## Chapter 1 : Grants Process Overview | calendrierdelascience.com

*Department of Transportation TABLE Department of Transportation Agencies that Support Social Knowledge Production and Application: Profile (fiscal , $ millions) Organizational Predominant Location of Total Social Social Social Knowledge Knowledge Knowledge Production Production Production and and and Application Application.*

The principal methods of networking that enable the Internet are contained in specially designated RFCs that constitute the Internet Standards. Other less rigorous documents are simply informative, experimental, or historical, or document the best current practices BCP when implementing Internet technologies. The Internet standards describe a framework known as the Internet protocol suite. The layers correspond to the environment or scope in which their services operate. At the top is the application layer , space for the application-specific networking methods used in software applications. For example, a web browser program uses the client-server application model and a specific protocol of interaction between servers and clients, while many file-sharing systems use a peer-to-peer paradigm. Below this top layer, the transport layer connects applications on different hosts with a logical channel through the network with appropriate data exchange methods. Underlying these layers are the networking technologies that interconnect networks at their borders and exchange traffic across them. The Internet layer enables computers "hosts" to identify each other via Internet Protocol IP addresses , and route their traffic to each other via any intermediate transit networks. Last, at the bottom of the architecture is the link layer , which provides logical connectivity between hosts on the same network link, such as a local area network LAN or a dial-up connection. Other models have been developed, such as the OSI model , that attempt to be comprehensive in every aspect of communications. While many similarities exist between the models, they are not compatible in the details of description or implementation. As user data is processed through the protocol stack, each abstraction layer adds encapsulation information at the sending host. Data is transmitted over the wire at the link level between hosts and routers. Encapsulation is removed by the receiving host. Intermediate relays update link encapsulation at each hop, and inspect the IP layer for routing purposes. The most prominent component of the Internet model is the Internet Protocol IP , which provides addressing systems, including IP addresses , for computers on the network. IP enables internetworking and, in essence, establishes the Internet itself. Internet Protocol Version 4 IPv4 is the initial version used on the first generation of the Internet and is still in dominant use. However, the explosive growth of the Internet has led to IPv4 address exhaustion , which entered its final stage in , [66] when the global address allocation pool was exhausted. A new protocol version, IPv6, was developed in the mids, which provides vastly larger addressing capabilities and more efficient routing of Internet traffic. IPv6 is currently in growing deployment around the world, since Internet address registries RIRs began to urge all resource managers to plan rapid adoption and conversion. In essence, it establishes a parallel version of the Internet not directly accessible with IPv4 software. Thus, translation facilities must exist for internetworking or nodes must have duplicate networking software for both networks. Essentially all modern computer operating systems support both versions of the Internet Protocol. Network infrastructure, however, has been lagging in this development. Aside from the complex array of physical connections that make up its infrastructure, the Internet is facilitated by bi- or multi-lateral commercial contracts, e. Indeed, the Internet is defined by its interconnections and routing policies. Services Many people use, erroneously, the terms Internet and World Wide Web, or just the Web, interchangeably, but the two terms are not synonymous. The World Wide Web is a primary application program that billions of people use on the Internet, and it has changed their lives immeasurably. These documents may also contain any combination of computer data , including graphics, sounds, text , video , multimedia and interactive content that runs while the user is interacting with the page. Client-side software can include animations, games , office applications and scientific demonstrations. Through keyword -driven Internet research using search engines like Yahoo! Compared to printed media, books, encyclopedias and traditional libraries, the World Wide Web has enabled the

decentralization of information on a large scale. The Web is therefore a global set of documents , images and other resources, logically interrelated by hyperlinks and referenced with Uniform Resource Identifiers URIs. URIs symbolically identify services, servers , and other databases, and the documents and resources that they can provide. Web services also use HTTP to allow software systems to communicate in order to share and exchange business logic and data. The Web has enabled individuals and organizations to publish ideas and information to a potentially large audience online at greatly reduced expense and time delay. Publishing a web page, a blog, or building a website involves little initial cost and many cost-free services are available. However, publishing and maintaining large, professional web sites with attractive, diverse and up-to-date information is still a difficult and expensive proposition. Many individuals and some companies and groups use web logs or blogs, which are largely used as easily updatable online diaries. Some commercial organizations encourage staff to communicate advice in their areas of specialization in the hope that visitors will be impressed by the expert knowledge and free information, and be attracted to the corporation as a result. Advertising on popular web pages can be lucrative, and e-commerce , which is the sale of products and services directly via the Web, continues to grow. Online advertising is a form of marketing and advertising which uses the Internet to deliver promotional marketing messages to consumers. It includes email marketing, search engine marketing SEM , social media marketing, many types of display advertising including web banner advertising , and mobile advertising. In , Internet advertising revenues in the United States surpassed those of cable television and nearly exceeded those of broadcast television. When the Web developed in the s, a typical web page was stored in completed form on a web server, formatted in HTML , complete for transmission to a web browser in response to a request. Over time, the process of creating and serving web pages has become dynamic, creating a flexible design, layout, and content. Websites are often created using content management software with, initially, very little content. Contributors to these systems, who may be paid staff, members of an organization or the public, fill underlying databases with content using editing pages designed for that purpose while casual visitors view and read this content in HTML form. There may or may not be editorial, approval and security systems built into the process of taking newly entered content and making it available to the target visitors. Communication Email is an important communications service available on the Internet. The concept of sending electronic text messages between parties in a way analogous to mailing letters or memos predates the creation of the Internet. Emails can be cc-ed to multiple email addresses. Internet telephony is another common communications service made possible by the creation of the Internet. The idea began in the early s with walkie-talkie -like voice applications for personal computers. In recent years many VoIP systems have become as easy to use and as convenient as a normal telephone. The benefit is that, as the Internet carries the voice traffic, VoIP can be free or cost much less than a traditional telephone call, especially over long distances and especially for those with always-on Internet connections such as cable or ADSL and mobile data. Interoperability between different providers has improved and the ability to call or receive a call from a traditional telephone is available. Simple, inexpensive VoIP network adapters are available that eliminate the need for a personal computer. Voice quality can still vary from call to call, but is often equal to and can even exceed that of traditional calls. Remaining problems for VoIP include emergency telephone number dialing and reliability. Currently, a few VoIP providers provide an emergency service, but it is not universally available. Older traditional phones with no "extra features" may be line-powered only and operate during a power failure; VoIP can never do so without a backup power source for the phone equipment and the Internet access devices. VoIP has also become increasingly popular for gaming applications, as a form of communication between players. Modern video game consoles also offer VoIP chat features. Data transfer File sharing is an example of transferring large amounts of data across the Internet. A computer file can be emailed to customers, colleagues and friends as an attachment. It can be put into a "shared location" or onto a file server for instant use by colleagues. The load of bulk downloads to many users can be eased by the use of " mirror " servers or peer-to-peer networks. In any of these cases, access to the file may be controlled by user authentication , the transit of the file over the Internet may be obscured by

encryption , and money may change hands for access to the file. The price can be paid by the remote charging of funds from, for example, a credit card whose details are also passed â€" usually fully encrypted â€" across the Internet. The origin and authenticity of the file received may be checked by digital signatures or by MD5 or other message digests. These simple features of the Internet, over a worldwide basis, are changing the production, sale, and distribution of anything that can be reduced to a computer file for transmission. This includes all manner of print publications, software products, news, music, film, video, photography, graphics and the other arts. This in turn has caused seismic shifts in each of the existing industries that previously controlled the production and distribution of these products.

*SURVEY OF FEDERAL AGENCIES TABLE Department of Health, Education, and Welfare Agencies that Support Social Knowledge Production and Application: Profile (fiscal , $millions) Total Social Knowledge Production and Application Agency Obligations Office of Human Development Services Public Health Service Social Security.*

Page Share Cite Suggested Citation: A Survey of Federal Agencies. The National Academies Press. The depart- ment was established in and thus represents one of the "new" supporters of social knowledge production and application. The de- partment was created to ensure the coordinated, effective administra- tion of federal transportation programs and to develop national trans- portation policies and programs conducive to the provision of fast, safe, efficient, and convenient transportation. The second-largest category is general purpose statistics. Within the department, the National Highway Traffic Safety Adminis- tration is the largest funder of general purpose statistics. The third- largest knowledge production and application category is policy formu- lation demonstrations, funded primarily by the Urban Mass Transpor- tation Administration. This chapter was written with the assistance of Pam J. Six of the seven operating administrations support social knowledge produc- tion and application activities. No social knowledge production and application activities were found in the Saint Lawrence Seaway Devel- opment Corporation or the Materials Transportation Bureau. Table presents the Department of Transportation agencies that fund social knowledge production and application activities. It is signif- icant that three of the four largest funders of social knowledge produc- tion and application in the department have third parties as their primary audience. The Study Project survey estimates that nearly 66 I I g? While some projects might have been categorized in other policy areas, the focus of every program area was clearly trans- portation and thus difficult to categorize elsewhere. Research Social research is conducted by the FAA in several areas: Research provides information necessary to improve the selection, training, and establishment of performance standards for air traffic controllers. Some of the research projects in this area are described below. The degree of stress for optimal training effectiveness was determined, and a psycho-physiological evaluation of the relationships of stress to training success was made. Air Traffic Control Workload and Environment A longitudinal study of health change in air traffic controllers was conducted. The study consisted of medical examinations, psychological assessments, and the collection of data on stress. Studies are con- ducted concerning aviation economics and alternative futures for the aviation industry. ENVIRONMENT This research attempts to identify and minimize the undesirable environmental effects caused by the air transportation sys- tem, including those related to noise emission and land use activities. In , Congress enacted a series of laws that added environmental considerations to the safety, control, and promotional functions of the FAA. To fulfill this responsibility, FAA conducts economic, financial, and energy impact analyses of alternative environmental regulations. Research is supported to develop improved environmental impact pre- diction techniques. Specific studies are described below. Noise Reduction through Airport Use Restrictions Research was supported to develop methodologies to estimate the total costs and benefits associated with airport use restrictions. Land Use Planning Research assisted in developing and evaluating environmentally compatible community land use planning criteria. The first is materials related to the environmental responsibilities of the FAA discussed above. Handbooks were prepared for the FAA staff and federal, state, and local officials concerning environmental impact statements and their preparation. The environmental impact assessment process eval- uates both the long- and short-term implications to individuals and their physical and social surroundings by exploring and documenting alter- native actions that will avoid or minimize adverse environmental im- pacts. The second type of material is training material for pilots. A major effort is being made to develop innovative training and educational technologies. Computer-aided education and mechanical training de- vices are now being studied. The agency is concerned with the total operation and environment of the highway system, with particular em- phasis on the improvement of highway safety. FHWA administers a program of financial assistance to states for highway construction as well as the

highway beautification program. FHWA is responsible for identifying and exploiting new technology to permit the highway program to carry out its mission. To accomplish that goal, FHWA also conducts studies to identify future problems. Socioeconomic research is funded in several program areas. Metropolitan Intermodal Traffic Management This group of proj- ects analyzes how urban transportation systems operate and develops concepts and techniques for use by local officials in managing traffic. Initial work in this program area has established performance measures for evaluating the effectiveness of urban transportation systems and developed tools for predicting social and environmental constraints, institutional coordination, and citizen participation. This information will be needed to establish performance measures for evaluating the transportation system and its effect on the community. Future studies will be conducted to develop or refine measures of the social, eco- nomic, and land use effects of highways on communities and their neighborhoods. Socioeconomic Factors in Highway Engineering and Location This project deals with the development of methodologies for measuring and evaluating the social and economic aspects of highway construction. The methodologies are for use by federal and state operating officers in establishing criteria for design changes and cost- effectiveness considerations relative to alleviating or eliminating ad- verse environmental effects. Improving Planning Methodology The objectives of this pro- gram are to develop new and improved procedures that will enable planners to evaluate and resolve a wide range of transportation issues and program alternatives. Improvements will be made in such procedures as travel demand forecasting, social and economic impact assessment, cost allocation, and investment strategies. The program aims to identify, cor- rect, and evaluate the effectiveness of potential solutions to the prob- lems of highway death, disabling injuries, and property damage on American highways. Traffic and Pedestrian Safety Improvements This program area analyzes data on accidents. The safety aspects of the mph speed limit are being evaluated. Pedestrian accident countermeasures are being identified and their effectiveness in reducing accidents evaluated. Recommendations have been developed on ways to control speed on residential streets. Railroad Highway Grade Crossing Research The goal of this pro- gram is improving safety conditions at railroad highway grade crossings. Accident data are analyzed to develop predictions of acci- dents for different types of warning devices. Cost-benefit studies have also been performed to indicate whether grade crossing protections will return greater benefits for a given level of investment than will grade separation. The goal of this program is to reduce the incidence of truck and bus highway accidents by regulating the safety of motor carriers engaged in interstate transportation of goods and people. Op- timal work-rest schedules have been developed by performance tests. The administrative feasibility of licensing physicians examining inter- state commercial drivers has been studied. General Purpose Statistics FHWA collects accident data for commercial motor carriers involved in interstate operations. These data are collected to identify areas of high accident frequency so that regulatory safeguards can be developed or revised. Department of Transportation Dissemination FHWA has an active dissemination program for the implementation of results from completed highway safety research projects. Research findings are identified and assessed for their potential benefits. If a research finding is judged to be potentially beneficial, the item is pack- aged, prepared, and promoted so that the user may apply it as quickly and effectively as possible. Department of Transportation, Seventh Street, S. The FRA conducts research and development activities in support of improved intercity ground transportation and future trans- portation requirements. Research Social research is conducted in two major areas: Industry Problems The FRA seeks to encourage increased service ability and efficiency in the railroad industry. Increased profitability in the railroad industry is viewed as an alternative to long-term govern- ment funding of large segments of the industry. Specific research areas are: Funding was increased in fiscal for the development and application of operations research and systems analysis techniques and procedures to be used in support of a broad range of network research efforts. General purpose analytical models and data bases are being developed in support of short-term network research and informational requirements. Commodity service analysis assesses the po- tential for large-scale productivity improvements in the distribution systems of rail-carried commodities. This program involves studies to de- termine the criteria for establishment of

rail-bus through rates and routes in specific areas. Freight Car Management Through this program. FRA supports in- dustry efforts to improve the use of freight cars at all levels of railroad operation. Social research is conducted on: Analysis of railroad operations management and short-run policy alternatives and strategies is conducted to im- prove existing management capabilities. Research is funded to develop management systems. Past work in the FRA human factors program has been devoted primarily to basic research problem definition, analysis of job requirements, and systems analysis ; current research is being conducted in a human factors laboratory. Department of Transportation Policy Formulation Demonstrations A small demonstration is being conducted on labor and management relations. A program to improve labor-management negotiations is being tested. The data are used in traf- fic flow studies, commodity movements studies, Interstate Commerce Commission rate cases, revenue studies, safety analyses, and railroad network analyses. The data are used in studies concerning economies of scale, production functions, and the nature of cost variability. Examples of data collected are type of crossing, number of accidents, causes of accidents, etc. The data are used in various studies to statistically isolate apparent accident-contributing characteristics or to determine cost-ratio benefits for alternative grade crossing improvements, etc. The agency is responsible for establishing and enforcing safety standards for motor vehicles and re- lated equipment. NHTSA also provides federal matching funds for state and local driver safety programs. A small amount of re- search into driver behavior is performed. Specific areas of research are listed below. This data base sup- ports the formulation of policies concerning inspection criteria. The objective of this program is to obtain a data base that can be used for the development of cost-effective countermeasures for accident avoidance.

## Chapter 3 : Our funding schemes

*The Funding of Social Knowledge Production and Application: A Survey of Federal Agencies. Study Project on Social Research and Development, Volume 2.*

Artistic research[ edit ] The controversial trend of artistic teaching becoming more academics-oriented is leading to artistic research being accepted as the primary mode of enquiry in art as in the case of other disciplines. As such, it is similar to the social sciences in using qualitative research and intersubjectivity as tools to apply measurement and critical analysis. It is based on artistic practices, methods, and criticality. Through presented documentation, the insights gained shall be placed in a context. This may be factual, historical, or background research. Background research could include, for example, geographical or procedural research. Patricia Leavy addresses eight arts-based research ABR genres: Documentary research Steps in conducting research[ edit ] Research is often conducted using the hourglass model structure of research. The major steps in conducting research are: Often, a literature review is conducted in a given subject area before a research question is identified. A gap in the current literature, as identified by a researcher, then engenders a research question. The research question may be parallel to the hypothesis. The hypothesis is the supposition to be tested. The researcher s collects data to test the hypothesis. The researcher s then analyzes and interprets the data via a variety of statistical methods, engaging in what is known as empirical research. The results of the data analysis in rejecting or failing to reject the null hypothesis are then reported and evaluated. At the end, the researcher may discuss avenues for further research. However, some researchers advocate for the reverse approach: The reverse approach is justified by the transactional nature of the research endeavor where research inquiry, research questions, research method, relevant research literature, and so on are not fully known until the findings have fully emerged and been interpreted. Rudolph Rummel says, " It is only when a range of tests are consistent over many kinds of data, researchers, and methods can one have confidence in the results. Maurice Hilleman is credited with saving more lives than any other scientist of the 20th century. This process takes three main forms although, as previously discussed, the boundaries between them may be obscure: Exploratory research , which helps to identify and define a problem or question. Constructive research , which tests theories and proposes solutions to a problem or question. Empirical research , which tests the feasibility of a solution using empirical evidence. There are two major types of empirical research design: Researchers choose qualitative or quantitative methods according to the nature of the research topic they want to investigate and the research questions they aim to answer: Qualitative research This involves understanding human behavior and the reasons that govern such behavior, by asking a broad question, collecting data in the form of words, images, video etc that is analyzed, and searching for themes. This type of research aims to investigate a question without attempting to quantifiably measure variables or look to potential relationships between variables. It is viewed as more restrictive in testing hypotheses because it can be expensive and time-consuming and typically limited to a single set of research subjects. Quantitative research This involves systematic empirical investigation of quantitative properties and phenomena and their relationships, by asking a narrow question and collecting numerical data to analyze it utilizing statistical methods. The quantitative research designs are experimental, correlational, and survey or descriptive. Quantitative research is linked with the philosophical and theoretical stance of positivism. The quantitative data collection methods rely on random sampling and structured data collection instruments that fit diverse experiences into predetermined response categories. If the research question is about people, participants may be randomly assigned to different treatments this is the only way that a quantitative study can be considered a true experiment. If the intent is to generalize from the research participants to a larger population, the researcher will employ probability sampling to select participants. Primary data is data collected specifically for the research, such as through interviews or questionnaires. Secondary data is data that already exists, such as census data, which can be re-used for the research. It is good ethical research practice to use secondary data

wherever possible. For example, a researcher may choose to conduct a qualitative study and follow it up with a quantitative study to gain additional insights. As such, non-empirical research seeks solutions to problems using existing knowledge as its source. This, however, does not mean that new ideas and innovations cannot be found within the pool of existing and established knowledge. Non-empirical research is not an absolute alternative to empirical research because they may be used together to strengthen a research approach. Neither one is less effective than the other since they have their particular purpose in science. Typically empirical research produces observations that need to be explained; then theoretical research tries to explain them, and in so doing generates empirically testable hypotheses; these hypotheses are then tested empirically, giving more observations that may need further explanation; and so on. A simple example of a non-empirical task is the prototyping of a new drug using a differentiated application of existing knowledge; another is the development of a business process in the form of a flow chart and texts where all the ingredients are from established knowledge. Much of cosmological research is theoretical in nature. Mathematics research does not rely on externally available data; rather, it seeks to prove theorems about mathematical objects. Research ethics[ edit ] Research ethics involves the application of fundamental ethical principles to a variety of topics involving research, including scientific research. These principles include deontology , consequentialism , virtue ethics and value ethics. Ethical issues may arise in the design and implementation of research involving human experimentation or animal experimentation , such as: Research ethics is most developed as a concept in medical research. The key agreement here is the Declaration of Helsinki. The Nuremberg Code is a former agreement, but with many still important notes. Research in the social sciences presents a different set of issues than those in medical research [44] and can involve issues of researcher and participant safety, empowerment and access to justice. The increasing participation of indigenous peoples as researchers has brought increased attention to the lacuna in culturally-sensitive methods of data collection. As the great majority of mainstream academic journals are written in English, multilingual periphery scholars often must translate their work to be accepted to elite Western-dominated journals. Please update this article to reflect recent events or newly available information. May Peer review is a form of self-regulation by qualified members of a profession within the relevant field. Peer review methods are employed to maintain standards of quality, improve performance, and provide credibility. Usually, the peer review process involves experts in the same field who are consulted by editors to give a review of the scholarly works produced by a colleague of theirs from an unbiased and impartial point of view, and this is usually done free of charge. The tradition of peer reviews being done for free has however brought many pitfalls which are also indicative of why most peer reviewers decline many invitations to review. Influence of the open-access movement[ edit ] The open access movement assumes that all information generally deemed useful should be free and belongs to a "public domain", that of "humanity". For instance, most indigenous communities consider that access to certain information proper to the group should be determined by relationships. On the one hand, "digital right management" used to restrict access to personal information on social networking platforms is celebrated as a protection of privacy, while simultaneously when similar functions are used by cultural groups i. This could be due to changes in funding for research both in the East and the West. Focussed on emphasizing educational achievement, East Asian cultures, mainly in China and South Korea, have encouraged the increase of funding for research expansion. Professionalisation [ edit ] The examples and perspective in this section may not represent a worldwide view of the subject. You may improve this article , discuss the issue on the talk page , or create a new article , as appropriate.

## Chapter 4 : What is impact? - Economic and Social Research Council

*The funding of social knowledge production and application: A survey of Federal agencies (Study Project on Social Research and Development) by Mark Abramson (Editor).*

Historical Background Philosophers who study the social character of scientific knowledge can trace their lineage at least as far as John Stuart Mill. Mill, Charles Sanders Peirce, and Karl Popper all took some type of critical interaction among persons as central to the validation of knowledge claims. Mill argues from the fallibility of human knowers to the necessity of unobstructed opportunity for and practice of the critical discussion of ideas. Only such critical discussion can assure us of the justifiability of the true beliefs we do have and can help us avoid falsity or the partiality of belief or opinion framed in the context of just one point of view. Critical interaction maintains the freshness of our reasons and is instrumental in the improvement of both the content and the reasons of our beliefs. The achievement of knowledge, then, is a social or collective, not an individual, matter. Whatever the correct reading of this particular statement, Peirce elsewhere makes it clear that, in his view, truth is both attainable and beyond the reach of any individual. Peirce puts great stock in instigating doubt and critical interaction as means to knowledge. Thus, whether his theory of truth is consensualist or realist, his view of the practices by which we attain it grants a central place to dialogue and social interaction. Popper is often treated as a precursor of social epistemology because of his emphasis on the importance of criticism in the development of scientific knowledge. Two concepts of criticism are found in his works Popper , and these can be described as logical and practical senses of falsification. The logical sense of falsification is just the structure of a modus tollens argument, in which a hypothesis is falsified by the demonstration that one of its logical consequences is false. This is one notion of criticism, but it is a matter of formal relations between statements. This is a social activity. For Popper the methodology of science is falsificationist in both its logical and practical senses, and science progresses through the demonstration by falsification of the untenability of theories and hypotheses. The work of Mill, Peirce, and Popper is a resource for philosophers presently exploring the social dimensions of scientific knowledge. However, the current debates are framed in the context of developments in both philosophy of science and in history and social studies of science following the collapse of the logical empiricist consensus. The philosophers of the Vienna Circle are conventionally associated with an uncritical form of positivism and with the logical empiricism that replaced American pragmatism in the s and s. According to some recent scholars, however, they saw natural science as a potent force for progressive social change. Cartwright, Cat, and Chang ; Giere and Richardson, eds. While one development of this point of view leads to scientism, the view that any meaningful question can be answered by the methods of science; another development leads to inquiry into what social conditions promote the growth of scientific knowledge. Logical empiricism, the version of Vienna Circle philosophy that developed in the United States, focused on logical, internal aspects of scientific knowledge and discouraged philosophical inquiry into the social dimensions of science. This family of positions provoked a counter-response among philosophers. These responses are marked by an effort to acknowledge some social dimensions to scientific knowledge while at the same time maintaining its epistemological legitimacy, which they take to be undermined by the new sociology. At the same time, features of the organization of scientific inquiry compel philosophers to consider their implications for the normative analysis of scientific practices. Big Science, Trust, and Authority The second half of the twentieth century saw the emergence of what has come to be known as Big Science: Theoretical and experimental physicists located at various sites across the country, though principally at Los Alamos, New Mexico, worked on sub-problems of the project under the overall direction of J. While academic and military research have since been to some degree separated, much experimental research in physics, especially high energy particle physics, continues to be pursued by large teams of researchers. Research in other areas of science as well, for example the work comprehended under the umbrella of the Human Genome Project, has taken on some of the properties of Big Science, requiring

multiple forms of expertise. In addition to the emergence of Big Science, the transition from small scale university or even amateur science to institutionalized research with major economic impacts supported by national funding bodies and connected across international borders has seemed to call for new ethical and epistemological thinking. Moreover, the consequent dependence of research on central funding bodies and increasingly, private foundations or commercial entities, prompts questions about the degree of independence of contemporary scientific knowledge from its social and economic context. John Hardwig articulated one philosophical dilemma posed by large teams of researchers. Each member or subgroup participating in such a project is required because each has a crucial bit of expertise not possessed by any other member or subgroup. This may be knowledge of a part of the instrumentation, the ability to perform a certain kind of calculation, the ability to make a certain kind of measurement or observation. The consequence is an experimental result, for example, the measurement of a property such as the decay rate or spin of a given particle the evidence for which is not fully understood by any single participant in the experiment. This leads Hardwig to ask two questions, one about the evidential status of testimony, and one about the nature of the knowing subject in these cases. With respect to the latter, Hardwig says that either the group as a whole, but no single member, knows or it is possible to know vicariously. Neither of these is palatable to him. Talking about the group or the community knowing smacks of superorganisms and transcendent entities and Hardwig shrinks from that solution. Vicarious knowledge, knowing without oneself possessing the evidence for the truth of what one knows, requires, according to Hardwig, too much of a departure from our ordinary concepts of knowledge. The first question is, as Hardwig notes, part of a more general discussion about the epistemic value of testimony. Much of what passes for common knowledge is acquired from others. We depend on experts to tell us what is wrong or right with our appliances, our cars, our bodies. Indeed, much of what we later come to know depends on what we previously learned as children from our parents and teachers. We acquire knowledge of the world through the institutions of education, journalism, and scientific inquiry. Philosophers disagree about the status of beliefs acquired in this way. Here is the question: Some philosophers, as Locke and Hume seem to have, argue that only what one has observed oneself could count as a good reason for belief, and that the testimony of another is, therefore, never sufficient warrant for belief. A number of philosophers have recently offered alternative analyses focusing on one or another element in the problem. In practice, however, only some results are so checked and many are simply accepted on trust. Not only must positive results be accepted on trust, but claims of failure to replicate as well as other critiques must be also. Thus, just as in the non-scientific world information is accepted on trust, so in science, knowledge grows by depending on the testimony of others. What are the implications of accepting this fact for our conceptions of the reliability of scientific knowledge? David Hull, in his argues that because the overall structure of reward and punishment in the sciences is a powerful incentive not to cheat, further epistemological analysis of the sciences is unnecessary. The structure itself guarantees the veridicality of research reports. And, while the advocates of cold fusion were convinced that their experiments had produced the phenomenon, there have also been cases of outright fraud. Thus, even if the structure of reward and punishment is an incentive not to cheat, it does not guarantee the veridicality of every research report. The reward individual scientists seek is credit. That is, they seek recognition, to have their work cited as important and as necessary to further scientific progress. The scientific community seeks true theories or adequate models. Credit, or recognition, accrues to individuals to the extent they are perceived as having contributed to that community goal. There is a strong incentive to cheat, to try to obtain credit without necessarily having done the work. Both Alvin Goldman Goldman, , and Philip Kitcher have treated the potential for premature, or otherwise improperly interested reporting of results to corrupt the sciences as a question to be answered by means of decision theoretic models. The decision theoretic approach to problems of trust and authority treats both credit and truth as utilities. The challenge then is to devise formulas that show that actions designed to maximize credit also maximize truth. Kitcher, in particular, develops formulas intended to show that even in situations peopled by non-epistemically motivated individuals that is, individuals motivated more by a desire for credit than by a desire for truth , the

reward structure of the community can be organized in such a way as to maximize truth and foster scientific progress. One consequence of this approach is to treat scientific fraud and value or interest infused science as the same problem. One advantage is that it incorporates the motivation to cheat into the solution to the problem of cheating. But one may wonder how effective this solution really is. Increasingly, we learn of problematic behavior in science based industries, such as the pharmaceutical industry. Results are withheld or distorted, authorship is manipulated. Hot areas, such as stem cell research or cloning have been subjected to fraudulent research. Thus, even if the structure of reward and punishment is an in principle incentive not to cheat, it does not guarantee the reliability of every research report. Community issues have been addressed under the banners of research ethics and of peer review. One might think that the only ethical requirements on scientists are to protect their research subjects from harm and, as professional scientists, to seek truth above any other goals. This presupposes that seeking truth is a sufficient guide to scientific decision-making. Heather Douglas, in her critical study of the ideal of value-freedom Douglas , rejects this notion. Douglas draws on her earlier study of inductive risk Douglas to press the point that countless methodological decisions required in the course of carrying out a single piece of research are underdetermined by the factual elements of the situation and must be guided by an assessment of the consequences of being wrong. Science is not value-free, but can be protected from the deleterious effects of values if scientists take steps to mitigate the influence of inappropriate values. One step is to distinguish between direct and indirect roles of values; another is the articulation of guidelines for individual scientists. Values play a direct role when they provide direct motivation to accept or reject a theory; they play an indirect role when they play a role in evaluating the consequences of accepting or rejecting a claim, thus influencing what will count as sufficient evidence to accept or reject. The responsibility of scientists is to make sure that values do not play a direct role in their work and to be transparent about the indirect roles of values. Steel and Whyte examine testing guidelines developed by pharmaceutical companies to point out that the very same decision may be motivated by values playing a direct role or playing an indirect role. Elliott questions whether only harmful consequences should be considered. If science is to be useful to policy makers, then questions of relative social benefit should also be permitted to play a role. This point will be pursued below. Torsten Wilholt argues that the research situation is more complicated than the epistemic vs. He argues that the reliance called for in science extends beyond the veridicality of reported results to the values guiding the investigators relied upon. Most research involves both results expressed statistically which requires choice of significance threshold and balancing chances of Type I vs. Type II error and multiple steps each requiring methodological decisions. These decisions, Wilholt argues, represent trade-offs among the reliability of positive results, the reliability of negative results, and the power of the investigation. In making these tradeoffs, the investigator is per force guided by an evaluation of the consequences of the various possible outcomes of the study. Wilholt references arguments about inductive risk offered originally by Richard Rudner and elaborated by Heather Douglas and discussed below. This attitude is more than epistemic reliance, but a deeper attitude: For Wilholt, then, scientific inquiry engages ethical norms as well as epistemic norms. Formal or mechanical solutions such as those suggested by the application of decision theoretic models are not sufficient, if the community must be held together by shared ethical values. Peer review and replication are methods the scientific community, indeed the research world in general, employs to assure consumers of scientific research that the work is credible. Peer review both of research proposals and of research reports submitted for publication screens for quality, which includes methodological competence and appropriateness as well as for originality and significance, while replication is intended to probe the robustness of results when reported experiments are carried out in different laboratories and with slight changes to experimental conditions. Scholars of peer review have noted various forms of bias entering into the peer review process.

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