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GLOBAL DIFFUSION OF INTERACTIVE NETWORKS

The Impact of Culture

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Abstract. The Internet and other interactive networks are diffusing across the globe at rates that vary from country to country. Typically, economic and market structure variables are used to explain these differences. The addition of culture to these variables will provide a more robust understanding of the differences in Internet and interactive network diffusion. Existing analyses that identify culture as a predictor of diffusion do not adequately specificy the dimensions of culture and their impacts.

This paper presents a set of propositions to be used in analyses of the impact of culture on the diffusion of interactive networks. The propositions were developed using cultural constructs presented by Hofstede, Herbig and Hall. Diffusion of innovations theory and critical mass theory provide the theoretical base. The development of the propositions resulted from a close examination of the theories for relationships mediated by culture. The resulting propositions use cultural variables in relationships established by the theories. It is hoped that the propositions will serve as a starting point for future research in the area of cultural influences on the diffusion of interactive networks.

1. Introduction

On a global basis, diffusion of the Internet is occurring at vastly different rates between the developed and less developed countries. These differences have been partly attributed to differences in GDP (Who's Winning..., 1996). However, if GDP were the only factor involved there would be equally high levels of diffusion across the economically developed countries. As the following chart shows, diffusion rates vary widely even among developed countries.

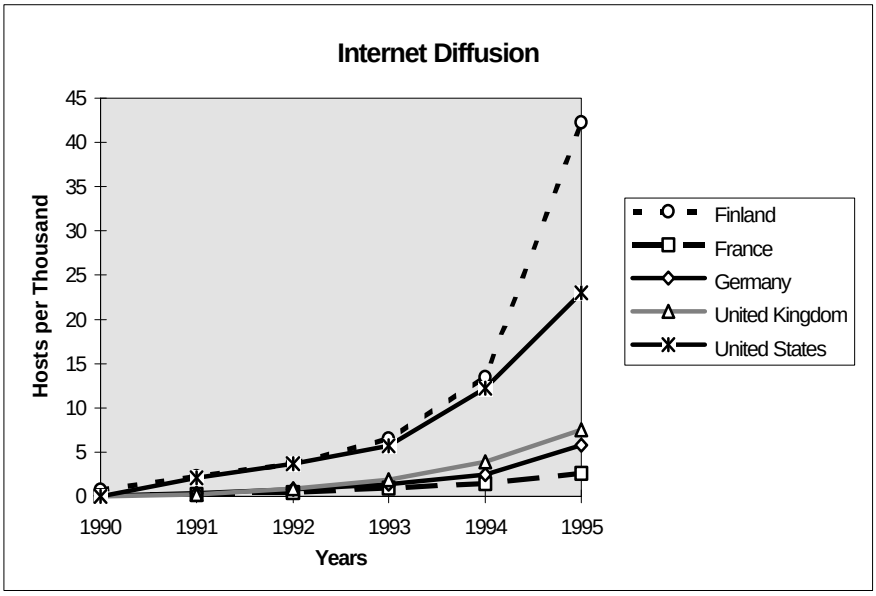

Figure 1: Internet Diffusion Patterns (Source: ITU Stars Database*)*

Obviously, a more complex explanation of the Internet diffusion process is required. Additional variables used to explain this difference include the availability of bandwidth (Hahne, 1997), pricing (Cronin, 1996), and the telecommunications market structure (Paltridge, 1996). Although these variables help explain some of the variance in Internet diffusion among countries, one important variable remains. That variable is culture. Culture has been mentioned as a factor in the diffusion of the Internet in several studies (Cunningham, 1995; Cronin, 1996; Goodman, Press, Ruth, and Rutkowski, 1994). For example, Goodman et al. (1994) state that barriers to network diffusion fall into three broad categories: (i) government policies; (ii) technical impediments; and (iii) local and cultural factors. Although inclusion of culture as a variable in this analysis is valuable, the method used to demonstrate its impact was anecdotal and therefore not as effective as it could be. The exact relationship of specific cultural variables to particular aspects of the diffusion process were not described. This treatment of culture as an explanatory factor is typical.

There are two reasons for the lack of rigorous analysis of the relationship between network diffusion and culture. The first is a perception that culture is an unquantifiable construct. Many anthropologists would agree with this notion. Cultural variables are seen by some to be constrained to the context in which they are observed so that generalizations across cultures and nations are not

possible. The second reason is diffusion theories do not explicitly state the relationships between cultural variables and network diffusion processes.

The goal of this paper is to clear away some of these barriers. Specifically, theoretically derived propositions will be developed based on established, empirically tested cultural variables. Theories, including diffusion of innovations and critical mass theory, will be explored for areas in which cultural variables can provide explanations for diffusion processes. Also, cultural variables relevant for the analysis of communication technologies, as presented by Hofstede, Herbig, and Hall, will be discussed. The result will be propositions that combine cultural variables with the existing diffusion theories, easing the integration of cultural variables into network diffusion studies.

Theories and propositions should be broad in scope. For this reason the following discussion will focus on diffusion of interactive networks in general, not merely the Internet. Examples of other interactive networks include proprietary networks such as CompuServ and America Online and private corporate networks. Cellular telephone networks are also interactive networks. Innovations which are not interactive networks are one way cable television systems and direct broadcast satellite service.

This paper is concerned with the diffusion of networks on a global basis, with countries serving as the unit of analysis. Diffusion studies rarely use countries as the unit of analysis. However, the questions answered by such an analysis are important for a wide variety of professionals, including policy makers, marketing strategists, development agencies, and academics. Typically, a study of network diffusion would have ‘use of the network’ as the dependent variable. However, on a global basis, use of interactive networks is difficult to quantify. A variable which is quantifiable is access. Therefore, in the following discussion when it helps to imagine specific independent and dependent variables, the hypothetical dependent variable will be ‘access to an interactive network.’ As a dependent variable, access provides basic answers about where use of a network can occur. Access does not, however, provide information about access disparities among groups within cultures, patterns of use, and the implications of use. These questions must be addressed separately but can be informed by research based on the propositions developed in this paper.

2. Culture and National Cultural Dimensions

The relationship between new technologies and culture is the subject of a large body of research. One area within this body is concerned with the role of culture in the process of developing new technologies. Questions regarding the role of culture in fostering characteristics of inventiveness or innovativeness are explored. National cultural characteristics are also presented as a prerequisite to technology development and the economic success that follows (Herbig, 1994).

Studies such as these define one end of a continuum of the technology diffusion process. Generally, they are interested in the point at which the innovation is created, the precursor to the diffusion process.

At the other end of the culture/technology continuum is an area of research concerned with the effects of diffused technologies on society. These studies examine the mechanisms through which technology affects culture. Specific examples include studies in which new communication technologies change social structures (Latane and Bourgeois, 1996), norms of communication (Dutton, Rogers, and Jun, 1987; Caron, Giroux, and Douzou, 1989), or the establishment or new norms (i.e. the norms of "netiquette"). Together these two areas define the ends of a continuum. In the middle of the culture/technology continuum, culture influences the diffusion of technology, and this is the topic of the following investigation.

2.1. CULTURE

The identification of variables used to examine the relationship between culture and the diffusion of networks requires a detailed explanation of culture. Culture is such a broad construct that the best one can do is place boundaries on its meaning for a particular application. Geertz (1973) defines culture as:

> "an historically transmitted pattern of meanings embodied in symbols, a system of inherited conceptions expressed in symbolic forms by means of which men communicate, perpetuate, and develop their knowledge about and attitudes toward life." (Geertz, 1973, p.89)

More simply, culture can generally be described as the way of life of a people (Rosman and Rubel, 1995). Specifically, it refers to the socially learned behaviors, beliefs, and values the members of a group or society share. Certain cultural features, known as cultural universals, are present in each society. These universals include language and other symbols, norms and values, and the tension between ethnocentrism and cultural relativism. Ethnocentrism refers to the belief that one's culture is superior to all others, while cultural relativism requires that the value of customs and ideas of a society must be judged from within the context of that society (Persell, 1984).

Although culture is defined as a societal level construct, it certainly has implications for individual behavior. Culture can be seen as a mediator between human nature, which is universal, and personality, which is specific to the individual (Hofstede, 1991). The result is that although a range of personality types will be found in any society, there will also be a preponderance of individuals with a particular kind of personality (Rosman and Rubel, 1995). The personality type represents how people within a society respond to their cultural norms. This demonstrates the ability to draw conclusions about societal culture based on responses of a sample of individuals from a society.

2.2. NATIONAL CULTURAL DIMENSIONS

Culture, therefore, is a societal construct. Although a society is more homogenous than a nation, and a nation may contain several distinct societies, studies often use nations as the unit of analysis. The reasons for this are simple. National governments collect data which are often only relevant at the national level. The problem this creates for the development and use of national level cultural characteristics is that one must be careful in interpreting results. National level characteristics must not be interpreted at the individual level.

Studies attempting to identify national cultural characteristics are plentiful. One of the most widely used sets of national cultural characteristics are those established by Geert Hofstede (1980). Hofstede analyzed survey data from an international sample of IBM employees from 1967 to 1973[1]. The survey questions were designed to measure work-related values. Hofstede used these measures of values, which are a component of culture, to identify national level cultural characteristics common among all of the respondents. He then created scales which provided a score on each of the characteristics for each of the 51 countries represented in the sample.

Hofstede found national cultures vary on five dimensions: individualism vs. collectivism, femininity vs. masculinity, long term vs. short term orientation in life, power distance, and uncertainty avoidance (Hofstede, 1991)[2]. For four of the five national cultural dimensions the implications for diffusion of interactive networks are inconclusive. Based on descriptions of the dimensions, contradictory hypotheses predicting both an increase and decrease in the speed of diffusion can be developed. This does not imply that the cultural dimensions are irrelevant for the study of interactive network diffusion. It does, however, highlight the need for a theoretical structure to more accurately predict the direction of the relationships. The meanings of these dimensions and their implications for interactive networks are discussed below.

The individualism versus collectivism dimension was defined by an individualism index. A country scored low on this index if it was a collectivist society (Colombia, Indonesia) and high if it demonstrated individualistic tendencies (USA, Australia). Hofstede states that for collectivist societies the prevailing work norms are that management is done on a group basis and that relationships prevail over tasks. For individualistic societies management is done at the individual level and tasks prevail over relationships.

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[1] For a detailed analysis of the method used see (Hofstede, 1980). The data were collected from IBM employees covering 72 national subsidiaries, 38 occupations, 20 languages, and at two points in time: 1968 and 1972. In total, there were more than 116,000 questionnaires with over 100 questions each.

[2] The short-term vs. long-term orientation dimension was in fact discovered by Michael Bond, although it is presented with Hofstede's original four dimensions in many studies.

The characteristics of individualism and collectivism do not directly address issues of technology. Conclusions based on Hofstede's descriptions suggest two contradictory hypotheses about the role of this cultural factor in the diffusion of interactive networks. First, the individualism construct is partially driven by GDP. This infers a positive correlation between individualism and interactive network diffusion. On the other hand, in collectivist nations the need to communicate with one's 'ingroup' could create greater demand for an interactive network. This suggests a negative relationship between diffusion and individualism. Therefore, it is theoretically unclear which of these two hypotheses should be supported if empirical tests were performed.

The masculinity versus femininity dimension is also described by an index. In this context, a masculine society has social gender roles that are clearly distinct. In a feminine society social gender roles overlap. A zero on the masculinity index indicates a feminine culture. In feminine cultures (Norway, Sweden) managers use intuition and strive for consensus; emphasis is placed on equality, solidarity and quality of work life; and resolution of conflicts is achieved by compromise and negotiation. In masculine cultures (Japan, Austria) managers are expected to be decisive and assertive and emphasis is placed on equity, competition among colleagues and performance; conflicts are resolved by fighting them out.

Again, explicit conclusions about the relationship between this dimension and the diffusion of interactive networks are difficult to make. On one hand, it could be proposed that feminine cultures will have faster rates of diffusion as they are more likely to provide access for all. On the other hand, the competitive nature of masculine cultures might provide an incentive for early and continued adoption. Which hypothesis is theoretically justified is not clear.

The long and short-term orientation in life dimension is based on Confucian ideals. It is reported as a long-term orientation index in which high scores indicate a long-term orientation. Characteristics of long-term oriented societies include respect for social and status obligations within limits, thrift, high savings rates, and perseverance. Countries scoring high on this index include China, Hong Kong, Taiwan and Japan. Short-term orientation cultures are characterized as having respect for social and status obligations regardless of cost, social pressure to 'keep up with the Joneses' even if it means overspending, and low levels of savings. Countries with a short-term orientation include Canada, Philippines, Nigeria, and Pakistan. The implications for this dimension on diffusion of networks are unclear. The high savings rates of long-term oriented countries would allow for greater investment in network technologies. However, the pressure to 'keep up' in short term countries might provide an impetus for diffusion of networks. As with the individualism/ collectivism dimension and the masculinity/femininity dimension, the

implications for the diffusion of interactive networks based on the short/long term orientation are ambiguous.

The power distance score assigned to each country describes the interdependence of relationships. It is defined as the extent to which the less powerful members of institutions and organizations within a country accept that power is distributed unequally. Hence in low power distance countries (Austria, Israel) it is generally believed that inequalities among people should be minimized and in high power distance countries (Malaysia, Guatemala) inequalities are expected and desired. Where interactive networks are concerned, power distance may manifest itself in the following ways.

In low power distance countries subordinates expect to be consulted and the ideal boss is a resourceful democrat. Consequently, in low power distance countries the more equal status of subordinates may provide a grass roots path for diffusion of a network. On the other hand, in high power distance countries subordinates expect to be told what to do and the ideal boss is a benevolent autocrat. In this situation, the autocracy may facilitate quick diffusion of a network once the decision to adopt is made. Another aspect of power distance is concerned with status symbols. In high power distance countries privileges and status symbols for managers are popular and expected. In low power distance countries status symbols are frowned upon. Adoption of some interactive networks, such as cellular telephony, is seen as a status symbol and would therefore be effected by power distance. Again, the implications of power distance on the diffusion of interactive networks is inconclusive.

Although the effect power distance has on the speed of diffusion is unclear, researchers have concluded the opposite: that diffusion of technology affects power distance. Teboul et al. (1994) suggest that computers, which are seen by some employees as intimidating, may actually increase power distance. Alternatively, an easy-to-use, non-computer-based fax machine may have the opposite effect. Therefore, power distance may be mediated by the introduction of this less intimidating technology.

The national cultural dimension whose implications for the diffusion of interactive networks is clear is uncertainty avoidance. The uncertainty avoidance dimension is reported as an index and is interpreted as the extent to which the members of a culture feel threatened by uncertain or unknown situations. In countries with low uncertainty avoidance (Jamaica, Denmark) it is common that motivation comes from achievement, esteem or belongingness; there is a high tolerance for deviant or innovative ideas and behavior. In strong uncertainty avoidance countries (Greece, Portugal) there is resistance to innovation and motivation for work comes from security as well as esteem and belongingness. The implications of uncertainty avoidance for diffusion of an innovation are clear. In low uncertainty avoidance cultures new ideas will be more readily accepted than in high uncertainty avoidance cultures. Thus, low

uncertainty avoidance cultures should experience faster rates of diffusion of new technologies.

Hofstede's work has been both supported and refuted by replication (Smith, Dugan, and Trompenaars, 1996), although the majority of replications support the existence of the dimensions (see Sondergaard (1994) for a review of the replications). Despite support for the dimensions, they are not all inclusive and there are additional variables that can be used to explain the relationship between culture and technological diffusion. Religion, gender equality and ethnocentrism (Herbig, 1994), and high and low communication context (Hall and Hall, 1987)[3] are examples of national level variables that have been used to date.

Although Herbig was concerned more with the development of innovations rather than their diffusion, the national cultural characteristics associated with generating innovations may also be relevant for their diffusion. For example, Herbig suggests gender equality will impact a country's innovativeness. He differentiates this from Hofstede's dimension of masculinity/femininity, which is more concerned with the relationship between gender roles rather than equality. Herbig's rationale for use of this cultural trait in explaining the source of innovativeness is simple. A country in which gender equality is low fails to tap the potential of half its population, thus reducing its potential for innovation. In high gender equality countries the potential for innovation is greater because a larger percent of the total population are in a position to innovate.

Although Herbig provides rankings on gender equality for 50 countries, alternative sources of annually updated gender equality scales exist. Each year in their Human Development Report the UNDP provide two measures of gender equality. One, the gender related development index (GDI) is calculated for 137 countries. The second index, the gender empowerment index, GEM, ranks 104 countries on gender inequality in areas of economic and political participation and decision making (UNDP, 1996).

Ethnocentrism, the belief that one's culture is superior to all others, is another national level cultural variable suggested by Herbig to impact innovation. As Herbig sees it, cultures low on ethnocentrism will be able to accept ideas from other cultures, leading to a higher degree of innovativeness. This may also mean such cultures will more readily diffuse certain innovations, especially those developed in other cultures.

A second way in which ethnocentrism may affect diffusion of communication technologies is through language. Low ethnocentrism implies a greater acceptance of ideas from other cultures. Ideas from other cultures will be shared in a variety of languages, which implies cultures low on ethnocentrism will support a greater number of languages. Language barriers have been shown to

[3] For an extensive list of studies concerned with cultural traits and innovativeness see Herbig (1994).

inhibit diffusion of communication technologies. A discussion of the diffusion of multimedia products in Europe concluded: “Language barriers are also seen as potential hurdle to expanding this market. On-line services would need to be translated to suit each local market” (Cunningham, 1995). Therefore, cultures low in ethnocentrism should experience higher levels of demand and faster rates of diffusion of communication technologies.

An additional national cultural characteristic which influences the diffusion of communication technologies is high and low communication context as presented by Hall (1987). Communication context is “the information that surrounds an event and is inextricably bound up with the meaning of that event” (p.7). Events and context combine to produce meaning from communication, and their importance varies among different cultures. Cultures in which communication context is highly valued have been labeled as high context cultures. Japanese, Arab and Mediterranean cultures have been labeled as high-context due to their extensive networks and close personal relationships. Low-context Americans, German, Swiss and Scandinavians, on the other hand, require more context specific information in their communications as their types of relationships do not make this information inherent to the communication event itself. Teboul et al. draw connections between Hall’s communication context and the use of communication technologies. They raise questions about the ability and satisfaction of persons from high and low context cultures to communicate through non-visual media (i.e. email) (Teboul, Chen, and Fritz, 1994). This cultural characteristic would certainly have implications for the diffusion of network-based interactive innovations such as email.

The works of Hofstede, Herbig and Hall demonstrate the construct of culture is very broad. When using this construct it is necessary to place boundaries on its meaning. The above discussion introduced several national level cultural variables relevant for studying differences in diffusion patterns of networks across nations. The next sections will discuss the special characteristics of interactive networks, and subsequently, the relationships between the diffusion of interactive networks and the cultural variables discussed above. These proposed relationships will be the result of the integration of cultural variables with diffusion theories.

3. Special Characteristics of Interactive Networks

The nature of the innovation will have implications for its diffusion (Lin and Zaltman, 1973) . It is widely recognized that the potential adopter’s perceptions of the innovation, and not “objective” characteristics of the innovation, are the determinants of an innovation’s diffusion (Rogers, 1995). However, it has also been recognized that network-based and interactive innovations possess certain objective characteristics which differentiate them from stand-alone innovations.

Rogers (1986) found it necessary to adjust diffusion of innovations theory for the special characteristics inherent to communication technologies. The following paragraphs describe these special characteristics.

The most fundamental characteristic of a network's diffusion is that both its demand and supply are affected by what is known as an externality (Antonelli, 1989; Allen, 1988). Varian (1992) describes an externality in the following way:

> "When the actions of one agent directly affect the environment of another agent, we will say that there is an externality."

The special status of an externality is derived from the assumption in economics that consumption decisions and the value or utility derived from consumption of a good are a function of autonomous preferences (Antonelli, 1989). When interactions between agents occur and preferences are affected externalities exist.

Externalities can be discussed along two dimensions. First there is the dimension of positive/negative and second is the dimension of consumption/production. Positive externalities exist when the interaction between agents results in an increase in utility. In networks positive externalities are present when new subscribers join a network and their utility is increased by the presence of existing members. The numbers of existing members and who those members are influence the new member's decision to adopt. Positive externalities may also be present for the existing members whose utility increases as a result of increased subscribership to their network[4].

Depending on the network and its members, new members may also activate negative externalities. Negative externalities are present whenever the actions of other agents decreases the utility for other network members. For example, a member of a congested network may be displeased with the addition of new members.

The examples used to demonstrate the difference between positive and negative externalities drew upon a particular economic action, consumption. These examples can be seen as positive and negative consumption externalities. The opposite of consumption is production. Production externalities exist when the interaction between agents affects one agent's ability to supply goods. With networks, production externalities also exist. The ability of a firm to diffuse its portion of the network may be a affected by the larger scale network to which they must connect to provide the services their customers desire. For example, an Internet service provider (ISP) is most often at the mercy of the local phone company to connect customers to the ISP as well as connect the ISP to the

[4] Mueller (1996) provides an alternate explanation of this phenomenon. He sees the increase in access to other subscribers at a less than proportional price as a demand-side economy of scope rather than an externality.

Internet. Positive externalities are present when the network is in place and working properly, while problems with the public network produce negative externalities for ISPs.

The discussion of network externalities raises another important characteristic which is critical mass. Critical mass is a phenomenon which affects the diffusion of *interactive* network-based innovations. The phenomenon occurs as a result of human nature and is compounded by the externality characteristic of networks. The concept of critical mass has its origins in the study of social movements where individuals' behavior in relation to other group members was examined. The concept has been applied to the diffusion of interactive technologies and is important for diffusion because the value of the innovation depends on the adoption decisions of others. The interdependence of adopters of an interactive innovation changes the shape of the diffusion curve from the regular S-shaped curve to a curve that has flatter slope initially but which quickly becomes more steep than the S-shaped curve. The point at which the slope makes this change and diffusion becomes self-sustaining is the critical mass (Rogers, 1995; Markus, 1990; Antonelli, 1989; Allen, 1988)[5]. Critical mass is concerned with the number of adopters, as well as the existence of opinion leaders among those numbers. This implies that the communication network structure, independent of the physical network being diffused, will play a vital role in contributing to the power of the critical mass (Rogers, 1986, p. 320).

A third characteristic of network-based innovations is that consumers must have access to the network before they can independently choose to adopt (Hadden and Lenert, 1995). For example, in the U.S. only roughly 60% of homes with access to a cable television network choose to subscribe to that network. The homes have access, a prerequisite for making their individual adoption decision.

There are different degrees of accessibility and they are determined by the type of network. Networks can generally be described as switched or unswitched and wired or wireless (Hadden and Lenert, 1995). Switched network accessibility may be constrained due to the significant cost switching equipment adds to the network. The wired/wireless characteristic of a network also has implications for accessibility. Wireless networks can be accessed easily because they are not constrained by the limits of physical connections[6]. For example, Direct Broadcast Satellite a wireless, unswitched network, is highly accessible as compared to a switched, wired network service such as the use of a cable modem.

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[5] It can be argued that the existence of a critical level of adoption to ensure success of diffusion is not unique to network based innovations (Fullerton, 1989). However, this ignores the interdependence of utility of adopters

[6] One should keep in mind however that wireless networks often at their core rely on wired networks. For example, cellular telephony providers switch their mobile customers calls onto the wired PSTN network.

The size of the serving area of a network is also an important characteristic. Hadden and Lenert (1995) expect networks to diffuse more slowly than stand alone innovations because wired networks must be built incrementally. However, this may not always be the case. The rapid diffusion of the Internet, a global network, has occurred because of the simultaneous development of smaller public networks all over the world. The description of the Internet as "a network of networks" demonstrates this point.

The final characteristic of networks relevant for diffusion is that they act as infrastructure and therefore have a special role in society (Hadden and Lenert, 1995). Societal expectations about infrastructure include equal access. There may also be an expectation that infrastructure is provided by the state and financed through taxes. Although the infrastructural aspect of networks does not affect the individual's adoption decision per se, it does have ramifications for the study of networks in that access, and more specifically lack of access, may be seen as a social problem. If lack of access is considered a social problem diffusion patterns of the innovation will be affected.

Characteristics of network-based interactive innovations which make them different from other innovations and thus require special treatment have been described above. These characteristics include the existence of externalities and the requirement of a critical mass to achieve diffusion. Additionally, that access is a prerequisite to adoption and that the availability of access varies depending on the type of network are also seen as unique characteristics of networks. Finally, the special role of networks as infrastructure in society will also be an important factor in the study of their diffusion.

4. Cultural Factors and the Diffusion of Interactive Networks

Research on culture and its effects on the diffusion of interactive networks requires a set of well-defined propositions. These propositions should be theoretically based and create a platform for the development of testable hypotheses. The propositions stated below are the result of a survey of diffusion theories which uncovered relationships that may be mediated cultural factors. (Factors relevant for diffusion but not related to culture include price, infrastructure, extent of change agents' efforts, type of innovation decision, etc.) The five propositions given below are merely examples of the many statements that can be made about the relationship between diffusion of interactive networks and culture. The theoretical source and role of culture for each proposition is explained on a case-by-case basis.

Proposition 1: The diffusion rate of an interactive network will be higher in weak uncertainty avoidance cultures.

The theoretical foundation for this proposition is diffusion of innovations theory (Rogers, 1995). The theory has identified five general factors used to explain the rate of adoption. One of the five factors is 'perceived attributes of the innovation.' Under this factor, there is an attribute labeled 'compatibility.' Compatibility in general is defined as the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. Hence, three variables have been identified: value compatibility, compatibility with previously introduced ideas, and compatibility with needs. The focus here is on 'value compatibility.' The theory predicts innovations compatible with local values, which increases the overall number of positive attributes of an innovation, will be adopted more quickly.

In cultures with weak uncertainty avoidance, values include a tolerance for deviance and innovative ideas. What is different is seen as curious, as opposed to dangerous. Therefore, in cultures with low uncertainty avoidance, all innovations, not just interactive networks, will be looked upon more favorably than in cultures with high uncertainty avoidance.

Research derived from this proposition will broaden the scope of traditional diffusion research and may also serve to clarify the compatibility construct. Problems with the compatibility construct, and its connection to culture, were first introduced by Katz (1963). Three general problems were identified. The first was finding ways to characterize cultures in terms of their values. This problem has been addressed by the Hofstede cultural dimensions. The second problem identified by Katz was deciding which elements of a culture are to be regarded as prominent in relation to the compatibility of a particular innovation with the adopting culture. Here an examination of the objective qualities of the innovation -- an interactive network -- has been made and was subsequently used to inform the choice of which cultural characteristics are relevant. The results are the topics of the propositions presented in this section. The third problem stated by Katz is that of specifying the concept of compatibility more clearly.

Specifying the concept of compatibility more clearly is most easily accomplished through careful research on the topic. Value compatibility, although theoretically important, is often overlooked in diffusion research due to problems of measurement. Rogers reflects "Past diffusion research suggests that compatibility may be relatively less important in predicting rate of adoption than relative advantage. This finding may be in part an artifact of difficulties in measuring compatibility." (Rogers, 1995, p. 234)

Although problems with measurement certainly stem from having to collect information about values from individuals, it also comes from a lack of clarity about the construct itself. In an example meant to demonstrate *value* compatibility, Rogers (1995) shows the difficulty of defining the construct. The example describes how software designed in a culture with a number system

that uses a period as the decimal-place-holder may be incompatible in a culture in which the number system decimal-place-holder is a comma (US $9,999.00 as opposed to FF 9.999,00). Rogers sites this example as a "cultural incompatibility." Cultural incompatibility is too broad. The symbols of a culture and the values of a culture are two distinct things, and incompatibility of symbols should not be confused with an incompatibility of values. Instead, incompatibility of symbols should be considered under other areas of diffusion of innovations theory such as differences in social systems or as an incompatibility with previously introduced ideas.

This confusion between "value compatibility" and "practical compatibility" is widespread. In a meta-analysis, 10 of 13 studies found positive relationships between compatibility and adoption. However, some studies measured practical compatibility, some measured value compatibility and others measured a combination of the two. This lack of clarity prevents researchers from identifying which aspect of compatibility is most powerful in terms of prediction and prevents the establishment of the independence of these two variables (Tornatzky and Klein, 1982). Therefore, research that integrates cultural variables into diffusion of innovation theory will hopefully serve to clarify constructs already present in the theory but that have been paid too little attention.

Proposition 2: The diffusion rate of an interactive network whose adoption confers status on an individual will be affected by a nation's score on the power distance dimension.

The theoretical basis for this proposition is also derived from the 'perceived attributes of the innovation' factor from diffusion of innovations theory. Included under this factor, along with 'compatibility' is an attribute labeled 'relative advantage.' Within the 'relative advantage' attribute, a variable shown to affect adoption is social prestige. Although price is the strongest of the relative advantage variables, the social prestige adoption brings may outweigh price in some circumstances. Communication technologies, particularly cellular phones, are seen as status symbols and therefore social prestige may be a good predictor of adoption of these technologies.

As previously discussed, the 'power distance' national cultural dimension as presented by Hofstede describes a culture's acceptance of status symbols. In high power distance cultures status symbols are accepted. The social prestige adoption of an innovation provides can increase a potential adopter's perceived relative advantage for that innovation. Perceived relative advantage is one of the most powerful predictors of innovation adoption. Thus, in cultures where status symbols are accepted, communication technologies will have increased perceived relative advantage and are therefore more likely to be adopted.

Once again, research derived from the above proposition will serve to strengthen diffusion of innovations theory. Social approval as a predictor of adoption has been undervalued in diffusion research, mostly because subjects are unlikely to report adoption of a new technology based on reasons such as the prestige it brings. Questions which are unlikely to be answered honestly are unlikely to be asked. Tornatzky and Klein (1982) found that of 75 innovation attribute studies only 8 cited social approval as an innovation attribute relevant to adoption behavior. Rogers laments that "Improved measurement approaches are needed to investigate different motivations for adopting an innovation, particularly such non-economic factors as status conferral." (Rogers, 1995, p.214)

Proposition 3: Diffusion of interactive networks will be more rapid in countries with higher levels of gender equality.

Diffusion of innovations theory will also serve as the theoretical base for this proposition. The theory identifies five factors that affect the rate of adoption. In addition to the 'perceived attributes of the innovation' factor, there is also a 'nature of the social system' factor. This factor recognizes the roles social norms play in the diffusion of an innovation and that norms can operate at the level of a small community or throughout a nation. Norms are of course an important component of culture.

If gender equality is considered a societal norm, diffusion of innovation theory connects this norm with the rate at which an innovation diffuses. As discussed previously, while studying innovativeness of nations, Herbig (1994) proposed that nations with higher gender equality will be more innovative simply because they are tapping the potential of a larger percentage of their population. If this proposition is extended beyond merely a country's innovativeness, but also to the diffusion of technologies through a society, interesting questions are raised.

Consider, for example, the diffusion of the Internet. Although use of the Internet is becoming more equal between the sexes in the United States, globally use is most likely a male dominated activity. This predominance of male users creates a situation in which gender equality could be a strong explanatory variable of differences in diffusion rates among developed countries. It may be the case that the percentage of male users from the national population is constant across countries and that the difference in Internet access across countries is a result of access by women.

Proposition 4: Diffusion of interactive networks will be higher in high power distance countries.

The theoretical underpinnings of this proposition come from critical mass theory (Markus, 1990). Although the concept of critical mass comes from nuclear fission and social movements, Markus' detailed application of the

concept to the diffusion of interactive media was an important step in bringing diffusion theory in line with the particular characteristics of interactive media. Rogers goes so far as to say that diffusion of innovations theory must be adjusted when applying the theory to networks.

In both economists' (Allen, 1988; Antonelli, 1989) and the sociologists' (Markus, 1990; Rogers, 1995) analyses of the role of critical mass in the diffusion process, the focus is on the interactive nature of the innovation, the give-and-take that occurs between new adopters and existing subscribers. Markus refers to this as reciprocal interdependence. Markus' application of reciprocal interdependence to interactive networks explains the value creation process in network diffusion. With stand-alone innovations, time allows for sequential interdependence, where early adopters influence late adopters. But with interactive networks adoption decisions depend on both existing and new users and this process results in diffusion patterns which are different from those of stand-alone innovations. Rogers describes the difference between interactive and non-interactive innovations as a built-in "forcing quality" in the adopter-to-decider relationship, which stems from the reciprocal interdependence of interactive innovations (Rogers, 1995).

In addition to providing parsimony to the discussion of critical mass, Markus' critical mass theory also makes important connections between diffusion of interactive technologies and the communities in which they diffuse. Community characteristics hypothesized to positively affect diffusion are its willingness and ability to supply equipment and services for members, social network density or community task interdependence, centralization, and geographic dispersion.

In centralized communities resources will be available from a single point, increasing the need for communication. Decentralization reduces this need. Critical mass theory suggests that centralization of communities increases the likelihood of achieving universal access for a communication technology. Hofstede states that one of the characteristics of high power distance nations is that centralization is popular. Hence, for cultures with strong power distance characteristics diffusion of interactive networks will be greater.

Proposition 5: Cultures low in ethnocentrism will begin diffusion of interactive networks before ethnocentric cultures.

This effect is theoretically derived from diffusion theory which categorizes individuals into adopter categories. The characteristics of particular categories of adopters are useful in targeting populations for adoption campaigns. In terms of their communication behaviors, Rogers (1995) finds early adopters of communication technologies as being more cosmopolite than later adopters. Cosmopoliteness is the degree to which an individual is oriented outside the social system. Early adopters are also more directly in communication with

scientific and technical sources of information about the new communication technologies.

Ethnocentricism, as previously discussed, is the belief that one's culture is superior to all others. Its implications for diffusion of interactive networks is that ethnocentric nations are less likely to absorb technologies developed in other cultures. Also, ethnocentric societies, through their lack of interest in other cultures, are less likely to be multilingual and because of this will further isolate themselves from developments in other parts of the world. Therefore, societies low in ethnocentrism will be more open to the ideas of other cultures and are more likely to have citizens who fit the profile of early adopter ideal type. The higher occurrence of early adopters in a society will lead to an earlier adoption than in societies where early adopters are a rare breed. Research based on this proposition will have to take into account the country where the technology was developed. If an ethnocentric nation itself develops a technology the direction of this proposition will change.

5. Conclusions

The propositions listed above are only a small subset of a large number of statements that express the relationship between diffusion of interactive networks and culture. In previous studies a wide range of variables have been attributed to the rapid global diffusion interactive networks and, in particular, of the Internet. To explain differences in rates of diffusion among countries, variables related to economic strength are most often cited. Occasionally, culture is mentioned as a variable but is not usually accompanied by a systematic analysis. One reason for the lack of systematic analysis where culture is concerned is that theories of network diffusion do not make explicit the relationship between variables affecting diffusion and dimensions of culture.

This paper presents a set of propositions developed from theories of interactive network diffusion in conjunction with quantified measures of national cultural dimensions. This is merely the first step toward research that is able to quantify the impact cultural variables have on network diffusion. However, it hoped that from this point researchers investigating diffusion of networks will include among the economic and policy variables, an additional set of variables that reflect cultural differences among nations.

Through such research the role culture plays in diffusion of technologies in general will be clarified. Once relationships between cultural variables and diffusion processes are more accurately defined, the relationship between culture and other aspects of interactive networks, such as use and their effects on society, can also be investigated. It is highly likely that cultural variables affecting diffusion of networks will also play an important role in further research on interactive networks.

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