The Effects of Monopoly in Information Technology on Democracy: A New Perspective on Microsoft's Monopoly

Departmental Honors Thesis

Department of Government and Politics
Department of Computer Science
University of Maryland, College Park

David Thaw

Advisors: Dr. Wayne McIntosh and Dr. Ashok Agrawala

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Section I: Introduction

The concept of free exchange of information and ideas is a central tenet of democratic theory. This exchange is crucial both to the deliberative process necessary for democracy and to the elements of personal liberty and self-actualization that are at the heart of democracy. For individuals to have the ability to make choices freely, they must have access to information relevant to their choices. Raw information, however, is generally too complex and/or diffuse to be processed in the time frame that individuals need for decision-making purposes. To be useful, information must be aggregated, sorted, and analyzed. In short, it must be processed according to individual needs and desires. Ideally, economic theory would suggest that competitive markets for this type of "pre-processed" information would result, and market economic principles would ensure that this "product" would be produced according to the demands of its consumers.

Information, particularly in modern times, requires a complex delivery system. As individuals demand increasingly complex and comprehensive information for their decision-making processes, information providers seek to develop better ways of organizing and delivering this information to their consumers. Indeed, recent years have shown a staggering growth in both the complexity and usage of modern information technologies including Personal Computers (PCs), mobile computing devices, wireless communications, and the Internet. Advances in computing technology, thus, have seemingly enabled information providers to better meet their consumers' demands.

While several other technological alternatives exist in widespread use, in recent years computer-based technologies (broadly understood) have emerged as a leading facility of information flow and communication. In particular, PCs and their myriad

communication software, PDAs, and cellular phones have dominated new equipment purchases for information management and exchange. At the heart of these systems is a technology known as the operating system, that software which controls the operation of the mechanical and electronic components of computing devices and provides a common platform on which task-oriented software applications reside. Were a private entity to become the primary (monopolistic) provider of operating systems, such an entity could obtain the ability to significantly influence the flow of information. Over the course of the past several years, it has become clear that such an entity has emerged – Microsoft Corporation.

Section II: Principles of Democratic Society

Recent developments in information technology and the importance of the free exchange of information to democratic society suggest the importance of examining the implications of the integration of these new technologies into society. Those aspects of a democratic society most affected by the flow of information provide the starting point for this investigation. This paper focuses primarily on two such aspects: 1) individuality and the process of self-actualization, and 2) the development and maintenance of effective democratic participation. It is through these two metrics that I will evaluate the potential impact of modern information technologies and attempt to prove that the potential exists for these principles to be aversely affected if such technologies continue to develop unchecked.

Information, broadly understood, is perhaps the most crucial element of individual decision-making processes. When individuals are faced with a decision, whether it be

choosing a movie to view or a candidate to vote for in an election, they collect information about the choices they are faced with and integrate that information into their decision-making process. Similarly, when forming opinions, individuals collect information which they then process and integrate into the formation of those opinions.

Individuality, Liberty, Freedom of Pursuit and Self-Actualization

J.S. Mill, in his essays On Liberty, argues that the concept of individuality, that right of each person to freely interpret experience and information, to form opinions, and – within appropriate forums – to express those opinions, is one of the essential elements of human "well-being." "[I]t is the privilege and proper condition of a human being, arrived at the maturity of his faculties, to use and interpret experience in his own way" (Mill 56). Mill's argument is particularly important when taken in the context of modern information delivery. The acquisition and processing of information is a critical element of an individual's experience. If, therefore, the whole of information available were to be pre-processed by some other entity, that pre-processing might endanger the individual's right to "interpret [that information and] experience in his own way." While "nobody denies that people should be so taught and trained in youth as to know and benefit by the ascertained results of human experience" (Mill 56), "[i]t is for [each individual] to find out what part of recorded experience is properly applicable to [his or her] own circumstances and character" (56). Furthermore, it is the right of each individual to develop such circumstances and character, subject to reasonable guidelines necessary for the preservation of individual rights, free of influence and coercion.

Effective Democratic Participation

The free exchange of information and ideas is also a critical element of the democratic process and the culture of a democratic society. "Rights are among the essential building blocks of a democratic process of government" (Dahl 48). Effective participation, for example, requires that citizens "[p]ossess a right to participate, a right to express their views on political matters, to hear what other citizens have to say, [and] a right to discuss political matters with other citizens… citizens must have a right to investigate alternatives [and] a right to participate in deciding how and what should go on the agenda" (Dahl 48-49). The flow of information is essential to the realization of each of these rights, particularly in large modern democracies. Increasing population size, interdependence of geographically separate regions, and the process of globalization requires that an individual have access to information about a much broader range of issues to effectively participate than in earlier times in democratic history.

Section III: The Importance of Information Exchange to Democratic Society

The distribution of information requires some form of mechanism to support it. Assuming that there exist common forms of expression for information (i.e., languages, visual representations, etc.) there must then exist mechanisms that can be used to disseminate these representations of information to consumers who desire it. Historical analysis of these mechanisms reveals that these mechanisms have continued to develop over time, and significant advances in these mechanisms often coincided with significant scientific, industrial, economic, and/or cultural advances (e.g., the development of the printing press and the spread of religion and culture throughout Europe, the development

of the US postal system and the early economic development of the United States). In each of these cases, the development and integration of new communications and information technologies had significant developmental consequences and influence over society and the economy. Likewise, with the introduction of each new information technology, the variety of information sought by consumers and the number of information producers increased. As each new technology provided for a more complex delivery system, science, culture, and the economy advanced adopting these systems and developmentally benefiting from them.

An Example – The Printing Press and Postal Systems

The printing press and the postal system are excellent examples of the influence that information distribution mechanisms can have on society and democratic processes. As Francis Grund stated, "the postal system had, in conjunction with the periodical press, done more to change 'the face of the world' than 'half a million of philosophers' or 'the bayonets of all the nations of Europe'" (John 12). Unlike person-to-person contact, such as debate and public speaking, these systems' influence was inherent in the mechanisms themselves rather than the information they conveyed. As John describes, "[a] given newspaper article, Grund conceded, might not exert as great an influence as a particularly moving speech. But if the message were repeated again and again, its effect was sure to be far more profound" (John 13). These mechanisms enabled messages to be "repeated again and again" throughout the United States, reaching more people across a broader geographical range than any public speaker could.

The influence of information distribution mechanisms was reflected not only in their ability to influence individuals directly, but also in their ability to facilitate democracy. In John's analysis of the U.S. Postal System as an agent of change, he examines the work of Eli Bowen, a nineteenth-century journalist and postal clerk. Bowen compared public life in the United States to that of the Greek and Roman empires. In particular, he focused on the failure of these empires to develop a form of democracy that included those individuals who did not reside in the foci of government found in the cities. "'We hear nothing,' Bowen observed, of… that class of landowning citizen-farmers who could participate in public life without ever leaving the farm" (John 14). According to John, Bowen argued that "[s]hould a Greek or Roman citizen-farmer wish to take part in public affairs, he had no choice but to leave his farm and move to the city, since he needed a good deal of information to participate effectively in public affairs, while this information was necessarily restricted to those individuals who lived in close physical proximity to the seat of power" (John 14). In contrast, for the United States, "[t]hanks to the postal system, the citizen-farmer had no trouble securing access to a steady flow of information on public affairs, making it possible for him to participate in national politics without leaving the farm" (John 15). These observations were shared by Alexis de Tocqueville, who calculated that in the mid-eighteenth century, based on postal revenue, "the average inhabitant of Michigan territory received a greater volume of nonlocal information than the average inhabitant of the Department du Nord," a bustling commercial center at the heart of France (John 1).

These observations demonstrate the importance of information and its distribution to a democratic society. The success of the United States as the first geographically

wide-scale democracy of modern times was significantly incumbent upon the use of these and future "information technologies." The postal system and the printing press were crucial in "transform[ing the United States] from a confederation of separate states into 'one great neighborhood'" (John 13). Having established the importance of information exchange and distribution to democratic society, I then move on to examine the conditions for the production and distribution of information.

Section IV: Information Markets

Raw information is generally too complex and/or diffuse to be processed in the time frame that individuals need for decision-making purposes. To be useful, therefore, information must be aggregated, sorted, and analyzed. In short, it must be processed according to individual needs and desires. Historically, information technologies have adapted to meet this requirement by providing palettes of choices from which individuals can choose. The printing press, for example, allowed the manufacture of periodicals that were tailored to various needs and desires. Similarly, broadcast radio has a variety of stations and broadcast television has a variety of channels. Thus the mechanisms for processing and distributing information – "information technologies" – become a critical link in the system of information exchange and as such have a meaningful influence on the content of that exchange.

Individuals comprise the primary consumers of information. Individuals use information for a variety of purposes, including decision-making, education, and entertainment. As discussed earlier, Mill argues that the right of individuals to freely interpret experience and information is an essential component of individual liberty.

Mill's discussion leads into the concept of "self-actualization," the idea that individuals in a democratic society have a right to freely develop themselves (within necessary guidelines for the maintenance of equal rights). This development includes an individual's right to educate and entertain him/herself as he/she sees fit, and the right to freely make decisions based on information without hidden bias.

Information Biases – The Production Problem

The concept of "hidden bias" derives from the idea that the same information can be analyzed, aggregated, interpreted, and packaged in more than one fashion and from more than one standpoint. Two scientists, for example, may examine the same set of laboratory observations yet come to completely different conclusions. Examples of this phenomenon are extremely common in American society, and can be witnessed by perusing almost the science section of any newspaper of record on almost any given day. These biases then affect the information end-product by analyzing, interpreting, and packaging the raw data that leads to information delivery to consumers in a manner consistent with the particular bias.

It is likely impossible, under the current state of human affairs, to expect that any or all sources and distribution systems of information will be unaffected by such biases. I examine two potential ways in which these biases can manifest themselves: 1) the information delivery systems, and 2) the producers of the end-point information delivered by their respective distribution systems. The former refers to the case in which the owners of the information delivery technology prefer a certain set of information sources

and/or opinions and provide producers favorable access to their delivery media. The latter refers to the case, an example of which is given above with "the two scientists," in which one producer interprets data differently from another. It is important to note that these two manifestations are not clearly distinct from one another and often operate together. In the case of newspapers, for example, one paper with a particular set of viewpoints may not only prefer certain sources/producers, but may also seek out such individuals and entities and employ them to assemble the information package the paper seeks to distribute. A classic example of this phenomenon is the New York City Metropolitan area, where the New York Times (a comparatively liberal paper) competes with the Wall Street Journal (a comparatively conservative paper).[1]

Rather, therefore, than examining these conditions separately, I will examine them together with the focus on the results affecting how delivery system owners will and should behave. This analysis begins by returning to individuals the primary consumers. Taking a standard market-economic approach, and assuming that the consumer-individuals in question are members of and wish to promote a democratic society,[2] I examine how the market will manifest and respond to individuals' preferences in order to

[1] It should be noted that this example is perhaps an unfair generalization of these papers, which are aimed not only at ideologically different audiences, but also at audiences with different substantive interests. The Times presents more of a generalist approach to news reporting, whereas the Journal focuses more on fiscal news.

[2] This is perhaps an unfair assumption about the majority of people in modern (American) society. Social Psychologists debate on whether altruism actually exists (Myers 474-485), and some argue that it is really a manifestation of social exchange theory, or "the theory that human interactions are transactions that aim to maximize one's rewards and minimize one's costs" (Myers 474). Nevertheless, the argument can proceed based on the assumption that individuals will seek these democratic goals because in the end it will all be to their mutual benefit.

produce outcomes desirable to democracy under the conditions described in **Section II**. (Baker 2002 63-95).

Individuals As Information Consumers

"The standard claim on behalf of the market is that it responds to people's real preferences; it provides audiences with what they want" (Baker 2002 80). Baker rightly argues that this proposition fails in the case of identifying consumer media preferences, for "[e]ven if the existing distribution of wealth were a fully appropriate criterion for weighting people's preferences… the market does not properly identify people's preferences" (Baker 2002 81). It can be reasonably dispensed with that the existing distribution of wealth is not "a fully appropriate criterion." According to Dahl, the democratic process entails (amongst other things) '[a] weak principle of equality: The good of each person is entitled to equal consideration" (Dahl 1985 57). Combine this with the proposition that "ownership and control contribute to the creation of great differences among citizens in wealth, income, status, skills, information, control over information and propaganda… [and] after all due qualifications have been made, differences like these help in turn to generate significant inequalities among citizens in their capacities and opportunities for participating as political equals in governing the state" (Dahl 1985 54). It is general knowledge that a small top percentile of people in the United States controls the largest percentage of wealth (which includes corporate ownership and control). From these statements then it follows, simply put, that all citizens do not have equal "capacities and opportunities" to participate as political equals, or, applied to Baker's argument, to express their preferences. For just as Dahl's political

inequalities present concern for effective citizen participation and consideration, the economic inequalities present in the United States present obstacles to equal preference identification in media markets predicated upon the idea that each citizen who wishes to express a preference should be entitled to a (relatively) consistent recognition of that preference (i.e., the concept of pluralism). In essence, therefore, those with greater economic capital are far better able to express their preferences and receive the media and information they desire.[3]

The Market As A Mechanism For Information Production and Distribution

Given the importance of information distribution mechanisms, media producers, and the products they create to a democratic society, it is therefore important to examine what means of organization are necessary (and possibly even what means are desirable) to maintain the principles of such a society. The market being the most prevalent organizational mechanism in the United States, we turn to it as the default case.[4] As examined above, individual citizens are the primary consumers in this case. Yet these consumers share a great deal of inequality, presenting concern about which preferences will be represented. For this mechanism to be effective, therefore, individuals must have

[3] There is a potential corollary argument from this proposing that, in the case of media choice, the preferences of economically underprivileged individuals are even further suppressed as a function of advertising. In short, those with greater economic advantage better express their preferences, those preferences are then translated into information products, which are then supported ("paid-for") by advertising aimed at the broader (economically disadvantaged) audience. Assuming the nature of advertising is such that it is aimed at convincing individuals of their "need" to purchase a product/service, it follows that these individuals utility to express their preferences would be further restricted both by the preferences forced upon them via the advertising and (possibly) by the reduced utility (economic assets) as a result of their purchasing the products/services they might ordinarily not have.

[4] An examination of comparative methods of information technology and media production organizations across different (democratic) nations would likely provide further useful insight into the issues discussed in this paper.

the ability to collectively express preferences in a manner that will both overcome potential inequalities and that will affect meaningful change among information technology and media content producers.

Under standard principles, "[m]arkets measure preferences only when a person makes purchases" (Baker 2002 81). This presents a particular problem in the case of media products, as Baker effectively identifies (2002 7-19). "Under certain purportedly normal circumstances, the market provides firms with an incentive to produce and sell the product as long as the product's cost is less than the marginal price. The market thereby leads to a preference-maximizing production and distribution" (2002 7). As Baker correctly identifies, however, this is not the case with markets for media products, and, I will argue, their associated information technologies.[5] Media and communications products are characterized by four aspects that differentiate them from other products (e.g., toasters) to which this model effectively applies: 1) they have significant "public good"[6] aspects; 2) they produce significant externalities; 3) two very different purchasers are involved in the transaction; and 4) there are a wide variety of different ways in which individuals "value" these products (2002 8-14).

Baker's analysis effectively shows how media and communications technologies exhibit the "nonrivalrous use" quality of public goods (2002 8-10). I take this argument a

[5] Baker's economic analysis of media products (2002 9, 20-22) can be applied to the production of modern information technologies, particularly computer software (especially operating systems), as well. These products share the same problem that media products do of incurring significant "up-front" costs of production but being relatively easy to produce after the initial "copy" is created.

[6] "[A]n item for which one person's use of or benefit from the product does not affect its use by or benefit to another person" (Baker 2002 8). Other definitions of public goods require the good to be both non-rival and non-excludable; in this case I adopt Baker's definition since certain information, communications, and media products are excludable as a function of the nature of their technology. Furthermore, recent efforts by American businesses (e.g., Microsoft's advanced anti-piracy technology in Windows XP and Office XP) indicate an increasing trend towards excludability in potential public goods.

step further, and assert that it can be similarly applied to modern information technologies, specifically, computer software products. Like Baker's "media products," computer software is a good for which "one person's use of or benefit from the product does not affect its use by or benefit to another person" (Baker 2002 8).[7] Person A using Microsoft Windows XP Professional as the operating system for his/her computer does not prevent, limit, or restrict Person B from doing so. Rather, it may even make it easier for person B to do so since they will likely be better able to assist one another and collaborate since they will have a common platform on which to work. Also, much like telecommunications systems, the production of computer software incurs a significant "up-front" cost. This cost encompasses the design and development of the software. Once completed, however, production of additional copies of this software incurs comparatively trivial costs. With telecommunications infrastructure, "[m]ultiple consumers can use this infrastructure with no or very modest extra expense. To the extent that adding an additional customer does not increase the cost of this infrastructure, which is usually true until crowding requires larger lines or mains, this infrastructure exists as a public good" (Baker 2000 8). Likewise, with computer software, multiple users can acquire and use additional copies of it with little marginal cost. Furthermore, the concern described in *Footnote 7* is addressed by Baker's attention to the case of marginal cost being negligible until crowding requires additional infrastructure changes. With computer software, the marginal cost of technical support and other post-

[7] This is not strictly true as there are certain marginal costs associated with the next user's use (e.g., technical support, update service request drain on servers, etc.). I would argue that these costs, however, are limited. It may, however, be a worthwhile exercise to attempt to characterize these costs to determine if they do affect the non-rival assertion. As of the time of this writing, however, I was unable to find sufficient data to support such a claim.

distribution services does not significantly increase the production cost until additional "infrastructure" is required as a result of crowding.

As is the case with Baker's communications and media products, "[t]his creates a problem" (2002 8). In short, the average cost of each software copy – while decreasing as a function of sales – is significantly higher than the marginal cost of each software copy. The problem results from this disparity. "If the product is priced at its average cost, some consumers will be unwilling (or unable) to pay that price, even though they want [or need] the products and would be willing to pay the added cost created by their usage. Charging the average cost [therefore] results in underproduction" (2002 9). To correct this problem, the seller could charge the marginal cost, "as efficiency considerations normally recommend" (2002 9), however this would produce insufficient revenue as the bulk of the costs are incurred pre-production, not at marginal production. As a result, insufficient incentives to produce would arise and innovation and development would suffer. (Baker 2002 8-10)

Baker's second criterion examines externalities created by media and communications goods production. He essentially discusses the potential benefits to and concerns for "a well-functioning democracy" (2002 10) created by the production and consumption of these goods. As discussed above, the flow and exchange of information is essential to such a society. Indeed, with modern information technologies such externalities continue to exist. In the case of computer software, however, additional externalities arise which Baker's analysis does not address. In the case of computer operating systems and office software, for example, the facilitation of collaboration and interoperability (or lack thereof) is a key externality. If many computing systems are

running the same software, and as a result, are fully interoperable, then the users of those systems will better be able to collaborate on projects and exchange information and ideas. The cost of doing so will be reduced as compared to groups of users running different software, where collaboration and information exchange will incur the added cost of "porting" that information across platforms and/or software packages.[8] The resultant externalities come from the increased or decreased ability for groups to collaborate and innovate. Take, for example, two researchers at different universities working on a technical development project. If these two scientists are using the same technical development software running on the same operating system platform, they will more easily be able to collaborate and share their work and will be able to more quickly complete their research. Assuming that the research is meaningful and important to society, its more rapid completion results in a positive externality to those individuals that will benefit from the research. Conversely, if they are not running the same software and/or systems, and their research is accordingly slowed, a negative externality will result for those that would have benefited from the research were it completed earlier.

Baker's third criterion introduces the idea that individual citizens, while the primary consumers in the transaction of information exchange, are not the only purchasers involved in these transactions. Baker argues that advertisers comprise this second category of purchasers – even though they do not necessarily "consume" the products in the traditional sense – and that "[s]elling to both audiences and advertisers

[8] It is important to note that these costs have likely reduced over time, as software has been developed for multiple operating systems platforms and communications infrastructure (specifically, the internet) has facilitated transfer across system platforms. These costs, however, have not been eliminated and I would suspect are likely still significant. This is another question for which I do not believe sufficient data exists and would be worthwhile to examine.

has especially significant consequences and adds special complexities" (2002 11). In the case of media products, as Baker identifies, this is certainly the case (2002 11-12). In the case of computer software, however, this trinary sales relationship takes on a different form. While some computer software does incorporate advertising,[9] for the most part commercial software does not depend on advertising revenues. One potential exception to this rule, however, is Microsoft's operating system software. In short, the idea behind this is that the operating system is the first thing a user sees when he/she buys a new computer and the first thing he/she sees when turning on the computer each day. It therefore affords the OS manufacturer the opportunity to "steer" users in the direction of certain producers for things like Internet access, specific classes of software (e.g., by providing a trial version of an office software package and then offering easy instructions for how to order the full version), and other communications services such as email or instant messaging. A further examination of this will be provided in **Section VII**.

Baker's fourth criterion examines the manner in which consumers "value" media and communications products. Individuals lack, he argues, sufficient means by which to evaluate if they have really received what they "wanted" when selecting such products. As Baker states, "[a consumer's] own preferences do not her give a complete standard by which to measure whether her purchases provide the right thing" (2002 12). Hence they must fall back to more general "rules of thumb for guessing whether they are likely to get [what they want]" (2002 13). Baker identifies two such "rules of thumb." "[Consumers]

[9] Examples include websites, AOL Instant Messenger℠, Kazaa Media Desktop (and other peer-to-peer sharing software), and many other non-commercial software packages. Packaging a product with advertising built-in and then offering a fully functional version without advertising (for normal sale) is a somewhat common practice for software manufacturers who do not produce full commercial products.

may know the seller's or producer's general reputation for expertise. In addition, [consumers] may have reasons to presume the seller or producer exercises independent judgment and to believe that this supplier users this independence to try to serve the purchaser's interests – reasons purportedly underwritten by professionalism in education, law, psychology, or the priesthood" (2002 13).

These two examples of how individuals evaluate media and communications producers illustrate a fundamental difference when applied to the computer software market. With regard to the first "rule," two problems arise. First, computer software is such a young market that its businesses have not been in existence sufficiently long for consumers to form meaningful opinions about their reputation. The tumultuous nature of the information technology and computer software sector during the last several years further exacerbates this problem. Second, in the area of computer software – particularly computer operating systems – Microsoft Corporation exercises such a powerful monopoly that individuals may find themselves compelled to form positive opinions about it due to a mere lack of choices combined with Microsoft's massive advertising ability.

The second "rule" presents a very interesting set of concerns. The computer software industry, unlike education, law, medicine, and engineering, is not currently underwritten by established and universally accepted private-sector professionalism. Equally troubling is the lack of state or federal laws requiring professionalism in computer software development and manufacturing. Yet we continue to use computer

software in high-reliability systems,[10] and it is increasingly becoming an integral part of our communications infrastructure. Thus consumers have no means by which to evaluate whether Microsoft Windows is an effective product for satisfying their needs, while at the same time Microsoft Corporation is able to include in Windows "marketing" aspects (as described in the above analysis of Baker's third criterion) that may influence the user in ways contrary to the ideals of equality and free exchange of information I examine as essential to a healthy democratic society.

The application of Baker's framework to modern information technologies, specifically computer software, presents obvious concerns for democratic society as it is evaluated in this paper. Pricing conditions, which will be examined later, could prevent individuals from being able to express their preferences through the market. This condition is further exacerbated by corporations' (particularly Microsoft Corporation's) ability to derive revenue from third parties involved in the transaction by providing them favorable positioning within their products.[11] At the same time, however, the potential positive externalities from choosing a software monopolist's product further increase pressure on consumers to utilize such products. Finally, the youth of software markets and other factors discussed above give consumers little ability to objectively evaluate the products they are purchasing.

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[10] High reliability systems tend to be subject to more strict internal guidelines for testing, system maintenance and stability that provide an increased level of security and operational guarantee not examined in this line of argument.

[11] This phenomenon is not strictly limited to operating systems manufacturers. Computer system manufacturers such as Dell Computer Corporation engage in similar practices when they setup and ship their pre-installed systems. Microsoft has, however, engaged in what was described by many as "predatory" practices in attempting to force companies like Dell into selecting the applications Microsoft preferred. Furthermore, Microsoft has the "first crack" at embedding such "software/services advertising" into their operating system in a manner such that the computer system manufacturers cannot remove it.

The conclusion of this analysis is that an unregulated private-sector market currently fails to provide consumers with the ability to express their preferences. Given the potential information technologies have to influence the content of the information they disseminate, therefore, and the inability of the market to guarantee the equality and choice necessary for the principles of democratic society examined here, it is prudent to examine how information technologies are developed to determine what alternative organizational structures may be used.

Section V: Information Technology Development

In discussing the impact of modern information technologies on democracy, therefore, it is important to examine the driving forces behind the development of these technologies. For the purposes of this examination I will look at two categories of producers: 1) private entities, in particular, non-governmental businesses; and 2) public entities, in particular, the federal government. While businesses and the federal government do not represent an exhaustive list of potential producers, in the case of information technologies and information producers these categories encompass the vast majority of producers.

In a capitalist society, such as the United States, it is reasonable to assume that a private entity will not be motivated to incur significant cost to produce a good merely for its social benefit. Private entities, rather, are generally motivated by the opportunity for economic gain. For a business or corporation to have incentive to produce a good, therefore, there must exist a potentially profitable market for the sale of that good. Goods

of this nature are most often excludable, and therefore comprise private goods and natural monopolies.

Likewise, in a democratically governed capitalist society, it is reasonable to assume that a public entity, in particular the federal government, will produce a good when that entity is politically motivated to do so. In theory, this condition should occur when the "will of the people" is such that a given good should be produced. For the purposes of this discussion, an examination of whether this condition is actually the case is not necessary. It is sufficient to recognize that a political motivation, such as the election process or concerns of national welfare, will motivate the federal government to produce a good. Goods of this nature therefore tend to be non-excludable, and are produced in conditions where the market fails including public goods and common resources. A relatively straightforward example is the creation of public highways funded by state and the federal governments.

Given the importance of these technologies to democratic society, however, it follows that their production and sale should be governed at least to some extent by the "will of the people." The protections and freedoms afforded private producers are a product of the people granting those entities the freedoms of a capitalist government, and as such it is reasonable for the citizenry to expect behavior becoming of participants in a democratic society in return.[12] In particular, a private producer should not be able to gain monopolistic control of the production of a given information technology lest that

[12] One example of this is the allocation of the frequency spectrum by the Federal Communications Commission. Specific slices of spectrum are allocated to different private entities by the FCC, giving these private entities a right to utilize them for things such as radio and TV broadcast. In return for this right, however, these private companies are expected to abide by certain regulatory practices and participate in such public activities as the maintenance and testing of the Emergency Broadcast System.

producer gain a potentially coercive power over society. Assuming that "government is the sole institution with the monopoly rights on the use of coercion" (GVPT170H 01/1999), no private entity should be legitimately able to gain coercive power without the consent of the citizenry. It therefore follows that in the case of natural monopolies, such as the telephone system, public regulation is both a legitimate and necessary response to protect the rights of the citizenry.

Given these various conditions, and the concerns raised in **Section IV**, it seems prudent to examine the historical schema by which information technologies have been produced. Assuming that we have achieved a reasonable degree of success thus far in maintaining production organization schema conducive to democratic society, we can then derive from these historical patterns information that can be applied to determine what alternatives are available to address concerns with emerging modern information technology systems production.

The Postal System

The postal system, strictly speaking, constituted a natural monopoly. Though significant additional volumes of postal items could affect the system's operation, one individual's use did not significantly reduce another's ability to use the system. Use of the system is an excludable good; a postal clerk could refuse to accept an individual's item or to deliver mail to an individual. Though natural monopolies tend to be produced by private entities, in this case historical tradition resulted in the postal system being instituted by the government. "In the seventeen-year period between 1775 and 1792, the

American postal system was little more than a mirror image of the royal postal system for British North America as it had existed prior to 1775" (John 25). The rationale behind this tradition lay in its fiscal success in Great Britain. "'There cannot be devised,' [William] Blackstone observed, a 'more eligible method… of raising money'" (John 26). This tradition was maintained with the adoption of the federal Constitution, which provided Congress with the power "[t]o establish Post Offices and post Roads." Eventually, as the necessity of guaranteeing "the citizenry the right to secure uninterrupted access to up-to-date information about the ongoing affairs of state" (John 28) became clear to Congress, more attention was given to the postal system as a benefit to democratic society. After much debate Congress passed the Post Office Act of 1792 that "broke radically and irrevocably with the inherited traditions of the past" (John 31) and began the shift of the postal system from a revenue-generating source to an instrument of American democracy. In addition to serving as a mechanism for citizens to communicate directly with one another more easily, the federal government granted special second-class mail privileges to newspapers. These privileges enabled newspapers to be more widely distributed to individuals than would have been possible at the time by providing a distribution infrastructure.[13]

[13] Furthermore, this provided an infrastructure to individual who would not likely be connected if such infrastructure were to be developed privately. There would be little incentive to develop the network to distribute one newspaper a week to a backwoods farmer. With the postal system, however, that backwoods farmer could just receive this newspaper in the mail.

Broadcast Radio

Broadcast radio was another information technology challenge that democracies faced. Broadcast radio provided a means by which information could be produced and disseminated from a single location to an (effectively) unlimited number of consumers,[14] provided they had the necessary equipment to receive it. "[By] 1922, more than 500 commercial broadcasting stations were licensed by Secretary of Commerce Herbert Hoover" (Emord 143). In 1922, as a result of technological advances, a vast increase in the number of radio broadcast stations was seen. "Erik Barnouw describes the prolific growth in the industry:

> So widespread was the feeling that broadcasting was a key to influence and power, that the rush was joined by many different interests. They included, not surprisingly, telephone and telegraph companies and the makers and sellers of electrical equipment. But educational institutions also took a prominent role. Scores of universities had long been active in radio experimentation and felt especially ready for this moment. By January 1923, broadcasting licenses had been obtained by 72 universities, colleges and schools, while many others prepared to follow. Newspapers were only very slightly less numerous; in the same period 69 newspapers became broadcasting licensees, along with 29 department stores, 12 religious organizations, several city governments, and a sprinkling of automobile dealers, theaters, and banks." (Emord 144)

This rapid and massive growth resembles the growth of the computing and Internet industry in the late 1990s. A new technology had been introduced, and organizations were becoming aware of its potential and rapidly moving to take advantage of it. A crucial difference existed between the radio and computer industries, however – the radio broadcast industry had already been and would continue to be subject to federal regulation.

[14] Within a given broadcast range.

In 1910, the United States Congress chose to exercise their regulatory power and passed the Wireless Telegraphy Act. "[I]t was designed to improve maritime safety in ship-to-shore and ship-to-ship communications by requiring all vessels that had more than 50 people aboard and that traveled between ports that were more than 200 miles apart to be equipped with efficient radio equipment" (Emord 140). This Act, however, failed to address several concerns and did not provide for a nationalization of the radio industry (140). Congress revisited the problem again in 1912, after the Titanic disaster, passing a law that "prohibited the use of any apparatus for radio communication unless the operator first obtained a license from the Secretary of Commerce and Labor" (141). "This zero-priced system[, however,] quickly produced an excess demand for authority to broadcast, causing [Secretary of Commerce] Hoover to withhold licenses on ground that interference would result" (144). The U.S. Court of Appeals for the District of Columbia, however, in *Hoover v. Intercity Radio Company*, ruled that the Secretary had exceeded his statutory authority and lacked the power to withhold licenses. The result was a period of four subsequent years during which most "regulation" of the industry was accomplished by agreements among private entities. While the Secretary was able to withhold licenses to some degree by restricting the available number of frequencies and delaying action on license applications, federal regulation during this period (1923-1926) was extremely limited. (Emord 140-146)

Congress reasserted itself in 1926. "In March 1926, the House Committee on the Merchant Marine and Fisheries began consideration of a bill for comprehensive federal regulation of radio" (Emord 167). Congressman Wallace H. White sponsored this bill. White argued that "[d]espite statements made by Department of Commerce Solicitor

Stephen B. Davis, Jr., that broadcast license were held by a diverse number of interests… an alleged monopoly [was] arising in the manufacture of radio receiving sets and [was] on the verge of taking over the entire broadcasting industry" (167). White's arguments were supported by Secretary Hoover, who "asked the committee to treat the businesses engaged in radio broadcasting as utilities that must not be conducted for private gain but must be forced to serve the 'public interest'" (167). Other Members of Congress expressed similar concerns for this "public interest." "Congressman William R. Johnson predicted:

> If the strong arm of the law does not prevent monopoly ownership and make discrimination by such stations illegal, American thought and American politics will be largely at the mercy of those who operate these stations. For publicity is the most powerful weapon that can be wielded in a Republic, and when such a weapon is placed in the hands of one, or a single selfish group is permitted to either tacitly or otherwise acquire ownership and dominate those who dare to differ with them, it will be impossible to compete with them in the ears of the American people." (Emord 170)

After extensive debate on both sides of the issue, Congress passed a compromise entitled the Radio Act of 1927 that vested licensing authority in the hands of a newly created Federal Radio Commission. This authority, while only temporary, was renewed by Congress until 1934 when the Communications Act of 1934 created the Federal Communications Commission. (Emord 175-183)

Broadcast Radio As Compared To Computer Information Technologies

The example of the radio broadcasting industry, the role of government in its regulation, and the debates surrounding this regulation provide some of the most striking historical parallels to the current information technology revolution. Similar to the events

of recent years, a relatively nascent technology began to explode in popularity as private entities realized its potential. Radio broadcast technology had been present prior to 1922; however it was relatively underutilized by the private sector for commercial purposes. Likewise, computing technologies had been present long before the information technology revolution of the late 1990s, but were relatively underutilized by the private sector. In each of these cases, a technological "boom" then ensued in which myriad organizations began to acquire interest in and utilize the technology. A crucial difference between these two examples, however, exists. While in both cases the technology was produced primarily by private corporations, in the case of the computer revolution virtually no regulation existed (or currently exists).

It is therefore important to determine why this difference exists and what implications the difference has for democratic society. I assert that the causal factors of the difference do not bear relevance to this argument.[15] Rather, it is important to focus on the implications of the difference. Congressman White described a monopoly in the manufacture of broadcast technology. I would assert that this technology, as will be seen later in **Section VI**, is constructively similar to the computer operating systems technologies in use today. Accordingly, we can then infer that many of the same

[15] The use of radio in Naval affairs and operations, combined with the extreme difficulty in selectively restricting radio use by force, led the Navy and associated maritime organizations to pressure Congress to regulate the airwaves. Since these organizations were among the forerunners in the use of radio technologies, and these requests were made nearly a decade prior to the commercial radio revolution, a precedent had already been established for federal regulation in this area (Emord 137-141). While these factors may explain the difference in regulatory involvement between the radio and computer revolutions, they do not provide meaningful insight into the implications of the lack of regulation for democratic society.

arguments expressed in justifying the regulation of the radio industry would apply to the computer industry should similar monopolistic conditions arise.

Modern Information Technologies

The microprocessor-based information technology industry, particularly the PC sector, is economically unique in that it comprises primarily unregulated private-sector producers. Furthermore, unlike broadcast television and radio, many of the goods produced by this industry are excludable, resulting in a shift in the industry from public goods production back to natural monopoly production. Early American information technologies, as discussed above, comprised primarily the printing press and the postal system. Both technologies are effectively non-rival, as one person's use of the postal system does not significantly reduce another's ability to effectively use the system. Likewise, one person's reading the material in a printed copy of a newspaper does not effectively reduce another person's ability to do so.[16] Unlike broadcast media, however, both of these "goods" were excludable. A postal agent could refuse to deliver an individual's mail, and a newspaper could refuse to sell an individual a copy of its publication. Broadcast media, in contrast, could be viewed or listened to by any individual with the appropriate hardware to receive the broadcast.

Information technologies have advanced significantly over the course of the past decade due largely to advances in computing technologies. Personal Computers (PCs) and other microprocessor-based devices have rapidly consumed portions of the market

[16] In fact, more readers could actually enhance the product for all by reducing the per-unit cost of production and distribution.

for information distribution technologies. While such devices have been more widely adopted in some information content markets than in others, nearly all information markets have seen a significant increase in the use of computing technologies over the past decade. It is therefore prudent to examine the impact these emerging technologies may have on personal liberty and democratic society given the importance of information and its distribution to these concepts of democracy.

Conclusions – Criteria For Impacting Information Flow and Democratic Society

Based on the analysis above, for an information technology to be able to impact personal liberty and/or democratic processes three conditions must be met. The technology must enable those who control it to influence either the content or availability of the information it distributes; those who control it must have incentive to influence the content/availability of that information;[17] and there must not exist sufficient alternatives for consumers such that they could seek the same information provided by that technology elsewhere.

Section VI: Understanding the Operating System

Influencing Information Flow

To examine if a technology enables those who control it to influence the content or availability of the information it distributes, we must first characterize the manner in which the technology functions with respect to information. In the case of modern

[17] This incentive may/may not be direct. It may be indirect, as in the case of product placement in TV/Movies.

information technologies, we focus on the computer. Computing technologies can be broken down into layers of abstraction. Silberschatz, Galvin, and Gagne argue that computing systems can be divided into four basic layers. These layers form a technological hierarchy, through which the computing system operates and produces results. The four components are: the hardware, the operating system, the application programs, and the users (Silberschatz 3).

Understanding how these layers interact is crucial to determining if a producer of a given technology can exert influence over the content or availability of the information that technology distributes. In most modern computing systems, the three technological layers – the hardware, the operating system, and the application programs – are not produced by any single entity.[18] The components that comprise these layers, rather, tend to be manufactured by a variety of different producers. At the hardware layer, for example, different manufacturers produce the central processing unit (CPU), the main memory, the storage devices, and the video processing and rendering hardware for most PCs. Likewise, at the application layer, most modern computers are sold with software from at least two different manufacturers (many are sold with more). The Operating System layer, however, is different in that its components generally comprise a single inseparable package that is at least sold, if not also produced, by a single entity. Furthermore, there are relatively few commercial producers of operating systems currently in business.

[18] Certain efforts by Microsoft Corporation are starting to defy this model. For the purposes of discussion within this section, I do not address the efforts.

Defining The Operating System – Establishing A Working Definition

In order to understand how Operating Systems may be used to influence the flow of information to the end user of a computing system, we must establish a working definition of what the operating system encompasses. There are several different definitions of what comprises an operating system. One viewpoint examines an operating system as a "resource allocator." "A computer system has many resources (hardware and software [or application]) that may be required to solve a problem: CPU time, memory space, file-storage space, I/O devices…" (Silberschatz 4). Each of the resources listed here comprises an element of the hardware layer. In this viewpoint, "[t]he operating systems acts as the manager of these resources and allocates them to specific programs and users as necessary for tasks" (Silberschatz 4). In essence, this view looks at the operating system in terms of its management of the hardware, and does not specifically address the distinctions between the applications and the operating system. This approach is important in that it does not limit the operating system to a specific set of functions, and fails to draw a clear line between the operating system layer and the application layer. Given the prospect of potential monopoly in operating systems technology as affording OS producers the ability to influence the availability and/or content of the information their systems provide, an expanding definition of the operating system permitted by this viewpoint presents a significant concern.

A more restrictive definition of an operating system, in contrast, describes it as "the one program running at all times on the computer (usually called the *kernel*)" (Silberschatz 5). This is a much more common definition in technical literature, though it may fail to reflect the average user's perception of an operating system. Furthermore,

given that the nature of the products actually marketed and sold by operating systems manufacturers almost always comprise far more than just the kernel, this restrictive definition is likely insufficient to use in examining the potential for a producer to exert influence over the information its system distributes.

For the purposes of this argument, a combination of the definitions presented in the literature will be used. This approach is primarily due to the practical implementation of operating system products available at the time of writing. We consider three primary manufacturers of computer operating systems: Microsoft Corporation, Apple Computer, and Sun Microsystems. Each of these manufacturers possesses a non-trivial market share, and was selected to represent a class of similar operating systems. In the case of each manufacturer, their operating system product includes three main sets of components: 1) the core operating system components, 2) a suite of utilities, and 3) an interface shell (usually comprising a Graphical User Interface or GUI). I propose these divisions as a way of modeling the shape of operating systems actually in use and on the market today. These divisions are not intended to be restrictive; in fact, there are several areas of overlap among them. Rather, they are designed to help define and classify what constitutes an "operating system" in modern PC markets.

The Core Operating System Elements

Describing the elements of the core operating system components is a comparatively easy task. Silberschatz breaks these down into eight pieces (Silberschatz 46-51):

- Process Management
- Main-Memory Management

- File Management
- I/O System Management
- Secondary Storage Management
- Networking/Communications
- Protection Systems/Security
- Command-Interpreter System(s)

Understanding the elements of the core operating system components is crucial because, as the foundation elements of an operating system, these will be the first to be implemented as operating systems are developed for expanding markets such as PDAs, mobile phones, and gaming systems. In particular, the Process Management, Networking/Communications, and Protection Systems/Security elements are of particular concern to the issue of information flow in computing systems. The potential manner in which these elements can affect information flow to the end-user is discussed further in **Section VII**.

More restrictive definitions of operating systems, as discussed above, are generally limited to components in this category. Prior to the 1990s, these definitions may have been more effective in capturing the nature of the products produced by OS manufacturers. MS-DOS versions 3 through 6, for example, qualified these more restrictive definitions of operating systems while providing limited additional functionality. Additional functionality (particularly in MS-DOS versions 5 and earlier) such as graphical user interfaces, third-party hardware device and peripheral drivers, and network communication required the installation of additional software. Often times this software was not available from the OS vendor. A similar case can be made for UNIX-variant operating systems; however it is important to note that Apple Computer's operating systems began to add some of these additional features in the early 1980s with

the introduction of the Apple Macintosh computer. (Silberschatz 6-11, 19-21)[19] From a practical standpoint it is clear – and is consistent with definitions in the literature (Silberschatz 46-51) – that these factors must be included in a working definition of an operating system.

The Suite of Utilities

The suite of utilities provided with an operating system varies by manufacturer, but historically such suites have included advanced storage management utilities, local area and internet-capable networking protocols, and drivers/controllers for standard peripherals. Examples include hard-disk defragmentation utilities, built-in TCP/IP protocol stacks and associated modem control software, and standard printer, hard disk, floppy disk, display, keyboard, and mouse drivers. While the manufacturer sometimes provided these drivers for inclusion with the operating system, they were almost always distributed with the operating system. In the case of Microsoft operating systems, the manufacturer-provided approach was most common. Apple Computer's systems were far more tightly integrated than "Intel-compatible" systems (as defined by Judge Jackson's ruling) and therefore Apple developed many of these utilities themselves (84 F. Supp. 2d 9).

Among the more crucial of these utilities is a set of software applications I will define as "information and media access software." These include applications for

[19] Much of the information provided in this section comes from knowledge I have acquired working with computing systems over the course of the last ten years. While some support for it is provided in the literature, the primary source of information is my own hands-on experience working with these systems.

accessing the World Wide Web, viewing multimedia content, and accessing basic (non-web-based) email services. While these applications clearly do not fall under the strict definitions of an operating system, Microsoft Corporation has been including them in their operating systems packages since the mid-1990s. These applications represent one of the core potentials of how an operating system can influence the flow of information. If such applications – which provide the essential means by which end-users access most types of information online – are considered part of the operating system, then the manufacturer of the operating system would effectively control which such applications ran on a given user's machine. Indeed, it is the case, as shown by the findings of fact in Judge Jackson's ruling, that Microsoft operating systems include web-browsing applications as part of their standard package (84 F. Supp. 2d 9). Furthermore, "[i]n contrast to other operating systems vendors, Microsoft both refused to license its operating system without a browser and imposed restrictions – at first contractual and later technical – on OEMs' [Other Electronics Manufacturers] and end users' ability to remove its browser from its operating system" (84 F. Supp. 2d 9).

Furthermore, Microsoft decided in 1997 to aggressively pursue the integration of multimedia/streaming media applications into their operating system (84 F. Supp. 2d 9). While pursuit of this integration has not been as strong amongst Microsoft's competitors, it has occurred to some degree with Apple Computer's "QuickTime" multimedia access application (Apple – QuickTime Player). Given the nature of these factors, it is clear that a practical working definition of an operating system must include the suite of utilities provided by major operating systems manufacturers. Furthermore, given Microsoft's massive market share, I assert that information and media access software must be

included in this suite of utilities and therefore considered part of the operating system as well.[20]

The Interface Shell (GUI)

The Interface Shell is an example of where some of the distinctions between the operating system component classifications I propose blur. For any computing system to function, it must be able to receive and process commands from the user. Returning to the hierarchical model of a computing system discussed above, we can now propose a fourth layer that sits above the applications layer – the "End User" (Silberschatz 3-4). Following from the condition then that layers in this hierarchical model generally interact only with those that are directly adjacent to them, we can conclude that there must exist an application program through which the user can interact with the operating system.

One of the core elements of the operating system discussed by Silberschatz is the Command-Interpreter System. "[It is] one of the most important systems programs for an operating system, [acting] as the interface between the user and the operating system" (Silberschatz 51). In its most basic form, the command interpreter consists of a text-based input (often referred to as a "command-line") into which the user can type commands that the operating system will execute. While "[s]ome operating systems include the command interpreter in the kernel, [o]ther operating systems, such as MS-DOS and UNIX, treat the command interpreter as a special program that is running when

[20] It should be noted that my assertion is for the purposes of a working definition, to be used in the analysis of how an operating systems monopolist might affect the flow of information to and end-user of a PC. This statement is not intended to make any assertion as to the proper or technically correct state of whether such utilities and applications should be included in the definition of an operating system.

a job is initiated, or when a user first logs on [or the computer is first activated]" (Silberschatz 51).

This logic, on the surface, seems counterintuitive to my point that the Interface Shell should be included in a working definition of an operating system. In fact, however, it represents an argument for why this working definition must be expanded to address the practicalities of modern OS implementations. Particularly in the case of more recent Microsoft operating systems (Windows 95 and later), it is virtually impossible for the user to run or use any software applications if the interface shell is not functioning.[21] While the Interface Shell, therefore, is technically an application program, it is one without which the operating system rendered effectively useless to the end-user. It therefore must be included in this working definition of the operating system.

The Resultant "Working Definition"

It can be concluded from this analysis that elements of the three main components included in each of the primary OS versions discussed above must be included in a working definition of an operating system.[22] For the purposes of this argument, then, an operating system will therefore be considered to be that portion of software, generally sold/delivered as a single package, produced by a single manufacturer, that is required for any application program to run on a PC. It will include all aspects of that software

[21] A relatively easy-to-accomplish demonstration of this phenomenon can be performed on nearly any Windows NT, 2000, or XP machine by manually closing the user shell ("explorer.exe") process via the Task Manager application. This procedure, however, is not recommended except to be performed by experienced users with the knowledge to manually restart the explorer interface shell.

[22] This working definition is intended for computer operating systems, and may not be extensive to expanding operating systems markets such as PDAs, mobile phones, and gaming systems. I would assert that the use of (non-proprietary) "software-based" operating systems in such devices is too new a phenomenon for there to be sufficient data from which to draw meaningful conclusions.

relevant to the control of hardware, application management, security, and the accompanying (usually graphical) user interface(s) to access these functions. Furthermore, it will include any information and media access software included with the operating system unless that software is clearly distinct and can be easily removed by the average end-user. Adopting then a broader definition of an operating system, we can examine how manufacturers could use their technology (whether intentionally or not) to influence information flow.

Section VII: How Computer Operating Systems Can Influence Information Flow

In its simplest form, a computer is a device for storing, manipulating, processing, distributing, and accessing information. It is a true "information technology" in this sense. While computing devices have been adopted to perform a wide variety of functions, we focus on the storage, processing, and transmission of information in this analysis. Extrapolating then from the working definition of an operating system established above, we find several ways in which it can influence information flow in a computing system.

Direct Influences

Direct influences result from situations when the operating system directs or forces the user to utilize a specific information source. Microsoft Windows XP, for example, provides a very easy-to-use interface for establishing an Internet connection when a user first sets up his/her computer. One of the steps in this "Wizard" (see **Figure I**) provides the user with the option to choose from a selection of means of connecting to

the Internet. One of the selections on this list is "Choose from a list of Internet Service Providers (ISPs)." This is the top item of the list, and also the default option. If the user selects this option, he/she is then taken to another screen with two primary options: 1) "Get online with MSN", and 2) "Select from a list of other ISPs."[23] MSN (loosely) stands for "Microsoft Network" and is Microsoft Corporation's primary Internet Service Provider. It is a direct competitor with America Online (AOL), and a user's selection of either service provider will significantly affect how he/she accesses information through the Internet, as each of these services have their own user interfaces and software for aggregating, analyzing, searching, and retrieving information from the Internet. Thus one direct method by which an operating system can influence information flow is by leading the user to select a specific means for establishing communications connectivity.

Given that the operating system includes information and media access software, and that the operating system controls which applications are used to perform different data access functions, it therefore can effectively direct a first-time user to use specific applications to retrieve information from the Internet and to access information that user possesses.[24] Furthermore, since the operating system controls the execution of programs and since the manufacturer of the operating system does not have to release all of its source code, the manufacturer could advantage certain programs over others in terms of efficient and stable execution. Microsoft has been repeatedly accused of doing this with their Internet Explorer web browser to the detriment of Netscape Navigator, a competing

[23] In the default setting for Windows XP Professional, the "other ISPs" list is empty. This may vary depending upon the computer manufacturer and what other ISPs they add to the configuration (if any). It should be noted, however, that Microsoft could add any additional ISPs they chose into the software and that MSN is always included.
[24] Information possessed by the user on other media such as CDs, DVDs, floppy and zip drives, etc.

web browser (84 F. Supp. 2d 9). The choice of an information and media access application is not insignificant to a user's experience. Certain multimedia playback software, for example, cannot open certain video files. Microsoft's Windows Media Player, for example, does not support "MOV" (QuickTime) format video files.[25] In another example, Microsoft Office XP's "Outlook" application, which is (amongst other things) the email client in its office suite, blocks certain types of file attachments as part of its default implementation. When operating as a standalone client, Outlook XP does not allow this setting to be changed.[26] Outlook provides this "functionality" in order to curb the spread of computer viruses, by blocking specific file types commonly known to transmit viruses. In doing so, however, Outlook is literally censoring the information a user receives. While Outlook is not a part of the Windows operating system, Windows does include a more "stripped-down" version of it, known as "Outlook Express." As of version 6, Outlook Express did not include this functionality. If Microsoft were to include this functionality in later versions of Outlook Express, however, it would effectively be using its operating systems monopoly to censor a potential user's email. Thus clear potential exists for an operating system monopolist to use information and media access applications to influence the flow of information through a given computer.

The Graphical User Interface (GUI) Shell is another means through which the operating system can influence the flow of information in a computer. The GUI Shell is actually what the user sees and interacts with when using the computer. It was first seen

[25] This is effective as of Windows Media Player Versions 8 and earlier. This refers to the default configuration – it may be possible to have Windows Media Player support these files; I have not been able to discover how.

[26] I have heard – informally – that there may be a way to override this. After extensive research in Microsoft's technical support and knowledge bases in August 2002, I was unable to determine any method of doing so.

prominently on the Apple Macintosh computer in the early 1980s, and was designed to replace the Command Interpreter as the sole method of allowing a user to operate the computer and execute commands. Since then, the GUI Shell has developed into an extremely complex program that presents and organizes information to the user about the computer's operation and its contents. In essence, the GUI informs the user about how to operate the computer – an information storage and processing device – and provides (essentially) the sole means through which this can be accomplished. By manipulating the operating system's GUI, therefore, an OS manufacturer can exert influence over the experience the user has with the computer and the manner in which he/she accesses, stores, and manipulates information.

Indirect Influences

Equally important, and perhaps more interesting are the indirect ways in which operating systems can influence information flow. There are many types of ways in which such influence can occur; for the purposes of this examination I will focus on those derived from the concept of the operating system as the "governor" of a computing system.

As discussed above in the "layered model" of a computing system, the operating system isolates the user from the hardware of a computing system.[27] The user does not directly manipulate the hardware, nor does the user (in general) run application software (other than the operating system) that does so. Rather, the user runs applications

[27] This refers to interface-based control, not simple operations such as opening or closing the CD tray or moving the mouse. However, it should be noted, that in newer operating systems even these operations are somewhat isolated from the user through the operating system.

designed to function on a specific operating system. These applications require the resources of the computer hardware and, as discussed above, access it solely through the operating system. This is generally accomplished through an Application Programming Interface (API). An API specifies what functions, or "tools," are available to a programmer designing a software application and how to implement or "use" these tools. Loosely speaking, each operating system has its own API. In general, modern software applications are developed for a given platform (operating system) and use the resources of that platform solely through the API.

The API clearly plays an important role in the development of computer software. It is clear that an operating systems manufacturer could use the API to affect what a computer was able to do, but the question of how and why the manufacturer would accomplish this remains. The answer to this question lies in the lack of necessity for operating systems manufacturers to expose (or make publicly available) their entire APIs. If an OS manufacturer were only to make publicly available a portion of its API, then other software manufacturers who wished to develop applications for that manufacturer's OS platform would be at a severe disadvantage against those to whom the manufacturer had exposed the entire (or larger part of) API.

The means discussed here are hardly an exhaustive list of how operating systems manufacturers can use their products to influence information flow in a computing system. The important point to note is that there exists great potential for doing so. While it is unclear whether any of the concrete examples discussed in this section are actually affecting information flow to end-users in a manner significant to democracy, the

clear potential for this to occur suggests that the question of whether manufacturers have incentive to engage in this type of behavior should be examined.

Section VIII: Incentives To Influence

The incentives for operating systems manufacturers to influence the flow of information derive from a combination of the current organization of production (i.e., unregulated markets) and my extension of Baker's theories on media and communications markets. For the purposes of this discussion, I will exclude the more grim possibilities of ideologically motivated corporations that seek to influence individuals for personal as opposed to economic reasons.

Baker's third criterion, as discussed in **Section IV**, describes a trinary sales relationship in media products. I have asserted that a similar relationship exists in the manufacture of computer software, especially that of computer operating systems. In an unregulated market, a corporation's primary objective will be to maximize profit. While still a member of a society, that corporation (provided it maintains legal activity) is held responsible only to its shareholders, who presumably will desire increased profits. The operating system manufacturer's primary goal, therefore, is to generate revenue as efficiently as possible.

There are two potential cases for an operating systems manufacturer: 1) an OS manufacturer whose primary product is their operating system and who does not have a meaningful investment in other software markets; and 2) an OS manufacturer who does have a meaningful investment in other software markets. While other permutations of investment and product breadth are of course possible, this categorization will better

characterize the potential incentives a manufacturer could have to influence information flow. The first case, I would assert, is moot at this point as there are no significant examples of such a company. It would be worth examining, perhaps, had Judge Jackson's proposed remedy of dividing Microsoft Corporation been upheld, however this was not the case, and the settlement approved by the Justice Department does not include such a remedy. Rather, then, we turn to the second case, under which Microsoft Corporation, Apple Computer, and Sun Microsystems would fall.

Given their overwhelming monopoly, Microsoft is clearly the current example most worth examining.[28] In addition to operating systems (which as discussed earlier we can define to include several information and media access applications), Microsoft also produces several major software applications packages, most notably its "Microsoft Office" package of standard business applications. Microsoft therefore has a vested interest in promoting these products. Furthermore, as an operating systems manufacturer, Microsoft has a vested interest in promoting the introduction of its operating system into emerging computing markets such as those for Personal Digital Assistants (PDAs), gaming systems, mobile telephones, and other devices that may at some time incorporate a software-based operating system. Microsoft therefore has strong incentive to use their operating systems monopoly to influence the flow of information in a way that promotes these business ventures. The above example of how Microsoft promotes the use of its MSN Internet service, is one instance of how the company is engaging in such practices

[28] A comparative analysis of other operating systems manufacturers might prove worthwhile, however such an analysis is outside the scope of this paper. It should be noted, however, that if market trends shift over the course of the next several years and the market becomes less monopolistic, such a comparative analysis would likely become important.

today. An extensive list of specific business practices Microsoft engaged in, both through the use of their operating system technology and through its software monopoly, is examined in extensive detail in Judge Jackson's Findings of Fact (84 F. Supp. 2d 9). Microsoft's actions included leveraging its monopoly against firms such as IBM, Apple Computer, and Real Networks.

Section IX: Insufficient Alternatives – The Shape Of The Market Today

Given the potential for operating systems to influence the flow of information in computing systems, the importance of computers to the exchange of information in modern society, the incentives for OS manufacturers to use this potential to influence the flow of information, and the importance of this information exchange to democratic society, it is clearly important to examine the current state of the market to attempt to characterize Microsoft Corporation's monopoly and determine whether it presents any real threats to democratic society. The original goal of this paper was to produce exactly that characterization and, based upon its results, attempt to design a series of policy recommendations that would protect the principles of democratic society discussed here. In the course of conducting my research, however, I discovered that this question is somewhat premature.

First, computer software markets are extremely young. Microsoft Corporation is less than 30 years old, and computer systems role in individuals' information exchange did not begin to reach substantial percentage until the 1990s. This presents an immediate problem in that with such young markets, it is unlikely that sufficient market data will be available to predict long-term outcomes. Second, collecting data on computer software

usage at-large is an extremely difficult task. In the course of my research, I examined resources including numerous journals, electronic databases, and texts.[29] I was unable to find reliable, comprehensive data regarding the utilization of various computer software.

The Problem of Analyzing Operating Systems Markets

Operating Systems Markets are particularly difficult to analyze for several reasons. Most of these reasons derive from the earlier discussed point of the negligible marginal cost of production of computer software. This problem is further exacerbated in environments where end-users do not need the actual physical media (usually CD/DVD-ROM) on which the software is distributed or their own individual copy of the packaging reference materials, as is often the case with large organizations.

First, continually changing licensing structures make point-of-sale transactions difficult to calculate. Site licenses, licenses that allow an organization to freely copy and install a specific (or unlimited) number of copies of software on machines used by members of that organization for purposes specified within the license, can make calculation of the exact number of computers using a given software package difficult. While in some cases these licenses are sold with a specific limit, it is difficult to determine how this number compares to the actual number of copies in use. Point-of-sale based tracking also may suffer from the question of whether a user is actually using the copy of a given software package he/she purchased, how long he/she continues to use it for, whether he/she uses more than one software package and the ratio with which he/she

[29] Sources examined included, but were not limited to: Gartner Research, comScore/MediaMetrix (non-commercial), Gale Group's "Business and Company Resource Center," Hoover's Online, LexisNexis, ProQuest "MarketResearch.com Academic," and multiple RDS Business and Industry databases.

uses those packages. These factors matter because an unused software package (presumably) will not be able to affect the flow of information in a given user's computing system.

Third, software piracy, a practice frequently decried by computer and software manufacturers, has real impact on the number of copies of software in use. Illegally copied software is virtually impossible to track, as users have no incentive to provide information about their activities in this regard. Although unable to prove exact numbers, estimates have ranged in the billions of dollars lost to the software industry per year over the past few years due to software piracy.[30]

Fourth, "Open Source" software presents an almost impossible-to-track problem. Open-source OS usage is difficult to reliably track due to the free availability of the software (i.e., there is no "point-of-purchase" transaction to use in collecting market data). While it might be possible to create sample populations and conduct surveys, I was unable to find sufficient information in the course of my research to suggest that there is sufficient knowledge to develop effective survey methodology.[31] The development of such methodology, if proven statistically valid, would present a solution to many of the problems above.

[30] See works Cited and Consulted: "Seventh Annual BSA Global Software Piracy Study," "Software Piracy Costs Businesses Billions," "Software Piracy Costs Billions."
[31] It may be the case that such methodology exists. I did not conduct as extensive a search into this as other areas of my research, however no obvious indicators of its existence were found.

An Introductory Analysis of Operating Systems Markets

Given that sufficient data are not available to analyze operating systems markets in a manner sufficient for the original goals of this paper, I have alternatively conducted an introductory analysis of the effects of current Microsoft pricing structures on the individual consumer. This analysis is neither intended to be comprehensive nor statistically sound, rather it is intended to introduce the reader to the problem of individuals begin unable to express their "preferences" (as described in **Section IV**) due to monopolistic conditions. It examines one of Baker's proposed solutions to the problem of marginal versus average cost pricing in media products, and discusses how Microsoft fits into this model.

With the current state of socioeconomic affairs, it is likely that individuals will experience a great deal of inequality in their ability to express their "preferences" through the market. Microsoft Corporation, for example, clearly does not suffer from a condition of underproduction – while I was unable to collect data to confirm it, it seems unlikely that they are charging their customers the marginal cost. While they have implemented some degree of price discrimination (i.e., with different versions of Windows such as XP Professional and XP Home), the overall price), this discrimination is unlikely to significantly differentiate among classes of consumers. The price difference between Windows XP Professional ($300 US) and Windows XP Home ($200 US) represents a 33% decrease. While this differentiation does represent a savings to the consumer, I would assert that an individual who is unable/unwilling to spend $300 for a necessary product will not have their ability to do so affected by reducing the price to $200,

particularly in modern American culture where lines of credit (particularly through credit cards) are easily obtained. A similar argument can be applied to the price discrimination between the upgrade and full versions, which at best represents a 50% reduction in cost (for Windows XP Home version) and requires a previous purchase of an operating system at full price. ("Windows XP: How To Buy"). The result is a situation in which consumers are beholden to pay the price that Microsoft determines.

Section X: Conclusions

This is a paper about the need to conduct research. It attempted to identify a potential problem that may affect democratic society, and examines under what conditions that problem could manifest itself. It then examined the current conditions, and based on those conditions makes suggestions about what types of research should be conducted to see if those conditions will manifest as meaningful threats to democracy in the future.

While plagued by a lack of sufficient valid data on the specifics of the current market situation, my research and experience leads me to conclude two important points. First, there is a real, demonstrable potential for an operating systems monopolist to exert influence over the flow of information through society. Computer operating systems form the foundation of computing systems, which are becoming increasingly integrated into our society. As effective "governors" of these technologies, operating systems become much like the radio broadcast equipment assailed by Congressman White in the 1920s. They are powerful tools that enable collaboration, innovation, and can bring great

benefit to society and the economy, yet at the same time bring important responsibility to those who produce and control them.

Second, Microsoft Corporation, while possessing a very powerful monopoly in the operating systems market, does not pose a real threat to democratic society today. I again return to my earlier point that this is a very young and rapidly changing industry, one about which we have too little data to predict the future with great certainty. I believe, however, based on my research and experience that it is the case that Microsoft could develop into a potential threat if their market share holds and they remain unregulated. The key elements exist – ability, motive, and a history of actions indicative of their willingness to act on these abilities and motives.[32]

The Need For Interdisciplinary Research

As discussed earlier, this is a paper about identifying a problem and asserting the need to conduct research about it. In particular, this paper is about the need for political and other social scientists to be concerned with developments in the computer and information technology industry. Their need for concern arises from the issues discussed in this paper, in particular, for political scientists, the issues related to effective democratic governance and maintenance of a democratic society.

This research, however, cannot be conducted in isolation. The efforts involved in writing this paper, for example, involved the support of computer scientists as well as political scientists. My assertion is not that there is some type of discipline-changing

[32] See Judge Jackson's opinions and findings of fact (84 F. Supp. 2d 9). Specifically, Judge Jackson outlines Microsoft's actions toward companies such as Apple Computer, IBM, Netscape Communications, AOL, and Real Networks. Conclusions of Law and Order may also be useful.

revolution occurring, rather, it is that as new information technologies permeate our lives with greater breadth and depth that social and technical scientists must work together to characterize, study, and understand the impacts of these technologies. It matters to the social scientist for her concerns about how technologies will impact questions that she studies. It matters to the technical scientist for her concerns about how her research will be received by, implemented in, and directly affects society.

Potential Research Avenues

Throughout the course of this paper I have suggested several potential research avenues that resulted from unanswered questions encountered in my research. Most of these questions focus on the lack of data available about the nature and shape of computing and information technology markets, especially for software. In addition, I have included several other "Unanswered Questions" that came up during the period I was conducting my research.

It is my hope that this work will inspire others to take seriously the types of questions I have raised and consider the other types of associated work that may be conducted.

Unanswered Questions

Microsoft Corporation is currently pushing a strong initiative for its ".NET" framework of Information Technology solutions. "Microsoft® .NET is a set of Microsoft software technologies for connecting information, people, systems, and devices. It enables a high level of software integration through the use of XML Web services—

small, discrete, building-block applications that connect to each other as well as to other, larger applications over the Internet" ("Defining the Basic Elements of .NET"). Microsoft has expanded the reach of this effort into most of its prominent software and services products, including Microsoft Windows XP, the popular MSN Hotmail email service, and several of its web server operating systems and their associated development platforms. Clearly encompassing a massive portion of Microsoft's efforts in the field of information technology, .NET represents a potentially important avenue of research for social and technical sciences concerned with issued related to the exchange of information in global society.

In February 2003 WalMart Stores, Inc. announced that it would begin selling retail copies of a Linux-based operating system as an alternative to Microsoft Windows ("WalMart.com to Sell Lindows OS"). "LindowsOS is a new, fun and exciting operating system that delivers the power, stability and cost-savings of Linux with the ease of a windows environment. LindowsOS is easy to experience because of its friendly graphical interface and support for popular Microsoft Windows file types (.doc, .xls, .ppt, .jpg, .gif, .mp3, etc.)" ("LindowsOS"). Additionally, WalMart announced that it would be selling Intel-based PCs preloaded with Lindows as an alternative to the now standard practice of preloading PCs with Microsoft Windows. As discussed above, the youth of the computer software market raised a variety of potential questions about whether the current state of the market will be representative of the future of the market. Alternatives such as Lindows, while likely insufficient for consumers today, present interesting alternatives worth researching.

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Figure 1 – Microsoft Windows XP Network Setup Wizard

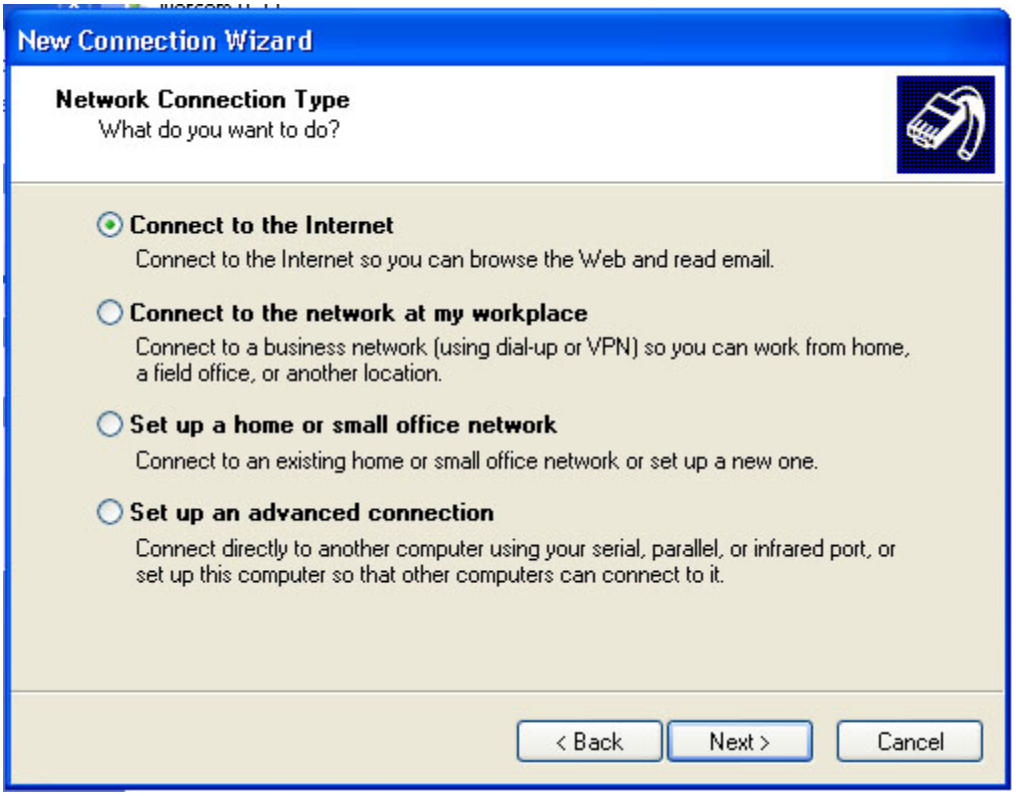

Figure 1.1 – First Wizard Screen

(This is what a user sees first after clicking on "Setup a New Connection" from the control panel or the automated setup that runs the first time Windows is started.)

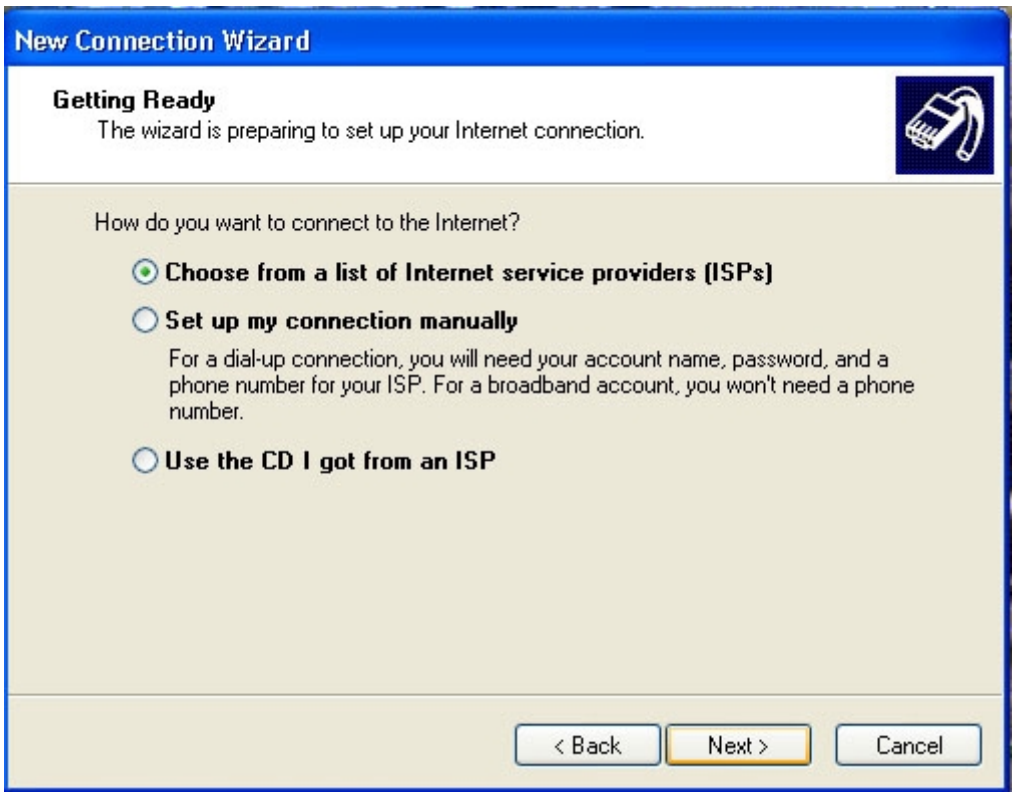

Figure 1.2 – Second Wizard Screen

(This is what a user sees after clicking on the default option in 1.1 "Connect to the Internet")

Figure 1.3 – Final Wizard Screen

(This is what the user sees after clicking on the default option "Choose from a list of Internet service providers (ISPs)" in figure 1.2 above. Selecting get online with MSN will automatically launch the MSN setup which comes installed by default as part of Microsoft Windows XP.)