Teaching Ethics to Scientists and Engineers: Moral Agents and Moral Problems

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Description

In this essay, Dr. Whitbeck outlines an 'agent-centered' approach to learning ethics. The central aim is to prepare students to act wisely and responsibly when faced with moral problems. She provides a number of examples and cases with descriptions of questions and directions for promoting student participation and stimulating thought and discussion.

Abstract

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In this paper I outline an "agent-centered" approach to learning ethics. The approach is "agent-centered" in that its central aim is to prepare students to *act* wisely and responsibly when faced with moral problems. The methods characteristic of this approach are suitable for integrating material on professional and research ethics into technical courses, as well as for free-standing ethics courses.

The analogy I draw between ethical problems[1]and design problems clarifies the character of ethical problems as they are experienced by those who must respond to them. It exposes the mistake, common in ethics teaching, of misrepresenting moral problems as multiple-choice problems, especially in the form of 'dilemmas', that is, a forced choice between two unacceptable alternatives. Furthermore, I clarify the importance for responsible practice of recognizing any ambiguity in the problem situation.

To foster in students the skills they need, teaching examples should preserve the open-ended, multiply-constrained, and ambiguous character of problem situations as experienced by the agent. I give guidelines for constructing open-ended scenarios that present moral problems much as an agent would experience them - guidelines which strongly influenced the construction of 'cases' in the second edition of ["On Being a Scientist"](#)- and I discuss how to present historical cases and cases from the instructor's own experience to best foster agent-centered learning.

Until quite recently the dominant approach to practical and professional ethics was the 'applied' ethics approach that began with abstractions (usually in the form of ethical principles) and sought to apply those abstractions to particular instances. Recent work in practical and professional ethics has instead started from particular instances or 'cases', which have been presented in any of a wide variety of forms -

stories or accounts, detailed or abbreviated - and written for a variety of purposes from news reports, personal recollection and historical investigation to Presidential Commissions. The method I outline here begins with cases. However, as I shall discuss, it supplements the usual consideration of cases from what the distinguished philosopher, Stuart Hampshire, identifies as "a judge perspective" with consideration from what he calls "an agent perspective". Presenting an ethical problem from an "agent perspective" means presenting a situation as it would appear to someone who must respond to it. For example, "Suppose that you suspect that cold temperature compromises the performance of the gaskets, and hence the safety of your vehicle, what should you do?" gives a thumb nail sketch of a situation with some uncertainties that calls for a response. In contrast, the question "Should you report a safety problem to the media and be fired and perhaps blacklisted, or should you say nothing and keep your job?" presents an unambiguous situation; it does not require you to devise a response but only to evaluate two given responses. I will use an analogy between ethical problems and design problems to clarify the agent perspective and show how to adapt actual or hypothetical cases to simulate the situation of a person faced with a moral problem.

The design activity, exemplified in engineering design or research design, requires more than merely analyzing the designs and making judgments on them; it requires the devising of possible solutions. In so doing, it illuminates the very aspects of the agent's response to practical problems that need more attention in the teaching of ethics. Ethical or moral problems are often, represented as conflicts between (usually two) opposing sides or opposing principles, but they are often better understood as problems in which there are multiple (ethical) constraints which may or may not turn out to be satisfiable simultaneously.[2]

The goal of agent-oriented ethics education is to prepare students to address the moral problems that are likely to arise in their work as engineers and scientists. In contrast, in their teaching of philosophical ethics, some of my fellow philosophers focus on intellectual puzzles or logic exercises that teach a very different set of skills (which may be appropriate for other educational purposes).[3] Such intellectual exercises are generally quite abstract in the sense of being presented as devoid of any historical or social context. Actual judges, of course, always view a matter from some particular social and historical vantage point, and indeed have moral responsibilities to make fair and impartial judgments. (The responsibility to be fair and impartial shows that actual judges are themselves agents whose actions take

the form of judgments made on behalf of some group or organization.) The judgments offered as responses to intellectual puzzles are not so constrained; those judgments have no authority. They are just the 'kibitzing' of a critical spectator.

A debater acts as a critical spectator, rather than as an agent. This point is worth emphasizing since efforts to increase class participation by involving students in a two-sided debate on some issue emphasizes skills needed to win a debate. Although practicing these skills may be good pre-law training, the skills are only marginally relevant to figuring out how to respond wisely and responsibly to a situation. Agents, unlike critical spectators, have to look into their situation and figure out how to respond in a way that satisfies as many potentially competing constraints as possible, as well as be clear about the criteria for ethical evaluation.

Important as it is for scientists- and engineers-in-training to understand the reasons for prevailing standards of research ethics in their communities, they must also know how to investigate the situation responsibly and formulate responses. The pedagogical methods presented here serve the important goals of helping students to understand the reasons behind specific standards for responsible research in their research communities and how these specific standards provide criteria for meeting general ethical responsibilities, such as those for the integrity of research results or for public safety. Such understanding prepares them to make sound ethical judgments. However, as Stuart Hampshire pointed out, skill in making moral judgments is part, but only part, of the skills that one needs in order to respond well to moral problems. The rest of the agent's task is a constructive or synthetic one of devising and refining candidate responses.

The agent-centered approach guards against some pitfalls and omissions in the teaching of science and engineering ethics that commonly occur when experienced practitioners of the scientific professions and vocations-or philosophers and other humanists-teach the subject. It may be obvious that those entering the scientific professions need to learn from the experience of seasoned practitioners. What is not obvious, however, is how practitioners can best make their experience useful to the new entrants. Often the events that stand out in a practitioner's mind are the most extreme or even outlandish ones, rather than the events that resemble the ones students are likely to encounter. Furthermore, where the instructor's own experience ended badly, or when an instructor uses a famous accident to discuss the engineer's or scientist's responsibility for safety, there is a tendency to reason as though that outcome ought have been prevented at *any* cost. Preventing a particular negative

outcome at *any* cost disregards other ethically relevant considerations and so actually undermines acquisition of the ability to respond well to similar moral problem situations. It does not teach students how to respond in a way that takes into account all of the relevant factors. This is especially likely if the instructor frames the problem as a multiple choice problem, for example, "Ought the protagonist have gone over her boss's head (or even to the media), or should she have kept quiet and kept her job."[4]

In drawing on one's own experience as a practicing scientist or engineer, it is essential to present the case or story in such a way that students can learn something that will help them to become wiser and/or more responsible in addressing such problems. Getting 'the right' answer to a multiple-choice question does not help very much in addressing real ethical problems. These commonly require formulation of the problem and rarely present themselves with possible responses specified in advance.

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Body

Ethical Problems are like Design Problems

To develop the moral skills needed to respond well to ethical problems, the problem statement should preserve as much of these design-problem characteristics as possible. There are four points of analogy between ethical problems and design problems:

- For interesting or substantive ethical problems, such as substantive problems of research design, there is rarely, if ever, a uniquely correct solution or response.
- Some possible responses are unacceptable - there are wrong answers even if there is no unique right answer - and some are better than others.
- However, solutions may have advantages of different sorts, such that where there are two candidate solutions, neither may be clearly better than the other.

- A proposed solution must do all the following (in addition to being reasonably secure against accidents and miscarriages):

1. Achieve the desired performance or end - In the case of an ethical problem this might be to fulfill some moral responsibility, a professional responsibility or a family responsibility.
2. Conform to given specifications or desired criteria - For an ethical problem, these specifications might include meeting the standards of care for one's profession, and not taking so much time that one fails in other particular commitments.
3. Be consistent with (usually unstated) background constraints, for example, that one not violate anyone's human rights and that one minimize the infringement of other rights.

The design problem model of ethical problems represents them as characteristically possessing more than one good (that is, wise and responsible) answer, thus contradicting the frequent assertion that "there are no right or wrong answers" to ethical questions. This is also in contrast to the representation of problems in practical and professional ethics as multiple-choice problems which usually have a unique best answer, especially when they are framed as choices between two alternatives. (When four or five choices are given, sometimes choices other than the one represented as 'best' are identified as 'acceptable'.) The design problem model clarifies the character of an agent's 'synthetic' or constructive task of formulating and refining responses, a task over and above those analytic tasks that agents share with judges.

Ethical Problems as a Teaching Tool

The differences in the design problem and the multiple-choice models have direct implications for the teaching of practical and professional ethics. In place of multiple-choice problems that teach the skills of debating and finding justifications (or rationalizations) for a given choice, students need problem statements that simulate a problem as an agent would experience it. Of course, the best problem is an actual problem that a student is experiencing. If a student is working with an actual problem, then the student can practice interrogating the situation and consider the

possible risks and costs of obtaining types of information or of particular means of obtaining it. In the case of problem statements, the student simply fills in background facts (and considers what difference it would make to fill in different facts) rather than practice interrogating the situation. Problem statements, may, if carefully crafted simulate many features of an actual ethical problem however.

To most adequately simulate a problem situation that the student might experience the problem statements should:

- involve an agent with skills and experience similar to that of the students
- be expressed in the form of open-ended scenarios requiring a response - what can and should you do now?
- be briefly stated, so it is clear that the discussants will fill in unstated information
- allow for ambiguity in the situation itself. Such scenarios give the following four types of practice relevant to addressing actual ethical problems:

1. Practice in thinking through what additional information might be relevant and the difference that it would make. Here the participation of experienced practitioners is invaluable to new members of the scientific professions - What seems to be the problem? If it is not your problem but creates one for you, what is your problem?
2. Practice envisioning alternative interpretations of the situation so as to avoid premature action that could prove disastrous if the situation were other than one supposed. - What could be going on here? More specifically:

- How, if at all, might further information resolve any ambiguity? Are the means for acquiring this information available to you without risk of worsening the situation?
- How can you act so as to be fair to all, no matter how the ambiguities are ultimately resolved?
- Where can you take an ambiguous problem? In your organization, is there an ombudsman or other source of unbiased advice about raising an ambiguous problem?
- In your organization, are there established ways of raising a problem of whatever kind this seems to be? How can you find out how to use them appropriately?

1. Practice 'brainstorming' about possible courses of action to take and the possible consequences, that is, uncritically putting forward a range of ideas about what one might do and then refining or discarding them in light of their consequences and implications - What can/should you do and how do you go about it? (This is a question of both ethics and feasibility.)
2. Practice comparing the advantages and disadvantages of various courses of action. Think (and talk) through what to do in case of the most likely and the worst case responses to each of the proposed actions.

Sample Scenarios

This section contains sample scenarios that illustrate some of the features described above for statements of ethical problems.

What about your contribution? - engineering version

For the first year of your graduate studies you worked with Prof. One on the Hot Research project. By the end of the first year, you not only became proficient at many of the more routine tasks of the project, but made a small but notable refinement to the approach to the segment assigned to you. At the end of the first year, Prof. One went on leave for a semester and you started working with Prof. Two in the same lab but on a very different project. Prof. One returned for the spring semester and took up the Hot Research project, among others. It is now autumn and you are beginning your third year. You hear from another student who was working on Hot Research that Prof. One is publishing a paper on some aspects of the project with this student, a paper which presumably contains your refinement.

What about your contribution? - biology version

As a graduate student you have worked in Prof. One's lab on the Hot Research project since you came here, although your work is largely under the direction of A.R., a postdoc. By the end of the second year, you have not only become proficient at many of the more routine tasks of your assignment, but made one small but notable refinement to the approach to the segment assigned to you. At the end of the second year A.R. leaves the project and the university, and a new postdoc who

has been working with another aspect of the project takes an interest in the area in which you had worked with A.R. It is now spring and you are in the middle of your third year. You hear from another student in the lab that the new postdoc is publishing a paper with Prof. One on the aspects of Hot Research on which you had been working, a paper which presumably contains your refinement.

What relevant information is missing? What are the ambiguities in the situation?

What, if anything, can and should you do? What should you do as a first step in light of any ambiguities in the situation?

And if you do not know how to raise the subject with the person you think you should talk to, where would you go for help in raising it? How might you raise the subject with Prof. One? What is it that you want to say/find out? How would you phrase that?

The Responsibility for the Integrity of Research

Chris was accepted into XU's doctoral program in Fantastic Engineering and Science. While at XU, Chris worked on a research project for the director of one of the labs. However, Chris failed to pass the qualifying exam in the department and, without completing the research project, immediately left XU for a position in industry. Chris left the unfinished data with the director who gave the project to a new graduate student.

A year and a half later, Chris comes across a report written by a graduate student from the same lab. When Chris reviews the article, the research data look like those that Chris collected. Chris is disturbed to find that not all of the data are presented. Furthermore, additional data are included that Chris does not recognize. The conclusions drawn from the data in the report contradict the preliminary conclusions that Chris had turned over to the lab director with the original data.-*based on a scenario by Miki Guerity & Simone Missirian, MIT '92*

What, if anything, can Chris do? What should Chris do as a first step in light of any ambiguities in the situation? What should Chris do if those initial efforts fail to achieve the desired results?

Meta-questions: Does it make a moral (as contrasted with legal or psychological) difference that Chris has left XU? If so, how does this bear on what Chris should do?

These questions can also be used with some other sorts of cases to bring out the agent's perspective.

Cases Based on Actual Events

Historical cases and the experience of faculty and practitioners are other sources of material for teaching cases. When these are used, it is important to ensure that the account gives information about the problems and resources available to individuals involved in it.

In the case of the explosion of the space shuttle, *Challenger,* Roger Boisjoly's account of his attempt to avert the disaster provides excellent material if one focuses on each of the stages of the development of the situation leading up to the explosion, and not merely on the actions the night before the flight, when the situation was quite atypical.[5]

Interviews

In addition to discussing problem situations, preferably with experienced practitioners, interviews provide another source of both valuable information and practice.

Student-conducted interviews, especially interviews with people with whom the students may eventually need to discuss potentially sensitive issues, give students practice in raising subjects as well as the opportunity to gain important information, or benefit from the experience of practitioners.

Interviews may be on how best to handle a situation described in a scenario or not. It is useful to give students sample questions to help them get the most out of the interview experience. Interviews also help build the competence of the interviewee in discussing ethical subjects. As a result, interviews of the faculty on ethical questions help make the faculty more articulate on ethical questions. This, in turn, helps increase the competence of the community to discuss and therefore handle ethical issues. Where interview questions raise potentially sensitive issues, it is a good idea to distribute them to the faculty in advance. Being able to discuss

potentially sensitive issues has the further advantage that it helps to build trust within a community. Below is a list of sample questions that graduate students in the Electrical Engineering and Computer Science graduate programs at MIT use to interview prospective advisors on the subject of their policies on credit and authorship.[6]

Sample Questions To Be Used in Interviews with Potential Advisors

How are graduate students' contributions to research and innovation recognized (beyond the course credit they receive)? When is a student's name listed as an author on a journal article?

What factors do you consider in determining the order in which the authors are listed?

What factors determine which person working in a research group gives a presentation on the research at a professional meeting?

How do these factors compare with those you use in deciding whether and how to list someone among authors? Do considerations such as whether the student is looking for a job play a role in these decisions?

If a student contributes to a research project the results of which will be presented in a report or presentation, instead of a publication, how is the student's work credited?

Does it matter if the sponsor or audience for the presentation is a potential employer of the program's graduates?

Credit and responsibility for research go together. One aspect of responsibility is to minimize mistakes and errors in research. In your field what sort of mistakes are regarded as trivial and what sort of mistakes are regarded as significant or serious? What are appropriate ways of dealing with mistakes in published or electronically disseminated research results, or those presented at professional conferences?

Role Playing

A final agent-oriented learning method is role play. Here, the student experiences what it is to formulate a response in the midst of interaction. It complements but does not substitute for other methods that allow more reflective consideration. It is often useful to have students change roles and experience the same situation from several vantage points. For an example, see the role play on intellectual property in MIT's introductory computer science course.[7]

In summary, agent-centered learning complements ethics education that focuses on ethical judgment and evaluation. It helps to develop the additional skills and knowledge needed to respond responsibly and wisely to moral problems. These methods include discussion of scenarios that capture many features of ethical problems, discussion of historical cases that have been written from the point of view of the person experiencing the situation, interviews, and role play.

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Footnotes

- [1] By an 'ethical problem' I mean a practical problem with significant ethical aspects. This is how most people would use the term 'ethical problem'. Some philosophers use the term somewhat differently, however. They mean a technical problem in philosophical ethics.
- [2] For an expanded discussion of the analogy between design problems and moral problems, and discussion of the relation of this approach to the recent literature on philosophical ethics, and to practical and professional ethics. See Caroline Whitbeck, *Understanding Ethical Problems in Engineering Practice and Research,* Cambridge University Press, winter 1995-96.
- [3] The agent-oriented approach is also very different in both its methods and goals from the activity commonly called 'values clarification' in which participants bring to conscious expression their own attitudes and sentiments. Although a great deal of 'values clarification' occurs as a by-product of ethics education, and values clarification may help people of high school or college age in their developmental task of self-awareness, values clarification is not appropriate subject matter for a university level course. Furthermore, when

offered by itself without any discussion of ethical standards and the rationale for them, values clarification leaves the mistaken impression that all attitudes and opinions are equally valid, that ethics is entirely subjective and therefore that reasoned discussion will not be fruitful.

- [4](#) Problems are implicitly framed as multiple choice problems when the instructor states alternative responses from which students assume they are expected to choose, but the multiple-choice format is also often used explicitly in some ethics education. This is especially common in ethics material used by corporations. However, this material is often directed more to indoctrinating employees into the norms of the corporation, than to helping them to handle moral problems more wisely and responsibly.
- [5](#) Roger Boisjoly's problem-solving responses are detailed in Chapter 4 of Ethics in Engineering Practice and Research, Cambridge University Press, winter 1995-96.
- [6](#) The entire series of research ethics activities, originally designed for the computer science 'area' of the department and now being mirrored for electrical engineering 'areas' is on the World Wide Web. The Online Ethics Center for Engineering & Science.
- [7](#) The role play on intellectual property was created by Hal Abelson, Caroline Whitbeck and other faculty members for MIT's introductory computer science course and can be seen on the link "[Role Play on Intellectual Property](#) for Computer Science Students in the Online Ethics Center for Engineering and Science."

Notes

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Use of Materials on the OEC

Resource Type

Instructor Materials

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Topics

Case Study Method

Discipline(s)

Teaching Ethics in STEM