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DIFFUSION OF INNOVATIONS

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What Is Diffusion?

When the World Health Organization launched a worldwide campaign to eradicate smallpox, it was engaged in diffusion. When Apple launched iPod, it was diffusing a new product. When Bob Dylan wrote “The Times They Are A-Changin’,” he was describing diffusion (Dearing & Meyer, 2006). When professional dancers—both standing up and sitting down (in wheelchairs)—perform on stage, as do the artistes of the Dancing Wheels dance company in Cleveland, they are diffusing a new image of what constitutes (dis)ability.¹

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers, 2003). An *innovation* is an idea, practice, or object perceived as new by an individual or other unit of adoption. The diffusion process typically involves both mass media and interpersonal communication channels. And, in today's world, information technologies such as the Internet and cell phones—which combine aspects of mass media and interpersonal channels, represent formidable tools of diffusion (Morris & Ogan, 1996). Consider the following experience of co-author Singhal in the Philippines.

In May 2006, as Singhal strolled down Epifanio de los Santos Avenue (known as “Edsa”) in Manila, Philippines, a Filipina colleague noted that “Edsa was the street where the government of President Estrada was brought down by cell phones.”² Grasping the puzzled expression on Singhal's face, she elaborated: “Some five years ago, a text message appeared on my cell phone. It said ‘Go 2EDSA.’” Within a few hours, Edsa was teeming with tens of thousands of Filipinos who had received the same message. They were demonstrating against the corrupt Estrada regime. Within a few days, the crowd swelled to over a million. Estrada was toppled.

Upon returning to the United States, author Singhal's Internet search revealed that in January 2001, the impeachment trial against President Estrada was halted by senators who supported him. Within minutes, using cell phones, the opposition leaders broadcast a text message “Go 2EDSA. Wear blk” to folks on their telephone lists. The recipients, in turn, forwarded the message to others. The rapid (almost instant) diffusion of a text message led the military to withdraw support; the government fell without a single shot being fired.

After reading the story on the Internet, Singhal forwarded it by e-mail to the 28 undergraduate students enrolled in his *Communication and Information Diffusion* class at Ohio University, asking them to share it with interested family and friends. Many did. So here we see how an innocuous interpersonal exchange on a street in Manila—about the consequential spread of an SMS message—was itself diffused from a single source (the instructor of a course) to many recipients and, in turn, to others in multiple cascading diffusion waves.

This chapter analyzes the research tradition of the diffusion of innovations, focusing on the origins of the diffusion paradigm, its methodological tenets, and its influence on communication research. We identify the distinctive aspects of diffusion research, detail the seminal Iowa hybrid

seed corn study, explain the strengths and limitations of the dominant paradigm that guided diffusion study for several decades, and look into the future of diffusion practice and research. We end our chapter by discussing the positive deviance approach which, we believe, provides an alternative ("inside-out") way of thinking about diffusing innovations, and one that capitalizes on peoples' indigenous wisdom.

Distinctive Aspects of Diffusion Research

Several distinctive aspects of the diffusion of innovations set it off from other specialized fields of communication study.

1. The study of the diffusion of innovations began during World War II, prior to the establishment of communication study in university schools and departments (Rogers, 2003). So diffusion research was well underway as a research activity before communication scholars entered this research front.

2. Although most observers agree that the diffusion of innovations is fundamentally a communication process, communication scholars constitute only one of the dozen research traditions presently advancing the diffusion field (along with geography, education, marketing, public health, rural sociology, agricultural economics, general economics, political science, and others). Other communication research areas such as persuasion and attitude change and mass communication effects also began prior to the institutionalization of communication study in university units (Rogers, 1962, 1983, 1995, 2003; Singhal & Dearing, 2006).

3. Diffusion research is also distinctive in that the communication messages of study are perceived as *new* by the individual receivers. This novelty necessarily means that an individual experiences a high degree of uncertainty in seeking information about, and deciding to adopt and implement an innovation. In the sense of the newness of the message content, the diffusion of innovations is unlike any other communication study except the diffusion of news. Diffusion of news, however, studies the spread of news events, concentrating mainly on such matters as how we become aware of news. In contrast, research on the diffusion of innovations centers not only on awareness-knowledge, but also on attitude change, decision making, and implementation of the innovation. The new ideas investigated by scholars of the diffusion of innovations are mainly technological innovations, so the behavior studied is quite different from that investigated in news diffusion studies. Obviously, however, both communication research areas involve a similar diffusion process, and both have been informed by the other (Rogers, 2003).

4. Diffusion research considers time as a variable to a much greater degree than do other fields of communication study. Time is involved in diffusion in (a) the *innovation-decision process*, the mental process through which an individual passes from first knowledge of a new idea, to adoption and confirmation of the innovation; (b) *innovativeness*, the degree to which an individual is relatively earlier in adopting new ideas than other members of a system; and (c) an innovation's *rate of adoption*, the relative speed with which an innovation is adopted by members of a system (Rogers, 2003).

5. The diffusion of innovations field emphasizes interpersonal communication networks more than any other type of communication research. From the first diffusion studies conducted about 60 years ago, the nature of diffusion was found to be essentially a social process involving interpersonal communication among similar individuals (Rogers & Kincaid, 1981; Rosen, 2002; Valente, 1995, 2006). A person evaluates a new idea and decides whether or not to adopt it on the basis of discussions with peers who have already adopted or rejected the innovation. The main function of mass media communication in the diffusion process is to create awareness—knowledge about the innovation. Study of the diffusion of innovations involves both mass communication and interpersonal communication, and thus spans the dichotomy that otherwise

divides communication into two subdisciplines. These dichotomies blur further when diffusion occurs through the Internet, cell phones, and Blackberry devices.

Background of Diffusion Research

The study of the diffusion of innovations in its present-day form can be traced from the theories and observations of Gabriel Tarde, a French sociologist and legal scholar (Rogers, 2003). Tarde originated such key diffusion concepts as opinion leadership, the S-curve of diffusion, and the role of socioeconomic status in interpersonal diffusion, although he did not use such concepts by these names. Such theoretical ideas were set forth by Tarde (1903) in his book, *The Laws of Imitation*.

The intellectual leads suggested by Tarde were soon followed up by anthropologists, who began investigating the role of technological innovations in bringing about cultural change. Illustrative of these anthropological studies was Clark Wissler's (1923) analysis of the diffusion of the horse among the Plains Indians. As in other anthropological works, the emphasis was on the consequences of innovation. For example, Wissler (1923) showed that adding horses to their culture led the Plains Indians, who had lived in peaceful coexistence, into a state of almost continual warfare with neighboring tribes.

The basic research paradigm for the diffusion of innovations can be traced to Bryce Ryan and Neal C. Gross's classic 1943 study of the diffusion of hybrid seed corn among Iowa farmers. This investigation was grounded in previously conducted anthropological diffusion work, which Ryan had studied while earning his doctoral degree at Harvard University, prior to becoming a faculty member in rural sociology at Iowa State University, where Gross was a graduate student. We discuss the hybrid corn study in detail later in this chapter.

During the 1950s many diffusion studies were conducted, particularly by rural sociologists at land-grant universities in the Midwestern United States. They were directly influenced by the Ryan and Gross investigation. As soon as communication study began to be institutionalized, this new breed of scholars became especially interested in the diffusion of news events, particularly through an influential study by Paul J. Deutschmann and Wayne A. Danielson (1960).

Communication Research on Diffusion

Deutschmann, a former newspaper reporter and editor, earned his doctorate in communication at Stanford University, gaining competence in quantitative methods, communication theory, and social psychology. He became a friend and research collaborator with Danielson, his fellow doctoral student at Stanford, and an individual with a similar background of professional newspaper experience.

Ev Rogers met Danielson in 1959 at the newly established Department of Communication at Michigan State University, where Deutschmann showed him the S-shaped diffusion curves for the spread of the news events that he was then studying. Compared to the diffusion curves for the agricultural innovations that Rogers was investigating, the news events spread much more rapidly. As Deutschmann stated at the time, this was "damn fast diffusion" (personal communication). Thanks to Deutschmann and Danielson's (1960) article on the diffusion of news events, this research topic became popular among communication scholars. Work on this topic has ebbed considerably, although spectacular news events—such as 9/11 or the 2003 space shuttle Columbia disaster—continue to attract scholars (Rogers & Seidel, 2002; Singhal, Rogers, & Mahajan, 1999).

In the early 1960s, Deutschmann moved to San José, Costa Rica, and collaborated with Dr. Orlando Fals Borda, a sociologist at the National University of Colombia in Bogotá, who

had been studying diffusion patterns in the Colombian village of Saució, a small Andean community of 71 farm households. Deutschmann and Fals Borda's (1962) diffusion study in Saució represented one of the first diffusion investigations in a developing nation. Soon there would be several hundred such diffusion studies, many conducted by communication scholars. The six agricultural innovations of study in Saució (such as chemical fertilizer, a new potato variety, and a pesticide) had been introduced in previous years by Fals Borda, who acted as an agricultural *change agent*—or one who introduced innovations to the public. The familiar S-shaped curve characterized the rate of adoption for each of these innovations in the Colombian village (Deutschmann & Fals Borda, 1962).

Deutschmann's study with Fals Borda in Colombia stimulated interest among communication scholars in the diffusion of technological innovations. He attracted doctoral students to Michigan State University who were interested in diffusion research. When Deutschmann's life was cut short in 1962, Everett Rogers was hired as his replacement at Michigan State University to continue diffusion research in developing nations. The number of diffusion studies completed by communication scholars has expanded rapidly since 1960. By mid-2007, an estimated 600 diffusion publications by communication scholars were available out of the cache of 6,000 diffusion studies,³ more than any other diffusion research tradition after rural sociology and marketing. Unlike rural sociologists, who are mainly concerned with agricultural innovations, or education diffusion scholars, who are interested in new educational innovations (for example, modern math or the multicultural curriculum), communication scholars investigate a wide range of different types of technological innovations. Communication scholars are interested in diffusion as a communication *process*, independent of the type of innovations that are diffused.

The Iowa Hybrid Seed Corn Study

When Ryan arrived in Ames, Iowa, in 1938, he was intrigued with the scholarly question of noneconomic influences on economic behavior. This issue had become important to him during his doctoral studies in the Department of Sociology at Harvard University, where Robert K. Merton, a young faculty member who had recently completed his own dissertation research on the sociology of science, was Ryan's doctoral advisor. The Harvard doctoral program in sociology was relatively new, and somewhat interdisciplinary in nature. Students earning degrees in sociology were encouraged to take courses in economics, anthropology, and in social psychology. Professor Talcott Parsons, the intellectual leader of Harvard sociology, had been trained in economics in Europe and helped introduce the theories of Vilfredo Pareto to American sociology. This interdisciplinary intellectual background was good preparation for Ryan, the individual who, more than any other, was to formulate the paradigm for research on the diffusion of innovations.

Iowa State University was an agricultural college, and so Ryan decided to investigate the diffusion of hybrid seed corn. This innovation was a profoundly important new idea for Iowa farmers, leading to increased corn yields of about 20 percent per acre. Ryan received funding for his proposed study of the diffusion of hybrid seed from the Iowa Agricultural Experiment Station, Iowa State University's research and development organization, which had played an important role in developing hybrid seed. This important innovation had spread widely to Iowa farmers in previous years, but Iowa State administrators were concerned that such an obviously advantageous agricultural technology had required so many years (about a dozen) for widespread use. This type of frustration on the part of officials who cannot understand why a seemingly advantageous innovation is not adopted more immediately explains why many diffusion studies continue to be sponsored.

Ryan collaborated with several economics professors at Iowa State University in designing the hybrid corn study, and his familiarity with anthropological research also affected the study's

design. However, Ryan proposed the seed corn study mainly as a survey relying on questionnaire-generated data, rather than using the ethnographic approaches of the previous anthropological research.

A newly arrived master's student at Iowa State, Neal C. Gross, was assigned as Ryan's research assistant. Ryan told Gross that if he would personally interview the several hundred farmers in the two Iowa communities of study, he could use the data for his master's thesis. Gross, who came from an urban background, was unfamiliar with the ways of Iowa farmers. Someone told Gross that farmers began work early in the morning, so he appeared at the farmstead of his first respondent at 4 a.m.⁴

The choice of hybrid seed corn as the innovation of study in the Ryan and Gross investigation was to cast a long intellectual shadow over future generations of diffusion scholarship. Hybrid seed was an overwhelmingly beneficial innovation, boosting corn yields considerably. Given the sponsorship of the hybrid corn study, it is understandable that Ryan and Gross tended to assume that Iowa farmers ought to adopt the innovation, and that the rate of adoption should have been more rapid. This proinnovation bias still characterizes most diffusion studies today. Ryan and Gross (1943) indicated their surprise that the diffusion of hybrid corn required 12 years to reach widespread diffusion, and that the average farmer needed seven years to progress from initial awareness of the innovation to full-scale adoption (indicated by planting all of the corn acreage on his farm in hybrid seed).

Stated another way, the hybrid corn study demonstrated just how difficult it was for most individuals to adopt an innovation. Hybrid corn had to be purchased from a seed corn company, at a price per bushel not trivial to Iowa farmers in the Depression years. Further, adopting the innovation meant that Iowa farmers no longer selected the more beautiful-appearing ears of corn for use as seed the following year. So the adoption of hybrid corn meant the unadoption of a previously existing practice, the visual selection of open-pollinated seed. Hybrid corn was one of the first of the new wave of scientifically based farm innovations that were to radically change the nature of Midwestern agriculture in the ensuing decades. In 1939, Iowa farmers were not accustomed to agricultural innovations that were later to flow from the land-grant universities like Iowa State and the U.S. Department of Agriculture.

Iowa State University was the perfect place for founding the paradigm for diffusion research in yet another sense: Ames was the principal point of importation for the introduction of statistical methods in America. These techniques for quantitative data analysis began among agricultural statisticians such as Sir Ronald Fisher and Karl Pearson in England. They were created to test hypotheses about the effects of fertilizers, new crop varieties, and livestock rations. Such statistical methods as analysis of variance and regression came to the United States in the early 1930s when Sir Ronald visited Iowa State University, where he helped establish the Statistical Laboratory. George Snedecor, leader of the Iowa State program in statistics, named the F statistic (for determining the significance of analyses of variance and regression) after Fisher. Snedecor popularized statistical methods for agricultural research in his book, *Statistical Methods* (1931). Iowa State's Statistical Laboratory went on to develop the area sampling methods widely used in survey research. Professors in the Department of Statistics, such as Paul G. Homemeyer, Ray J. Jessen, and Snedecor, served as informal consultants to Ryan in planning the hybrid corn study, and this pioneering diffusion investigation was designed as a highly quantitative analysis, utilizing statistical methods to test hypotheses. As noted earlier, this was a marked departure from anthropological ethnographic diffusion research.

In the late 1930s sociological research in the United States was moving toward quantification, away from the qualitative methods that had been pioneered by the Chicago School in the 1915 to 1935 era (Rogers, 2003). Sociologists thought that to become scientific was to pattern themselves after the biological and physical sciences, at least in their research methods. This

move to quantification implied the use of individuals as units of response and as units of analysis, so that statistical methods, borrowed from agricultural-biological research, could be utilized in sociological studies.

Ryan and Gross's hybrid corn diffusion research expressed this sociological search for scientific respectability in its choice of methods. Data were gathered by personal interviews with all of the farmers in the two Iowa communities of Jefferson and Grand Junction (by coincidence, these communities were located within 30 miles of where Rogers grew up on a farm). Each farmer was regarded by the two rural sociologists as a decision-making unit for the adoption of hybrid corn.

The focus on individual farmers led to the greatest shortcoming of the hybrid corn investigation. Sociometric questions to measure the interpersonal network links among the Iowa farmers of study were not asked. This mistake is all the more puzzling given that diffusion is essentially a social process. While the mass media often create awareness-knowledge of an innovation, interpersonal communication with peers is necessary to persuade most individuals to adopt a new idea (Rogers & Kincaid, 1981).

Ryan and Gross gathered data from a complete census of the farmers in Jefferson and Grand Junction, Iowa, an ideal sampling design for measuring network links and thus for determining peer influences on farmers' decisions to adopt the innovation. The farmer-respondents were asked about the sources and channels from which they first learned about hybrid corn (commercial seed dealers and salespeople were mentioned as most important) versus the sources and channels that convinced them to adopt (other farmers like neighbors and friends were reported as most important). So Ryan and Gross established the importance of social networks in diffusion, but failed to investigate them in an appropriate way.

Applying the Diffusion Model in San Francisco's STOP AIDS Program

In the early days of the AIDS epidemic in San Francisco, in 1981 and 1982, considerable disagreement existed within the gay and bisexual community about how to cope with HIV/AIDS. By 1992, an astounding 48 percent of them in this city were HIV-positive. Some outspoken individuals questioned whether sexual behavior spread HIV (they suspected that straight society was using the AIDS threat to close the San Francisco bathhouses, in order to limit the sexual freedom of gay men). Eventually, gay organizations pulled together to combat the epidemic through the STOP AIDS program, founded by gay San Franciscans. It was based on social psychologist Kurt Lewin's small group communication theory and on diffusion of innovations theory (Rogers, 2003).

Focus group interviews were initially conducted by STOP AIDS in order to assess how much gay men already knew about the epidemic, and what they wanted to know (Singhal & Rogers, 2003). This formative research was carried out in order to design an effective intervention. Gradually, the STOP AIDS founders realized that the focus group interviews were having a strong educational effect on the participants, as the group members exchanged useful information about HIV prevention. Men were recruited on Castro and other streets in gay neighborhoods to attend the small group meetings that were held in homes and apartments. STOP AIDS employed a cadre of outreach workers to organize and lead these meetings.

STOP AIDS "relied heavily on diffusion theory, which suggests that only those early adopters, who make up a relatively small segment of the population, need to initiate a new behavior for it to spread throughout the population" (Wohlfeiler, 1998, p. 231). A well-respected individual who was HIV-positive led each small group of a dozen or so gay and bisexual men. The means of transmission of the virus were explained, and individuals were urged to use condoms and/or to seek monogamous partnerships. Questions were asked and the answers were discussed by the group. At the conclusion of the meeting, each member was asked to make a commitment to safer sex, and to volunteer to organize and lead future small-group meetings of other gay men (such

commitment, witnessed by other members of a group, is part of the Lewinian social psychology of individual behavior change).⁵

From 1985 to 1987, STOP AIDS reached 30,000 men through its various outreach activities, with 7,000 of these individuals participating in the small-group meetings that launched the diffusion process in the gay community. A media campaign was aimed at the gay population of San Francisco to raise awareness-knowledge about HIV/AIDS. The number of new HIV infections dropped from 8,000 annually in the earliest years of the epidemic, to only 650 by the mid-1980s. Then attendance at the small-group meetings fell off, and it became difficult for STOP AIDS to recruit fresh volunteers. The critical mass of early adopters of safer sex in the gay community had been reached, and the idea of safer sex would continue to spread spontaneously thereafter. STOP AIDS declared victory in 1987, and closed down its local operations. In 1990, however, STOP AIDS swung back into action in San Francisco in order to carry the safer sex message to new cohorts of younger gay men who were migrating to the city (Rogers, 2004).

San Francisco was one of the first cities in the world in which prevention programs caused a major decrease in the rate of new HIV infections. Unfortunately, by the late 1980s, about half of the gay and bisexual men in San Francisco were infected and were on their way to AIDS-related deaths. Nevertheless, further infection was greatly slowed.

Why was STOP AIDS so successful in bringing about this massive sexual behavior change? This intervention (1) was highly targeted to a specific population of high-risk individuals; (2) it was founded and implemented by respected leaders of the target community, rather than by "outside" professional organizers and educators; (3) it depended mainly on volunteer leaders, which kept costs low; and (4) the intervention was based on two theories of behavior change communication: Lewin's theory of small group communication and individual commitment, and Rogers' diffusion of innovations theory (2003). These theories provided a basis for the communication strategies utilized in the STOP AIDS intervention in San Francisco, and subsequently in other parts of the world (Singhal & Rogers, 2003; Svenkerud, Singhal, & Papa, 1998).⁶

The Dominant Paradigm for the Diffusion of Innovations

One can still detect the intellectual influence of the hybrid corn study on diffusion research, 64 years and some 6,000 publications later. More than any other diffusion investigation, the Ryan and Gross study formed the paradigm for later diffusion research. What were the essential elements of this diffusion paradigm?

1. The main dependent variable was innovativeness, defined as the degree to which an individual or other unit is relatively earlier to adopt than are others. For convenience in understanding diffusion research results, the continuous variable of innovativeness is often divided into adopter categories, such as innovators, early adopters, early majority, late majority, and laggards (Rogers, 1983). Ryan and Gross (1943) were the first to use adopter categories in their analysis (although they did not use these five categories by name).
2. When the cumulative number of farmers adopting hybrid corn was plotted over time, the distribution formed an S-shaped curve. When plotted on a frequency basis, the number of adopters over time formed a normal, bell-shaped curve (which later scholars utilized to divide the variable of innovativeness into the five adopter categories in a standard way).
3. The Iowa farmers' sources and channels of communication were found to differ at various stages in the innovation-decision process with the mass media more important at the awareness-knowledge stage and with interpersonal communication, especially from peers, more important at the persuasion stage. The notion of stages in the individual's innovation-decision process has been widely utilized by later diffusion scholars (Rogers, 1983).

The importance of the hybrid corn study in forming the paradigm for work on the diffusion of innovations is illustrated by Diane Crane's (1972) analysis of the invisible college of rural sociology diffusion researchers: 18 of the 30 most important scholarly innovations in the field were reported in the Ryan and Gross (1943) study. Each intellectual innovation consisted of the first time that either a dependent or an independent variable was used in an empirical study of diffusion. Thus, the methods of study, as well as what to look for in diffusion investigations, were established by Ryan and Gross.

Because of World War II, the diffusion paradigm created by Ryan and Gross did not spread immediately among rural sociologists. A decade-long delay, until the mid-1950s, resulted from Gross's serving in the Navy while Ryan worked for a United Nations agency (he did not return to the faculty at Iowa State University after World War II). Two other Iowa State rural sociologists, George M. Beal and Joe M. Bohlen, popularized the diffusion paradigm, starting in 1954, and soon this approach to studying the diffusion of agricultural innovations was taken up by a widening circle of rural sociologists, especially at land-grant universities in the Midwestern states. By 1960, some 405 diffusion publications had appeared, with the largest number authored by rural sociologists. However, this diffusion research tradition soon ran out of intellectual gas, and thereafter fewer and fewer diffusion studies were conducted by rural sociologists.

Spread of the Diffusion Paradigm

Meanwhile, the diffusion approach infected the other social sciences, and spread to other fields such as marketing, industrial engineering, and education. The key event in this wider acceptance was James S. Coleman, Elihu Katz, and Herbert Menzel's 1966 study of the diffusion of tetracycline, a new medical drug, among physicians. This investigation began when the director of marketing at the Pfizer drug company approached the three sociologists, then at Columbia University's Bureau of Applied Social Research, with a request to determine the effectiveness of Pfizer's tetracycline advertising in medical journals. This rather humdrum marketing question was converted into a particularly influential diffusion study by Coleman et al. (1966).

They collected data via personal interviews with virtually all of the medical doctors in four small communities in Illinois. Prescription data were also collected from pharmacies, so they knew the date when each doctor first prescribed the new drug. This represented an important methodological improvement—observed actual adoption—over the usual diffusion investigation, which depended upon respondent accuracy in recalling the date at which an innovation was adopted. Further, Coleman et al. asked sociometric questions to determine the interpersonal network links among their sample. Interestingly, they were not aware of Ryan and Gross's hybrid seed corn study until after they had completed their data-gathering.

The rate of adoption of tetracycline followed an S-shaped curve, as had the rate of adoption for hybrid corn, although only 17 months elapsed before most doctors had adopted (compared to 12 years for the Iowa farmers adopting hybrid seed). The most innovative medical doctors were cosmopolite, making numerous out-of-town trips to medical specialty meetings. Similarly, the farmer-innovators in the hybrid corn study made numerous trips to Des Moines, the largest city in Iowa, located about 90 miles away. As with the Iowa farmers, mass media channels (such as articles in medical journals) were most important in creating awareness-knowledge, while interpersonal communication channels with peers were most important in persuading a doctor to try the medical innovation.

By far the most unique intellectual contribution of the medical drug study was the evidence that it provided of diffusion as a social process. For instance, Coleman et al. (1966) found that doctors who were linked in more interpersonal networks adopted the innovation more rapidly than did more isolated doctors. Even though tetracycline had been scientifically evaluated in numerous clinical trials, which were reported to the medical doctors of study in medical journals, and even though Pfizer salespeople gave them free samples, they evaluated the innovation mainly through the personal experiences of their fellow doctors. An early adopting doctor might tell his office partner, a social friend, or a golfing partner, "Look doctor, I prescribed tetracycline to several patients of mine last week and it acted like a miracle drug. Perhaps you should try it." Thus, the meaning of the medical innovation was socially constructed through interpersonal communication among peers. Since the Coleman et al. (1966) medical drug study, many other diffusion researches (i.e., Anwal & Singhal, 1992; Rogers & Kincaid, 1981) have gathered network data to better understand the social influences on individual's innovation-decisions.

The Bureau of Applied Social Research at Columbia University was a particularly prestigious center for social science research at the time of the drug study, and Coleman and Katz were soon to become much-admired scholars. The diffusion paradigm spread rapidly and was utilized by other sociologists. Publication of a general textbook about diffusion (Rogers, 1962) helped widen paradigm application in such fields as geography, economics, psychology, political science, and, as related previously, communication.

Research Methods for Studying Diffusion

Most diffusion researchers have followed the methodological path set forth by Ryan and Gross in the hybrid corn study. Data are mainly gathered by personal or telephone interviews from respondents who are asked to retrospect about their time of adoption, the sources or channels of communication that they used in the innovation-decision process, to report their network links with others, and other variables such as their personal and social characteristics. The individual is usually the unit of analysis, although in recent years a number of studies have been conducted in which an organization is the unit of analysis (Wildemuth, 1992; Zaltman, Duncan, & Holbek, 1973). Inadequate scholarly attention has been given to the consequences of technological innovations (only anthropologists have investigated such consequences in any significant way).

Alternative methods of data gathering have been little utilized, even as a means to supplement the predominant approach of survey data gathering and quantitative methodologies of data analysis. One wonders why ethnographic methods like in-depth interviews and observation have not been utilized more widely, especially in the organizational innovation studies—many of which are conducted by organizational communication scholars and by students of organizational behavior, both of whom increasingly utilize ethnographic methods. The dominant style of diffusion investigations is thus the quantitative analysis of data gathered by survey interview methods from large samples. The overall effect of these dominant research methods has been to emphasize an understanding of the diffusion process as the product of individual decisions and actions. Interpersonal influences on individuals in the diffusion process have been underemphasized because of the research methods used. Perhaps the approach to studying diffusion formulated by Ryan and Gross has become overly stereotyped.

However, in recent years, several communication scholars have investigated the critical mass and individual thresholds in the diffusion process, especially for the spread and adoption of interactive innovations such as electronic mail or fax in an organization or in some other system (Kramer, 1993; Markus, 1987). At a certain point in the diffusion process for any innovation, the

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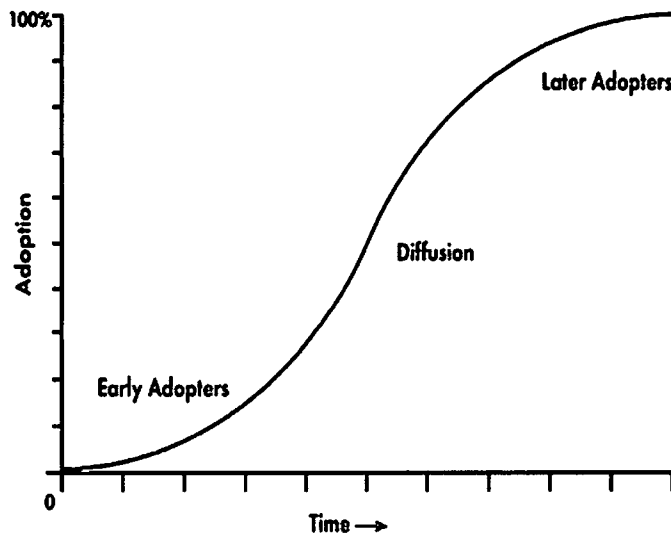


Figure 27.1 The diffusion S-curve. Reprinted from *Diffusion of Innovations* (4th ed., p. 11) by E. M. Rogers, 1995, New York: Free Press. Copyright 1995 by E. M. Rogers. Reprinted with permission of the author.

rate of adoption begins to suddenly increase at an inordinate rate. This take-off in the rate of adoption creates the S-curve of diffusion (see Figure 27.1).

However, for innovations that are essentially a means of interactive communication, such as the new communication technologies of fax and e-mail, a critical mass occurs when the diffusion process becomes self-sustaining. After the critical mass point, individuals in a system perceive that “everybody else” has adopted the interactive innovation. With each successive adopter of an interactive innovation, the new idea becomes more valuable not only for each future adopter, but also for each previous adopter.

For example, consider the first adopter of the telephone in the United States about 120 years ago. This innovation had zero utility to the first adopter. But when a second adoption occurred, the innovation became more valuable to both parties. And so it went until gradually there were so many adopters that an individual could assume that anyone he or she might wish to call would also have a telephone. Note that the first adopters of the telephone had a very low threshold of resistance to the innovation (they adopted when there was little actual benefit for doing so). Valente (1995) reanalyzed the Coleman et al. data in light of such concepts as the critical mass and individual thresholds, which he helped formulate and sharpen theoretically. Perhaps Allen (1983) said it all when he described the diffusion process for an interactive innovation as one in which “everyone is watching while being watched” (p. 270).

Future Directions: Inside-Out Diffusion

Perhaps one might wonder why diffusion research has persevered for so many years, and why the number of diffusion publications continues to grow. Few other areas of communication research have such a lengthy history and represent such a tremendous scholarly outpouring. We suggest that the popularity of diffusion research is due to its practical importance and its applied nature. The agricultural officials at Iowa State University in the late 1930s who sponsored the hybrid corn study have contemporary counterparts in other organizations who are equally frustrated

The Internet: A Spectacular Innovation

The Internet has spread more rapidly than any technological innovation in the history of mankind, removing the physical, spatial distance in who talks to whom about a new idea (Rogers, 2003).

The origins of the Internet trace to the Cold War era. Because the U.S. Pentagon feared a nuclear attack from the Soviet Union, computer scientists designed and implemented ARPANET, the predecessor of the Internet, without a central headquarters. Each networked computer passes along a message to another computer in the direction of the message's destination (indicated by its address) by means of a wired or wireless connection with no predetermined or prescribed route. Thus an e-mail message on an Internet server from Hanoi, Vietnam to San Francisco may travel through any one of millions of possible routes (Singhal & Rogers, 2001).

This computer network, ARPANET, designed for national defense purposes, evolved into the Internet by the late 1980s, when the number of users in the United States, and then in other countries, began to explode. Compared to other communication channels like postal mail or long distance telephone calls, communication via the Internet is quicker, cheaper, and more reliable. A very rapid rate of adoption of the Internet, including the World Wide Web, occurred during the 1990s, in large part because of the prior adoption of personal computers through which the Internet was accessed. Many observers consider the Internet one of the great transformational technologies (ranking with the steam engine, railroads, electricity, etc.) that at first challenged, and then fundamentally changed, the way that people learn, play, create, communicate, and work.

By September, 2007, the Internet had 1.24 billion worldwide users—that is, about 19 percent of the world's population. The United States and Canada account for about 18 percent of all users, down from 62 percent in 1998, as the Internet continues to make rapid inroads in countries of Asia, Africa, and Latin America.⁷ This massive adoption of the Internet in developing countries is largely fueled by the establishment of cyber cafes, telecenters, and public access facilities; that is, to be an Internet user one no longer needs to own a personal computer.

Among millions of applications, the Internet spawned the era of e-business (electronic business), which consists mainly of e-marketing and e-commerce. *E-marketing* is the use of the Internet to market one's products or services; *e-commerce* is commercial transactions between two parties on the Internet. Almost \$10 trillion of commercial transactions had occurred on the Internet by 2007.

The growth of the Internet has boosted interest in the study of diffusion, especially the study of communication networks. Unlike in the pre-Internet era when communication networks were ephemeral and difficult to capture, the Internet keeps an electronic record of human message exchanged. So, the proliferation of the Internet has also made possible a better understanding of how communication networks work in the spread of an innovation.

as to why their innovations are not adopted more rapidly; thus, diffusion studies continue to flourish.

The classical diffusion paradigm has been criticized for reifying expert-driven, top-down approaches to address problems and thus, by default, overlooking, and rejecting local solutions (Papa, Singhal, & Papa, 2006; Singhal & Dearing, 2006). Diffusion of innovation experts now

increasingly (and humbly) acknowledge the value of local expertise and indigenous wisdom in finding culturally appropriate solutions to community problems. One such inside-out approach to innovation diffusion is exemplified by the positive deviance approach.

Positive deviance (PD) is an approach to social change that enables communities to discover the wisdom they already have, and then to act on it (Pascale & Sternin, 2005; Sternin & Choo, 2000). PD initially gained recognition in the work of Tufts University nutrition professor Marian Zeitlin in the 1980s, when she began focusing on why some children in poor communities were better nourished than others (Zeitlin, Ghassemi, & Mansour, 1990). Zeitlin's work privileged an assets-based approach, identifying what's going right in a community in order to amplify it, as opposed to focusing on what's going wrong in a community and fixing it.

Jerry Sternin, a visiting scholar at Tufts University, and his wife Monique built on Zeitlin's ideas to organize various PD-centered social change interventions around the world. They institutionalized PD as an organizing for social change approach by showing how it could be operationalized in a community-setting (Papa, Singhal, & Papa, 2006).

In 1991, the Sternins faced what seemed like an insurmountable challenge in Vietnam. As Director of Save the Children in Vietnam, Jerry was asked by government officials to create an effective, large-scale program to combat child malnutrition and to show results within six months. More than 65 percent of all children living in Vietnamese villages were malnourished at the time. The Vietnamese government realized that the results achieved by traditional supplemental feeding programs were rarely maintained after the programs ended. The Sternins had to come up with an approach that enabled the community to take control of their nutritional status. And quickly!

Building on Zeitlin's ideas of PD, the Sternins helped in seeking out poor families that had managed to avoid malnutrition without access to any special resources. These families were the positive deviants. They were "positive" because they were doing things right, and "deviants" because they engaged in behaviors that most others did not. The Sternins helped the community to discover that mothers in the PD families collected tiny shrimps and crabs from paddy fields, and added those with sweet potato greens to their children's meals. These foods were accessible to everyone, but most community members believed they were inappropriate for young children (Sternin & Choo, 2000). Also, these PD mothers were feeding their children three to four times a day, rather than the customary twice a day.

The Sternins helped the community members create a program that allowed them to emulate the positive deviants in their midst. Mothers, whose children were malnourished, were asked to forage for shrimps, crabs, and sweet potato greens, and in the company of other mothers were taught to cook new recipes that their children ate right there. Within weeks, mothers could see their children becoming healthier. After the pilot project, which lasted two years, malnutrition had decreased by an amazing 85 percent in the communities where the PD approach was implemented. Over the next several years, the PD intervention became a nationwide program in Vietnam, helping over 2.2 million people, including over 500,000 children improve their nutritional status (Sternin & Choo, 2000; Sternin, Sternin, & Marsh, 1999).

Positive deviance questions the role of outside expertise, believing that the wisdom to solve the problem lies inside. Social change experts, usually, make a living discerning the deficits in a community, prioritizing the problems, and then trying to implement outside solutions to change them. In the PD approach, the role of experts is to find positive deviants, identify the uncommon but effective things that positive deviants do, and then to make them visible and actionable (Pascale, Milleman, & Gioja, 2000). PD is led by internal change agents who present the social proof to their peers. In PD, the role of the expert is mainly to facilitate a process that can help amplify this wisdom locally. In so doing, solutions and benefits can be sustained, since the solution resides locally.

The PD approach emphasizes hands-on learning and actionable behaviors.⁸ As Jerry Sternin notes: "It is easier to act your way into a new way of thinking than to think your way into a new way of acting" (quoted in Sparks, 2004). So, the PD approach turns the well-known KAP (knowledge, attitude, practice) framework on its head. As opposed to subscribing to a framework that says increased knowledge changes attitudes, and attitudinal changes change practice; PD believes in changing practice. PD believes that people change when that change is distilled from concrete action steps.

Evaluations of PD initiatives show that PD works because the community owns the problem, as well as its solutions (Sternin, 2003). Positive deviance is now being used to address such diverse issues as childhood anemia, the eradication of female genital mutilation, curbing the trafficking of girls, increasing school retention rates, and promoting higher levels of condom use among commercial sex workers (Sternin, 2003).

The positive deviance approach to innovation diffusion is located at the intersection of theory, method, and praxis. Theoretically, it privileges local knowledge. Methodologically, PD does not treat deviance as an anomaly. In contrast to traditional diffusion approaches that favor "regression to the mean," PD valorizes outliers. PD's praxis is humane. It believes in inside-out social change with the help of outside expertise and facilitation.

When author Singhal visited Jerry and Monique Sternin in their Cambridge home in January 2005, they were making preparations to travel to Davos, Switzerland to conduct a Positive Deviance workshop at the World Economic Forum. When Singhal noted that PD was "going places," Jerry winked and responded: "Yes, the world could do better with more deviance."

Conclusion

Diffusion of innovations research promises to enhance our understanding of how social change occurs, a fundamental issue for all scholars of society. What is the role of technology in bringing about social change? One way to find out is through diffusion research, a microlevel type of study of the macrolevel issue of social change. Scholarly interest in new communication technologies by communication students has given a special boost to interest in diffusion research in recent years. There is no reason to expect that the scholarly popularity of diffusion research by communication (and other) scholars will decrease in the foreseeable future. Innovations continue to be generated and studied.⁹

However, we do not need more-of-the-same diffusion research (Meyer, 2004). The overwhelming focus on the individual as the unit of adoption needs to be broadened to the levels of organizations and communities-of-practice. More scholarly attention needs to be paid to the consequences of technological innovations. Alternative methods of data gathering including ethnography, in-depth interviews, and participant observation should supplement the predominant quantitative methodologies of data collection and analysis.

Also, diffusion of innovations practice needs to increasingly acknowledge and value the role of indigenous wisdom and solutions. Indeed innovations that are generated locally are not just more likely to be culturally appropriate, but also more likely to be owned by the potential adopters. When adopters are externally persuaded to buy into the vision of an outside expert, they tend to demonstrate inertia and resistance, much like the Iowa farmers who for years resisted the adoption of hybrid seed corn.

Everett M. Rogers and Diffusion of Innovations

This chapter is dedicated to our senior co-author Everett M. Rogers, a prolific scholar of communication and social change and a wonderful human being, who passed away in Albuquerque, NM in October 2004. Best known for his book, *Diffusion of Innovations* (published in the fifth edition in 2003), Ev Rogers' life—all 73 years—represented a curious engagement with the topic of innovation diffusion.

The story begins on the family Pinehurst Farm in Carroll, Iowa, where Ev Rogers was born on March 6, 1931.¹⁰ The Great Depression was raging, and life on Pinehurst Farm was tough for everyone, especially for young Ev, who was responsible for carrying out such daily chores as milking cows, feeding chickens, and cleaning the barn. Ev credited that daily hard work ethic, learned early on an Iowa farm, for his illustrious scholarly career, complete with 36 books, over 300 peer-reviewed essays, and countless research reports.



Who would now believe that Ev almost never went to college? He would have stayed home and farmed if it were not for Pep Martens, a high school teacher, who packed a bunch of promising seniors in his car and drove them to Ames, Iowa, the home of Iowa State University. It was Ev's first visit to Ames, located 60 miles from the family farm. Ev liked Ames, and decided to pursue a degree in agriculture.

Iowa State in those years had a great intellectual tradition in agriculture and in rural sociology. Numerous agricultural innovations were generated by scientists at Iowa State. Rural sociologists—including Bryce Ryan and George Beal, Ev's doctoral advisor—were conducting pioneering studies on the diffusion of these innovations—like the high-yielding hybrid seed corn, chemical fertilizers, and weed sprays. Questions were being asked about why some farmers adopted these innovations, and some did not. These questions intrigued Ev.

At the farm, Ev remembers that his father loved electro-mechanical farm innovations; but was resistant to biological-chemical innovations such as the new hybrid seed corn, even though it yielded 20 percent more crop, and was resistant to drought. However, during the Iowa drought of 1936, while the hybrid seed corn stood tall on the neighbors' farm; the crop on the Rogers' farm wilted. Ev's father was finally convinced. It took him eight years to make up his mind.

These questions about innovation diffusion, including the strong resistances, and how they could be overcome, formed the core of Ev's graduate work at Iowa State University in the mid-1950s. Ev's doctoral dissertation sought to analyze the diffusion of the 2-4-D weed spray (and a cluster of other agricultural innovations) in Collins, Iowa, a community close to Pinehurst Farm. In the review of literature chapter, Ev reviewed the existing studies of the diffusion of all kinds of innovations—agricultural innovations, educational innovations, medical innovations, and marketing innovations. He found several similarities in these studies. For instance, innovations tend to diffuse following an S-Curve of adoption.

In 1962, Ev published this review of literature chapter, greatly expanded, enhanced, and refined, as the *Diffusion of Innovations* book. He argued that diffusion was a general process, not bound by the type of innovation studied, by who the adopters were, or by

place or culture. By reviewing diffusion studies across a range of disciplines, he concluded that the diffusion process displayed patterns and regularities, across a range of conditions, innovations, and cultures (Rogers, 2004).

The book provided a comprehensive theory of how innovations diffused, or spread, in a social system. The book's appeal was global (Hornik, 2004). Its timing was uncanny. National governments of newly independent countries of Asia, Africa, and Latin America were wrestling with how to diffuse agricultural, health, and family planning innovations in their newly independent countries (Barker, 2004; Bertrand, 2004; Haider & Kreps, 2004; Murphy, 2004). Here was a theory that was useful. During the 1960s and 1970s, for every copy of *Diffusion of Innovations* that was purchased in the U.S., Ev estimated that four were being purchased in countries of Asia, Africa, and Latin America.

When the first edition of *Diffusion of Innovations* was published, Ev was 31 years old. But he had also become a world-renowned academic figure. As per the Social Science Citation Index, *Diffusion of Innovations* is the second most cited book in the social sciences.

Not bad for an Iowa farm boy who almost did not go to college!

Notes

1. Founded in 1980, Dancing Wheels has performed, taught, and inspired children and adults of all (dis)abilities. In the United States, the company presents more than 100 performances reaching audiences of 125,000 each year. Co-author Quinlan performed with Dancing Wheels in June 2007. Retrieved June 18, 2008, from <http://www.gggreg.com/DW/pages/company.htm>
2. This case is discussed in detail in Singhal and Quinlan (in press).
3. No other field of behavior science research represents more effort by more scholars in more disciplines in more nations (Rogers, 2003).
4. Gross averaged 14 personal interviews per day during the summer of 1939, an enviable record for survey research by today's standards.
5. Kurt Lewin was a German-born scholar who migrated to the United States in the 1930s in order to escape Hitler's fascism. Lewin fathered the modern field of social psychology.
6. Another behavior change theory, which was implicitly involved in the STOP AIDS program's use of opinion leaders, was Albert Bandura's (1986, 1997) social learning/social modeling/social cognitive theory. DiFrancisco and others (1999) found that a national sample of 77 HIV prevention programs in the United States reported that Bandura's theory was the most widely used theoretical basis.
7. See <http://www.internetworldstats.com/stats.htm> (Retrieved November 15, 2007).
8. A positive deviance inquiry focuses on eliminating those client behaviors from the strategy mix that are true but useless (TBU). TBU is a sieve through which a facilitator passes the uncommon qualities of positive deviants to ensure that the identified practices can be practiced by everyone.
9. However, as Dearing (2004) and Dearing and Meyer (2006) argue, there is a strong tendency to "reward the new at the expense of the proven." Usually, heavy investment is made in generating "best practices" or innovations, and scant resources are then set aside to diffuse it.
10. This boxed case draws upon Singhal and Dearing (2006).

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