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The Internet's role in diffusing innovation knowledge among software developers

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THE INTERNET'S ROLE IN DIFFUSING
INNOVATION KNOWLEDGE
AMONG SOFTWARE DEVELOPERS

A Thesis

Presented to

The Faculty of the School of Journalism & Mass Communications
San Jose State University

In Partial Fulfillment of the Requirements for the Degree
Master of Science

by Allison J. Taylor

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ABSTRACT

THE INTERNET'S ROLE IN DIFFUSING INNOVATION KNOWLEDGE AMONG SOFTWARE DEVELOPERS

by Allison J. Taylor

This qualitative study investigates why and how software developers use media such as the Internet as initial sources of new software knowledge. Findings from the interviews suggest the Internet is primarily used for technology information-seeking, and that a mix of communications vehicles play a role in diffusing new software information among developers.

Insights gained from this study include the dominant role of search engine technology in content selection, the integrated nature of communication use such as interpersonal communication through email across the Internet, and the importance of content quality and its rapid availability relative to the limited impact of on-line formatting and design.

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Introduction

The emergence of a commercial, global electronic network known as the “Internet” has offered researchers the opportunity to experience and study a new mass medium. An inventory of existing mass communications research related to traditional media can be juxtaposed with this newest channel for interesting interpretations of the Internet’s role, impact, uses, and gratifications. The Internet is especially useful to study within a mass communications discipline because of its role as a communications tool, in which it diffuses information and enables instant interaction to and between audiences, as will be further explored in the literature review section.

The Internet, or the linking together of computers to establish networks of information accessible on-line, has already significantly impacted both the communications field and the multitude of sectors that utilize communication technologies (Hiebert & Gibbons, 2000). In 1999, it is estimated that email became the number one usage of the Internet, outpacing the research function (Kleindl, 2001). It has been accepted faster than any other new communications medium (Sterne, 1995), and is used frequently for business, education, entertainment, and a variety of other purposes (Sterne, 1995). Some might even consider the Web part of the “planetary infrastructure, like highways and electricity” (Rosenoer, 1999, p. 15). Business executives can use it as an unconstrained, no-cost message delivery system that affects a company’s image, service visibility, and expansion (Sterne, 1995). Consumers can find an instant response information base (Rosenoer, 1999).

From this communications perspective, mass audience usage of the Internet is definitively increasing, as measured both by the number of domains (World Wide Web addresses) and the number of individuals (Kleindl, 2001). Estimates of Internet usage and growth vary depending on sources, with CIO Web Business magazine reporting a 300 percent growth in Internet users between 1997 and 1999, and Georgia Tech

University estimating 99 million users in the United States alone. The same Georgia Tech survey shows males using the Internet more than twice as much as females, with the average user's age at 35, income level at \$52,000, and education level of some college for at least 80 percent of the user group.

The Internet at its outset served as a knowledge base and rapid message tool (Sterne, 1995) that only computer programmers and other specific individuals utilized. As a tool developed by government for educational and defense purposes, user interfaces were complex. As a result, one of the first specialty groups to use the early Internet was the software programmer.

The usage of the Internet is no longer limited, however, to one group. Some consider this reach across segments a reason the Web is ideal for niche marketing, enabling tailored information and the targeting of narrow markets (Kleindl, 2001). The senior citizen enterprise Third Age estimates that 13 million people over the age of 50 have access to the Internet. Others view this ability to establish smaller, specialized groups as possibly polarizing or fragmenting audiences (Hiebert & Gibbons, 2000). While some 95 percent of the population once tuned into one of the major TV networks, that number dropped to 60 percent several years after the introduction of cable TV (Hiebert & Gibbons, 2000). Similarly, the Internet could deteriorate tendencies toward homogenous societies.

This study examines the early user group of computer programmers to more deeply understand how this specialty group uses the Internet for knowledge gain. It takes into consideration the possibility that different specialty groups relate differently to the new tool, and that the Internet's various roles thus play out differently in various sectors (uses and gratifications). In particular, this study reviews literature that offers context for the proposed research questions, "is the Internet the primary medium used by software developers to raise their *knowledge* levels about business-to-business software innovations?" and "if so, *how and why* is it used as a communication vehicle for the knowledge phase of the diffusion process?" This knowledge is considered in relation to the Innovation Decision Process Theory by Everett Rogers (Ryan & Gross, 1943), which

notes the first stage of diffusion to be *learning about a new innovation*, or in categorical terms, the “knowledge” stage of diffusion.

Purpose

This study proposes a qualitative analysis to uncover deeper information regarding software developers’ uses and gratifications of the Internet for innovation knowledge. Is it true that this tech-savvy population relies on machines to first become aware of diffused knowledge? Could it be that the Internet’s interpersonal communications aspects, such as chat rooms and email, are what this population leverages, and is that still considered use of mass media? Or is the Internet, for this group, just another type of mass media acting a broadcast channel for knowledge? This study hopes to illuminate the tendencies and nuances of this audience in relation to diffusion theory. With no specific quantitative study available for this audience, and little academic research probing their specific Internet uses, a qualitative approach is proposed. Assumptions unique to developers will be considered, including:

- Software developers have easy access to the Internet since they are frequently working with networked computers as part of their daily routine (Evans, 2001).
- Software developers have more experience than laypeople with Internet usage and thus may already understand how to use all aspects of the Internet (news groups, etc.) (Evans, 2001).
- Software developers need specific software innovation information to successfully perform their jobs, and cannot find such information through general media sources.

Rationale

Just as the introduction of TV heralded a new medium and thus a fresh set of research questions, the Internet provides a fortunate opportunity to note social and economic effects of another new medium. It is estimated that 530 million people used the Internet and the World Wide Web communication infrastructure in 2001 (Juliussen,

2002). Now that access to this electronic network of computers has become routine in some segments of the population (CommerceNet, 1998), it is worthwhile to consider in detail early adopters and their potentially increased reliance on the media for knowledge of topics.

Software developers in Silicon Valley, who are often early adopters of software technology (Moore, 1995), were selected for this study. Related audience segments such as technology end-users and consumers have been studied in their attention to Internet banners (Schlosser, Shavitt, & Kanfer, 1999, Rosenoer, Armstrong & Gates, 1999). It appears, however, that the Silicon Valley software developer segment has not been academically studied in any detail in relation to diffusion theory. At the same time, companies are investing millions of dollars in information technology each year; this technology is primarily used by this software developer segment.

Also relevant in this study to the possibility of advancing mass communications theory is the nature of the Internet within communications, since in some ways it can be considered a mass media channel (i.e. on-line newspapers) and other ways an interpersonal communications tool (i.e. personal electronic mail). Flanagin and Metzger (2001) note there is “rapid development of and sparse research on the Internet as a communication and information tool.” By studying an audience’s use of this medium for increasing knowledge about new software products, one can potentially examine further the potential mix of interpersonal and mass within one “channel.” Should it be found that software developers, for example, frequently use this one tool for multiple levels of communication, additional studies could be undertaken to see if the same is true for teachers, journalists, or other occupations.

Finally, beyond the introduction of a fascinating new communications tool that mixes many characteristics of prior channels, and the fact that advanced software developers are not routinely analyzed in academic studies, it is also notable that this study’s results can affect preconceived notions in the advertising and marketing fields. Should it appear that on-line content plays the greatest role, and or the only role in this audience’s knowledge level of business to business (B2B) software innovations, software

suppliers may need to significantly adjust their business and marketing strategies. For example, million dollar investments in print and television advertising may find zero results, or in contrast, focus purely on chat rooms and e-zine product reviews may significantly positively affect software innovation knowledge levels among software developers. This research becomes especially important as economic tides shift and excruciating focus is placed on corporate expenditures, particularly in the marketing area.

This literature review covers a broad swath of research that can be applied to the research questions “is the Internet the primary medium used by software developers to raise their *knowledge* levels about business-to-business software innovations?” and “if so, *how* is it used as a communication vehicle for the knowledge phase of the diffusion process?” However, it also reveals the need for much more specified, updated, and conclusive information in order to test potentially circumstantial evidence uncovered in the study.

The literature review presented in this proposal summarizes findings relevant to the Diffusion Theory research questions. Two core categories, Mass Communications and Business, house the foundations of the literature review. Within those two core categories, relevant research was found in many sub-areas of study, such as the social and commercial usage of mass communications, and the marketing and technology sectors of business research (whether applied or commercial). The at-a-glance approach to the literature review is represented in Figure 1, but in outline form it is composed as follows:

I. Mass Communications Research (first of two core categories)

A. Mass Communications Channels

1. New media mass communications channels
2. Social uses of mass communications channels – Private Sector
 - a. Functional channel research findings
 - b. Structural channel research findings
3. Commercial uses of mass communications channels – Commercial Sector

- a. Mass media & marketing research findings
 - B. Mass Communications Effects
 - 1. Channels effects research
 - a. Traditional media
 - b. New media effects research findings
 - 2. Audience effects
 - a. Uses & gratifications of mass communications
- II. Business Research (second of two core categories)
 - A. Applied Research
 - 1. Marketing
 - a. Public relations
 - b. Customer relationship marketing (CRM)
 - c. Branding
 - B. Commercial Research
 - 1. Technology
 - a. Software development trends
 - b. Information demand

Problem Statement: Literature Gaps

Delineating the internet's communication modules.

Studies that focus on the Internet do not always clearly delineate its related entities – bulletin boards, chat rooms, Web sites, email, etc. – which are important aspects of this new media sector (Flanagin & Metzger, 2001). Too many studies broadly sweep these differentiated communication models under the Internet label, thus making it difficult to truly compare efficacy in providing knowledge. Email alone, for example, can include rich-text formats, or video clips, and such nuances may actually be causal factors in why one audience member may grasp a new technological design while another will have to imaginatively try to visualize the design without visual aid. Particularly, as McQuail noted (2000), as technologies converge, the Internet will encompass a host of specialized services and communication capabilities, whether video game play across the

Web or videoconferencing from handheld devices. Recognizing early on this vast array of communication capabilities within the Internet sector might also encourage specialization moving forward. The proposed study offers an opportunity to examine the Internet and all of its communications components such as instant messaging, webcasting, on-line events, and e-zines. The proposed study's use of a qualitative approach leaves the door open to the possibility that these components may play a major role in Internet usage among software developers.

Focusing on the information technology audience.

The literature review also revealed no academic study on the preferences, routines, and patterns of information technology (IT) professionals using the Internet for software knowledge gain, or more particularly within that IT community, software developers. While some studies find that people learn much information from surfing the Web while at work, the type of people are not identified. Also, while home PC ownership was mentioned in one study, nothing could be found about the impacts of having 24x7 access to the Web, both at home and work, as is the case for many software developers.

Notably, the IT community professionals were among the first users of Internet technology, during a stage requiring extensive technical knowledge, prior to commercialization of the World Wide Web (Holz, 1999). This early interest has also placed them in an early adopter status, thus studying their habits could eventually lead to generalizability to followers who may take the same path, only later. Additionally, it could be hypothesized that this specialty group engages in frequent use of the Internet both for work purposes, for learning and communication among other things, as well as for personal needs due to their familiarity with the technology. For example, one firm specializing in training its IT professionals heavily offers \$10,000 pay increases for each software certification an employee acquires (Business Week, 2000). As a result, this group of information-intensive professionals, with its on-going access and comfort level with the Internet, could lead to insights in how future groups may react as cultural forces further move toward an information society.

For the purposes of the research questions posed here, extensive qualitative research into the habits and needs of this audience group needs to be carried out to fill this literature gap. Software developers, for the purposes of this study, include the following job classifications and their derivatives:

IT architect

Web designer

Web developer

These positions within the developer community were selected since they are typically grouped together organizationally within Silicon Valley high-tech companies and thus accessible enough and numerous enough to ensure the possibility of enough case study completions in the study timeframe.

New e-commerce software content.

Various studies hone in on the categories of politics (Lazarsfeld, Berelson, & Gaudet, 1940), news (Carocci, 1985), education (Mort, 1953), and health (Valente & Saba, 1998; Coleman & Katz, 1966; Valente, Paredes, & Poppe, 1998) content in relation to diffusion, yet no research was located on business-to-business e-commerce software innovations content. This proposal suggests a study that takes the other two previously mentioned gaps into consideration, and maps them to content exclusively on this e-commerce software topic, to potentially lead to more specified findings. This would be similar to the way the category of news diffusion was split into health care news, political news, and other research subtopics. Accordingly, the notion of software innovations in this proposed research is more granularly identified as business-to-business software. Other studies that mention software more in passing typically reflect the enormous scope of software technologies, from the adoption of air traffic controller software in U.S. airports to on-line translation tools in Europe, and do not isolate a particular type of technology.

Literature Review

This literature review summarizes research findings in the *media channels*, *effects*, and *content* areas of study, presented in relation to the central research question. Trends in *applied research* in the marketing field, as well as background information regarding the high-tech *market environment*, are also summarized. Sub-questions related to the overall thrust of the main research question are answered by the research and prepare the grounds for additional study specific to the medium choice (Internet), audience (software developers), and content (new product innovation). A review of diffusion theory research is also included. Initial findings of surveyed research relevant to the central research question (as detailed in the Literature Review section) are detailed further below. An overview of the areas reviewed is summarized as follows:

1) Is the Internet a medium?

New media studies note that computer mediated communication in some ways represents a convergence of various media, and in other ways is distinctly different in its speed, diversity of channels, and degree of interactivity (Hiebert & Gibbons, 2000; Slevin, 2000). It is a media in how it shares information available beyond one's hard drive and serves as a tool for communications (Holz, 1999). Media channels, as well as functional and social media research findings, support the view that the Internet is a medium and thus is an appropriate channel for providing knowledge (Westley and MacLean, 1957). At the same time, research regarding commercialization of the media simultaneously purports that the Internet is a commercial vehicle through which goods and services are sold and marketed (Mattelart and Stourdze, 1993).

2) Do the Internet's characteristics as a channel affect the audience, and in addition, does the psychological state of audiences affect how well the Internet can provide knowledge?

Studies in media differences reveal that characteristics such as form and speed of message distribution change the way knowledge is perceived by an audience (Culbertson, 1997; Salomon, 1984), as detailed in the literature review section following this overview. In addition, significant literature in uses and gratifications research reveals the importance of the audience's perceived need and use for media in affecting how they use (or don't use) knowledge presented through it (Katz, 1973). Motivation and expectancy levels, as well as orientations, mental maps, and reception analysis affect the way individuals perceive information and even whether they seek knowledge through information (Altheide and Snow, 1979), all of which is explained in detail in the literature review following this overview.

3) Does the type of content relate to the success of providing knowledge through a medium?

Various diffusion-related studies choose different types of content and reveal that salient content types, such as news, can impact knowledge levels (Carrocci, 1985). In addition, advertising research, especially message recall, notes that formats, styles, and layouts used to present the knowledge also affect how and if a user will grasp the knowledge a mass medium may present (Thorson, 1996), as explained in detail in the literature review that follows this overview.

4) What trends in the marketing field affect the use of the Internet as a medium through which to provide information?

Several trends in the area of marketing applied research relate to using the Internet for knowledge diffusion, including the need for public relations professionals to relate to their key publics in ways that better leverage the Internet's newer technology capabilities. The Internet's ability to foster many-to-many relationships and its bulletin boards and other technologies support a "global conversation" that turns upside down the communication between producers and receivers (Holz, 1999, p. 56). Trends in branding prompt ubiquitous displays of messages as well as suggestions that ample information regarding brand are best amid a media savvy population (Klein, 2000). In addition, integrated marketing is developing as a trend that encourages mixes of new and

traditional media (McQuail, 2000). Again, the research findings are explained in detail in the literature review which follows this overview.

5) Does the high-tech market impact the ability or need for the Internet to play a role in diffusion of information?

Studies characterizing the high-tech market reveal the need for information-intensive campaigns (Glazer, 1991) due to the rapid pace of technological change surrounding products as well as the inexperience of potential buyers with such products. Both drive information-seeking (Macrimmon and Taylor, 1976).

The following sections are precluded by a brief synopsis of the Innovation Decision Process knowledge stage, and are then sequentially ordered to trace the findings of these five subquestions related to the central research question. This organization of the literature review provides a clear framework through which to consider the wealth of research findings that help illuminate the questions “is the Internet the primary medium used by software developers to raise their *knowledge* levels about business-to-business software innovations?” and “if so, *how and why* is it used as a communication vehicle for the knowledge phase of the diffusion process?” The organization of this literature review is represented graphically in Figure 1.

Figure 1: Pictorial overview of literature review subject interrelationships.

Diffusion Theory & The Innovation Decision Process

Before an action can be taken, a behavior changed, or a viewpoint swayed, people must first be exposed to information and become “aware” of an innovation, situation, opinion, or fact. Information and the understanding of it lessens uncertainty and aids in diffusing knowledge (Rogers, 1983). This diffusion of knowledge, whether for planting new hybrid corn seeds or evaluating a new software product, has been studied for several decades under the heading of “diffusion,” initially introduced by Ryan and Gross in 1943. Everett Rogers expanded the field and defined diffusion as “a process by which an innovation is communicated through certain channels over time among members of a social system,” considering it a “special type of communication” concerned with new ideas (Rogers, 1971, pp. 5-6). Through information-seeking and information-processing, knowledge is sought (Rogers, 1983).

Rogers delineated diffusion in the 1995 Innovation Decision Process Theory by organizing this process of information dissemination and behavioral change into five distinct stages:

1. Knowledge
2. Persuasion
3. Decision
4. Implementation
5. Confirmation

It is in this first stage that the individual is exposed to the existence of an innovation and first starts to gain some understanding (Rogers, 1983). In the knowledge stage, mass communications and interpersonal communications affect diffusion by formulating, emphasizing, and affecting frequency of messages communicated (Rogers, 1995). Media play a role in disseminating information, and as Rogers notes, different communication channels play different roles at various stages (Rogers, 1983). Altogether, he writes that eighteen studies have proved that mass media are important in the knowledge stage, and eight studies reveal mass media importance particular to early adopters (Rogers, 1983).

As the next sections clearly outline, traditional media have been amply studied in relation to diffusion theory and its knowledge stage, while the Internet is a new entrant in the media portfolio. At the same time, the number of people exposed to messages on the Internet continues to rise, and its application in a variety of commercial and academic settings continues to contribute to its establishment as a routine communication form in the 21st century (Lawrence, 2000). For this reason and others, it is interesting to consider the Internet alongside traditional media providers of knowledge, including newspapers, radio, TV, and magazines, and consider its advantages and shortcomings in this role.

In the mass communications discipline alone, three major areas of research can be applied to help interpret the Internet's role in diffusing knowledge including media channels, media effects, and media content. In addition, recent trends in marketing and a survey of key high-tech market characteristics provide additional relevant research. The following sections synthesize key findings in these topical areas in relation to the question at hand.

New Media Mass Communications Channels

To determine whether or not the Internet could have impact in the knowledge stage of diffusion, it's first essential to review traditional media from functional and social perspectives and determine their roles as information *channels*. The Internet, although newer in relation to traditional media, nonetheless shares categorical characteristics with other media, rendering this investigation appropriate. If traditional media are channels through which information flows, then the Internet by association could also be studied as a mass communications channel. It's worthwhile here to explore various studies that analyze how the Internet compares to traditional media.

In some ways, the Internet shares similarities to existing media. It is a channel that can transmit messages to large numbers of people. It supports "multiple forms of interaction at many levels of the social structure...relating issues and events to each other to allow audiences to contemplate" human relations (Jensen, 2002, p. 171). It can show video and text. Yet in fascinating ways, this information network and all of its technologies bring to life new communications capabilities. The commercial segment of

the Internet, the World Wide Web, generates a new approach to activity and participation in communications (Sterne, 1995). Partially for these reasons, the Internet within the mass communications field is frequently classified as new media.

Various studies show that this new media differs from traditional media in its speed, channel diversity, and interactivity (Hiebert & Gibbons, 2000). For those leveraging the media to communicate broadly, it is less expensive than other mass communications methods such as television production, enables messages to span far greater distances, and can return messages at equal speed (Hiebert & Gibbons, 2000). Some view the computer (which is often needed to access the Internet) as a channel of social communication that augments human intellect (Jones, 1998), or as technology “capable of integrating previous media technologies in a single meta-medium” (Kay & Goldberg, 1999, p.12). Slevin reiterates the point that it enables technical integration and convergence between previously separated media (Slevin, 2000).

Jensen identifies several distinct aspects of the Internet that greatly set it apart from traditional media. The nature of the Internet as a medium is “more discursive” than traditional media, thus it includes the terminology hypertext (HTML) that makes formerly more random associations more explicit (Jensen, 2002, p. 187). Its use of hyperlinks and other digital media capabilities change the extent and possibility of links between text and images, creating an entire system of communication that is both more flexible in itself and modifiable by users (Jensen, p. 188). He notes that this third level of articulation between links that change order and complexity is an area that has not seen significant study.

Overall, Jensen estimates that the Internet became recognizable as a medium particularly during the 1980s, with PCs becoming pervasive in 1993. Yet he views the Internet “not a mass medium, but...a new category of medium for a mass public” (Jensen, 2002, p. 182). He further summarizes media capabilities in three degrees (2002). The first degree, biological, requires the human body and includes things such as speech and dance. The second is technically reproduced media, which includes mechanical devices like the printing press (2002). The third and final degree of media is digitally

processed media, where messages are reproduced and recombined, and where the networked personal computer plays a central role (2002). In surveying recent research in the computer mediated field, Jensen concludes that there are two primary effects of computer-mediated communication within the media field (2002). One conclusion is that individual media are increasingly interrelated, and the second is that there is a less absolute divide between what is reality and what is virtual (2002).

The Media's "Private Sector" and "Commercial Sector" Roles in Society

Understanding the nuances that new media additionally bring to the communications repertoire, a review of mass communications theories further lays the groundwork for this study. From the functional perspective, various researchers have concluded that media have a role in the diffusion of information. Laswell (1948) described it as a "correlation" function, and related it to distributing news about troop movements or other foreign events that could then warn a public about danger or a state of affairs. Westley and MacLean (1957) considered this role a "communicator" function, one in which the media passed along messages from sources to receivers. However, their view was that the media worked as "agents" of the audience members.

Roscoe notes that "the Internet is coming to be perceived as a mass medium," which he defines as "one whose dominant model is that of a small number of centralized sites of production, which disseminate content to a large numbers [sic] of receivers" (Roscoe, 1999, p. 678). His article points out that this is happening despite the fact that the World Wide Web's original conception emphasized ease of production of content as much as it did browsing information through a channel serving up content (Roscoe, 1999).

While the media was shown as capable, and in fact, active in this function, researchers also found that it was not necessarily the ideal channel through which to convey information. Coleman and Katz (1966), for example, in their study of how doctors learned about new medical drugs, found that interpersonal communication worked best. Doctors chatting in social settings presented the most common source of knowledge about the latest drugs and treatments, a far more frequent occurrence than ads

affecting knowledge. Valente and Saba (1998), on the other hand, mediated both the interpersonal and mass communications role in their study of diffusing knowledge about contraception techniques. They found that while those people with strong circles of friends and family rarely learned about birth control from media, Latin Americans without established personal networks frequently relied on media for information. Altheide and Snow (1979) took a slightly different perspective, noting that media are in fact set up merely to emphasize presentation and not to provide content.

Understanding the findings in research on the function of the media as institutions answers one part of the question of whether or not the Internet is a medium through which knowledge is made available. The second perspective in this area of research is the media's role within society and its relation to the members of social groups.

According to McCombs and Shaw (1977), not only did the media make knowledge available; they even decided which information was most appropriate. Through selection of content, or censorship of content, they theorized that the media set an agenda and deemed which knowledge was most appropriate or important for society. Ball-Rokeach and DeFleur (1989), meanwhile, viewed media as instruments of the wealthy, presuming that news was like a hypodermic syringe injecting propaganda into masses, but finding, as will be noted in later sections, the impact of society and audience. Members of the Frankfurt School took the media role in society concept a bit further. They applied it even more broadly to show that the media prompt conformity, selecting topics and conveying knowledge only about those things consistent with the social values of the society and even with the ideological standing framing these values.

While the functional and social perspectives of media research confirm the media's role in information diffusion to the public, with success in varying degrees, other research purports the media as mainly commercial vehicles for marketing and selling products. Schiller (1994, p. 36) described media usage in this manner as a "takeover of the domestic information system for selling goods and services." He pointed to television as a technology made to "clear corporate shelves" and movies as places to pack product plugs. For Schiller, the media's role in providing knowledge reflected American

capitalist values that equate “consumption” with “democracy.” McQuail (2000, p. 277) additionally cited the media as a “purveyor of goods.” Mattelart and Stourdze (1993) placed media research under the influence of merchants selling their wares, a phenomena he attributes to the U.S. example.

As could be expected, research in the marketing discipline exploits the media’s role as commercial vehicles through which to convey commercial knowledge to key publics. Studies in brand awareness offer applied research to determine which vehicles are most appropriate for which audiences. While this topic will be considered more deeply in the marketing trends section, one especially interesting point is worth noting here. Not only are many companies in the digital age concerned about providing brand information through media, but also the media themselves are using other media to raise awareness about their utility. The *Wall Street Journal* uses TV, print, and billboard ads to talk about its “Adventures in Capitalism” campaign - and is not just promoting use of its print newspaper, but is also hawking the electronic version of its news channel (Fine and Cuneo, 2000). Similarly, the *Financial Times* uses print and outdoor campaigns, while the *New York Times* relies on TV, print, and radio (Crains, 2000).

Media Effects

The prior research confirmed the media’s role as important channels used to diffuse knowledge, whether for social, functional, or commercial reasons. The next relevant aspect for application to the Internet research question is the investigation of media effects. Here the subject is divided into two different perspectives from which media effects can be interpreted:

- 1) Effects of the channel itself
- 2) Audience effects on the media’s attempt to convey knowledge

Effects of the channel itself.

Various studies considering differences between media characteristics reveal that in fact, the type of channel changes and affects how knowledge is diffused and even if it

is noticed by receivers (Wanta, 1997). While Culbertson (1997) theorized that visual images are more easily processed than read words, Salomon (1984) purported that ease of processing is not the point when it comes to knowledge acquisition. In fact, the more effort put into processing the knowledge, the higher the level of learning. Thus from Salomon's perspective, newspaper reading provides a more optimal choice for providing knowledge. Krugman (1965) supported this view, noting that print ads frequently are stronger than TV ads. Weissman (1999) more recently reached similar conclusions when the knowledge provided is about products, noting that magazine ads are better than TV ads for promoting brand awareness.

From the opposite perspective, research from Lester (in Wanta, 1997 with no further citation information offered) found that television activates three of the four important brain cell functions for processing information, including color, form, and movement, lacking only depth. Thus he found it optimal for providing information that can be easily processed. Singer also agreed that reading is more complicated than watching TV, but warned that remembering information learned through TV is more difficult. He found a direct correlation between recall and the type of media that originally conveyed the knowledge.

In terms of space for elaborating on information, thus potentially raising the possibility for more enlightened knowledge of topics, McCombs cited newspapers as the first medium typically to cover particular knowledge or information. With multiple pages on which to provide information, there is ample opportunity to fill in varied topics and thus provide knowledge earlier than mediums such as TV that have only minutes to allocate. More recently, one trade article noted that radio was a better channel for describing complicated topics, citing on-line travel company Travelocity.com as most successful in conveying information about its products by describing technical features in sixty second spots (*B to B* 2000). The company continued to use radio with excellent results in making people aware of its site for low priced airfares.

Still emerging as an accepted form of mass communication (although well-established within particular communities including academia and government), new

media, including the Internet and personal computers, have been somewhat studied in their ability to convey knowledge compared to other media types.

One recent investigation especially relevant to this proposed study analyzes choices of media *including* the Internet and its various elements (Flanagin and Metzger, 2001). Results indicated that the Internet “was the most highly used for getting information, over other technologies such as newspapers, television, books, and magazines,” with 82 percent of the 684 participants indicating they use the Internet for retrieving information. The researchers purport that as lack of exposure and access to the Internet become lesser issues, the Internet is folding into traditional media and it is less likely to be separately distinguished due to similarity in types of content delivered. It is worth noting that the study also concludes that “information seeking is a common function of nearly all communication technologies” (Flanagin and Metzger, 2001).

Ball-Rokeach and Reardon (1988), though limited to what they term telelogic technologies, nonetheless were able to define key characteristics that differentiate traditional and new media. These included the fact that on-line communications are not time-bound (also known as asynchronous), are interactive, and are decentralized. They concluded that telelogic communication shares characteristics of both interpersonal and mass communication, but not enough that it is simply a blend. Instead, it is its own unique form, particularly due to its characteristics of not being time-bound while still enabling intimate and emotional content. At the same time, noted McQuail (2000), the distinctions between media are becoming less sharp as new technologies emerge. High definition television, computers with streaming video, and Web sites with text blur the lines.

Computer owners with a modem and Internet service provider were the focus of a study by Perse and Dunn (1998) that linked computer reading to the level of print reading in knowledge absorption, and found it less effective than TV for presenting information. However, they noted, with few people at the time affording PCs, the results reflected a particular demographic of well-educated computer users who also read other media

heavily. Gaziano (1989) elaborated on this issue in his study revealing that access to technology differs per social class, and must be addressed in related studies.

While studying the flow of rumors, Bordia and Rosnow (1998) uncovered a lack of inhibition among on-line communities, noting that communications role patterns reflect face-to-face communications, yet information sharing on-line was more efficient and rapid. Similarly, Hagel (2000) pointed to virtual communities as targets for knowledge sharing and advised companies to use them to attract potential customers. Eric McLuhan (1998) called this mass yet individualized on-line community the electric crowd, interspersing prose to explain his belief that they are beings experiencing technology without the need for bodily awareness and are becoming one, yet part of a crowd.

In a study involving 1000 participants, Schlosser, Shavitt, and Kanter (1999) compared interactive advertising to traditional print advertising in its ability to provide information, and revealed that interactive advertising was viewed as more informative and more trustworthy than traditional print ads. A recent article in *B to B* magazine, meanwhile, notes that business-to-business companies still rely heavily on banner ads, having spent \$343 million in 12 months on 13 billion impressions (Crain, 2000). One company, Zixit, was cited as using only interactive advertising to provide product information, and was successful in doing so because of the nature of its products – Internet security software. Another industry article pointed to email as the area of growing emphasis for business-to-business companies sharing knowledge about new products or product updates.

These individualized studies, when considered as a group, make it clear that the type of media used in conveying knowledge do have an effect. Not only is it important to consider choosing the Internet itself as one factor, but the different types of interactive communication present additional considerations. As these studies show, using an on-line ad versus an email versus a passing comment in an on-line chat room can change the nature of the knowledge and how well it is received.

Audience effects on the media's attempt to convey knowledge.

Shoemaker and Reese (1996) noted the past tendency of mass communications researchers to focus on individuals receiving messages instead of on the institutions shaping the content. Yet in understanding whether the Internet is an ideal medium to realize the first stage of diffusion, knowledge, a research review would not be complete without considering the motivations, expectancy levels, and orientations of audience members. A business-to-business enterprise cannot invest millions in informational campaigns attempting knowledge absorption without understanding what resonates with the audience. One particular area of research is especially relevant to the central research question posed herein, and that is uses and gratifications.

McQuail (2000) made particular note, when discussing new media, that the audience can utilize choice and response. They can choose at what pace they read a Web site, whether they access the Web site, or if they even sign up for Internet service. And they can respond to email marketing, banner ads, or probing Web sites – or not. Herzog elaborated on this choice much earlier in noting how audiences have ways and reasons that they use the media, or as Katz (1973) noted, the uses and gratifications. Katz looked to psychological factors affecting media use, analyzing the needs different media fulfill for different people.

For Blumler (1973), the main factor affecting information gain through media is cognitive motivation. For Ettema and Kline (1987), it is also motivation, but as well the situation of the individual. This is similar to what Hall (1980) called reception analysis, which in essence implies that every individual will interpret information differently, although Hall referred more to interpretation of symbol systems related to language and culture, while Katz, Blumler, and Ettema and Kline emphasized internal states of mind and needs such as loneliness or diversion.

Altheide (1979) found that people already have mental maps of what media they use for what purposes. In this context, providing knowledge about a new software innovation in local newspapers may be interpreted as odd or inappropriate for engineers used to accessing new product specifications on text-only Web sites. Perse and Dunn

(1998), in their study of computer owners, cited clusters of media functionality; some people prone to reading newspapers may also be prone to watching news on TV.

These types of media usage and routines reveal that individuals use and expect to use the media for different purposes at different times. Simply posting information about a new software product on a Web page would not leverage these researchers' insights and would ignore an important factor in communication – the active audience. As Flanagin and Metzger (2001) point out, there is little uses and gratifications research that focuses on new communication technologies.

Media Content

The previous section outlined the role of both the knowledge provider – the media – and the potential knowledge receiver – audiences – to enlighten the discussion on the Internet's applicability for sharing new innovation information. The various research findings can guide a business-to-business vendor toward understanding the different characteristics the Internet might introduce, as well as the important notion of what the individual audience members may feel and expect from the media. This next section is an appropriate follower to media effects and analyzes research related to what type of knowledge is conveyed by the media, and how that content type may or may not affect the efficacy of knowledge.

Two segments of research are relevant to this discussion:

- 1) Content type
- 2) Content format

Particularly in the application of the diffusion theory, various content topics have been studied, and they relate to the topic at hand of evaluating the media's role in the knowledge stage of diffusion. Table 1 summarizes a few relevant studies and includes the researchers, key types of knowledge trying to be diffused, media studied, and abbreviated findings.

Table 1

Select Diffusion Theory Research Overview, Highlighting Findings from Different Disciplines.

Researcher	Topic/Type of Knowledge	Medium Studied	Findings
Valente & Saba (1998)	Healthcare: Contraception techniques in Bolivia	Radio, TV ads	Interpersonal communication still important; media especially helpful for those without strong personal networks
Coleman & Katz (1966)	Healthcare: New drug	Print ads	Doctors learn more about new drugs from each other than from advertising; those traveling to big cities are more aware of new drugs; doctors without close networks of peers less likely to know about drugs
Carocci (1985)	News: Tylenol scare	Radio, TV news	Radio (36%), TV (34%), then interpersonal communications (27%) were sources. Within 24 hours, >80% of the Chicago-area population knew about the cyanide-laced tablets
Lazarsfeld, Berelson, & Gaudet (1940)	Politics: Candidate preferences	Newspaper	Word of mouth spreads faster than media

As these highlighted studies point out, content type may affect how well knowledge is both sought after and consumed. News items that may immediately affect

an individual are willingly and rapidly shared. A new software product, however relevant to the individual, may not carry as much weight, and may need to prove itself within various circles of critics before being recommended. In addition, various vehicles may need to be employed since it would be difficult for an enterprise to act on findings such as the level of an audience's personal networks.

Rogers pointed out this factor of content in diffusion by specifying "software" content from other content and noting that mass media can effectively transmit this type of information, which he defines as the what, how and why of the innovation (Rogers, 1983). He notes that the newness of the innovation gives it "special character" (Rogers, 1983, p. 5). This software content is diffused differently, notes Rogers, than how-to knowledge that is required for proper use of the innovation, or principles knowledge, which is helpful for understanding what's behind the innovation (Rogers, 1983).

After differentiating whether the Internet would be used to provide knowledge about the Pill, the Pentagon, or a PeopleSoft software program, an enterprise would also have to consider relevant research from the advertising field that highlights the importance of the *format* of the content. Thorson (1996) summarized a variety of advertising techniques to evaluate a campaign's success in making an audience aware of its good or service, including message recall, or the ability for the audience member to remember both the knowledge gained (e.g. software that helps automate on-line purchases) and the brand (e.g. software from IBM). She noted that choice of word, color, typespace, font, and position can affect how successfully information is noticed.

In a popular guidebook on designing Web sites, Nielsen (2000) was even more specific, noting that background colors on the screen, location of navigation bars, and length of text per page greatly affect a visitor's ability to grasp information quickly. Nielsen summarized the need for usable Web sites in context of commercial market survival: "With all the other millions of sites out there, you are in competition for the users' time and attention, and Web users get their expectations for great usability from the very best of all these other sites" (Nielsen, 2000).

Applied Research

The contribution of business to studies in conveying knowledge was alluded to in the previous section, which noted advertising agency techniques to test message recall and product awareness levels. Several additional sets of commercial contributions are also relevant to the central research question of this paper. While these are not necessarily academic theories tested using traditional qualitative or quantitative methods, the momentum of these trends warrants discussion here. They also enhance the effort to design a research plan that answers the central research question by tying together well-established mass communications theory with newer, albeit less proven, trends in the industry.

Critical to the marketing function, the public relations field has changed significantly with the introduction of the Internet's communications capabilities. Holz perhaps best summarizes this impact as affecting four models in the public relations field (Holz, 1999). First, it changes the communications between groups from a few-to-many model to a many-to-many model (Holz, 1999). Specialty groups have equal weighting and can quickly offer both positive and negative feedback as part of the "global conversation" (Holz, 1999, p. 56) through discussion groups, user groups, and other Internet capabilities. Second, it moves public relations to a receiver-driven model instead of a producer-driven system. There is no more logical flow or sequential order to the communications out, since in fact the overloaded receiver is self picking and choosing which messages to take in (Holz, 1999). A third change to public relations instigated by the Internet, according to Holz, is a move to access-driven communications, which goes hand in hand with his description of the fourth model, attracting a market sample of one. In this information age, companies need to "spread branded info so it gets to targeted individuals" rather than building one-to-one relationships and exchanging information in close environments (Holz, 1999, p. 34). This means having information ready and waiting for the moment the one targeted individual chooses to seek it, such as posting an article about air conditioner repair to a contractor Web bulletin board. Additionally, it

means allowing for some redundancy across communications, such as providing that same article by a call-in phone number that automatically faxes it.

Changes to these four models further affects all aspects of the field as the impact trickles down to application in the field. For example, with the capability to quickly scan information and move from one site to another, consumers must be fed short and targeted information (Holz). When press releases are placed on the wire, public relations professionals must consider if they will appear, with unapproved commentary, across numerous user sites, and must monitor any related discussion. As a result, techniques such as agent technology, outsourcing for on-line monitoring, and usenet search tools must all be added to the public relations professional's toolbox now that the Internet has arrived as a communications tool (Holz).

Customer Relationship Marketing, or CRM, is a third dimension of marketing (Baker, Buttery, and Richter-Buttery, 1999) after transaction marketing, going beyond the positioning of goods and services to various marketing segments to take into account individualized, long-term needs of customers. With the introduction of sophisticated CRM software packages, as well as with the rise of advanced computer networks connecting millions of market segments, CRM has regained prominence.

When considered in light of uses and gratifications, it is a familiar concept that applies technology to track individual motivations, likes, and dislikes in the hopes of tailoring messages more salient to an audience. Kirchner (2000) called it the "market segment of one" and pointed out the Internet's highly evolved capabilities for personalizing content as a driver for this trend. By identifying which audience members just got married, for example, a vendor can portray only those product sets useful to that situation, as Ettema and Kline (1987) might have called it. Iacobucci, Arabie, and Bodapati (2000) pointed to search agent technology as enabling this one-to-one marketing, since the agents identify commonalities among audiences and tie together virtual communities. *Brandweek* (2000) added that the high cost of acquiring new customers – estimated at \$82 per customer for the average Web site – is shifting

companies' focus away from new customer acquisition and back toward upselling and cultivating the existing customer base.

Brands can be defined in a variety of ways, but overall they represent a promise to a potential buyer and fulfill emotive and/or functional needs (Klein, 2000). As *The Economist* (1997) noted, technology companies need brands to attract boards of directors, who more and more frequently make important technology decisions. Particularly as software becomes a commodity (Eisenberg, 2000) and using e-business software gets routine, companies rely on brand to differentiate. "Before share of market, you need share of mind," was the phrase Branch (1999, p. 52) used to describe the important connection between knowledge about a product and its eventual sale.

In relation to understanding whether the Internet is the ideal medium through which product information is provided, the push for brand awareness might provide a clue. A recent *Fortune* article highlighted the keys to branding success in the .com age as ubiquity, guerilla public relations, and the Web, among other things. Klein (2000, p. 25) described information society power as "projecting the brand's idea onto as many surfaces of the culture as possible." These two recommendations alone provide obvious evidence that the commercial sector must consider on-line information sharing a critical portion of its product promotion campaigns.

Just how they represent their product or brand, and how they share knowledge about new product features and innovations, has also been considered in various industry discussions. Lukas emphasized the need to move away from presenting products and brands as ideals, citing the high level of media savvy in society (Lukas, 1997). This media savvy, he noted, enables people to seek knowledge on their own rather than receive it through traditional filtered media (Lukas, 1997). As a result, any exaggeration of a product's features can be quickly unraveled, through on-line bulletin board discussions or independent Web site editorials, for example.

Regardless of how the brand is represented, however, the trend toward building brand awareness and loyalty can impact the use of the Internet as the vehicle for conveying innovation information. Especially in the competitive landscape of the high-

tech environment, which the next section will discuss, the need for high knowledge levels will most certainly affect the usage of online capabilities for information dissemination.

Environment

This literature review would not be complete without considering any particular characteristics known to exist in the high-tech market, the environment referred to in the central research question. Even if an enterprise was able to accommodate and maneuver through the various research in the previous sections to choose a channel, understand an audience, adapt content type and format, and take advantage of marketing trends, it could all fizzle within seconds if the particular market environment was not taken into account.

High-Tech Markets

While Geoffrey Moore (1995) popularized Rogers' early adopter models and is frequently cited in describing the nature of high-tech start-ups, other more academic research is available to better understand the market from a proven, carefully tested perspective. As early as 1976, Macrimmon and Taylor noted that the rapid pace of technological change within the high-tech environment initiates a search for new product information. Aldrich (1979) also noted that uncertainty accompanies this rapid pace of change, and may also account for the need for information.

In a comprehensive study directly related to knowledge-gain demands in high-tech markets, Weiss & Heide (1993) discovered that not only did such factors as noted by Aldrich (1979) and Macrimmon and Taylor (1976) prompt information search, but also the buyer's *perceptions* of market conditions affected whether they began an information search for high-technology product information. Weiss & Heide (1993) encapsulated the findings of various studies characterizing high-tech markets, noting that Eisenhardt identified the very time-sensitive nature of high-tech product information, and that Anderson, Chu, and Weitz found that lack of experience with technologies also encouraged the seeking of information. These findings portray a rapidly evolving

environment that Glazer (1991, p. 4) also called “information intensive,” and one that “imposes information processing demands on buyers.”

More recently, Hansen and Haas (2001) studied the supply of information in a consulting company, discovering that a change from information scarcity to information richness has occurred. As a result, the researchers contend that Web sites will not be used by those with limited amounts of time to consult knowledge unless they are “more selective and concentrated.” Yet the study finds instead that a “more-is-more” strategy tends to be in use by Web site managers.

Warnock & Brush honed in on studying marketing in the high-tech sector, and found that five factors are specific to the industry and must be taken into consideration when communicating with potential buyers (Warnock & Brush, 1997). These factors include the short lifespan of technology products, the interdependence of such products, the need for technical support to users of the products, the importance of pricing that includes follow-up maintenance, and the need for strategic alliances with other companies to complete the offering or showcase capabilities.

These demands for ever-changing information, and the need to gain knowledge about new technological tools, provide an intriguing rationale for investigating the Internet’s role in conveying information. The next section explores this further.

Software Developers

From an academic perspective, software developers are frequently noted in articles and books that describe Web site design techniques these developers can use, yet hardly are they documented in studies as users of Internet technology with particular needs and gratifications. In their design role, they are compared to film directors and their crews: “system developers and programmers play a specific role in facilitating turn-taking...they are communicating with users” by designing how end users will interact with pages and programs (Jensen, 2002, p. 184). In this capacity they take control of time and of information, behind the scenes preparing conditions for new social formations (Kay & Goldberg, 1999).

Commercial market research, perhaps due to its well funded nature, does provide significant in-depth reporting on software developers compared to academic research. These reports are helpful to this study in providing base information about the population under study. Additionally, various Web studies offer insights, however, their credibility is often difficult to determine. For example, one poll of 158 people on-line discovered that 39 percent of the supposed developers surveyed do not read developer magazines (Programmer's Heaven, 2001). However, it cannot be determined if the poll takers fit this study's criteria, if they voted only once, and if they voted legitimately.

One credible market research firm, IDC, estimates there are 2.7 million software developers in the United States (IDC, 1999). Another firm, specializing in software developer communities, carries out yearly surveys among developers to study attitudes and opinions (Evans, 2001). In 2001, 809 developers were interviewed on the phone or filled out an on-line questionnaire to share their typical work responsibilities, programming languages used, and audiences their software programs are created for (Evans, 2001). The research noted that software developers within an enterprise are involved in software application development, broken out as Table 2 illustrates.

Table 2

Type of Development Projects Worked on by Software Developers, by Frequency and Percent.

Software development activity	Frequency	Percent
Commercial applications for sale to people outside the company (ISVs)	181	22.4%
Corporate-wide applications for use inside the company (Corp Enterprise)	199	24.6
Applications for individuals or small workgroups inside the company (Corp Workgroups)	151	18.7
Applications which support devices sold by your company (OEMs)	58	7.2
Custom applications of any kind for clients outside your company (VARs, SIs)	164	20.3
Scientific/engineering or intensive computation graphics	24	3
Other	32	4

Note: From Evans Data Corp, North American Developer Survey, Volume 2, 2001, Fall.

The same study notes that a significant percentage, 36.2 percent of the developers, said they spend more than half their time developing for the Web. While this does not specify if the computers used for programming are hooked up to the Web, it does imply significant exposure to computers.

Methodology

Design

This study proposes a qualitative case study approach to uncover initial patterns among a very specific target group, Silicon Valley software developers. The case study approach is used for the following reasons:

- Not enough prior academic research specific to this topic and population exists, thus an open-ended question format may uncover more information and provide deeper insights
- No quantitative study on this precise topic was uncovered in the literature review, thus there is no existing model to replicate and test
- This study seeks out the “how and why of a contemporary phenomenon,” which Yin notes are especially suited to the case study approach (Yin, 1984)

Research Direction

The study seeks to better understand the relationship between software developers and their use of the Internet for technological product information. Specifically, it questions how they are first exposed to diffused information, both in relation to Rogers’s diffusion theory and to assumptions found through mass communications uses and gratifications research. Do software developers use only new media to uncover information about new business-to-business software innovations? If so, do they only use the interpersonal communications aspects of the Internet, or do they use it more like other mass media channels? What’s behind their drive toward the diffused information, and how is that gratification different based on the developer’s individual characteristics? Particularly for the important “knowledge” phase of diffusion, why potentially do they rely on Internet capabilities such as email? As noted in the Introduction section, some assumptions prompting this study include:

- Software developers have easy access to the Internet since they are frequently working with networked computers as part of their daily routine (Evans, 2001)

- Software developers have more experience than laypeople with Internet usage and thus may already understand how to use all aspects of the Internet (news groups, etc.) (Evans, 2001)
- Software developers need specific software innovation information to successfully perform their jobs, and cannot find such information through general media sources

Data Collection

This study proposes a qualitative case study methodology with at least ten individual software developers who will each be asked a set of questions to determine how they initially learned of new business software innovations. If more than ten software developers are willing, able, and qualified to participate, this study will not be limited to that number. However, due to the expected time constraints among this population, which is typically compensated based on strict adherence to product release dates, ten is the proposed number of participants to be interviewed in person. Face-to-face, telephone, or email interviews will be conducted with data captured either through typed note-taking on a computer, recording with a device, or handwritten notes. A sample interview outline is provided in Appendix A.

Data Analysis

Trends in answers will be evaluated in the data analysis to uncover trails for future research. For example, will all developers use the Internet in the same way? If not, what causes the difference, is it age or organizational environment? Answers will be compared and summarized. However, the case study nature of this research intends to provide overall insights that would later encourage broader based study through quantitative methods.

Generalizability

This study's qualitative focus eliminates the broad generalizability of findings. However, it does lay solid groundwork upon which to craft a subsequent quantitative

study that would enable better generalizability. In addition, this qualitative study provides depth of information about a specific audience in an area where little specific academic research is currently available.

As with all academic research, it will face limitations including points already emphasized by Rogers (1983). Limitations include, but are not necessarily limited to:

- Whether or not the subjects are telling the truth
- Whether or not the subjects remember accurately their initial exposure to a message (Rogers, 1983)
- Whether a bias is created based on which subjects are allowed by their supervisors to participate in the study

The following factors should be considered by researchers considering subsequent studies emphasizing generalizability:

- Whether reactions are captured only because of the interpersonal, case study approach; other approaches may change the willingness of the participant
- Personal attribute variance, whether gender, economic status, or cultural upbringing may supercede the importance of the job category
- Regional variance, should this study be duplicated in other areas with vastly different characteristics compared to Silicon Valley

Schedule

The availability of software developers will be based on the researcher's business connections. Beyond the fact that Silicon Valley is considered by many in the high-tech field to offer advanced approaches to software development, the study is also limited to this region to reduce budget impact and reduce the possibility that in an economic downturn, funding for travel may not be available. These sources will be interviewed within a six-month window beginning June 2003.

Conclusion

Surveying the landscape of both academic and commercial studies related to the media's use in diffusion, particularly stage one in knowledge, reveals five core areas of relevant study. Media channels, effects and content, trends in applied research in the marketing field, as well as background information regarding the high-tech market environment provide nearly a 360-degree view of core issues related to the central research questions "is the Internet the primary medium used by software developers to raise their *knowledge* levels about business-to-business software innovations?" and "if so, *how and why* is it used as a communication vehicle for the knowledge phase of the diffusion process?"

This literature review reveals that as a result of its kinship to traditional communications media, the Internet can be considered a medium, and provides both a functional role in society as well as a commercial role in providing information about goods and services for sale. Like any other type of media, the characteristics of the vehicle can affect how well knowledge is conveyed, and importantly, the state of mind of the audience will equally affect knowledge of innovations. Formats and types of content alter how well information is understood and interpreted, and may change the speed at which a large volume of viewers or readers learn about a new product. The differences between new media and traditional media also affect the Internet's usage. And as the emphasis on public relations, CRM, and brand awareness especially drive technology companies to seek more ways to portray products and emphasize different features based on an audience member's preference at a particular moment, the Internet may provide the most essential media vehicle in relation to one-to-many business survival. Especially in the high-tech market, where information demands are intense, and rapid technological changes affect knowledge gain, the Internet may provide an ideal medium that is easily updated, multimedia-ready, and readily accessible to the software developers.

Based on this background, this study proposes a qualitative study to specifically analyze the software developer audience and the various subgroups of the Internet to

better understand how and why software developers use new media to uncover information about new business-to-business software innovations, including frequent use of electronic news lists, email, and instant messaging.

Results

This Results section summarizes the primary findings uncovered through the qualitative interviews. The subsequent Discussion and Interpretation section evaluates these findings in light of the literature review and proposal expectations.

Methodology Revisions

Out of twenty individuals initially identified to participate, ten software developers were actually interviewed in a time range of seven months, from June 2003 to December 2003. Every developer was initially contacted by an email request for an interview, offering the option of telephone or email format. Two of the ten subjects, or 20 percent of the cases, preferred a telephone interview to emailed questions.

Availability of software developers grew difficult amid an economic recession. Participants who initially agreed to answer the questions later declined, citing job pressures with deadlines moved up, as well as increased workloads as colleagues were laid off. Other participants were no longer employed as software developers, with one moving out of state to another profession, and another remaining unemployed (thus disqualifying them from the study). A formal request for participation was posted on a developer forum Web site, still viewable at the time of this writing at <http://www.codeguru.com/forum/showthread.php?s=&threadid=274705>. In two months time, not one person responded. Other queries for code help on the same site showed dozens of responses, some within hours of the initial query posting.

After four of the email question sets were returned with answers, the question set was slightly revised in several ways to improve the data collection. First, the questions were numbered and tightened down to nineteen questions in total. Second, they were reordered to move up the diffusion questions, which improved the depth of answers due to a more logical order. Third, the language was adjusted to a more casual and less academic tone in an attempt to mimic the type of language and tone received on initial responses from the first participant set. The questions were made more literal, since the initial respondents frequently provided their answers to exact detail of the question, rather

than offering additional information or interpreting the question in any way. The questions also added newly discovered information, such as a point in the demographics about noting if they were unemployed, and a question about whether they use search engines. Both the proposed question set and the revised one are included in the appendix.

Demographic Summary

Although this information cannot be applied as a generalization of the findings, it is important to document the diversity of nationality and ages of participants in this study in case further studies investigate these variables. The demographic summary in the tables below shows the participant age ranges from twenty-six to thirty-nine, with an average age of 31.9 and a mean age of 31. Eight males and two females participated. The developers represented four different nationalities including American, Indian, Canadian and Russian. At the time of the interview, they were located in two locations including the State of California in the United States and the country of India (in various locations, mainly Kharagpur).

Education levels of the participants were all four-year college degrees or higher. Company size ranged from large multinationals such as Apple Computer to small companies. Developer languages the respondents use on a daily basis include C, Java, and Perl. Their job activities range from the creation of functions for the latest Macintosh operating system, the maintenance of customer relationship management software, technical support for business software, designing applications to deliver weather data, and creating developer environment tools for large mainframe applications. The majority of respondents have Internet connections from home and the office, with the lowest speed connection a 56k modem. Only one participant has Internet access from a mobile device (a cellphone), with all others citing computers as having the connection.

Table 3

Participant Ages, Average Age, and Mean Age

26 years old

27

28

29

30

32

34

37

37

39

Average: 31.9

Mean: 31

Table 4

Participant Gender Breakout

8 Male

2 Female

Table 5

Participant Nationalities

4 American

4 Indian

1 Canadian

1 Russian

Table 6

Participant Locations

6 USA, California

4 India

The usage of the Internet for this population had to be further defined as to whether or not time on-line included email review or composing. The minimum time any respondent spent on-line on any given day was one hour a day, not including email. The maximum time was eighteen hours a day, including email. Most respondents answered with a range of time in hours, with the average minimum time working out to 5.5 hours on-line a day and the maximum time across the ten developers at 7.3 hours on-line a day. Although a solid percentage of the typical workday is spent on-line for those interviewed, it is not the case that they are fully wired from all places all the time, as could have been expected with this technical population.

Uses and Gratifications

This population showed specific uses and gratifications for the Internet compared to other media, with half the respondents saying TV and the Internet are not interchangeable. Most notably, information seeking was a primary driver for the majority of the participants in choosing to use the Internet over TV or print media. The words “reference” and “resource” came up often, with one person stating they seek information off-line only when they cannot find it on-line.

The most prominent activity uncovered in this study was the use of a search engine called Google. Every participant mentioned this technology, initially without any solicitation from the interviewer. Every participant noted how this search tool fits into his or her media routine. For those interviewed, the developer typically described a routine of having some idea of a term or category to look for on-line, such as an API (computer code to connect software applications in a standard way). The developer then would go directly to Google, type in the term, and look at the results to find further information. One developer noted that the level of specific detail that can be searched for is a valuable trait, such as the ability to type in a bug tracking number to uncover the exact problem with a piece of code and instantly find related fixes. Other reasons cited for the popularity of this search tool in particular are the rapid response time, the clean information that is returned, and the complete nature of the responses.

The convenience factor of the Web as a reference tool was a prominent theme in the developers' use of the media. One respondent noted that although he works in the lab where technical documentation books for one of the world's most widely used database software applications is physically housed, he often prefers simply to search on-line for information rather than flip through the manuals. Another developer stated that although he has CD-ROMs with information handy, it is easier to use the Web to look up information. Similar to commentary explaining the search engine popularity, the granular information capability of the Internet was cited as an important variable driving the use of the tool for information-seeking.

Chat and real-time communication were also cited as important reasons the developers use the Internet. One noted the requirement of the profession to work in teams, since development of code is broken up into small parts that are dispersed across teams for individual development. The code must be in concert among all its pieces, and thus the team must communicate frequently and with specific questions. Commercial chat tools were also used for personal communication, while several respondents noted the use of company-owned intranet chat as a primary communication tool. (The intranet houses or hosts a software application enabling chat among employees, while protecting information from the publicly accessed Internet.) One respondent explained that chat is often used to communicate even with local colleagues situated down the hall, particularly when a simple, specific question is asked. This format enables the embedding of related links or documents as back-up information to answer the question. When the communication is more involved, such as drawing a diagram on a whiteboard, the respondent said that interpersonal, face-to-face communication is preferred. He also noted that typing long answers on chat can be time-consuming and complicated, and sometimes there is no replacement for a face-to-face meeting.

Besides chatting and news checking, only one respondent emphasized a set of personal functions, including banking and shopping, as core drivers for using the Internet. This same developer said setting up travel plans also drove use of the Internet because travel information is better on-line, offering benefits such as more easy availability of a

wider range of resources, time savings in finding information, and cost savings. Other personal functions cited as affecting Internet usage, but not cited as primary drivers, included entertainment, such as checking television program guides on the Internet and playing games with children.

Web conferencing was not a primary function for this population in using the Internet to communicate. While some respondents use it or had used it, they did not describe it as routine or as a main reason for using the Internet. Chat, also known as instant messaging (IM), was the common tool used and mentioned, and email was mentioned in mixed responses as a useful tool (as detailed further below in the mass media interpretation section).

Type of content viewed with this media included technical documentation, computer code, learning materials, animation and entertainment information. Related to the use of the medium for their profession, the notion of technology problem-solving came up repeatedly, and directed their choice of content. For example, one developer said he searches for code that is reusable rather than having to develop something completely from scratch. Another noted that much of the technical support provided by software vendors in their contracts is on-line only. The developers also view personal content while at work, saying they check on-line news frequently, sometimes as much as hourly throughout the day. Sports scores from their native countries and maps for driving to locations drive some of the personal content searches; hobbies such as cars and cartoons instigate other personal content viewed. But as noted earlier, the primary forces affecting their choice of Internet content stem from job-related information seeking more than personal content viewing. Additionally, as noted, the results of a search engine query most significantly dictate what content is viewed.

Many respondents emphasized that the quality of content significantly affected their usage, with clean and easy-to-locate, specific information critical. There is also a value-add of edited information or consolidated information that helps drive its use as a reference tool for this population. For example, one developer can find directly relevant information tailored to the Macintosh community by visiting a news site that consolidates

Mac information. He also uses a version tracking Web site that continually updates information about software versions from many manufacturers. Another developer keeps only twelve sites bookmarked, all of them portals that filter various sites and publications and organize content accordingly.

Nearly every developer mentioned they do not read any pop-up advertisement content, and others expressed dislike for any type of ads in email or on the Web. One of the developers has installed technology to block such boxes that pop up without user request. Others mentioned the use of Google as positive because it does not carry major banners on the site, but notes in text form any sponsored links.

When asked about font size or other formatting and its effect on their use of the Internet, the majority of respondents said it was not especially significant, but could impact how quickly they find information (emphasizing again how they use the medium as a reference tool). One developer explained that the only formatting issue relevant to Internet usage in his opinion was the use of animation, something he finds particular to the Internet and without which the experience is ruined for certain sites. Another respondent emphasized how the quality of content significantly changes what Web sites are visited and overrides any type of cutting-edge graphic design or presentation in importance to usage of the medium. It is also worth pointing out that for this population, video-rich or slickly developed email messages are not as considered as valid as direct, technical answers to instantly messaged questions.

Speed of the Internet connection affected some of the respondents, particularly in the need to download software, whether professional (code) or personal (music). Several noted that because of the quick response time for on-line search results, it is easier to problem-solve technical questions, and should the access not be so speedy, other media such as books might be more useful. For one developer who must respond to technical support on-line, speed is critical in being able to answer queries in a timely manner. Another developer noted that slower speeds limit the amount of time spent exploring the Internet from home. A third participant noted that the frequency in code exchange requires a continuous file transfer protocol (FTP) connection to the other side of the

country so teams can always swap data. The same respondent noted that any slower speeds at home would ruin the entertainment and learning value of the Internet, especially animation and games on sites such as Nickelodeon Junior.

Those who frequently use other media noted the ability to physically carry the media as a reason for using it, such as taking a news magazine to the living room to read. One person prefers learning from books and buys them for that reason. Television was cited by two respondents as media used for relaxation and entertainment, or for generating a feeling of company in the house. The majority of the participants read newspapers on-line only, pointing out that they can peruse multiple media on-line quickly for different perspectives, and can more easily find language-specific newspapers from their native countries.

Internet as Mass Media

Eight of the software developers interviewed consider the Internet a mass medium, but different reasons were cited for the classification. Some consider the relatively universal access to the Internet criteria for making it mass, noting it only requires the proper equipment and connection and can then be accessed from anywhere. Two others said the unrestricted ability to publish any type of information is criteria for mass media. Another participant highlighted the freedom to choose what content is seen as the key distinguishing factor between personal communications and mass media. The same participant pointed out that email does not meet the mass media criteria in his opinion because one cannot completely control what arrives in the on-line mailbox. Others disagreed, saying email as well represented mass media, but did not elaborate why they grouped it together with the Internet. (On a related note, nearly every participant mentioned they do not read unsolicited email and find it a poor tool to deliver information.) Lastly, it was noted that the broad reach of the Internet qualified it as a mass medium. Those two that do not consider the Internet a mass medium cited exactly opposite rationale, noting that because it is less controllable and more egalitarian, it is not

mass medium. One would classify it as a resource, not a communications tool, in his opinion.

Knowledge Stage

How these developers first become aware of information and how they increase their knowledge about software subjects can be traced in some part back to uses and gratifications. As noted, the search engine tool is a prominent task in their on-line media routine. However, friends, Web sites, email lists, and even print and radio still play a part in their first knowledge exposure. Table 7 summarizes how each of the participants first heard of any kind of software in the past six months (at the time of interview), their main drivers for using the Internet, and the main content they reviewed. Note that some developers inadvertently chose to list attributes that attract them to using the Internet (such as “instant access”) instead of listing what they actually use the Internet for (such as “banking”). Nonetheless, the information offers insight into their activities around this medium.

Specifically, as detailed in the table, nine different types of communication sources were identified across the ten developers as the initial source for their software knowledge in the past six months. Frequently, more than one kind of source was listed, and frequently, this combined on-line and interpersonal communications, such as an emailed news list the developer subscribes to and the recommendation of a colleague or friend. In some cases this reflected the fact that the developer could not recall which came first, the personal recommendation or the on-line exposure, and in other cases, there were different types of software knowledge gained from different sources. For example, one developer distinguished between finding out about software for video games versus software for professional use. In the case of games, he said friends were more likely to tell him about something that he then searched for on the Web, while on-line news magazines were more likely to alert him to something to use for work. Another developer who noted the use of Google as a first exposure, explained that the search engine also pulls up many user groups and community boards that post URLs with

information, and that these communication formats served as first exposure to new software. The type of Web sites that offered the knowledge ranged from on-line technology news sites such as cnet.com, to industry sites, to some vendor sites.

Table 7

Software Developer Knowledge Awareness and Internet Use, Summarized

<u>Developer ID#</u>	<u>Source of Software Knowledge</u>	<u>Main Driver for Internet Use</u>	<u>Main Content Viewed</u>
1	Group email lists Industry sites	Intranet IRC Server ("chat") Email Web Google IM ("instant messaging")	APIs News stories
2	Office	Technology information seeking - Google Entertainment Communication	Technology forums, articles, tutorials, standards information Movie trailers, songs, cartoons Books
3	NA - Did not answer	Search Chat	Google Hotmail
4	Internet Friends	Searching for information	Tech Support
5	NA - Did not answer	More resources Time saving Cost saving	Technology related problem-solving Search engine Intranet on career benefits, news
6	Web Sites News Group Info News Group Post URLs in commercials	Variety Instant access Real-time interaction	News Software downloads Russian newspapers Interact with friends
7	Google	Obtain news Information	

8	Internet technology News site (cnet) Friends	Info seeking 90% Communications 10% Necessity Easy & fast Get what you need	Download products Download documentation Email Chat
9	Software Tools: Co-workers Internet newsletters & magazines Web site Printed technology magazines Searches: Google Software Games: Friends Web sites	Banking Shopping Communicating	Portals News
10	Colleague recommendation Radio ad	Info seeking for job Email Chatting	Intranet IM Google Yahoo Nick Jr.

Results Discussion and Interpretation

Methodology Interpretation

One initial finding of this study emanates from the methodology revisions.

Internet communications require a different tone of language and different format. In this study, the questions initially developed for telephone usage did not hold up well under email scrutiny. Marks had to be made to distinguish the question from the answer in a text email format. Questions had to be easy to read. Developers were literal in their interpretation, but also friendly in their tone and more casual in their use of grammar and language. While this could be attributed to the nationality of the particular developer, the consistency across the board in this study makes it more likely that either the nature of the media or the nature of the population drive the behavior. Future studies could identity this more precisely by creating two sample sets of demographically identical developers, then posing the same questions in two ways. One would use a rigid, formal form that is filled out, and another would use a more casual, short, in-line set of email questions. The tone used for the responses could be evaluated, as well as the length and depth of responses, and whether or not the developers were even willing to participate, since the tone could affect their attitude.

In this study, three formats were used, with phone and email communication methods triggering responses, but an on-line posting for participation turning up nothing. It is also worth noting that any developers even selected use of the phone when offered the choice of phone or email, since the population had emphasized how much they use on-line communications tools. However, this could be explained by the response of one developer, who as noted, explained that more in-depth questions, such as those proposed in this qualitative study, require a different type of communication besides email. Whatever the specific rationale for the choice of format, it is clear that different media, including the Internet, alter the type of communication.

Uses & Gratifications Interpretation

The Internet for this population does not necessarily replace other media such as television or newspapers, however, it appears to be the central media used for information-seeking, especially technology related information. This central finding supports research by Macrimmon and Taylor (1976) specific to the high-tech market, where fast paced changes in technology and the inexperience of buyers drive information-seeking.

In this study's findings, television is used more for entertainment, with the majority of developers stating that the media's pre-established, one-time airing of programs limit its use for other functions. While technology is available for TV content to be recorded with programs viewable at discretion, the simple availability of information that is specific and quickly accessed draws this population more to the Internet.

For the television industry, the interpretation of this usage would of course first need to be confirmed by testing that in fact the segment at large, and other segments adding up to a mass audience worthy of the cost investment, also reflect this insight. Further testing could then identify what types of entertainment are most attractive to the largest set of segments. Once content types are better identified, this media could flourish in this role by focusing on the entertainment value, making perhaps richer programs with sound and visual depth that would be difficult to match on current computer screens. Another option would be to continue cross-pollination of TV and Internet media, building on current trends to show movie trailers on-line and post viewing guides on search sites. A different option might be to leverage low cost models of new digital or satellite TV technologies to offer segment-specific entertainment channels, for example, a TV channel mapping all content to the needs of highly educated, international technical personalities. As for the future of television news, however, the population in this study is not an avid user of broadcast news, unless Internet access is too slow or sporadically down. One developer went so far as to describe television news as a form of entertainment, with limited information value.

Printed newspapers seem to be used less than other media by this population, superceded by targeted, filtered on-line sources of news. However, one could interpret this as newspapers increasing in popularity, since this population does routinely view multiple language and location-specific newspapers on-line. The increase in usage would come from the low cost of visiting news sources on-line compared to delivery. For example, an Indian developer located in California might not spend on home delivery subscriptions for multiple newspapers, reading only certain sections such as sports, but would visit various newspapers on-line. For the print newspaper business model that drives revenue from local advertising, however, the on-line reading versus home delivery impact could be problematic, since the population in this study emphasized two opposing trends. One is the distaste for any type of advertising as a credible source of information, thus on-line ads might not make up for the revenue. The second trend is their use of search engines like Google, which locates specific information regardless of its packaging in a newspaper on-line, and which locates this information with no wasted paper or time. What perhaps could help the traditional newspaper business, however, is this population's commentary that edited and carefully selected, accurate information is valued, although how much one is willing to pay for this value remains to be seen.

Print magazines were mentioned as part of several developer sources of information, but the majority used the Internet versions of the magazines in the same way they use newspapers on-line. Search results that include the magazines usually dictated the use of the publication. However, it could be studied whether non-technology topics such as international affairs or surfing, as examples, change how much the developers depend on magazines. This study found much of the information seeking related to the profession of software development, and some personal content viewing based on hobbies and news. A study specifically formulating questions around the hobbies and personal content might uncover different usage patterns for print magazines. This study's findings, however, show that for this population, print media cannot compete well with the highly specialized, instant access to information-seeking available through Internet searches, or to the interactive animation capabilities of the newer media.

Radio was mentioned only once as part of one developer's routine in driving to work in the morning, and did have a slight impact in making this person aware of software. However, the developer did not necessarily remember the exact site mentioned in the ad, and instead said he would go to Google to search for the topic. In such a case, the particular software advertised might not even appear in the search return, especially if the market category has many similar types of software. Another developer pointed out that content typically found on the radio such as music, is already available on-line anyway, and free sharing programs make it very easy to try different types of music or get recordings quickly, thus the radio for him is irrelevant. It could be useful to investigate if there are any entertainment functions the radio provides that cannot be better fulfilled by the Internet, similar to TV's complementary function. Additionally, if it is true for the mass set of developers that radio is used for drive-time, the trend could be evaluated for its longevity and programs tailored to that type of routine. For example, satellite radio enabling hundreds of radio programs could include content geared toward this population if in fact they will continue to commute (some telecommuting studies might prove otherwise).

When asked about different features of the Internet they use, the results were somewhat surprising considering the vast technical capability of this population and their average of 5.5 hours on-line every day. Few of the developers said they routinely play on-line video games. One developer noted one explanation for this: the mentality of wanting to win does not fare well against hard-to-beat computer-generated challengers, and this ruins some of the gratification of the game experience. This insight supports research such as Altheide and Snow (1979) who mention motivation and expectancy levels as affecting individuals' perceptions. Future studies could study those who heavily play games on-line and compare their motivation behind the activity, further evaluating if the same motivations exist in a larger segment of the software developer population.

Handheld devices were not as frequently used as could have been expected to access communications tools on the Internet or to learn about new software, with just one developer using a phone for connectivity. Movies or commercials were not cited as

something they choose to watch on-line, such as with webcasting technology, and on-line events were not mentioned as a core feature or time-consumption of their on-line experience. Future studies would need to analyze whether this is driven by the heavy information-seeking use of the Internet or by other factors such as media maps (Altheide and Snow, 1979); perhaps they associate viewing movies with TV or theaters. Other assumptions to test could be whether the connection speed makes the experience too slow or of poor quality, or if they simply do not concern themselves with packaging of content compared to digestion of the content itself, a theme that did come through in the interviews.

Knowledge State Interpretation & Discussion

The diffusion theory still remains at play in the Internet age, with both interpersonal communication and mass media communications affecting the first exposure to information; in other words, the Internet does play a part in accommodating the first stage of diffusion called knowledge. An interesting finding of this study is the intertwined nature of mass media and interpersonal communications. For example, the developers noted the broad availability and reach of the Internet as qualifying it as a mass medium, yet they also described a sense of community and teamwork built by using the Internet's chat capabilities. They stated clearly they do not read unsolicited emails which they consider commercial, yet they sometimes first find out about software through an email from a news list they subscribed to. Despite the fact these technologies can and do reach millions of people in an instant, in this population they appear most relevant for communications when they are specific to the user in a personalized way.

Interestingly, these findings support previous research summarized in the literature review of this document that highlights the convergence of various media and the simultaneously distinct characteristics the Internet nonetheless brings to the mix (Hiebert & Gibbons, 2000; Slevin, 2000). As McQuail explained (2000), new and traditional media are being leveraged for integrated marketing. This study's findings also support the various views provided across decades of research that propose the Internet as

both a medium appropriate for providing knowledge (Westley and MacLean, 1957), and a commercial vehicle for selling goods (Mattelart and Stourdze, 1993). In this study, the speed and granular detail on the Internet's delivery of information make it appropriate for providing knowledge to these software developers, but the unsolicited use of email to sell or market goods and services to them is unpalatable.

In the future, a quantitative study could identify if this intertwined aspect appears consistently or is peculiar to the small set interviewed in this study. Would a larger sample base show that in fact, it is considered mass media that is also used for interpersonal communications? Or would it appear more toward one use or the other? In this study, the Internet is, in fact, a technology leveraged initially for information search, but also one used for rapid communication both personally and professionally. Some companies already design software that sends customized emails to large groups of people, yet in this study's population, even those emails would not be reviewed unless the developer had asked for the information and received it from a list that is credible and more personal.

Another finding of this study is the difference that the type of software knowledge makes in media usage. Developers explained that their first source of knowledge about new software can change depending on whether the software is a free download or an expensive business application. Friends may be helpful for initial awareness about a technology capability such as telephone-type talking over the Internet, with a search engine used to then find the sample of programs. On-line opinions in technical articles or on search engine returned sites may play a larger role in evaluating costly software, with a trip to the vendor Web site only afterwards to download basic specification information and pricing. Again, there was a mix of interpersonal sources, such as a colleague recommendation, and mass media, such as magazine editorial, in diffusing the information that developers first discovered.

These findings support research detailed in the literature review that proves that content types can affect diffusion (Carrocci, 1985), however it is not necessarily saliency of the content in this case as much as the cost, or cost risk, involved in finding out about

software. While the Carrocci study found that saliency of news, for example, changes how it gets diffused, it did not evaluate the impact on the audience of *not* having the knowledge. In this study, some developers were concerned about negative impacts from *not* having the correct level of knowledge about a product, and thus for more expensive types of software, they seek additional or different sources for knowledge. What could be considered supportive of the news saliency research is the finding that interaction with friends drives the information search for a related product. For example, when one Canadian developer with Polish roots wanted to converse with his friends in Poland, he used their recommendation about software to go search for an on-line telephone program via Google.

The search engine habit insight of this study makes somewhat irrelevant advertising research that suggests layouts and styles affect how users grasp knowledge (Thorson, 1996). In the case of on-line search tools, text formatting information is perfectly acceptable and desired, since the quality and relevance of the information is most critical. For Web site designers targeting this population, content must come before design in a manner that enables rapid information finding. Since the primary motivation is to locate something and either download it or review it, the design must take that into consideration with minimal time-consuming artwork or vague terminology.

Overall, for marketing professionals tasked with diffusing technology to the developer population, this study's insights suggest a different use of communications vehicles depending on the nature of the software and the type of content desired to be broadcast. The heavy usage of Internet search technologies such as Google makes it difficult for the marketing professional to justify any spending on a single media without first ensuring cleanly available on-line search returns, built through carefully selected wording and industry terminology. It does remind such communicators that although no one media outdoes everything, the Internet appears to be a dominant source of information searches for this population.

Research in the public relations field that emphasizes the need to understand the on-line conversations happening through multiple publics is supported by these findings

(Holz, 1999), since professionals who do leverage key words and who do understand search technologies will be able to tap into this segment's media routine and communications habits. But those professionals involved in developing brand equity or building brand awareness will find a challenging environment in factual search returns that provide information based on generic categories, not on brands. In this study, no developer specified that brand was important in the software selected. While some did say they had searched by a brand name for a software product, they also said they followed up by then searching the overall category for comparative products.

For media institutions accustomed to the control and filter of information, search engine technology places more control in its search results than in editorial selections of magazines or newspapers. Unless these outlets can add value through new associations of information, or evaluation of continually updated, highly specific information, they will be part of a list of URL returns and not the primary portal to information.

Future Research Direction

Future research recommendations that could clarify or build upon individual insights uncovered in this study have already been noted throughout the prior Results section. For a more comprehensive contribution to the mass communications field, however, it is recommended a follow-up study be carried out on the basis of the search engine finding in particular. Considering its potential function as a filter of content communicated to people in disparate locations, a comparative study is recommended to evaluate search engine technology and media institutions. This comparison can evaluate several factors to uncover how the Internet's role in media changes a traditionally known business and institution, specifically:

- How broadcasted information is filtered when it is search engine technology deciding what is "aired" on-line instead of media professionals; how this will impact the future of journalism curriculum and the role of the editor;

- How the targeted nature of search compares to prior media usage of sections or segments, and how this might impact audience reach; will the Internet leverage search in some form for mass broadcast of messages, or will tiny subsets of audiences be sustained by numerous, specialized media outlets?
- How the business model of news may or may not change considering these factors, including whether the current low cost model of the Internet will continue and how that will prompt its use by the media; will the media absorb existing search technology or develop its own expertise in search to own the filtering rights to broadly published information on-line?
- Is the media institution dead, lost to companies well-versed in technology and well-funded in engineering talent? Is the new ABC in fact Microsoft?

These are interesting questions brought about by computers networked around the world, searchable in an instant. Thanks to discussions with developers, this comparative study concept could help mass communications researchers predict and perhaps then adjust curriculum to prepare the next generations of communicators, digital or not.

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Appendix A: Sample Interview Questions - Proposed

Individual Characteristics

Please provide your age, gender, nationality, and education level.

Please explain your present occupation, including type of developer, title, main project/work, and main programming language you use.

Internet Usage & Gratifications

Where do you have access to the Internet? (Home and work? From mobile devices?)

What speed of access do you have? Does this speed affect how and why you use the Internet?

How many hours a day do you spend on-line? What affects this day/hour usage?

What types of features do you use on the Net (discussion groups, news lists, chat, search engines, Web conferencing)?

Does any particular feature or set of features affect your usage of the Internet? In what way(s)?

What are the top three reasons you use the Net? (or more open-ended, why do you use the Internet?)

New Software Knowledge

Have you tried any new software products recently (in the past six months)? Why?

If yes, what type? (consumer, business)? Did you care about the brand?

[If not, disqualified]

Where did you first learn about this product? Any reason why?

If on the Internet, how exactly? (banner ad, email from friend)

If not on the Internet, did you use the Internet to obtain further information? If so, how did you use it?

What is typically your first source for first learning about a new software product (Media, friend, Internet)? Does your first source change depending on what type of software?

Media Usage & Gratifications

Do you think of the Internet as a mass media channel? Why or why not?

Do you think the Internet is too commercial? Why or why not?

Do you read print magazines, watch TV, and visit Web sites? What for and why? (Entertainment, information seeking, etc.) How often?

Do you read on-line sources of information? What kinds? How often? What affects what you read on-line (for example, font size, information source, type of Internet whether bulletin board or Web site)?

Thinking about all these media, do you see any patterns in your choice of one media over another for different uses or needs? (wait for answer, then ask the next question)

For example, is there content you seek on the Internet versus other media? If so, why? If not, do you think the various media are interchangeable for you in terms of becoming aware of new products?

Finally, considering all the answers to these questions, would any of this behavior change if you lost your job, changed professions, or had no sponsorship of any media or communications costs?

Appendix B: Interview Questions – Second Set, After Revisions

Name

Date

A) DEMOGRAPHICS

1 * Please provide your age, gender, nationality, and education level.

2 * Please explain your present occupation, including type of developer, title, main project/work, and main programming language you use. If unemployed, list last type of development work you did when last employed.

B) MEDIA USES & GRATIFICATIONS

3 * Do you think of the Internet as a mass media channel? Why or why not? What about email?

4 * If you read print magazines, watch TV, and visit Web sites, try to list out which ones you use/watch and what drives you to use them (entertainment, information seeking, etc.) Feel free to note how often you use different types of media.

5 * Do you ever read on-line sources of information? Like what? More often than off-line info?

6 * What affects what you read on-line (for example, font size, information source, type of Internet whether bulletin board or Web site)?

7 * Thinking about all these media, do you see any patterns in your choice of one media over another for different uses or needs? (For example, is there content you seek on the Internet versus other media? Are TV and the Internet interchangeable for you?)

C) KNOWLEDGE DIFFUSION

8 * Have you tried any kind of new software recently (in the past six months) and if so, what prompted it? (like new job requirement or tax season)

9 * Try to remember where you first learned about, or even heard of, this piece of software – describe the first exposure (for example, was it from a friend who told you just the name, from an article you read, or did you just come across it on the Internet or through an email?)

10 * What type of software was it? (consumer, business, etc.)? Do you think your first source (media, friend, Internet?) changes depending on what type of software you're interested in?

11 * Did you use any search tools to find the software at all, or to find out more after the initial exposure you mentioned in the prior question set?

12 * If you first heard of it from someplace besides the Internet (like a radio ad), did you use the Internet to obtain further information? If so, how did you use it? (search engine, Web site...)

13 * Do you think the case you mentioned is typical for how you first learn about new software and if not, please tell me more...

D) INTERNET USES & GRATIFICATIONS

14 * Where do you have access to the Internet and at what speeds? (Home and work? From mobile devices?)

15 * Does this speed affect how and why you use the Internet? In what ways?

16 * How many hours a day do you spend on-line, and what affects how long you're on? Does this usage time include email?

17 * What are the top three reasons you use the Net? (or more open-ended, why specifically do you use the Internet?)

18 * What kinds of individual features do you use on the Net? (like discussion groups, video games, news lists, chat, search engines, Web conferencing, intranet vs. internet?)

19 * Any other thoughts you have on why you first learn about things in one place vs. another, or how the Internet and other media serve as tools or affect this?