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## *Getting to the Source of Ethical Issues \**

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## Getting to the Source of Ethical Issues

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Research with open source software (OSS) raises the same ethical issues as other disciplines in which publicly released materials are the objects of study, and the creators of those materials are still living. These disciplines are literary and artistic criticism and public policy research. As El-Emam (this issue) mentioned there are also similarities to research employing internet newsgroup posts as data.

The fact that the software engineers or programmers are still living is important since it raises the possibility that they may be harmed by the research. (Were they dead instead, research with OSS would more closely resemble archaeology, which raises different ethical issues.) As El-Emam noted analyses could rank the programmers according to the defect rate of their code, thus adversely affecting the careers of the worse programmers. Some readers may be of the opinion that this is perfectly acceptable from an ethical perspective, arguing that the better programmers should be rewarded and the worse programmers should be punished. However, this position assumes that the metric accurately captures the programmer's value, which may not be the case. For instance, one programmer's code may contain more defects than another's but may also be easier to fix, maintain, modify, and reuse—characteristics that were not captured by the metric but are nonetheless valuable. Additionally, the difficulty of the coding tasks undertaken by each programmer may have varied greatly, such that defect rates alone do not adequately measure programming skill. Consequently, a metric-based ranking of programmers can be misleading, resulting in harm that is not a function of the programmer's true worth.

The potential for harm is important because it increases the importance of obtaining informed consent. If the potential for harm were eliminated, the need for consent would be greatly reduced. To illustrate, consider a completely different research situation that would not normally require the informed consent of the subjects (45 CFR 46; Tri-council, 1998). Researchers place two telephone booths side by side. One is covered in graffiti and one is clean. The goal of the research is to determine whether the two telephone booths will attract an equal proportion of callers. Consequently, a researcher sits in view of the two phone booths and counts the number of people who enter each one. The researcher does not note any information that could be used to identify the research subjects. In such a case, the subjects cannot be identified, reported data cannot be traced back to them, the

subjects are not harmed, and the researcher does not interact with the subjects. Consequently, there is little need to ask for consent. If the metrics researcher using OSS could report the data and findings in such a way that the programmers could never be identified, then the programmers could not be harmed, so the need for consent would be greatly reduced. The only remaining reason to obtain consent is that the OSS is being used in a way that was not intended by its creators. This issue is discussed further below, following the discussion regarding the removal of identifiers. In general, the strategy of eliminating personal identifiers from the data and ensuring the anonymity of the subjects reduces the need to obtain informed consent. Moreover, this strategy can be applied in many empirical studies of software engineering and information technology.

An added complication for empirical studies of software engineering is that the company (or organisation) involved in a study must also be protected from harm. As described above, possibly the best method for minimising harm is the removal of any information that can be used to identify the company. In the case of OSS analysis, this would also alleviate the researcher from obtaining the company's consent. However, when analysing proprietary information, researchers must obtain the company's consent even if the data and reports are made free of identifiers (ACM Executive Council, 1993). As a parenthetical note to this issue, when analysing a company's source code, should the programmers' consent be obtained? The company owns the code and the intellectual property rights to it, so therefore, it seems that the creators of the code can neither institute nor prevent the research.

One problem with the approach of removing identifiers is that it is not as simple as it sounds. Identifiers are not limited to personal or company names, but include descriptions of the subjects (or their source code) that could lead the subjects to be identified. To illustrate, consider the following description of source code: OSS that constitutes a web browser, with UNIX, Mac, and Wintel versions. Obviously, the description refers to Netscape Communicator. Including some lines of code in the paper could also lead to the identification of the OSS, and through the OSS, to the subjects.

Another difficulty with stripping identifiers is that it reduces the replicability of the findings. Replicability allows researchers to ensure that they are using the same methods as those reported in an article. The methods can then be applied elsewhere, or modified, and the results compared to those reported in the initial article. If a metrics researcher published work using some particular OSS, other researchers should be able to obtain the same findings using the same metrics, measurement methods, and source code. However, if the identity of the OSS remains confidential, there is no way to know whether the inability to replicate results is due to the use of different code or to an ambiguity or error in the specification of the metrics and measurement procedures. As a consequence, this reduces the comparability of the initial and new findings. Note that this problem currently exists when researchers use proprietary code, since other researchers typically do not have access to the same source code. Nonetheless, from an ethics perspective, it would be quite useful if metrics researchers could develop acceptable reporting techniques that do not

include identifiers, and thus protect the anonymity of the programmers and their organisation.

Recall that research with OSS was compared to artistic criticism and public policy research. In these fields, the creators of the critiqued or investigated works are harmed. However, it is recognised that work in these fields could not occur under the condition that all reports contain no identifiers (Tri-council, 1998). In contrast, it should be possible to remove identifiers from metrics research reports. Therein lies the crucial difference between metrics research and artistic criticism and public policy research. This is why, for the sake of ethics, it is recommended to remove identifiers from metrics research reports.

OSS metrics research was also compared to research using newsgroups as data (El-Emam, this issue). This research practice is growing in popularity, especially in sociology and anthropology. For example, a researcher might read posts to a cancer patient's newsgroup to collect data for research on the reasons for which people turn to alternative medicine. Such research raises two ethical issues (in addition to all the issues raised when informed consent is obtained): the violation of the subject's expectation of privacy, and the violation of the subject's intended purpose of the post (Thomas, 1996). Obviously with OSS, the programmers or organisation did not expect that the source code would remain private, in fact, it was purposely put into the public domain. The problem occurs, however, with the use of the data. Typically, data cannot be used for a purpose to which the subject has not consented (Tri-council, 1998). Therefore, although the OSS is in the public domain, it was not necessarily intended to be the object of metrics research. The unintended use of OSS suggests that the researchers obtain informed consent. However, given that the OSS is intentionally made public, if all identifiers are removed, the need for consent is minimal. Obtaining consent from the organisation that produced the OSS, *if possible*, should be sufficient from an ethical perspective.

The final issue that we will consider is whether OSS metrics research is governed by US federal regulations (with which we are most knowledgeable). Based on our analysis, we believe that metrics research projects need not go before an ethics review board.<sup>1</sup> The US Common Rule (see Sieber, this issue) states that only projects constituting research that involves *human subjects* are subject to IRB review. Human subjects are defined in the Common Rule as "living individuals about whom an investigator (whether professional or student) conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information... Intervention includes both physical procedures by which data are gathered and manipulations of the subject or the subject's environment that are performed for research purposes... Interaction includes communication or interpersonal conduct between investigator and subject." Identifiable private information is defined as including "information about behaviour that occurs in a context in which an individual can reasonably expect that no observation or recording is taking place, and information which has been provided for specific purposes by an individual and which the individual can reasonably expect will not be made public." We do not believe that metrics research involves human subjects because there is no

intervention or interaction on the part of the researchers with the programmers. If researchers interviewed the programmers or collected data from them in some other way, then that portion of the research would be subject to government regulations.

However, in considering ethical issues one must keep in mind the distinction between research that falls under the aegis of regulations and research that does not. One should not conclude that any research program or practice existing outside the legislation's jurisdiction is ethical. A particular research practice is ethical to the extent that it complies with the set of ethical principles agreed upon by a community. Moreover, for research that does fall under the aegis of regulations, it is important to remember that legislation is imperfect, such that practices consistent with legislation may nonetheless be found unethical when principles are considered, or that research practices that are perfectly ethical in terms of the principles may nonetheless violate the regulations. In addition, consider that regulations specify the minimal standard that must be met, such that a research practice that is acceptable according to a regulatory standard may nonetheless be improved to increase its compliance to ethical principles.

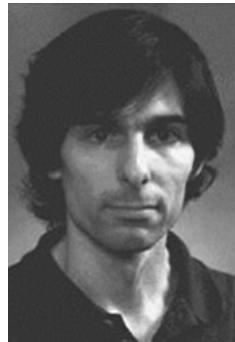
In sum, although from our perspective, research with OSS is not governed by federal regulations, it is nonetheless fraught with ethical issues.<sup>1</sup> We encourage metrics researchers to become familiar with these issues and to proactively address them via the creation of ethical guidelines which detail appropriate use of OSS in research situations. We have already mentioned some general safeguards (removing identifiers, and gaining consent where possible). We are sure that the metrics research community can work together to find many more.

## Notes

1. Researchers must contact their Institutional Review Board to determine the board's stance on metrics. Interpretations of the regulations may differ from board to board.

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**Dr. Vinson** is a cognitive psychologist whose research focuses on visual perception and spatial cognition as they relate to human-computer interaction. He is also interested in the psychological processes involved in data visualization and analysis. His current project is to devise and test design principles supporting human navigation in virtual or augmented reality. Dr. Vinson also collaborates with Dr. Singer in examining the ethical issues raised by human subjects research in information technology fields. The Institute for Information Technology (IIT) of the National Research Council (NRC) of Canada has recently begun to perform research involving human subjects. The NRC's Research Ethics Board is unaccustomed to reviewing proposals for human subjects research in information technology. Drs. Vinson and Singer are examining the ethical issues involved in such research to ensure that human subjects research practices at the IIT are both ethical and reasonable. Dr. Vinson is a member of IEEE.



**Dr. Singer** is a cognitive psychologist working in the Software Engineering Group of the National Research Council Canada. Dr. Singer conducts studies on the work practices of software engineers with the goal of improving both software engineering tools and processes. Her current methodological approaches are primarily ethnographic, such as observation and interviewing. In the past, however, she has had a great deal of experimental experience. Dr. Singer is also interested in the application of ethics to research in software engineering. She currently serves on the Research Ethics Board of the National Research Council Canada, which reviews research proposals ranging in scope from human computer interaction studies to complex biomedical experiments.