

**Diffusion Theory in an Internet Environment:
Testing Four Key Components**

by

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Abstract

How does diffusion theory operate in an Internet environment? A test of four key diffusion components - adopter categories, mass communication channels, cosmopolitan experience, and gender - was conducted among college students. Results confirmed Rogers' hypotheses for traditional media: innovators and early adopters read more online news and had more cosmopolitan experience than later adopters and laggards. The study also went beyond Rogers' predictions, showing that gender was not only a strong predictor of adopter categories but also an antecedent factor to the relationship between online news adoption and online news reading.

Introduction

In Rogers' (2003) most recent edition of *Diffusion of Innovations*, he warned that diffusion theory might perform differently in the Internet environment. The Internet might be changing the diffusion process in certain fundamental ways—for instance, removing or diminishing the role of spatial distance in who talks to whom about a new idea. Consequently, to define a social system becomes difficult, if not impossible. Second, Rogers wrote that the Internet functioned as both a mass communication channel (e.g. websites) and an interpersonal communication channel (e.g. e-mail). Thus, it blurred the distinction between the effects of mass communication and interpersonal communication. By examining online news behavior of college students, this study offers an opportunity to test the validity of these theoretical questions.

In terms of online news diffusion, only 15% of the population in 1995 read news on the Internet; eight years later, 58% read news online, making reading news the third most popular activity on the Internet (Pew Research Center, 2005). Was this dramatic increase in online news reading also taking place in the college student population—an age group traditionally disinterested in news? Historically, young adults (age 18 to 24) have paid less attention to news than older adults (Poindexter & McCombs, 2001). But with the advent of the Internet, there is some evidence that young adults were more likely than older adults to read news online (Hartman, 2003). Also, studies focusing exclusively on the college population have found that the longer students had been in college, the more likely they read or watched online news (Henke, 1985; O'Keefe & Spetnagel, 1973; Vincent & Basil, 1997). Although all young adults are not college students and all college students are not young, the college population and the newness of online news offer a unique opportunity to test diffusion theory's key components in an Internet environment.

Theoretical Framework

The emergence of the Internet urges many scholars to revisit classical theories and to test whether they hold in a new environment. Diffusion of innovations was first introduced by Everett Rogers in 1962. Today, there are more than 5,200 publications referencing his framework (Rogers, 2003). The significance of Rogers' diffusion theory

lies in the ability to profile adopters, identify diffusion channels, and make predictions. The present study wonders how diffusion theory operates in an Internet environment. Specifically, the study will answer how college students adopt online news through which channels and with what characteristics.

Four Key Components

Adopter Categories. Adoption of a technological innovation is a function of one's willingness to try a new idea. Thus, if online news is considered a *new* news channel, diffusion theory can predict who will be among the first to adopt it. Rogers (1962) in his first edition of *Diffusion of Innovations* defined innovativeness as "the degree to which an individual is relatively earlier to adopt new ideas than other members of his social system" (p. 159). Rogers identified five categories of adopters: innovators (the first 2.5%); early adopters (the next 13.5%); early majority (the next 34%); late majority (also 34%); laggards (the last 16%).

Mass Communication Channels. Different mass communication channels play different roles at different steps of the adoption process. In general, earlier adopters have greater exposure to mass communication channels. When innovators adopt a new idea, there is almost no one in their system familiar with the innovation. Innovators need to rely on mass communication channels to acquire new knowledge. Thus, Rogers (2003) hypothesized that "earlier adopters have greater exposure to mass media communication channels than do later adopters" (p.291). Here, Rogers means that more innovative individuals ought to have greater exposure to all mass media, not only to the one related to the innovation (personal interview, March 2, 2004). For example, innovators of online news should have higher exposure than later adopters to newspapers, radio and TV news, cable news etc..

Cosmopolitan Experience. Cosmopolitan experience is not a new component in diffusion theory but few studies work on this concept. Rogers (1962) mentioned that "it is obvious that the new idea must enter the social system from some source ... one individual is more cosmopolite [cosmopolitan] than another because he received the new idea from a source outside of the social system" (p.17). Cosmopolitan experience could

be obtained from mass communication channels (e.g. mass media carrying external sources) or from interpersonal communication channels (such as change agents, visits to places outside a social system, or outside visitors) as long as these channels convey messages external to a social system.

Demographics. According to Rogers (1962), earlier adopters have more years of formal education, higher social status, greater upward social mobility, and larger-sized estates. In terms of age and gender, Rogers said that there was no consistent evidence about a relationship with early adoption. Since college students are a relatively homogeneous group, gender is chosen as the only demographic variable. By testing gender as an antecedent variable, this study will investigate the effect of gender on online news adoption and online news reading.

Literature Review

Mass Communication Channels

Studies that have applied diffusion theory in *new* communication channels have produced contradictory results; they did not fully support Rogers' prediction that earlier adopters of one channel would also be heavier users of other channels. Regan (1987) found that adoption of a given media innovation was powerfully related to adoption of other technologies such as videotext, PCs, CDs and cable. LaRose and Atkin (1992) also reported that use of audio-text was related to functionally similar information services such as videotext and 1-900 numbers. However, Lin (1994) discovered the opposite pattern: videotext use was unrelated to use of other media. Jeffres and Atkin (1996) even found that the use of online services had no effects on other media use. Therefore, this study provides another opportunity to investigate the existence of such a relationship—earlier adoption of one mass communication channel and heavier use of all other ones.

Cosmopolitan Experience

Overall, few studies have paid attention to cosmopolitan experience. One of the pioneer studies about the urban-rural experience can be trace back to 1940s. Ryan and

Gross (1943) found that the earliest adopters of Iowa hybrid corn traveled to urban centers more often than the average farmers. Coleman, Katz, and Menzel (1966) reported that medical doctors who are among the first to adopt a new drug attended more out-of-town professional meetings than non-innovators. However, in the Internet environment, no studies have investigated the role of cosmopolitan experience in the diffusion process.

Gender

Rogers inferred that gender has only minimum influence in the adoption process. However, when it comes to the Internet, the influence of gender difference, in some cases, is evident. Howard, Rainie and Jones (2001) found that the most aggressive users of the Internet were males. With regard to online news, the gap between men and women has been around 10% among adult Americans (Pew Research Center, 2004); that is, more men than women go online for news regularly. Weiss, Meraz, Figur, and Poindexter (2003) conducted one of the first studies to empirically identify one of the reasons for gender's influence. According to their results, males were more likely than females to be online news readers because males had been reading online news longer than females. In other words, Internet experience conditioned the gender effect. The present study will examine whether there is a successive relationship among gender, online news adoption, and online news reading.

Hypotheses and Research Question

Does diffusion theory operate differently in an Internet environment as Rogers suggested? To test this supposition, diffusion theory was studied in the Internet environment among college students. Specifically, this study will apply diffusion theory to college students' adoption of online news by testing three hypotheses:

H1: Earlier adopters of online news are more likely than later adopters to be regular users of all news channels.

H2: Earlier adopters of online news are more cosmopolitan than later adopters.

H3: Males are more likely than females to be earlier adopters of online news.

If support is found for these hypotheses, the author will answer the following research question:

RQ: What is the relationship among the three variables: gender, adoption of online news, and online news reading?

Methodology

Web-based Survey

To test the hypotheses and answer the research question, 10,248 randomly selected college students at a large southwestern university were surveyed as part of a graduate research methods class project. Students were emailed a request to complete a Web-based survey that included 56 questions on public affairs, media, lifestyles, and demographics. Students were promised confidentiality and directed to click on a link to the questionnaire, which was available on the web from November 4 through 10, 2003. A reminder email was sent on the third day. Results were automatically sent to a database and analyzed using SPSS. Response rate was eight percent, representing 842 students with a sampling error of $\pm 3.4\%$.

To test H1, the following measurements were used: (a) how many years the respondents had been reading news on the Internet; (b) how often they read a daily newspaper or news on the Internet, or watched local TV news, network news, or cable news. To measure (a), respondents were asked an open-ended question. For (b), response choices were ordinal: “never or seldom,” “one or two days a week,” “three or four days a week,” “nearly every day,” and “every day.” To test H2, cosmopolitan experience were operationalized in three questions: (a) Is your source of international news mostly from a non-U.S. source, (b) how often do you communicate online with people outside of the U.S., and (c) how many countries have you visited. To test H3 and answer the research question, respondents were asked their gender.

Analyses

The question asking the number of years reading news online made it possible to sort the college students into Rogers’ five adopter categories—innovators, early adopters,

early majority, late majority, and laggards. Survey participants who did not read online news were excluded from the analysis.

In terms of news use, respondents' answers were recoded into regular use and non-regular use. Respondents who got news online three or four days a week, nearly every day, or every day were considered as regular users of online news. As for cosmopolitan experience, the author recoded the "read non-U.S. source", "communicate people outside", and "visit outside" into "no=1" and "yes=2," and then added the responses to build a scale ranging from 3 to 6. Respondents scoring 3 and 4 were recoded as little cosmopolitan experience; while respondents scoring 5 and 6 were recoded as much cosmopolitan experience.

Rosenberg's (1968) three-step test was used to find whether gender is in fact the antecedent variable to the relationship between online news adoption and online news reading. The first step is to determine if all three variables—gender, online news adoption, and online news reading—are related. Second, when the antecedent variable—gender—is controlled, the relationship between online news adoption and online news reading should not vanish. Lastly, when the independent variable—online news adoption—is controlled, the relationship between gender and online news reading should disappear.

Results

Adopter Categories

The sample of 842 randomly selected college students had a mean age of 24 and a median household income of \$60,000-\$69,000. Of all respondents, three-fourths were Caucasian or White. Other races included: Hispanic or Latino (9%); international students (7%); Asian American (5%); Indian-American, African American, Native American, and Arab-American (5%). Females represented 56% of the sample; males represented 44% of the sample.

The author excluded non-adopters from the analysis, yielding 678 valid respondents as online news adopters. That is, 81% of the respondents had read news on the Internet. Compared to the whole sample, online news adopters had more males (46%) and fewer

Whites (73%) than the whole sample, but the mean age (24) and median income (\$60,000-\$69,000) have no variation. Based on years of reading online news, the 678 respondents were further matched with Rogers' five categories: innovators (3%) with 10 to 13 years of experience; early adopters (17%) with 6 to 9 years of experience; early majority adopters (31%) with 4 to 5 years of experience; late majority adopters (41%) with 2 to 3 years of experience; and laggards (9%) with only 1 year of experience (see Figure 1). Actually, because of the relatively large interval of measurement (by year) in this study, the exact percentage of adopters specified by Rogers in each adopter category could not be attained. For example, laggards should ideally occupy the last 16% of the adopters, but there was no cutoff point which left 16% of respondents in this category: 9% reported having one year experience and 27% reported having two years experience. For purposes of this study, only respondents with one year experience were classified as laggards (see Figure 1).

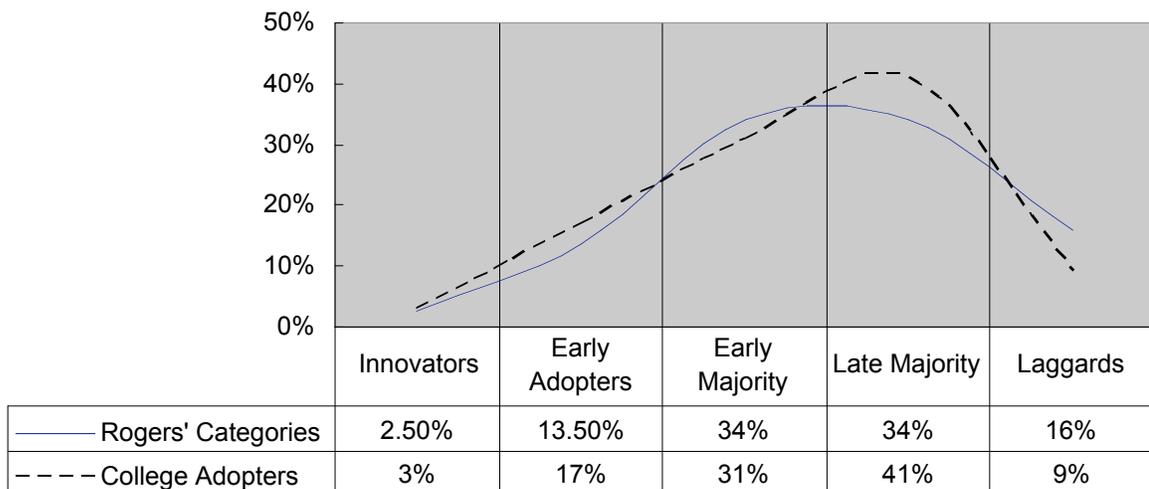


Figure 1. Matching college online news adopters with Rogers' adopter categories.

Mass Communication Channels

Partial support was found for H1: earlier adopters of online news were more likely to be regular users of all news channels than were later adopters (see Table 1). In this study, early adoption of online news was significantly correlated with regular use of

online news, cable news, and local TV news. In other words, innovators and early adopters were more likely than late majority and laggards to read online news and watch cable and local TV news. However, early adoption of online news was not significantly related to regular newspaper reading and network news watching.

Table 1

Regular News Use by Online News Adoption

	Online news adoption					tau-c value
	Innovators	Early adopters	Early majority	Late majority	Laggards	
	(%)	(%)	(%)	(%)	(%)	
Regular news use						
Online news	67	84	77	65	43	.22 (p < .001)
Cable news	71	50	38	29	20	.22 (p < .001)
Local TV news	28	26	19	16	13	.09 (p < .05)
Newspapers	44	66	58	53	55	.07 (n.s.)
Network news	11	22	15	14	17	.04 (n.s.)

Cosmopolitan Experience

H2—earlier adopters are more cosmopolitan than later adopters—was tested after creating the new scale, cosmopolitan experience, which combined three variables representing external sources: (a) non-U.S. news sources, (b) communication with people outside of the U.S., and (c) number of countries visited. Support for H2 can be found in Table 2. Innovators (88%) and early adopters (70%) had more cosmopolitan experience than late majority (58%) and laggards (54%). Also, online news adoption is significantly related to the degree of cosmopolitan experience with earlier adopters being more cosmopolitan ($p < .01$). In other words, students who were among the first to adopt online news read more non-U.S. news sources, communicated more online with people outside the U.S., and visited to more countries.

Table 2

Cosmopolitan Experience by Online News Adoption

Cosmopolitan experience	Online news adoption				
	Innovators (%)	Early adopters (%)	Early majority (%)	Late majority (%)	Laggards (%)
Much	88	70	70	58	54
Little	13	30	30	42	46
(valid cases)	(16)	(109)	(201)	(253)	(54)

tau-c = .15, $p < .01$ ***Gender and Adopter Categories***

H3 stated, “Males are more likely than females to be earlier adopters.” Table 3 showed support for H3: males were more likely to be innovators (4% > 1%), early adopters (23% > 11%) and early majority (32% > 30%). On the other hand, females were more likely to be late majority (47% > 33%) and laggards (10% > 8%). Gender was a significant influence on college students’ online news adoption. Moreover, gender also had significant impact on online news reading ($p < .001$), which encouraged the author to explore a three-variable relationship among gender, online news adoption, and online news reading.

Table 3

Online News Adoption by Gender

Online news adoption	Gender	
	Male (%)	Female (%)
Innovators	4	1
Early adopters	23	11
Early majority	32	30

Late majority	33	47
Laggards	8	10
(valid cases)	(309)	(361)

$\chi^2 = 27.409$, d.f. = 4, $p < .001$.

Gender, Adopter Categories, and Mass Communication Channels

To answer the research question, “what is the relationship among the three variables: gender, adoption of online news, and online news reading,” gender was tested as an antecedent variable to the relationship between online news adoption and online news reading. To determine if gender is an antecedent variable, one must first establish that each two-variable relationship is significant: (a) online news adoption and online news reading, (b) gender and online news adoption, and (c) gender and online news reading (Rosenberg, 1968). Table 4 showed the 3 two-variable relationships were all significant. Second, when the antecedent variable—gender—is controlled, the relationship between independent and dependent variables should remain significant. Table 4 showed that significant results were also found when controlling for gender. Finally, the relationship between antecedent variable (gender) and dependent variable (online news reading) should disappear when the independent variable—online news adoption—is controlled. Table 4 showed that the relationship between gender and online news reading disappeared when controlling for online news adoption. In sum, gender as an antecedent variable determined how early college students adopted online news, which further influenced how often they read it.

Table 4

Relationship between Gender, Online News Adoption, and Online News Reading

	Value	Significance
3 two-variable relationships		
Online news adoption \Leftrightarrow Online news reading	tau-c = .217	$p < .001$
Gender \Leftrightarrow Online news adoption	$\chi^2 = 27.409$	$p < .001$

Gender \Leftrightarrow Online news reading	$\chi^2 = 21.309$	p < .001
Control for gender		
Male Group	$\chi^2 = 18.738$	p < .01
Female Group	$\chi^2 = 16.574$	p < .01
Control for online news adoption		
Innovators	$\chi^2 = .138$	n.s.
Early adopters	$\chi^2 = 3.197$	n.s.
Early majority	$\chi^2 = 2.326$	n.s.
Late majority	$\chi^2 = 2.597$	n.s.
Laggards	$\chi^2 = .724$	n.s.

Discussion and Conclusion

This study tested three hypotheses and found partial support for H1 and full support for H2 and H3. Although previous research found that college students and young adults had been disinterested in news, this study showed that the earlier a college student began reading online news, the more likely he/she was to become a regular online news reader. In general, early adoption of a given communication channel is a significant predictor of regular use of that channel. However, when this hypothesis was expanded to other news channels, results became inconsistent: earlier adopters regularly watched cable and local TV news, but they were not regular newspaper readers or network news watchers. The finding disagrees with Rogers' prediction that earlier adopters of one communication channel are also heavier users of *all* other communication channels.

How can this be explained? Perhaps a better explanation is that those earlier online news adopters prefer a news channel to be timely and convenient. Newspapers cover mainly yesterday's news and network news airs only twice a day, while 24/7 cable news and local TV news¹ offers timely information and great convenience. Future diffusion studies need to take functional similarities and differences between communication

channels into account; adopters of one service tend to use functional similar services on a regular basis.

In addition, this study discovered an unusual pattern: 71% of college innovators chose cable news as their major news gathering channel despite the fact that they were innovators of online news (Table 1). Could the pattern be linked to the emergence of digital TV in which newscasts can be recorded on demand? Does it suggest any future diffusion of another innovation—digital TV? More research is needed to explore the introduction of digital TV and media use.

The author also found support for H2: earlier adopters were more cosmopolitan than later adopters. Previous research paid more attention to measuring adopters' local experience but failed to find consistent results (Rogers, 1961). By examining college adopters' source of international news, communication with people outside the U.S., and number of countries visited, this study successfully constructed a scale to measure cosmopolitan experience and found a significant relationship with online news adoption.

By finding support for H3 and the antecedent variable, this study suggests that gender is a strong predictor of online news adoption. A gender gap does exist in online media—Internet. Although Rogers (1962) argued that gender was not an important variable in diffusion theory, this study contradicts that generalization, at least in the case of online news adoption. In fact, gender is also an antecedent variable, which reinforces previous findings on the one hand and identifies gender as a relevant variable to diffusion theory on the other. Weiss et al. (2003) found that early adoption of online news was a consequence of gender and a determinant of online news reading among the general population; the author finds exactly the same result from college students. This suggests that gender has predictive power in diffusion theory and should be considered in future Internet studies. Overall, to profile online news adopters among college students, the author concludes that earlier adopters of online news are males, cosmopolitans, and regular users of online, cable, and local TV news.

One of the limitations of this study is the low response rate. However, web-based or e-mail surveys offer many advantages such as rapid surveying, large samples, and little cost (Schaefer & Dillman, 1998) and it is especially appropriate for this study to conduct

a web-based survey in that nearly 100 percent of college students have e-mail access. To compensate for the low response rate, a comparison between the sample in this study and the university's demographic census ("University of XXX Student Profile, 2003) may throw some light on the representativeness of the study. The appendix shows that the survey population demographically mirrored the student body within the $\pm 3.4\%$ sampling error.

Furthermore, this study benefits from the high adoption rate of online news among college students. Many Internet studies which failed to support the diffusion theory claimed that the Internet was still in a pre-adoption stage (Dupagne, 1999). In this study, online news adopters represent 81% of the sample, which is significantly higher than the general population (about 40%). The high adoption rate provides a more valid application of the diffusion model and a more reliable portrait of the college students' adoption process. Another advantage for this study is that the research design and results may serve as a model for scholars and industry professionals who are trying to predict where online news use is headed.

In sum, this study tested four key diffusion components—adopter categories, communication channels, cosmopolitan experience, and demographics—and found results that matched Rogers' traditional predictions: college innovators and early adopters read more online news and had more cosmopolitan experience than later adopters and laggards. The study also went beyond Rogers' predictions, showing that gender was not only a strong predictor of adopter categories but was also an antecedent factor to the relationship between online news adoption and online news reading. Diffusion theory works in an Internet environment!

Note

¹ Local TV news in this researched population includes four network affiliates and one 24/7 news station.

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Appendix

A Comparison of a Random Sample and the Census

	Student sample	2003-2004 student census
Age	(years old)	(years old)
Undergraduates	21.0*	20.7
Graduates	29.3*	28.9
Gender	(%)	(%)
Male	43.8*	50.5
Female	56.2*	49.5
Classification	(%)	(%)
Freshman	9.7*	13.7
Sophomore	12.5*	15.8
Junior	16.5*	18.3
Senior	24.8*	26.8
Graduate	29.3*	22.5
Other	7.2*	2.9

*The sampling error for a random sample of 842 students is approximately $\pm 3.4\%$. After factoring in the sampling error, all of the sample statistics match for the census data.