Created Creates Creator

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Abstract

Technologies often have uses outside of or beyond what their designer intended. This paper presents both a theory describing how technology disperses as well as a description of the various routes a technology can take to maturity. Widening the scope of IS, we argue that IT, rather than merely being passively consumed, simultaneously creates new needs and wants which then drive the emergence of even newer technologies. Following a discussion of this framework, we present a series of examples, put forth propositions relating to various facets of technology as they influence its trajectory, and end with implications for both practitioners and researchers.

Keywords: Information technology, information systems, technology dispersion, technology trajectories

1. Introduction

In the past decade, electronic commerce has captivated practitioners and scholars. While scholars have written widely on electronic commerce, organizations have spent vast sums transforming their relationships with stakeholders and new businesses have emerged whose brands have become household names. When we examine the origins of this revolution, we find that one of the core technologies, HTML, responsible for such a prolific shift was actually designed to facilitate the exchange of information among physicists. Unanticipated at the time of its development, HTML has enabled a new medium for human interaction and become the basis for a new world of commerce. Information technologies often have emergent impacts well beyond their original intended purpose; yet, IS scholars have not directed substantial efforts at theory development around the dispersal of information technologies or to presenting a framework to understand and identify their trajectories. Similarly, manager's view IS as a means to an end, rather than an active force involved in shaping services and customers alike. Thus, it is our opinion that a key conceptual component is absent, and we present an initial effort to supply this missing link.

There are several influential factors worth reviewing prior to constructing a framework to understand better the emergent nature and creative influence of information technologies. A management information system (MIS) in its early incarnation was defined as "… an integrated, user-machine system for providing information to support operations, management, and decision-making functions in an organization" (Davis et al. 1985). MIS Quarterly, probably the most influential journal in the information systems (IS) field, implicitly defines MIS as "the management of information technology and the use of information technology for managerial and organizational purposes." Nowadays, with the extension of ubiquitous networks to support a wide range of interactions (Watson et al. 2002), IS embraces, we maintain, all electronic systems that enable information to be gathered, processed, stored, and disseminated. Information systems

have moved beyond managers and organizations to encompass a broad spectrum of stakeholders, such as customers and investors.

Two important anomalies are apparent in the foregoing paragraph. First, the broad term IS implies more than just computers in the generic sense. Today's IS professional deals with communications networks, personal digital assistants, networks, smart phones, digital media systems, and a range of emerging technologies as much as they do with traditional computer systems, so their sphere has indeed become broader. Second, the term "user" (those within an organization who use information technologies) is an unfortunate throwback to the days of mainframe computers, when those within an organization were undeniably "users" of the firm's mainframe. IS professionals today would generally acknowledge that users are far more akin to customers and clients, frequently as knowledgeable as the members of IS departments, and very demanding in what they require of IS departments (Pitt et al., 1995).

The efforts of IS units within firms have been devoted to understanding and addressing the needs of organizations themselves. The skills they have applied have matched their understanding of the capabilities of developing information systems and the strategic directions and operational requirements of firms. In doing so, they have focused on harmonizing at the macro level the strategic direction of the organization with the emerging capabilities of information technologies. The strategic alignment literature (e.g., Henderson et al. 1999) also supports this macro goal. At a lower level, IS units have concentrated on the requirements and needs of users (e.g., Davis 1982), and have measured their success in this regard by concentrating on issues such as user satisfaction (e.g., Ives et al. 1983) and the service quality (e.g., Pitt et al. 1995) of IS departments. While these efforts are laudable, in this paper we contend that they are also myopic in that they focus on the instrumental role of technology, and downplay the emergent nature of IS.

Organizations don't only use IS to implement strategies, in many instances information systems create new emergent strategies for firms. Similarly, while information systems may be used to satisfy the needs and wants of organizational customers, just as (if not more) frequently they create new needs and wants. This creative, emergent nature of technology has been under-appreciated. It, therefore, behooves IS professionals to divert some of their efforts from satisfying customer needs to ponder for a moment on how technology evolves and shapes consumer needs. Academic researchers aid in illuminating this symbiotic relationship between consumer needs and information technologies. Information technology advances no longer evolve from consumer needs alone; consumer needs may evolve from available technological advances. Quickly a cycle establishes itself in which consumer needs and information technologies beget one another until new fields emerge. These processes and cycles need to be better understood and their implications for the practice of IS management considered.

2. The meaning of technology

Technology has been defined as the application of science, especially to industrial or commercial objectives (Houghton Mifflin 2000), reflecting a general view of technology as a product or a tool that can be used to accomplish a purpose. A new tool can be developed in simple terms by the application of "technical knowledge" – the knowing of how something works – to a problem, and in doing so enables the problem to be solved.

Before proceeding, we would like to distinguish clearly between information systems and information technology, a distinction that seems lacking in much of the literature as the terms are often used interchangeably. We define these terms as follows:

- An information technology transmits, processes, or stores information.
- An information system is an integrated and cooperating set of software directed information technologies supporting organizational goals.

In other words, IS applies IT to accomplish the assimilation, processing, storage, and dissemination of information. Thus, a mobile phone is not merely a device but rather it is a collection of multiple information technologies forming a personal information system. This instrumental perspective posits technology as something created by people and organizations, who use that technology to achieve objectives in their lives, and, fully in control of the technology, make their lives "easier and better". The implication is that if humans face problems, they develop technologies that will solve those problems. The human is there, and so is the problem, but the technology is not. When the technology is developed, and used, the problem disappears, and the human is still there but in an elevated state of well-being. Indeed, marketing is predicated on the idea that if entrepreneurs can identify the problems of customers and solve them, their organizations will succeed (e.g., Drucker 1974).

Technology and society are reciprocally linked, such that the trajectory of each is co-dependent and emergent. As Bonhiem (1935) observes 'created creates creator'. Thus we argue that technology produces people in the following senses. First, technology enables and influences how people enact their self-identities. Second, technology changes how people interact with one another, and enables the possibilities of new types of community, while shaping the development and evolution of extant social groups. Finally, through each of the above, technology changes how people interact with the wider environment. We are often identified by the technology we master (e.g., the butcher, baker, and candlestick maker). Technology, and our ability to use it, strongly determines our social status, our financial wherewithal, and quality of life.

From the information systems organizational perspective, IS practitioners have focused their efforts on solving the information problems of users and organizations by identifying, sourcing, developing, and managing information systems. In successful IS departments, considerable effort has been expended on identifying what information individuals require to perform their tasks, and making that information available to them. Simultaneously, effective IS departments endeavor to align the objectives of organizations with IS capabilities, and constantly investigate how the emergence of new technologies may enable their host firms to compete more effectively in dynamic markets.

Academics in the broad field of IS have devoted considerable effort to studying the factors that make for efficient and effective IS departments and the implementations of information technologies in organizations. These endeavors have considered issues such as the development of instruments to measure constructs such as user satisfaction, service quality, and the acceptance of technologies. They have also investigated the factors leading to the success or failure of IS systems within organizations and the impact of these on the competitive positions of firms. Most notably, they have also attempted to gauge the return on investment firms have achieved on their IS outlays. It is impossible to argue against these rationales, for they make perfect sense.

We maintain, however, that by focusing almost entirely on an instrumental perspective of technology, both parties might have missed an important aspect of the overall picture – the emergent aspects of technology. Therefore, we contend that both IS professionals and scholars will have much to gain from a perspective on IT that sees it not just as something created and consumed (used) by its users, but also as something that creates and indeed consumes users. Examination of the IS literature supports our assertion that scholars have focused almost exclusively on an instrumental perspective of IS, i.e., how it is used by individuals and organizations and how it might be used more effectively or efficiently.

We now expand our contention that technology, and IT specifically is as much a creator and consumer of as that which is created and consumed. We then provide a framework for the integration of the two perspectives of IS (instrumental and emergent) and demonstrate that these perspectives are indeed not "either/or" and mutually exclusive, but indeed complementary .We conclude by identifying the implications of this expanded view of IS for practitioners, and identify directions for the future research for IS scholars.

While much emphasis in information systems has been placed on technology as a means, and the traditional role of consumers 'consuming' technology; the role that technology has played in revealing, eliciting, and creating new realties has received less attention. As we have argued, technology is not a passive substance but an active force. Technology consumes consumers. Society is as technology does. Capabilities create intentions; capabilities create un-intentions. IS scholars need to analyze and explain the morphing power of IS beyond the boundaries of the organization. Consider the simple diagram in Figure 1. The possible categories of how technology relates to the developer's original intentions are: extension, conversion, subversion, diversion, emersion, and aspersion (see Figure 2). Our choice to focus on intentions is purposeful, because actions in a social setting are guided by individual intention (Elster 1983). Both those who initially create and those who transform existing technologies have intentions, regardless of any possible differences in intentions that may exist.

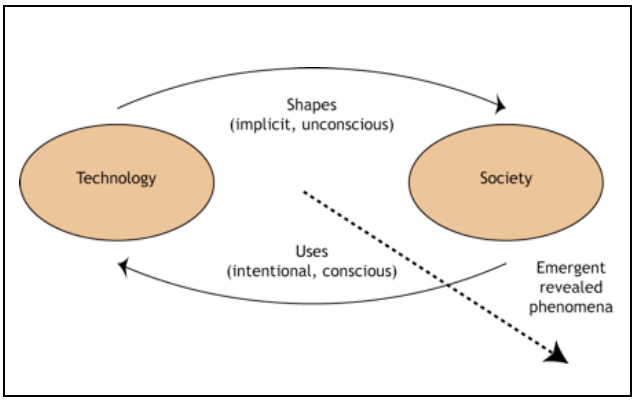

Figure 1: Technology and society

3. When Technology is Created…

A technology is created in response to an expressed or perceived consumer need. As a result, technology is often meant to solve a specific problem and thus designers usually have a single purpose in mind. This does not preclude the possibility that some designers attempt to place their work into a larger setting.

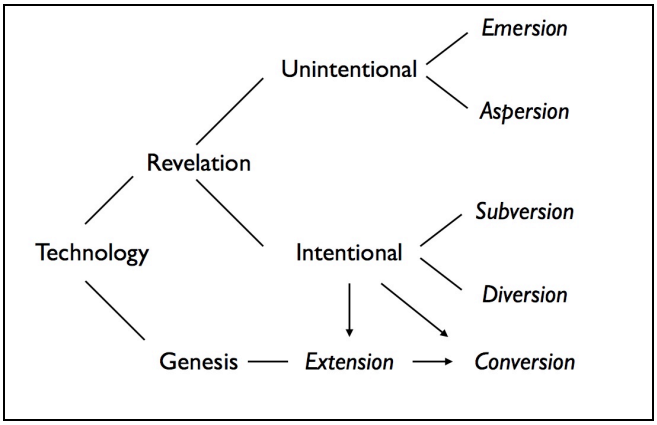

Figure 2: The Technology Diaspora

The larger frame within which IS designers operate is often not appreciated. As we have already discussed, HTML was developed to serve the needs of a group of Physicists, and escaped to become the world standard for the electronic sharing of distributed information. This is

due in no small way to the fact that systems developed by IS designers are programmed and thus highly adaptable. As the flexibility of a product increases, so too does its uses. In this article, as captured by Figure 2, we detail a conceptual framework for examining how an IS can evolve following its creation. We would argue that an information system should be designed by pondering how it might change its larger context. Designers need to contemplate the possibilities for conversion, subversion, diversion, emersion, and aspersion of their designs.

We now discuss each of these possibilities and explain the ideas illustrated by Figure 2 by drawing upon examples of the effects of various information technologies. We begin with the traditional genesis of technology by extension and conversion.

- **Extension** - Notebook computers are widely used by all types of consumers in the manner in which they were designed. They are functional tools for accomplishing a variety of tasks or entertainment goals. Countless millions have been sold, and they dominate the way people work in the office, on the road, and at home. Their original hardware designs have been extended by adding larger disks, improving the interface, reducing their weight, and by adding features such as DVD drives. Similarly, their onboard software has been extended to now work with onboard video cameras, motion sensors, and remote controls.
- **Conversion** - Conversion takes place when an existing IS is modified and repositioned to accomplish different goals. When Apple introduced its first cell phone, the iPhone, in January 2007, it was offered as a smart phone merged with an iPod media player and had a mobile web browser. In March 2008 Apple release a software development kit allowing 3rd parties to develop applications that would run on the iPhone. The result was a conversion from smart phone to a mobile computing platform and the complete redefinition of the mobile phone into new segments of the market formerly occupied by dedicated single-function devices (GPS, PDA, etc…). In 2010, more than 140,000 applications are available allowing users to convert their phone into a navigation device, a flashlight, a fitness tracker and myriad other uses.

Intentional Revelation - After a technology enters the open marketplace, new creations can develop due to the intentional actions of consumers, firms, and competitors. The technology is complemented, imitated, and re-targeted. Consumers subvert and third parties divert the designer's intended use of the technology.

- **Subversion** - While Sony's PlayStation Portable (PSP) was sold primarily as a gaming console with movie and music capabilities, consumers have taken Sony's PSP and intentionally subverted it into a much more fully-featured device than it was originally meant to be. Hobbyists have created software that allows the device to be used for online chatting, web browsing, and even reading comics. To support such efforts, entire websites (e.g. www.psp-hacks.com) have emerged and are full of vast repositories of user-created guides to enabling such feature sets. While some speculate that Sony may have left some holes open expressly for consumers to play with, it was ultimately consumers that made the choice to experiment with their purchases.
- **Diversion** - While consumers often intentionally subvert an intended use of a technology, so too can third parties divert a technology to serve a different purpose. This can be accomplished through methods as diverse as legal, political, social, or technological interventions. A great example of diversion occurred when Apple first introduced the iPod Mini which utilized a very small compactflash compatible hard drive called a MicroDrive. Hitachi and IBM sold 4GB MicroDrives, the same as those used in the iPod Mini, for between $450 to $500 US. The iPod Mini retailed for $250. Needless to say, enterprising third parties were quick to seize this arbitrage opportunity and began snapping up iPod Mini for the sole purpose of removing the valuable MicroDrive. In response, Apple disabled a crucial interface mode of the MicroDrives they used, rendering it unable to work in digital cameras, the primary market for such drives.

Unintentional Revelation - Unintentional revelation occurs when a technology has, inadvertent and unplanned effects beyond what they initially envisioned. This does not preclude those making the changes, though, from having clear and deliberate goals to their actions. Emersion occurs when a technology is widely adopted and significantly changes society and consumers in a generally positive manner. When a new technology instead causes negative changes to people and society, Aspersion takes place. While there may be a lag between the recognition and eventual resolution of the problem technology, there is active formal and informal resistance within society to the new technology.

- **Emersion** - Emersion refers to situations where a technology has an unexpectedly strong influence on some aspect of society which is largely regarded as positive. One example is the now almost ubiquitous Google which has gone from being a new, obscure search engine to not only an advertising mogul but also a verb. Starting out as simply a clean, efficient search engine, the company has expanded enormously into such realms as scholarly journals (Google Scholar), maps and directions (Google Maps), email (Gmail), video (Google Video as well as acquired YouTube), news (Google News), and bargain shopping (Froogle). Google services have become emersed into life literally across the globe forever making setting expectations of free access to services.
- **Aspersion** - Aspersion takes place when a new technology creates unwanted effects on society. A few years ago, mobile phone manufacturers began including small cameras in the feature sets of their latest handsets. Within a short period of time almost

every handset on the market contained a camera. Network operators supported this move in the belief that consumers would pay for the ability to send photos over their data networks. While high pricing on the part of network operators repelled consumer adoption of the service, the inclusion of cameras on mobile phones resulted in a host of privacy concerns for individuals, businesses, and governments alike. While pulling out a camera in a change room would undoubtedly raise questions, the ubiquity of mobile phones allowed them to be used virtually anywhere without concern. As a result, some individuals employed cameras on mobile phones to engage in collection of indecent photographs of unwitting and non-consenting victims.

4. Technology Dispersion Factors

Observation clearly illustrates that some technologies undergo greater dispersion than others. We contend that three factors contribute significantly to explaining the extent of this diversion, and now we discuss each of these.

Openness

Closed systems, such as most cellular handsets, have seen far less innovative software built for their platforms than more open systems such as Linux, Unix, or Windows. Availability of information such as application programming interfaces (API) can dramatically increase the ease of dispersion. iRobot, a company that began by specializing in small, intelligent robots for military and tactical uses, later expanded into a line of robotic consumer vacuums. Robot hobbyists soon realized that such robots, with factory equipped sensors and excellent mobility, were a fantastic foundation from which to begin building other types of robots. iRobot decided to facilitate such tinkering by providing an affordable plug in tool called OSMO Hacker which allows developers easy access to the robot's open interface as well as numerous support resources on their website. Building on this popularity, iRobot released a non-vacuuming robot called iRobot Create solely for this market segment with even more extensibility. By providing such open technologies to this market, iRobot's robots are now the standard robot used in robot creation and have been repurposed for thousands of different uses.

Open standards thus encourage technology dispersion and designers who encourage the open dissemination of information about their technology promote its initial adoption and subsequent reinvention. Thus, we propose:

P1: The degree of conversion, subversion, diversion, emersion, or aspersion of a technology is determined by the openness of the information system supporting that technology.

Programmability

The more programmable a technology is, the easier it is to adopt to different uses and applications. Access through APIs allows adopters unfettered access to all of a technology's potential and greatly aids in their ability to extend or alter its functionality. With over 140,000 applications written for it, Apples iPhone exemplifies the programmability of IT devices. The iPhone combines a variety of information technologies (phone, WiFi connection, GPS, compass, light sensor, camera, media player, etc.) with a rich set of services (ubiquitous internet, SMS, online music store, maps, etc.) in a programmable platform that enables it to be reconfigured to virtually limitless uses. Therefore, we propose:

P2: The degree of conversion, subversion, diversion, emersion, or aspersion of a technology is determined by the programmability of the technology.

Self-organizing mechanisms

Swarming, an instance of aspersion, illustrates mass self-organizing fostered by cell phones and SMS. Young woman used cell phones to distribute information on the whereabouts of England's Prince William when he was a student at the University of St. Andrews. The Scottish Daily Record reports (Garreau 2002), "A quite sophisticated text messaging network has sprung up. If William is spotted anywhere in the town then messages are sent out. It starts off quite small. The first messages are then forwarded to more girls and so on. It just has a snowball effect. Informing 100 girls of his movements takes just seconds."

New administrative forms reflect changes in the economy (Chandler 1962). Self-organization is one of the structures greatly facilitated by the network economy. Thus, we propose that self-organizing contributes to the technology diaspora.

P3: The degree of conversion, subversion, diversion, emersion, or aspersion of a technology is determined by the availability of information technologies that support self-organizing emergence.

5. Conclusion

IS scholars initially focused their attention on the organization, not surprisingly because that is where computer-based information systems were found. Nowadays, information systems are ubiquitous, and IS scholars need to decide whether their domain of inquiry should be enlarged. Some argue for continued and precise attention to the organization (e.g., Benbasat et al. 2003), but such a circling of the wagons around the organization cedes a great deal of territory to other scholars and disciplines. While there are more than enough problems within organizations to keep IS scholars actively engaged in studying interesting phenomena, this is not what disquiets us. Rather, we are concerned that by narrowing the field we potentially relinquish the opportunity for IS scholars to define the conceptual foundations of IS in a new era.

We have demonstrated in this article that, by taking a very broad perspective of IS, we make three important contributions. First, we show that information systems are a central aspect of human life. Thus, in order to understand the development of civilization, we need to augment Diamond's (1997) thesis of a propitious climate and domesticable animals to include the role of information systems. Second, we capture the breadth of the technology diaspora (Figure 2) by studying an information system that is not confined by the strictures of an organization, where it is less likely to morph broadly. Third, we present three propositions that scholars can use as a foundation for investigating information systems dispersion. We doubt that such propositions would have emerged from studying IS within the organizational cage.

Information systems have come to be at the heart of our identity, how we interact, and the environment we create. To truly understand IS, we must know it from genesis to revelations.

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