

SERENDIPITY AND SOME POTENTIALLY GENERALIZABLE FACTORS IN THE SUCCESSFUL DIFFUSION OF INNOVATION

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ABSTRACT

Marketing and management studies have tended to use individual consumers as the main unit of analysis, maintaining a focus on understanding the individual traits of innovators, laggards, opinion leaders, and such. The present paper proposes that successful diffusion is because of product appeal to a mass audience through low cost, easy to use products, and that this appeal to a mass audience must occur through an enabling structure that is owned by all of society.

INTRODUCTION

"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). Videotex was a technology that could distribute information that is similar in content to what is currently distributed via the World Wide Web. Videotex did not diffuse successfully, yet the World Wide Web, with the commercial launch of Netscape in late 1994 (c.f., Blum 1996; Harris and Kidder 1996), has rapidly diffused in the meantime.

Prior to the eventual success of the World Wide Web, Owen (1991) opened with the above quote as an example of a product that appeared to be doomed for failure, proposing that successful diffusion of a discontinuous innovation tends to occur through initial appeal to a "mass" audience. Owen further observed that, among other ideas, successful diffusion is often serendipitous or accidental - that marketers have tended not to recognize the factors that caused successful or unsuccessful diffusion. The present paper is a reassessment and extension of the historical observations and conclusions that were drawn by Owen, additionally including some more recent events to suggest factors that could be under control of the marketer.

The observation that many products have diffused through serendipity and through a "mass" audience is an interesting idea, but it is not especially useful in developing marketing strategy. That is, the observation of serendipity suggests that the diffusion of new ideas and products is out of the control of the marketer. The idea in the present paper is that if some generalizable factors of successful or unsuccessful diffusion can be found from past example, then these could be of value to marketers who are attempting to launch a product which has elements of a discontinuous innovation, perhaps with "luck" being reduced to a more minor nuisance variable. If we know what has enabled diffusion from past example, then perhaps we know what to look for in future diffusion situations.

THE MORE COMMON AND THE LESS DEVELOPED VIEWS OF DIFFUSION

Rogers' (1995) extensive work on diffusion notes that marketing and management studies have tended to use individual consumers as the main unit of analysis (Rogers 1995, Table 2-1). Marketers have maintained a focus on understanding the individual traits of innovators, laggards, opinion leaders, and such. From this perspective, an innovative idea or product spreads through a social system composed of these individuals, starting with, say, innovators, and eventually becoming fully diffused when the laggards have finally adopted the idea or product. Much of the work that is reported in the marketing literature has focused on "communication channels" and how it is that an innovation is transmitted through members of a social system (Gatignon and Robertson 1985; Mahajan, Muller, and Bass 1990; Rogers 1976).

Sheth (1981), however, proposed the "Less Developed Concept," or "LDC", of diffusion of innovation, proposing that our interest should be less in how a minority of people first adopts an innovation, and more in how a majority of people resist an innovation. The focus of the LDC is less on individual adopter categories (innovators, laggards, and such), and how the innovation diffuses through these, but more on how an innovation might have value to the vast majority of members of a social system. Owen (1991) suggested evidence in historical example to support this idea, noting that products such as the automobile did first have an appeal to "innovators," but that the rapid diffusion of the automobile through the Model T was in its appeal to a majority of people. That is, the automobile did not diffuse as a social process that started with innovators and ended with laggards, but rather diffused very rapidly when a product was introduced which had appeal to a mass audience.

This observation would seem to be useful in setting marketing strategy - that one should try to appeal to a mass audience first, and then segment the market, rather than try to first appeal to segments of innovators, then to early adopters, and so on. The camera was able to skip diffusion through adopter categories with the introduction of proprietary film processing by George Eastman. Making photographs was not a do-it-yourself project prior to the introduction of Eastman's strippable film, and his new method, requiring the stripping of a chemical film off of a paper roll, was not even a process that could easily be handled by the amateur photographers of the day. To enable people to easily use his product, he rolled enough of the strippable negative film, a new way of making photographs, into a box camera such that an ordinary person could take 100 pictures and then send the camera back to a Kodak processing plant. The camera was promoted with the advertisement, "You press the button, we do the rest." The camera could now be used by anyone - a mass consumer market from the perspective of Sheth's LDC - and did not have to slowly diffuse through the adopter categories of a social system.

However, Eastman probably did not create the strippable film process as a way to appeal to a mass market. The strippable film process was created as a way to get a lot of pictures into a small box to keep the user from having to change the large, bulky, fragile plates onto which the image was exposed as a positive. With strippable film, each successive image was exposed onto a small portion of chemical film that was painted on a long roll of paper. Then the paper had to be carefully separated from or stripped off of the thin, fragile film. The final picture then had to be enlarged from its small size on the film and printed on a larger piece of paper.

This was not a process that could be done easily by amateur photographers of the time. Eastman solved the problem by packing a camera with film at the factory, and then leased the camera with the film to the user who would send the camera back to the factory where the film was unloaded, stripped, developed, and printed as a final positive image on a piece of paper (in the same manner as is done currently with disposable cameras). Eastman came up with a brilliant strategy that not only enabled the amateur photographers to use the new strippable film technology, but serendipitously happened to allow any ordinary person to use a camera. That is, the diffusion of the camera as a consumer product was probably due to the luck of strippable film being so difficult to process, requiring a marketing strategy if it was ever to sell, rather than being invented as a deliberate strategy to create a consumer product with mass appeal.

SERENDIPITY AND FACTORS WHICH ENABLE IT

The Model T Automobile¹

Serendipity to the Marketer. The Ford Model T is popularly discussed as an example of a well-planned, successful product, targeted toward a mass market. Contrary to this perception, however, it is doubtful that Henry Ford initially understood the commercial significance of the Model T as a "car for the masses" and more likely that luck played a greater role (cf., Pound 1940; Sward 1948). The automobile was contemporaneously described as a mere curiosity prior to 1900 but as "[affecting] American life profoundly" after 1910 (Langley 1926, p. 451), coincident with the launch of the Model T in 1908. Indeed the Model T was likely to be a cause of the successful diffusion of the automobile in the U.S., but it is also very possible that this was the result of coincident serendipitous events.

The first commercial vehicles designed under the direction of Henry Ford around the turn of the century were said to have been high-priced racing models, with Ford twice involved in failures in joint ventures to produce automobiles (Ford 1926; Pound 1940; Seltzer 1928; Sward 1948). With the start of the Ford Motor Company in 1903, the new company again almost met with disaster by producing heavy models, with the first model selling for about \$100 more than the Cadillac and \$100 more than the successful Oldsmobile (cf., Parlin and Bremier 1932; Sward 1948).

The lower priced Model T was introduced in 1908 and was probably not planned as a "car for the masses." In court hearings in 1927, one of the original co-founders of the company and Ford's first sales manager both described the original conceptualization of the Model T as a "farmer's car" that was capable of running farm machinery (Sward 1948, p. 25). As evidence that the significance of the Model T as a "car for the masses" was not recognized at the time, Henry Ford and his remaining partner entered into negotiations in 1908 and again in 1909 to sell out to William Durant of what was to become the General Motors Corporation (McManus and Beasley 1929, p. 103), and it is "most likely" that the Ford Motor Co. would have been purchased had it not been for a cash-only payment that was demanded by Ford (Federal Trade Commission 1940, p. 120). An agreement was reached in 1909 for \$2 million in cash and \$6 million in two years, but the deal fell through because Durant was unable to obtain financial support (Pound 1934, p. 120).

Enabling Factors of the Environment. By the early 1920s, more than half of all farmers owned automobiles ("Farmers Use of Automobiles" 1924). However, cars on farms and in small towns at that time accounted for only 30% of U.S. car registrations (N.A.C.C. 1924). The population was shifting from rural areas to larger cities and urban housing starts were rising (Owen 1991, Table 1). A nationwide survey conducted in the early 1920s found that many automobile owners were moving to the suburbs, relying solely on the automobile for transportation to work, to avoid high rents in the city (Western Newspaper Union 1923). Babson (1923, p. 26) predicted that "within a radius of 15 or 20 miles of the cities, which the motor car and good roads opened up, that the most spectacular development in new building should take place."

People were moving from farms for work at factories in the cities, resulting in high rents for housing close to work. The cheap (low priced, but of lesser quality than many competing models) Model T allowed people to move into the sub-urban areas with lower housing costs. Designed as a vehicle for the farm, the Model T traveled on roads that existed at the time and, lacking the luxuries of models that existed when it was introduced, was affordable to many people who worked in the cities. The evidence suggests that Ford planned a car for the wrong market; there appears to be no evidence that Ford anticipated that the Model T would sell well to people who saw the product as a substitute for high rents in the city. That is, the Model T, as a catalyst in the diffusion of the automobile, appears to serendipitously have been the right product at the right price at the right place at the right time.

Generalizable Observations from the Diffusion of the Automobile. The Model T, unlike predecessor models of automobile, was a product that happened to be needed by a mass market, rather than by the innovator adopters, and it diffused through a mass market rather than through adopter categories in a social system. The mass market was able to use the product, and the mass market was able to afford the product. Importantly, a system of roads, with gas stations, parts supplies, and such, had begun to emerge (see further discussion in Owen 1991); the Model T, unlike the larger, more expensive cars around the turn of the century, was able to use the existing infrastructure of roads used by horse-drawn vehicles.

Online Services: Videotex/Teletext vs. the World Wide Web

Serendipity to the Marketer. The current case of the U.S. government vs. Microsoft includes, in part, issues of the Web browser that has been bundled with the Microsoft Windows operating system. Perhaps the successful Internet Explorer Web browser and enhancements such as Java might not have been of any interest to Microsoft without the introduction of products first by competitors such as Sun Microsystems and Netscape (Hegarty 1998; Kehoe 1998; Wolfe and Kehoe 1998). However, perhaps none of these products would ever have been possible without the operating system that was enabled by Microsoft. That

Microsoft ever itself initially recognized the value of these products, even of the operating system that it sells, is unlikely.

According to Stone (1997), Microsoft didn't even produce the PC-DOS operating system that diffused through the introduction of the IBM PC microcomputer. It was approached by the IBM design team because they thought that the young, small Microsoft could sell a license for an existing and popular operating system, CP/M, that was produced by Digital Research. Microsoft was approached simply because the founder of Digital Research, Gary Kildall, was out of the office for the day. Microsoft did not have a license to sell CP/M and had not itself developed an operating system that could be used by IBM, but purchased an existing operating system called QDOS from another company (for a mere \$50,000) and then licensed it to IBM. The IBM PC sold very well, as did clones of the well-known computer brand name, and Microsoft serendipitously rode the sales of the IBM brand and its clones. The result was a fallout of a variety of computer systems for a standardized platform, perhaps enabling the online services which currently exist.

Enabling Factors of the Environment. Videotex and telex (ca. 1980s) were systems that enabled the transmission of material through a television via cable broadcast. Text information can be included with the vertical blanking signal of the TV broadcast signal, not interfering with the TV picture, but able to be stripped out, decoded, and displayed on the TV separate from the show that is being broadcast. Proprietary (not Internet) online service providers such as CompuServe were formed in the 1980s, at the same time as experiments with Videotex services, providing proprietary services via phone lines to people with modems and home computers. CompuServe also did not diffuse rapidly, at least not in a manner that is currently seen in the diffusion of the Web. Some reasons for the failure of Videotex is perhaps apparent in the positive comments of Alber (1985, pp. 36-37):

"No one will offer Videotex services and manufacture decoders in volume until a market for them exists, but no one will pay inflated prices for a decoder that has limited use because of a lack of available service . . . Videotex service is extremely expensive today; but as Videotex matures, it too will achieve mass market appeal."

The issue of this problem seems much clearer now with more than a decade of hindsight and the successful diffusion of browsers on the World Wide Web. Videotex was expensive and required specialized equipment, and therefore would probably only diffuse to an "innovator" market rather than to a mass market. CompuServe required a computer, which was not yet a common household appliance in the 1980s, and a modem to connect to the proprietary service. As with the introduction of early models of automobile, these are characteristics that make it likely to be a product that has appeal to an "innovator" market rather than to a mass market.

By the early 1990s, however, the Internet had become something analogous to the unpaved automobile roads of the 1900s - indeed, it has acquired the nickname of "information superhighway". Information could be transported across a non-proprietary medium that was owned by society rather than by a single institution or company. Prior to the World Wide Web of the 1990s, the Internet was used primarily for research. The creation of html (hypertext markup language) in the 1989 enabled a standardized way to send and receive textual documents; it was something like adding pavement to dirt roads, allowing a variety of equipment and software to communicate in an easy way. Html was not initially intended to transmit images or to include sound and video, but it laid the foundation for such capabilities that are now standard Web browser features. The first Web software was introduced on the NeXT computer and demonstrated in 1991 at the Hypertext '91 conference (Eager 1996). (This and the following discussion are based on contemporary sources such as Blum 1996; Eager 1996; Ellsworth and Ellsworth 1994; Harris and Kidder 1996; Kientzle 1995; Musciano and Kennedy 1996.)

Mosaic, an application introduced in 1993 by the National Center for Supercomputing Applications, is a graphics based "browser" that could display different font types and images (picture information) from information sent over the Internet using the html idea. Mosaic was released for free, and could be downloaded via the Internet by anyone with a connection. Netscape was formed in late 1994, based on the Mosaic application, but now with commercial backing.

Microcomputers were now powerful enough to handle such a graphics-based application, and they were cheap enough that they were affordable to a mass market; at the same time, the market was starting to standardize to a common PC-DOS/Windows based operating system. Computers were being used more and more by people at work and at school, and so more and more people were familiar with them and now owned them as a general-purpose home office and entertainment appliance. The graphics capabilities of the Netscape browser, and later the Microsoft Internet Explorer browser that was bundled with the then-new Windows 95 operating system, made these applications easy for almost anyone to use. The idea of bringing information into people's home on a wire, which did not diffuse via Videotex and proprietary modem services such as CompuServe, began to diffuse rapidly in the middle 1990s because, perhaps, some sort of common roadway existed in the Internet and because reliable and low priced computers were available to the masses.

Generalizable Observations from the Diffusion of the Online Services. As in the case of the automobile, the diffusion of online services finally occurred when a common, non-proprietary roadway was in place for the low-cost use of all members of society. As in the case of the automobile, the diffusion of online services occurred when a cheap, reliable vehicle was made available - low-priced microcomputers with a cheap (somewhat unreliable but low priced) easy to use operating system and free, easy to use Web browsers.

CONCLUSIONS

The emergence of a contemporary innovation, online services via the World Wide Web on the Internet, provides a case to contrast and compare with older examples of innovation diffusion. Owen proposed that innovations such as the automobile failed to diffuse successfully through a social process of adoption through innovators and such, but diffused successfully when the product could be adopted by a majority of people - a mass market. Online services appear to have followed in the same pattern; the earlier attempts of videotex and proprietary online modem services had characteristics that could only appeal to "innovators," but the World Wide Web, being easy and of low cost to use, diffused successfully and quickly through a mass market.

Owen (1991) had proposed that serendipity, or a lucky series of events, plays an important role in the diffusion of innovation. Although such an observation is interesting, it is not managerially useful. The present paper, in comparing the diffusion of the automobile with the diffusion of online services, proposes the following:

- (1) successful diffusion occurs through appeal to a mass market
 - (a) the product is low in cost to adopt (price)
 - (b) the product is easily used by members of this mass market
- (2) successful diffusion requires an underlying infrastructure in place to support the product

The idea of an underlying infrastructure is an important issue that does not appear to be discussed anywhere in the diffusion literature in marketing (c.f., Owen et al., forthcoming). Nonetheless, it appears to be a crucial issue in some cases. The Model T that caused the diffusion of the automobile not only appealed to a mass market, but it also traveled on the roads that were in existence at the time. There was an underlying infrastructure, owned by all of society, upon which the Model T could travel: it was relatively rugged and reliable, and was designed something like a horse-drawn buggy - not characteristics of the heavy luxury cars and the racing cars that Ford and other auto makers had been trying to sell.

Videotex services did have in place an underlying infrastructure, because the videotex information was broadcast in the vertical blanking signal with a standard television broadcast signal (of the NTSC format that is used in the U.S.). However, because of the special equipment that was required to use it, it

could not have appeal to a mass market. Online services that used the Internet, a network which, like roads, was essentially owned by society and low in cost to use, had a much better chance of appealing to a mass market. When this network became easy to use through the development of html and graphical browsers (and cheap, easy to use computers that had the power to run these applications), the World Wide Web - the system of html standards and graphical browsers - quickly diffused.

Whether or not marketers can contemporarily observe these potentially controllable factors remains to be seen - hindsight makes these issues more clear. Thomas Edison, however, did seem to be able to foresee that such an underlying structure was necessary to the diffusion of the electric lamp, developing all of the dynamos, switches, fuses, and such that were necessary for an electrical distribution system before a suitable filament had even been found (Jones 1931). Nonetheless, the system upon which the electric lamp relied had to be in place at low cost to individual members of society if the product was to diffuse. Edison at least recognized that this system had to be in place if the electric lamp was to be a commercial success, but even he, like Ford with the Model T, had not projected the electric lamp to become the big commercial success that it eventually became ("Thomas A. Edison Predicts" 1925). If marketers can create an underlying structure for an innovative product, or recognize when one exists, then they have the beginnings of successful diffusion. (This structure in Internet terms is being termed a "backbone".) If they can also create a product that is low in price and easy to use by a mass market, rather than create a product that has appeal only to an "innovator" market, then they are likely to increase the chances for successful product diffusion.

ENDNOTES

1. Much of this section is a liberal summary of Owen (1991); see original for more extensive discussion.

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