal to a radio signal request for information. A chip sewn into the collar of a shirt, another glued into the sole of a shoe, chips embedded into other items in a shopping basket, and another embedded in the credit card of a retail store patron can identify themselves individually as the shopper walks out the front door of the store. This could make shopping very convenient for consumers - no waiting in

checkout lines, no transaction to process. But for all of its promises, RFID has issues on the infrastructures described above.

A marketer might imagine that a shopper carrying an RFID card can be identified not only for billing, but also for promotional purposes. Walking down a retail store aisle, the shopper might hear from the shelves, "Hey Sally! Remember that tablet computer that you bought last week? We will give you ten percent off on accessories if you make a purchase on your way out of the store today. We'll help you to select accessories that fit your new tablet as you near them if you continue walking up this aisle."

A trade industry survey (Roberti 2004) found several years ago that consumer concerns were potentially inhibiting factors to this technology. The survey found that while many consumers were aware that RFID technology was being used to track goods in the supply chain, they had a concern that it could also be used to track their own shopping behaviors and purchase decisions. Consumers not only have issues with privacy, but some even have religious objections (RFID Gazette 2007). While much of what consumers believe could be based on mis-information, that is still an important factor in the social infrastructure that must be overcome if this technology is to diffuse.

The core/technological infrastructure of RFID for retailers is also not yet fully developed, and this could inhibit growth in the industry. There are issues of the presently high costs of the RFID tag itself and of the associated equipment, competing non-standardized technology, and a lack of a skilled labor pool. These issues also implicate the competitive infrastructure as both enabling and inhibiting diffusion of this innovation. Additionally, RFID diffusion is inhibited in part by regulatory issues. Privacy issues have yet to be addressed, and different countries have different regulations regarding radio frequency usage (Garfinkel 2006; RFID Gazette 2007).

Such issues with RFID suggest that its use as a persuasive technology (in addition to its more widespread use in supply chain management) is probably getting close to consumer adoption if this qualitative ELDC model is correct. We also have a number of promising new technologies in the quickly evolving study of IoT or Internet of Things. IoT includes Internet-connected devices such as refrigerators, automobiles, wearable items such as clothing and prosthetics – any kind of smart device that can provide data to and accept data from the Internet to be acted upon immediately or interactively. Imagine – currently - that your refrigerator tells you that it is low on milk and would like your permission to order a delivery to arrive tomorrow morning. Imagine that your artificial fingernail warns that the drink someone ordered for you at the bar contains an illicit dating drug. These are some of the persuasive technologies that are right around the corner – a machine attempting to persuade you to buy more milk, an electronic fingernail attempting to persuade you not to drink a gift. By using the qualitative ELDC model of diffusion, we might be in a better position to qualitatively judge how close we are to mass adoption of a persuasive technology and what it might be that is inhibiting it.

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