8 Navigating the Virtual Minefield: Using the Internet as a Medium for Conducting Primary Social Research

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While the computer revolution is seen by many to be the third great revolution in human history (Danziger 1985), it was not until the early 1990s with the popularization of the global telecommunications, information, and entertainment network known as the 'Internet' that computers began to move out of the stigmatized domain of the 'nerd' and 'techno-geek' and into that of popular culture. By combining the essential communication functions of the telephone and post-office with the information and entertainment appeal of the television, radio, newspaper, etc., in an inexpensive and easy to use package, the Internet has taken on a global following. Although it is difficult to know exactly how many people use the multiple platforms that make up the Internet, recent estimates indicate that the numbers could be as high as 50 million in North America alone (CommerceNet 1997).

The main components of the Internet are Email, Usenet or Newsgroups, the World Wide Web (WWW or the Web), File Transfer Protocol (FTP), and Internet Relay Chat (IRC). The most developed and used component of the Internet is Electronic mail or 'Email.' Email is a global postal system that enables its users to transmit written, audio, or visual messages around the world through telephone lines within seconds (Atchison 1996; Lowman, Atchison, and Fraser 1996). Another frequently used component is the Usenet or newsgroups. The Usenet is a compilation of over 25,000 distinct topic specific news and information forums (similar to newspapers or bulletin boards) where individuals may read or post text or audio/video files (Atchison 1996; Lowman, Atchison, and Fraser 1996). File Transfer Protocol (FTP) is an interface that allows the user to transfer specific information or data files between their personal computer and a designated server or host computer (Atchison 1996; Lowman, Atchison, and Fraser 1996). Internet Relay Chat (IRC) is a format for users on different systems at different locations to gather and engage in type-written live discussions at one semi-private location (Atchison 1996; Lowman, Atchison, and Fraser 1996). Finally, the most hyped feature of the Internet is the World Wide Web (WWW or the Web). The Web gives users a graphical magazine-style interface to the Internet by using a programming language that allows the user to jump from one

piece of information to another with a simple click of the mouse (Atchison 1996; Lowman 1996; Digital 1996).

As more users come on-line, the need and demand for features that emulate radio, telephone, personal conference calling, and three-dimensional or live video has increased. To accommodate these demands, several major stand-alone programs and 'plug-ins'[1] have been developed that allow users to expand upon the traditional interface. These newly developed platforms include: audio-video streaming software (Real Audio, Net TV), chat direct software (Internet Phone), and Virtual Reality Mark-up Language (VRML) viewers. Audio-video streaming software allows users to see and hear live radio and televised broadcasts from around the world. Chat direct software expands upon and privatizes the traditional IRC interface to allow users to conduct secure private individual and group discussions without the burden of long distance charges. Finally, VRML viewers add a third dimension to traditional Web pages, pushing the utility of the Web page to the next level of interactivity.

Although the specific focus differs from researcher to researcher, depending on their particular filed of study, the object of much social research is to understand the often complex interdependent relationships that exist between individuals and/or groups and the environment in which they live. The emergence of the Internet is of particular importance for social researchers due to the ever-increasing public and academic pressure to 'cure social ills' and to conduct unique research without the financial support that appears to be abundant within many of the hard sciences. Perhaps, the greatest advantage the Internet offers to social researchers is its ability to provide direct, inexpensive, and easy access to millions of individuals, groups, organizations, and social artifacts from over 170 countries around the world.

It is important that, before this technological wonder is heralded as the next great panacea for the fiscal and methodological pressures confronting empirical research in the social sciences, an attempt is made to outline the types of primary[2] research that may be conducted on-line, the methodological advantages and impediments inherent to such research, and ways in which researchers may deal with these impediments so as to successfully conduct social research on-line. This essay is not concerned with illustrating how-to conduct specific research on the Internet,[3] nor will it attempt to discuss the theoretical or ethical dimensions of specific research designs and methods or issues surrounding the use of the Internet as a tool for conducting secondary research.[4]

METHODOLOGICAL OPTIONS FOR ON-LINE RESEARCHERS

The dynamic nature of the multiple interfaces that make up the Internet make it very adaptable to a wide range of methods for collecting primary data.[5] By using one, or a combination of, Email, Usenet, the Web, FTP, IRC, audio-video

streaming, chat-direct, or VRML, respondents from around the world may participate in on-line experiments, self administered questionnaires, interview surveys, and Internet phone surveys. In addition, some of these platforms may be used to conduct participant and direct observation.

Due to the varying levels of control required, experimental research is the most technologically laborious to conduct on-line. Although the logistics of many social science experiments require an absolute control over the physical environment or physical contact between the experimenter and the participant, by making use of audio-video streaming, CGI scripts, and programming languages such as HTML and VRML, it is possible to conduct experiments on perception, audio/visual sensation, interpretation, learning, memory, thinking, language, motivation, emotion, aggression, and attraction (to name a few).

An excellent example of the feasibility of the Internet for on-line experimentation can be found in the recent medical research conducted out of the Beth Israel Hospital.[6] Here physicians and psychologists have been developing effective ways to conduct on-line diagnosis and monitoring of certain physical and psychological ailments. They report that recent advances in telecommunications and computer-aided medical testing devices have enabled patients who require frequent medical testing and/or supervision to use a specially-equipped home computer to connect to health-care professionals on-line for monitoring and testing.[7]

The mutually compatible platforms of Email, Usenet groups, and the Web, combined with the versatility of HTML programming language and CGI scripts, make the Internet an ideal place in which to conduct self-administered questionnaire style research. Researchers may use Email, Usenet, IRC, listservers, and the Web to solicit participation from general or specific populations of interest. Once respondents are secured, the Web provides an ideal universal access point where they can complete and return stand-alone surveys.

The research conducted by Lowman, Atchison, and Fraser (1996; 1997) and Atchison (1996; 1997) provides an excellent example of how effectively this method is for collecting data from large numbers of previously hard-to-contact respondents. Here Email, Usenet groups, IRC, public Web sites, and major search engines were used to direct respondents to an on-line questionnaire concerning sexuality with a focus on the male sex buyer. A total of 554 English speaking adult Internet users (including 251 male sex-buyers) completed the questionnaire, which took between one and three hours to complete (Atchison 1997; Lowman, Atchison, and Fraser 1997). To my knowledge, this is the first large-scale social science survey to be conducted on-line and its success in attracting large numbers of participants to spend hours filling out an on-line survey is a clear indication of the enormous potential the Internet has to offer this type of social research.

Although audio-video streaming, IRC, or chat direct has yet to be used as a method for conducting interviews or Internet telephone surveys, recent advances

in telephone and cable modem hardware accompanied by the increased availability and use of inexpensive Internet based software applications have made this type of research a viable option for social scientists. By using Email, Usenet groups, and the Web to direct perspective participants to designated interview sites or channels, researchers can now engage in on-line interviews with Internet users from around the planet.

Finally, as the Internet has grown in size and popularity, distinct social spaces have emerged where sub-groups of 'netizens' with like interests gather to electronically chat and exchange information. Usenet groups, IRC rooms, and listservers (Email discussion groups) provide topic specific areas where groups ranging in size from 2 to 200,000 gather and interact. Because the interaction between individual participants in these groups takes the form of a textual exchange, only the Email, Usenet, or IRC software, a connection to the Internet, and an understanding of where to find the desired groups is needed in order to conduct research.

Some of the earliest reported on-line social science research was based on both participant and direct observation of Usenet posts and IRC discussions. The most notable of these early studies, now known as the 'Rimm Study,' was undertaken by Carnegie Mellon undergraduate student, Marty Rimm. Rimm used standard Usenet and BBS software to collect text descriptions of erotica files posted in adult Usenet groups and BBSs. He also managed to contact individual users and site managers in order to compile revealing socio-demographic descriptions of the adult-site users. The study gained notoriety in America after *Time* magazine reported the controversial findings reported by Rimm in the *Georgetown Law Journal*. This prompted many academics to take a closer look at the study, and, as a result, questions over the ethical conduct of Rimm and his research team at Carnegie Mellon University emerged.

ADVANTAGES TO USING THE INTERNET FOR PRIMARY SOCIAL RESEARCH

It is clear from the examples provided that primary research can be, and is being, done on-line. Using the Internet as a research medium can serve to strengthen the sampling, observation/data collection, and analysis/data processing phases of certain research designs. Although some of the facilitative aspects of on-line research are specific to particular types of research, many are more universal in their application.

Sampling

Perhaps, the biggest advantage the Internet has to offer for sampling research participants lies in the fact that at any given time a researcher has access to

millions of participants from over 173 countries. This means that the numbers of potential research participants grows exponentially when the Internet is used for sampling purposes. It also means that it is now possible to conduct cross-cultural research on a scale never before possible (Hewson, Laurent, and Vogel 1996). Finally, the length of time required to obtain the desired sample size will be reduced drastically, freeing up more time for other stages of the research process such as instrument development and data analysis and interpretation.

Internet users have a dual citizenship of sorts; on one hand, they are residents of traditional physical society, and, on the other, they are members of a newly-emergent electronic society that has its own language ('netspeak'), rules and regulations ('netiquette' and acceptable use policies), and social organization. This duality extends the space social researchers may use to contact and study individuals or groups of interest, thereby 'increas[ing] the availability of samples whose diversity approximates that of the entire population' (ibid.: 186). This access is particularly important when the individual or group being studied is difficult to locate or contact in the off-line world.

In addition to extending the range of samples and the ease with which they are contacted, burrows of on-line interaction such as Usenet groups, IRC rooms, and listservers are usually subject and user specific. This helps in the identification and tracking of subjects and their activities, and it frees up time for the researcher to concentrate on determining how to best solicit the subject's trust and/or participation. Furthermore, because the Internet never sleeps, interaction between the researcher and subject may occur at any time of the day or night.

The unrestricted availability of the integrated and interactive software needed to use the various components of the Internet is quite an advantage when contacting and soliciting participants for research. Because many users have free access to, and use of, the software necessary to use the various components of the Internet, researchers are able to solicit samples by using one or a combination of Email, listservers, Usenet groups, IRC rooms, or the Web. Furthermore, when subjects are solicited on a platform other than the one where the research takes place, researchers do not have to design research instruments for each individual platform or worry that subjects will not be able to access and participate in their research.

Observation and Data Collection

In the areas of observation and data collection, the Internet provides several notable benefits not found in more traditional approaches to social research. The greatest benefit associated with on-line observation and data collection is the cost. The amount of money required for even the most complicated research design can be as little as 10% of that required for the same research conducted off-line. The typical Internet researcher will not have to secure funding for

stationary, postage, physical space, transportation, long distance charges, transcription, or printing. As computers are often supplied by most academic institutions, for the cost of a simple Internet connection, on-line storage space, and researcher time, most researchers will be in the position to begin to implement their research design. For the more advanced experimental and survey designs that exceed the technical skills of the typical academic researcher, additional money may have to be spent to secure the services of a computer programmer or technical assistant.

Another major advantage of using the Internet for observation or data collection is that it is often possible for the researcher to provide the participant with the assurance of partial or even complete anonymity. This is particularly important when the subjects of study hail from stigmatized or 'deviant' populations such as men who buy sex, pedophiles, and drug users. By providing a guarantee of anonymity to the respondent, the researcher increases the probability that the information they get is complete and truthful. In addition, in a mutually anonymous environment, the attributes and/or behavior of the researcher and the respondent are less likely to have a biasing influence on the research (ibid.).

The Internet also offers a certain level of safety and convenience for both the researcher and the participant. For the researcher, most observation and data collection can be done from their computer terminal, greatly reducing the possible dangers associated with certain types of primary research. With most designs, it is possible for an individual to participate in the research from the comfort of their home, office, or wherever their personal computer might take them, at any time of the day or night. If the observation or data collection process is made convenient, interesting, and easy, the chances that greater numbers of individuals will participate is increased (ibid.).

Yet another advantage of on-line research is the degree of control over observation and data collection that it offers the researcher. Since most social research involves human decision making and interaction, it is a rare event when a research design is carried out without any complications or errors. Often, once the research begins and subjects are being solicited or data collected, the researcher finds an error in the advertisement or instrument that could seriously jeopardize the outcome of the research. When such an error is found during an off-line research project, researchers are sometimes forced to spend time and money reprinting and/or reposting material in order to correct the problem. Because most on-line research does not require printed materials and because the research is often conducted from a single private access site or channel, the researcher can make modifications to any individual component of the research at any time without delaying the project or having to violate her often meager budget.

The Internet also provides the researcher with an increased degree of control over the individual participants and the information they provide. Meta and

spider based search engines[8] and Email and Web page directories make it easy for researchers to find and contact participants and to record much of their on-line posting behavior. Furthermore, by paying special attention to the construction and programming of the research instrument, researchers can reduce the amount of missing or incomplete data. Through the use of advanced programming languages, researchers can design experiments or questionnaires so that participants have no choice but to complete certain tasks or provide specific information that is crucial to the objectives of the research.

Data Processing and Analysis

The final area where the use of the Internet is an advantage for social researchers is that of data processing and analysis. Because pre-coded experimental and survey data are already in a binary form, with the right design and programming, these data can be fed directly from the participant into a data file, thereby reducing the natural human errors and time required to enter data into a data base. Once the data are in a data file, they are often easily translated into a format, such as text or tab delimited, where they can be cleaned and analyzed with most data analysis programs such as SPSS or SAS.

When it comes to the collection of more qualitative data from Internet Phone surveys, IRC interviews, and direct or participant observation of listservers or Usenet groups, the Internet has a great advantage over conventional methods. Because individual and group interaction is text-based, search engines can be used to locate and catalogue exchanges that may then be cut and pasted into data files, virtually eliminating the tedious nature of the coding phase of these types of research (Harris 1996). For on-line interviews done via Internet phone or IRC and because the interview is already in text format, researchers no longer have to spend time and money on transcription, making discourse and communication analysis much easier (ibid.).

DISADVANTAGES OF USING THE INTERNET FOR PRIMARY SOCIAL RESEARCH

Despite the many advantages the Internet offers to social research, there are several major methodological limitations that must be recognized and dealt with before it can be considered a viable research medium.

Sampling

The solicitation of participants creates two unique methodological problems for the on-line social researcher. The most significant problem with sampling research participants on-line relates to the fact that it is impossible to know with

any certainty how many people use the Internet. Without a specific knowledge of the number of Internet users, and who they are, probability sampling techniques such as random and cluster sampling are not possible. As a result, on-line researchers are restricted to gathering their samples through less reliable and powerful methods such as convenience, purposive, snowball, or quota sampling. When these samples are obtained, it is impossible to know if the participants sampled are in some way atypical of most Internet users. It is possible that this type of sampling may encourage the participation of individuals who are better educated, more sociable, and who have more time and money to spend on-line (Hewson, Laurent, and Vogel 1996: 189).

Another potentially devastating problem researchers may encounter when attempting to secure participants on-line involves the laws of the Internet, known as 'netiquette' and acceptable use policies (AUPs). Each individual Internet service provider, Usenet group, IRC room, and listserver has their own, often unique and sometimes ambiguous, set of rules and regulations. Sometimes these are posted in files labeled 'Frequently Asked Questions' (FAQ); however, they are often difficult or impossible to locate because they have not been posted or are simply believed to be understood. The existence of differing sets of written and unwritten rules of conduct for Email, Usenet, IRC, and the Web means that researchers must invest a great deal of time and energy into ensuring that they understand and obey the group rules, especially when it comes to sampling. Unwelcome or improper advertisement (referred to as 'spamming' or 'Velveta') through Usenet, Email, or IRC rooms may be deemed by group members to be a violation of 'netiquette' or AUP and met with a varying degrees of informal and formal social control. A campaign of nasty Email (known as a 'flaming' and 'mailbombing'), slanderous posts discussing the research, and formal complaints to Internet service providers (ISPs) undertaken by vigilante netizens whose 'netiquette' or AUPs are offended can result in unreliable samples or even a complete shut down of the project.

Observation and Data Collection

Researchers must be very careful when it comes to making assumptions about the ability and interest of Internet users. Since 1990, the number of new Internet users ('newbies') has grown by as much as 300% each year (Digital 1996). As a result, researchers are faced with the additional burden of having to cater their observation and data collection methods to participants who may not be familiar with how to navigate their way around the Internet and download, install, and operate necessary software applications. Catering a research design to the 'newbie' may limit observation or data collection by making certain research temporally, monetarily, or technically impractical. In addition, because some

users pay a premium for their on-line time, most researchers will find that the observations they can make and the data available are limited by a general reluctance on the part of participants to spend a great deal of time involved in activities they are not interested in or that do not offer an immediate reward.

There are also technical obstacles to on-line observation and data collection, the first of which relates to global hardware and software incompatibility. There are currently a number of different operating systems and platforms in use globally. Although many of these systems and platforms are compatible, in many cases they are not. This incompatibility seriously limits the observations that may be made and the data collected because it is virtually impossible for a researcher to anticipate all of the different system and software requirements. Even if someone did know all of the systems and platforms, developing on-line instruments that would appreciate them is impractical. As a result, many participants may not be able to complete the required tasks and/or drop out from the research altogether. Such subject mortality can lead to internal invalidity of the data.

The second technical problem with doing research on-line relates to the vulnerability of the observations and data to third-party intervention or interception. Because the Internet operates through a network of telephone lines connected to personal and business computer systems, it is possible for savvy computer users to employ an open modem connection to break into and read, alter, delete, or pilfer data from a system's hard-drive. This activity, known as 'hacking', calls into question both the integrity and security of the observations made and the data collected. Furthermore, because the data collected must pass through modem lines to get from the participant to the researcher, the potential exists for sensitive information to intentionally or inadvertently fall into the hands of a third party, compromising the anonymity, confidentially, and privacy of participants.

Data Processing and Analysis

The final weakness of on-line research relates to the actual data gathered and the generalizations that may be made from them. As discussed earlier, researchers who decide to use the Internet as a medium for contacting participants are severely limited in how they may go about the task of sampling. Since the dimensions of the Internet universe are unknown, researchers are restricted to soliciting their samples through convenience, purposive, snowball, or quota techniques. Data obtained from samples solicited through these non-probability methods cannot be understood to represent any group other than the sample itself. Furthermore, when the data are quantitative, the only statistical tests available for analysis are of the considerably less powerful non-parametric

variety (Siegel 1956). As a result, the social science community must be very cautious when evaluating the data gathered and the conclusions drawn on the basis of research conducted via the Internet.

SUGGESTIONS FOR FUTURE ON-LINE RESEARCH

Although the Internet provides the social researcher with safe, convenient, anonymous, and instant 24-hour access to millions of individuals and groups, the use of this medium for primary social research is accompanied by significant methodological problems. In order to determine the future utility of on-line research, an attempt must be made to offer suggestions as to how to reduce the potential impact of the sampling, observation and data collection, and data processing and analysis problems identified above.

Sampling

Where the expressed object of the research is to explain or describe an individual, group, organization, or social artifact in relation to some wider population, using the Internet as a sampling universe should not be seen as a viable option. When the objective of the research is to achieve new insights or to formulate new questions, or when the data are meant to be viewed as a cumulative part of a much bigger research picture, then the Internet may be an excellent source for information and research participants. It is important to remember that, when generalizability is an important goal of the research, the Internet may not be the best medium for collecting data.

Social scientists struggling with the decision to pursue their research on-line should keep in mind that a great deal of off-line social research, especially that involving stigmatized or deviant populations, relies almost exclusively on convenience, purposive, snowball, and quota sampling as methods for soliciting participants. What is most important for on-line researchers is that they are quite clear about their own epistemological position and what they hope to be able to accomplish through their research.

When it comes to the issue of response bias, it must be remembered that, although the Internet user who decides to participate in on-line research may be atypical of other Internet users or members of some wider population, this problem is not unique to on-line research. No matter how careful one is in their sampling, ultimately, an individual will choose whether or not to participate in a research project. While it is possible that those who choose to participate in research may be fundamentally different from those that do not, there is no reason to believe that the venue used to contact participants intensifies this difference.

Although 'netiquette' and AUPs can severely limit sampling, when Usenet,

IRC groups, listservers, or the Web are used as a means of soliciting participants or collecting data, it is important to ensure that every effort is made to understand and obey both the letter and spirit of each group's rules and regulations. If these platforms are used to contact participants, researchers should: (1) address a single advertisement to no more than 10 groups at one time, no more than once in a calendar month (called cross-posting); (2) never attempt to solicit research in areas not expressly concerned with the subject matter of the research; (3) never use search engines or Email to solicit participants without first acquiring their expressed permission to do so; and, (4) never use information from any group or site without first obtaining permission from the site owner or operator. Obeying these four rules, in addition to the specific group 'netiquette' or AUP, will help prevent attacks on the research that could limit participation or hinder its completion.

Observation and Data Collection

Since many operating systems and software configurations are either difficult to use or not compatible with one another, many researchers will be faced with the problem of subject mortality. To reduce the chances of participants not participating or leaving the research before completing the required tasks, alternative options should be provided. It is often most practical to simply supply participants with an off-line option. Not only will this help to reduce the effects of hard and software incompatibility, but it also provides a simple and inexpensive way for individuals who are not willing or able to spend a great deal of time on-line to participate in the research.

The ease with which private and confidential information collected on-line can fall into the hands of a third party poses a serious threat to both the integrity of the data and the willingness of people to participate in the research. Although researchers cannot prevent private data from accidentally being misrouted or intercepted by a third party during transmission through the modem lines, they can make sure these data cannot be read by the unauthorized recipient. By using a specially designed program, researchers can encrypt[9] all information before it is sent through modem lines; doing this guarantees that only the intended recipient can read the data and the participant's anonymity, confidentiality, and privacy will not be compromised. The most effective way to prevent 'hackers' from breaking into the computer system where research data reside is to make sure that the computer is not connected to a network or modem line. However, doing this does not prevent people with easy access to your computer from simply turning it on and accessing the data files. For complete protection, one should either encrypt all data files and communications or keep this information on an external storage device such as a floppy disk.

Data Processing and Analysis

Finally, when it comes to the processing and analysis of data collected on-line, generalization of findings to a broader population may not be necessary when the goal of the research is exploratory, to achieve new insights or to formulate new questions, or when the data are meant to be viewed as a cumulative part of a much bigger research picture. While social researchers should be aware of the limitations of data available via on-line research, many would do well to remember that all social research does not have to rigidly conform to the hypothetico-deductive model to contribute to our understanding of the way things are.

A FINAL THOUGHT

In this essay, I have attempted to identify many of the major advantages and disadvantages associated with conducting social research on-line. I have also made several suggestions for modifying traditional research designs in order to cope with the unique methodological problems associated with on-line research. The issues presented in this discussion are only the tip of the iceberg. It is clear to me that, in order to determine the most effective application of the Internet for the social sciences, continued discussion and development must be encouraged. The first step in this process is to break through the 'old guard' mentality in academia which has been reluctant to learn and accept this new technology. Next, traditional research methods texts and ethical guidelines must be re-conceptualized and re-written to appreciate the unique challenges posed by the Internet. It is also vital that continued funding be provided to encourage development and testing of on-line sampling and data collection methods and continued empirical research. The results of this testing and research should be published in peer-reviewed academic journals so that a continued discourse is maintained. Finally, a greater emphasis needs to be placed on providing specialized methods training in undergraduate and graduate research methods courses.

The Internet is not simply another fad or a passing phase; it is predicted that, by the year 2000, half a billion people will be on-line (Digital 1996). It is imperative that the social science disciplines begin to pay attention to the importance of this medium as a vehicle for enhancing our knowledge and understanding of human social behavior. It is equally important that they begin to plan for the future, and, from this vantage point, the future is on-line.

NOTES

1 'Plug-ins' are software programs designed to operate in conjunction with existing platforms, expanding on the features of the original program.

2 The term 'primary research' used here denotes that novel research which involves direct contact between the researcher and the research participant in the form of an experiment, self administered questionnaire, interview survey, telephone survey, participant observation, or direct observation.

3 For a detailed discussion of how to conduct Internet research see C. Harris (1996).

4 For a more detailed discussion of issues relating to the ethical responsibilities of on-line researchers see J. Thomas (1996a, 1996b).

5 Although not the subject of this discussion, the Internet appears to be quite adaptable to secondary research methods such as case studies, content analysis, analysis of existing data, policy analysis, and historical or archival analysis.

6 A detailed search of the existing empirical literature and on-line data bases revealed that, to date, the Internet has not been used a vehicle for conducting on-line social-scientific experimentation. In order to illustrate the feasibility of this method for social scientists, I have provided an example of research that is currently being done within the natural sciences.

7 For a detailed review of this and other medical technology advances under study at Beth Israel, visit their research information web page at http://enterprise.bih.harvard.edu/research.html.

8 Search engines such as AltaVista and SiFMuG Universal Interface are software programs designed to scan the Internet and catalogue the occurrence of individual words and symbols in pages and posts on the Web and in Usenet groups. The words and symbols are organized into a publicly-accessible electronic index data base that allows individual users to find subject or word specific pages or posts on the Internet.

9 Encryption or enciphering information involves using a computer program to scramble specific information in a hopelessly complicated way, rendering it unreadable to anyone but the owner or intended recipient of the information.

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