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Source: *Philosophy & Public Affairs*, Spring, 1991, Vol. 20, No. 2 (Spring, 1991), pp. 150-167

Published by: Wiley

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Thinking Like an Engineer: The Place of a Code of Ethics in the Practice of a Profession

Most discussions of engineering ethics dismiss the idea of codes of ethics from the outset. Codes are described as self-serving, unrealistic, inconsistent, mere guides for novices, too vague, or unnecessary.¹ I will not do that here. Instead, I will argue that a code of professional ethics is central to advising individual engineers how to conduct themselves, to judging their conduct, and ultimately to understanding engineering as a profession. I will begin with a case now commonly discussed in engineering ethics, finding my general argument in a detailed analysis of a particular choice. While I believe the analysis to be applicable to all professions, I shall not argue that here.

I. THE CHALLENGER DISASTER²

On the night of 27 January 1986, Robert Lund was worried. The Space Center was counting down for a shuttle launch the next morning. Lund,

Early versions of this article were presented to the Society of Hispanic Professional Engineers, Chicago Chapter, 10 June 1987; and to the American Society of Civil Engineers, University of Illinois at Chicago, Student Chapter, 4 May 1988. I should like to thank those present, as well as my colleague Vivian Weil, for many helpful comments.

1. See, e.g., John Ladd, "The Quest for a Code of Professional Ethics: An Intellectual and Moral Confusion," in *AAAS Professional Ethics Project*, ed. Rosemary Chalk, Mark S. Frankel, and Sallie B. Chafer (Washington, D.C.: American Association for the Advancement of Science, 1980), pp. 154–59; Samuel Florman, "Moral Blueprints," *Harper's* 257 (1978): 30–33; John Kultgen, "The Ideological Use of Professional Codes," *Business and Professional Ethics Journal* 1 (1982): 53–69; and Heinz C. Luegenbiehl, "Codes of Ethics and the Moral Education of Engineers," *Business and Professional Ethics Journal* 2 (1983): 41–61. Note also how small a part codes have in a text on engineering ethics, such as Mike Martin and Roland Schinzinger, *Ethics in Engineering*, 2d ed. (New York: McGraw-Hill, 1989), esp. pp. 86–92, 103–4.

2. The following narrative is based on testimony contained in *The Presidential Commis-*

vice-president for engineering at Morton Thiokol, had earlier presided over a meeting of engineers that unanimously recommended *against* the launch. He had concurred and informed his boss, Jerald Mason. Mason informed the Space Center. Lund had expected the flight to be postponed. The Center's safety record was good. It was good because the Center would not allow a launch unless the technical people approved.

Lund had not approved. He had not approved because the temperature at the launch site would be close to freezing at lift-off. The Space Center was worried about the ice already forming in places on the boosters, but Lund's worry was the "O-rings" sealing the boosters' segments. They had been a great idea, permitting Thiokol to build the huge rocket in Utah and ship it in pieces to the Space Center two thousand miles away. Building in Utah was so much more efficient than building on-site that Thiokol had been able to underbid the competition. The shuttle contract had earned Thiokol \$150 million in profits.

But, as everyone now knows, the O-rings were not perfect. Data from previous flights indicated that the rings tended to erode in flight, with the worst erosion occurring on the coldest preceding lift-off. Experimental evidence was sketchy but ominous. Erosion seemed to increase as the rings lost their resiliency, and resiliency decreased with temperature. At a certain temperature, the rings could lose so much resiliency that one could fail to seal properly. If a ring failed in flight, the shuttle could explode.

Unfortunately, almost no testing had been done below 40°F. The engineers' scarce time had had to be devoted to other problems, forcing them to extrapolate from the little data they had. But, with the lives of seven astronauts at stake, the decision seemed clear enough: Safety first.

Or so it had seemed earlier that day. Now Lund was not so sure. The Space Center had been "surprised," even "appalled," by the evidence on which the no-launch recommendation had been based. They wanted to launch. They did not say why, but they did not have to. The shuttle program was increasingly falling behind its ambitious launch schedule. Congress had been grumbling for some time. And, if the launch went as scheduled, the president would be able to announce the first teacher in space as part of his State of the Union message the following evening, very good publicity just when the shuttle program needed some.

sion on the Space Shuttle Challenger Disaster (Washington, D.C.: U.S. Government Printing Office, 1986), esp. 1:82–103.

The Space Center wanted to launch. But they would not launch without Thiokol's approval. They urged Mason to reconsider. He reexamined the evidence and decided the rings should hold at the expected temperature. Joseph Kilminster, Thiokol's vice-president for shuttle programs, was ready to sign a launch approval, but only if Lund approved. Lund was now all that stood in the way of launching.

Lund's first response was to repeat his objections. But then Mason said something that made him think again. Mason asked him to *think like a manager rather than an engineer*. (The exact words seem to have been, "Take off your engineering hat and put on your management hat.") Lund did and changed his mind. The next morning the shuttle exploded during lift-off, killing all aboard. An O-ring had failed.

Should Lund have reversed his decision and approved the launch? In retrospect, of course, the answer is obvious: No. But most problems concerning what we should do would hardly be problems at all if we could foresee all the consequences of what we do. Fairness to Lund requires us to ask whether he should have approved the launch given only the information available to him at the time. And since Lund seems to have reversed his decision and approved the launch because he began to think like a manager rather than an engineer, we need to consider whether Lund, an engineer, should have been thinking like a manager rather than an engineer. But, before we can consider that, we need to know what the difference is between thinking like a manager and thinking like an engineer.

One explanation of the difference stresses technical knowledge. Managers, it might be said, are trained to handle people; engineers, to handle things. To think like a manager rather than an engineer is to focus on people rather than on things. According to this explanation, Lund was asked to concern himself primarily with how best to handle his boss, the Space Center, and his own engineers. He was to draw upon his knowledge of engineering only as he might draw upon his knowledge of a foreign language, for example, to help him communicate with his engineers. He was to act much as he would have acted had he never earned a degree in engineering.

If that explanation of what Mason was asking of Lund seems implausible (as I think it does), what is the alternative? If Mason did not mean that Lund should make his knowledge of engineering peripheral (as it seems Mason, himself an engineer, did *not* when he personally reexam-

ined the evidence), what was he asking Lund to do? What is it to think like an engineer if not simply to use one's technical knowledge of things? That is a question engineers have been asking for almost a century. Answers have often been expressed in a formal code of ethics.

That may seem odd. What business, it may be asked, do engineering societies have promulgating codes of ethics? What could they be thinking? Ethics is not a matter for majority vote but for private conscience, or, if not for private conscience, then for experts; and the experts in ethics are philosophers or clergy, not engineers. Such thoughts make any connection between engineering and ethics look dubious. So, before we can say more about what Lund should have done, we have to understand the connection.

II. THE POSSIBILITY OF ENGINEERING ETHICS

A code of (professional) ethics generally appears when an occupation organizes itself into a profession. Usually, the code is put in writing and formally adopted. Even when formalization is put off, however, the code may still be a subject of frequent reference, whether explicitly, as in "*our* code of ethics," or implicitly, as in, "That would not be proper for one of *us*."

Why this connection between codes of (professional) ethics and organized professions? Several explanations have been offered over the years.³ But, for our purposes, the most helpful is that a code of ethics is primarily a *convention between professionals*.⁴ According to this explanation, a profession is a group of persons who want to cooperate in serving the same ideal better than they could if they did not cooperate. Engineers, for example, might be thought to serve the ideal of efficient design, construction, and maintenance of safe and useful objects. A code of ethics

3. See, e.g., Robert M. Veatch, "Professional Ethics and Role-Specific Duties," *Journal of Medicine and Philosophy* 4 (1979): 1–19; Benjamin Freedman, "A Meta-Ethics for Professional Morality," *Ethics* 89 (1978): 1–19; and Lisa Newton, "The Origin of Professionalism: Sociological Conclusions and Ethical Implications," *Business and Professional Ethics Journal* 1 (1982): 33–43.

4. For more on this explanation, see my "The Moral Authority of a Professional Code," *NOMOS XXIX: Authority Revisited*, ed. J. Roland Pennock and John W. Chapman (New York: New York University Press, 1987), pp. 302–38; "The Use of Professions," *Business Economics* 22 (1987): 5–10; "Professionalism Means Putting Your Profession First," *Georgetown Journal of Legal Ethics* 2 (1988): 352–66; and "The Ethics Boom: What and Why," *Centennial Review* 34 (1990): 163–86.

would then prescribe how professionals are to pursue their common ideal so that each may do the best she can at minimal cost to herself and those she cares about (including the public, if looking after the public is part of what she cares about). The code is to protect each professional from certain pressures (for example, the pressure to cut corners to save money) by making it reasonably likely (and more likely than otherwise) that most other members of the profession will *not* take advantage of her good conduct. A code protects members of a profession from certain consequences of competition. A code is a solution to a coordination problem.

According to this explanation, an occupation does not need society's recognition in order to be a profession. It needs only a practice among its members of cooperating to serve a certain ideal. Once an occupation has become a profession, society has a reason to give it special privileges (for example, the sole right to do certain work) if, but only if, society wants to support serving the ideal in question in the way the profession has chosen to serve it. Otherwise, it may leave the profession unrecognized.

A profession, as such, is like a union in that it is organized to serve the interests of its members, and unlike a charity or government, which is organized to serve someone else's interests. But professions differ from unions in the interests they are organized to serve. Unions are, like businesses, primarily organizations of self-interest. They exist for the benefit of their members, just as businesses exist for the profit of their owners. A profession, in contrast, is organized to help members serve *others*—according to a certain ideal expressed in its code of ethics. In this sense, professions are organized for public service. That, I think, is true by definition. But it is not a mere semantic truth. When a group of individuals constitute themselves as a “profession,” they explicitly invoke this way of understanding what they are up to. They invite examination according to the standards proper to such an undertaking. They give what they do a distinct context.

Understanding a code of (professional) ethics as a convention between professionals, we can explain why engineers cannot depend on mere private conscience when choosing how to practice their profession, no matter how good that private conscience, and why engineers should take into account what an organization of engineers has to say about what engineers should do.⁵ What conscience would tell us to do *absent* a cer-

5. Here, then, is an important contrast between my position and the “personal analysis” of professional duties one finds, for example, in Thomas Shaffer, “Advocacy as Moral Dis-

tain convention is not necessarily what conscience would tell us *given* that convention. Insofar as a code of professional ethics is a kind of (morally permissible) convention, it provides a guide to what engineers may reasonably expect of one another, what (more or less) “the rules of the game” are. Just as we must know the rules of baseball to know what to do with the ball, so we must know engineering ethics to know, for example, whether, *as engineers*, we should merely weigh safety against the wishes of our employer or instead give safety preference over those wishes.

A code of ethics should also provide a guide to what we may expect other members of our profession to help us do. If, for example, part of being an engineer is putting safety first, then Lund’s engineers had a right to expect his support. When Lund’s boss asked him to think like a manager rather than an engineer, he should, *as an engineer*, have responded, “Sorry, if you wanted a vice-president who would think like a manager *rather than* an engineer, you should not have hired an engineer.”⁶

If Lund had so responded, he would, as we shall see, have responded as “the rules of the engineering game” require. But would he have done the right thing, not simply according to those rules but all things considered? This is not an empty question. Even games can be irrational or immoral. (Think, for example, of a game in which you score points by cutting off your fingers or by shooting people who happen to pass in the street below.) People are not merely members of this or that profession. They are also persons with responsibilities beyond their professions, moral agents who cannot escape conscience, criticism, blame, or punishment just by showing that they did what they did because their profession required it. While we have now explained why an engineer should,

course,” *North Carolina Law Review* 57 (1979): 647–70; or Charles Fried, “The Lawyer as Friend: The Moral Foundations of the Lawyer-Client Relation,” *Yale Law Review* 85 (1976): 1060–89. Unlike these others, I do not treat professional activity as primarily involving a relation between one person with an important skill (the professional) and a series of others (the client, patient, or whatever). The appeal of the personal analysis probably comes from focusing too much on professions, like law and medicine, that have a clearly defined client. One feature of engineering that should make it more interesting to students of professional ethics than it has been is the absence (or relative unimportance) of individual clients. In this respect, engineering may represent the future of law, and perhaps even of medicine.

6. Cf. my “The Special Role of Professionals in Business Ethics,” *Business and Professional Ethics Journal* 7 (1988): 83–94.

as an engineer, take account of his profession's code of ethics, we have not explained why anyone should be an engineer in this sense.

Let me put the point more dramatically. Suppose Lund's boss had responded to what we just imagined Lund to say to him: "Yes, we hired an engineer, but—we supposed—an engineer with common sense, one who understood just how much weight a rational person gives a code of ethics in decisions of this kind. Be reasonable. Your job and mine are on the line. The future of Thiokol is also on the line. Safety counts a lot. But other things do, too. If we block this launch, the Space Center will start looking for someone more agreeable to supply boosters."

If acting as one's professional code requires is really justified, we should be able to explain to Lund (and his boss) why, as a rational person, Lund should support his profession's code as a guide for all engineers and why, even in his trying circumstances, he cannot justify treating himself as an exception.

III. WHY OBEY ONE'S PROFESSIONAL CODE?

The question now is why, all things considered, an engineer should obey her profession's code. We should begin by dismissing two alternatives some people find plausible. One is that Lund should do as his profession requires because he "promised," for example, by joining an engineering society having a code of ethics. We must dismiss this answer because it is at least possible that Lund never did anything we could plausibly characterize as promising to follow a formal code. Lund could, for example, have refused to join any professional society having a code (as perhaps half of all U.S. engineers do). Yet, it seems such a refusal would not excuse him from conducting himself as an engineer should. The obligations of an engineer do not seem to rest on anything so contingent as a promise, oath, or vow. So, the "convention between professionals" (as I called it) is not a contract. It is more like what lawyers call a "quasi-contract" or a "contract implied in law"; that is, an obligation resting not on an actual agreement (whether express or tacit) but on what it is fair to require of someone given what he has voluntarily done, such as accepted the benefits that go with claiming to be an engineer.

The other plausible alternative we can quickly dismiss is that Lund should do as his profession requires because "society" says he should. We may dismiss this answer in part because it is not clear that society

does say that. One way society has of saying things is through law. No law binds all engineers to abide by their profession's code (as the law does bind all lawyers to abide by theirs).⁷ Of course, society has ways of saying things other than by law, for example, by public opinion. But it seems doubtful that the public knows enough about engineering to have an opinion on most matters of engineering ethics. And even on the matter before us, can we honestly say that society wants engineers to do as their code requires (treat safety as paramount, as explained below) rather than (as most people would) treat safety as an important consideration to balance against others?

However that question is answered, it seems plain that neither public opinion nor law should decide what it is rational or moral to do. After all, there have been both irrational laws (for example, those requiring the use of outmoded techniques) and immoral laws (for example, those enforcing slavery). The public opinion supporting such laws could not have been much less irrational or immoral than the laws themselves.

The two answers we have now dismissed share one notable feature. Either would, if defensible, provide a reason to do as one's profession requires quite independently of what in particular the profession happens to require. The answers do not take account of the contents of the code of ethics. They are formal. The answer we shall now consider is *not* formal. It is that supporting a code of ethics with a certain content is rational because supporting any code with a content of that sort is rational.

Consider, for example, the code of ethics drafted by the Accreditation Board of Engineering and Technology (ABET) and adopted by all major American engineering societies except the National Society of Professional Engineers and the Institute of Electrical and Electronic Engineers. The code is divided into "fundamental principles," "fundamental canons," and (much more detailed) "guidelines." The fundamental principles simply describe in general terms an ideal of service. Engineers "uphold and advance the integrity, honor and dignity of the engineering profession by: I. using their knowledge and skill for the enhancement of

7. Some engineers, so-called Professional Engineers (PEs), are bound by law in exactly the way lawyers, doctors, and other state-licensed professionals are. But most engineers in the United States—nearly 90 percent—are not so licensed. They practice engineering under the "manufacturer's exemption." They can practice engineering only through a company with a PE, who must ultimately "sign off" on their work.

human welfare, II. being honest and impartial, and serving with fidelity the public, their employers and clients [and so on].” What rational person could object to others’ trying to achieve that ideal? Or at least, what rational person could object so long as their doing so did not interfere with what she was doing? Surely every engineer—indeed, every member of society—is likely to be better off overall if engineers uphold and advance the integrity, honor, and dignity of engineering in that way.

Below the fundamental principles are the fundamental canons. The canons lay down general duties. For example, engineers are required to “hold paramount the safety, health and welfare of the public,” to “issue public statements only in an objective and truthful manner,” to “act in professional matters for each employer or client as faithful agents and trustees,” and to “avoid all conflicts of interest.” Each engineer stands to benefit from these requirements both as ordinary person and as engineer. The benefits for an engineer as ordinary person are obvious: As an ordinary person, an engineer is likely to be safer, healthier, and otherwise better off if engineers *generally* hold paramount the public safety, only make truthful public statements, and so on. How engineers stand to benefit *as engineers* is less obvious. So, let us try a thought experiment.

Imagine what engineering would be like if engineers did not generally act as the canons require. If, for example, engineers did not generally hold paramount the safety, health, and welfare of the public, what would it be like to be an engineer? The day-to-day work would, of course, be much the same. But every now and then an engineer would be asked to do something that, though apparently profitable to his employer or client, would put other people at risk, some perhaps about whom he cared a great deal. Without a professional code, an engineer could not object *as an engineer*. An engineer could, of course, still object “personally” and refuse to do the job. But if he did, he would risk being replaced by an engineer who would not object. An employer or client might rightly treat an engineer’s personal qualms as a disability, much like a tendency to make errors. The engineer would be under tremendous pressure to keep “personal opinions” to himself and get on with the job. His interests as an engineer would conflict with his interests as a person.

That, then, is why each engineer can generally expect to benefit from other engineers’ acting as their common code requires. The benefits are, I think, clearly substantial enough to explain how an individual could

rationally enter into a convention that would equally limit what he himself can do.

I have not, however, shown that every engineer *must* benefit *overall* from such a convention, or even that any engineer will consider these benefits sufficient to justify the burdens required to achieve them. Professions, like governments, are not always worth the trouble of maintaining them. Whether a particular profession is worth the trouble is an empirical question. Professions nonetheless differ from governments in at least one way relevant here. Professions are voluntary in a way that governments are not. No one is born into a profession. One must claim professional status to have it (by taking a degree, for example, or accepting a job for which professional status is required). We therefore have good reason to suppose that people are engineers because, on balance, they prefer to have the benefits of being an engineer, even given what is required of them in exchange.

If, as we shall now assume, the only way to obtain the benefits in question is to make it part of being an engineer that the public safety, health, and welfare come first, every engineer, including Lund, has good reason to want engineers *generally* to adhere to something like the ABET code. But why should an engineer adhere to it himself when, as in Lund's case, it seems he (or his employer or client) stands to benefit by departing from it?

If the question is one of justification, the answer is obvious. Lund would have to justify his departure from the code by appealing to such considerations as the welfare of Thiokol and his own self-interest. An appeal to such considerations is just what Lund could not incorporate into a code of ethics for engineers or generally allow other engineers to use in defense of what they did. Lund could not incorporate such an exception into a code because its incorporation would defeat the purpose of the code. A code of ethics is necessary in part because, without it, the self-interest of individual engineers, or even their selfless devotion to their employer, could lead them to harm everyone overall. Lund could not allow other engineers to defend what they did by appeal to their own interests or that of their employer for much the same reason. To allow such appeals would be to contribute to the breakdown of a practice Lund has good reason to support.

I take this argument to explain why, all things considered, Lund

should have done as his profession's code requires, *not* why he should have done so in some premoral sense. I am answering the question "Why be ethical?" *not* "Why be moral?" I therefore have the luxury of falling back on ordinary moral principles to determine what is right, all things considered. The moral principle on which this argument primarily relies is the principle of fairness. Since Lund voluntarily accepts the benefits of being an engineer (by claiming to be an engineer), he is morally obliged to follow the (morally permissible) convention that helps to make those benefits possible.⁸ What I have been at pains to show is how that convention helps to make those benefits possible, and why, even now, he has good reason to endorse the convention generally.

I have been assuming that engineers do in fact generally act in accordance with the ABET code, whether or not they know it exists. If that assumption were mistaken, Lund would have had no *professional* reason to do as the code requires. The code would be a dead letter, not a living practice. It would have much the same status as a "model statute" no government ever adopted, or the rules of a cooperative game no one plays. Lund would have had to rely on private judgment. But relying on private judgment is not necessary here. Lund's engineers seem to have recommended as they did because they thought the safety of the public, including astronauts, paramount. They did what, according to the code, engineers are supposed to do. Their recommendation is itself evidence that the code corresponds to a living practice.⁹

8. I hope this appeal to fairness will raise no red flags, even though the principle of fairness has been under a cloud ever since the seemingly devastating criticism it received in Robert Nozick, *Anarchy, State, and Utopia* (New York: Basic Books, 1974). I have, it should be noted, limited my use to obligations generated by *voluntarily* claiming benefits of a cooperative practice that are otherwise not available. Most attacks on the principle of fairness have been on the "involuntary benefits" version. See, e.g., A. John Simmons, *Moral Principles and Political Obligations* (Princeton, N.J.: Princeton University Press, 1979), pp. 118–36. And even those attacks are hardly devastating. One can either refine the principle, as Richard Arneson has done in "The Principle of Fairness and Free-Rider Problems," *Ethics* 92 (1982): 616–33; or, as in my "Nozick's Argument for the Legitimacy of the Welfare State," *Ethics* 97 (1987): 576–94, show that Nozick's original criticism, and most subsequent criticism, depends on examples that, upon careful examination, fail to support the criticism.

9. I am not claiming that the engineers treated safety as paramount because they knew what the ABET code said. When you ask a lawyer about a professional code, she is likely to tell you she studied the ABA code in law school and, claiming to have a copy around, will produce it after only a few minutes of searching her desk or bookshelves. When you ask an engineer the same question, he is likely to tell you that his profession has a code while admitting both that he never studied it and that he has none around to refer to. Yet,

So, when Lund's boss asked him to think like a manager rather than an engineer, he was in effect asking Lund to think in a way that Lund must consider unjustified for engineers generally and for which Lund can give no morally defensible principle for making himself an exception. When Lund did as his boss asked (supposing he did), he in effect let down all those engineers who helped to establish the practice that today allows engineers to say "no" in such circumstances with the reasonable hope that the client or employer will defer to their professional judgment, and that other engineers will come to their aid if the client or employer does not defer.

Lund could, of course, still explain how his action served his own interests and those of Thiokol (or, rather, how they seemed to at the time).¹⁰ He could also just thumb his nose at all talk of engineering ethics, though that would probably lead to the government's barring him from working on any project it funds, to fellow engineers' refusing to have anything to do with him, and to his employer's coming to view him as an embarrassment. What he cannot do is show that what he did was right, all things considered.

This conclusion assumes that I have not overlooked any relevant consideration. I certainly may have. But that is not important here. I have not examined Lund's decision in order to condemn him but in order to bring to light the place of a code of ethics in engineering. There is more to understand.

IV. INTERPRETING A CODE OF ETHICS

So far we have assumed that Lund did as his boss asked, that is, that he thought like a manager rather than an engineer. Assuming that allowed us to give a relatively clear explanation of what was wrong with what Lund did: Lund acted like a manager when he was also an engineer and should have acted like one.

anyone who has spent much time with working engineers knows they do not treat safety in the same way managers do (hence Mason's plea to "take off your engineering hat"). The engineers' code of ethics seems to be "hard-wired" into them. Interestingly, engineers are not the only professionals for whom the written code seems to play so small a part. For another example, see my "Vocational Teachers, Confidentiality, and Professional Ethics," *International Journal of Applied Philosophy* 4 (1988): 11–20.

10. I do not claim that he would explain his decision in this way. Indeed, I think his explanation would be quite different, though no less troubling. See my "Explaining Wrongdoing," *Journal of Social Philosophy* 20 (1989): 74–90.

We must, however, now put that assumption aside and consider whether engineering ethics actually forbids Lund to do what it seemed he did, that is, weigh his own interests, his employer's, and his client's against the safety of the seven astronauts. Ordinary morality seems to allow such weighing. For example, no one would think you did something morally wrong if you drove your child to school, rather than letting him take the bus, even if your presence on the road increased somewhat the risk that someone would be killed in a traffic accident. Morality allows us to give special weight to the interests of those close to us.¹¹ If engineering ethics allows that too, then Lund—whatever he may have thought he was doing—would not actually have acted unprofessionally. Let us then imagine Lund's reading of the ABET code. What could he infer?

Of the code's seven fundamental canons, only two seem relevant: (1) "[holding] paramount the safety, health and welfare of the public" and (4) "[acting] in professional matters for each employer or client as faithful agents or trustees." What do these provisions tell Lund to do? The answer is not all that clear. Does "public" include the seven astronauts? They are, after all, employees of Thiokol's client, the Space Center, not part of the public as are, say, those ordinary citizens who watch launches from the beach opposite the Space Center. And what is it to be a "faithful agent or trustee" of one's client or employer? Is it to serve all the interests of a client or employer, or only the financial ones? And how is one to determine even those? Does the client or employer have the final word, or may an engineer make an independent assessment? After all, the actual result of Lund's decision was a disaster for both employer and client, though one both employer and client may have thought themselves justified in risking. And what is Lund to do if the public welfare requires what no faithful agent or trustee could do? Does "holding paramount" the public welfare include sometimes acting as a faithful agent or trustee would *not* act?

These questions are surprisingly easy to answer if we keep in mind the connection between professions and codes of ethics, remembering especially that a code is not a stone tablet inscribed with divine wisdom but the work of engineers, a set of rules that is supposed to win the sup-

11. Here, then, is why I reject the "universalistic" interpretation of engineering ethics in, e.g., Kenneth Alpern, "Moral Responsibility for Engineers," *Business and Professional Ethics Journal* 2 (1983): 39–48.

port of engineers because the rules help engineers do what they want to do.

The language of any document, codes included, must be interpreted in light of what it is reasonable to suppose its authors intend.¹² For example, if “bachelor” appears undefined in a marriage statute, we interpret it as referring to single males, but if the same word appears in directions for a college’s graduation ceremony, we instead interpret it as referring to all students getting their baccalaureate, whether male or female, single or married. That is the reasonable interpretation because we know that marriages usually involve single males (as well as single females) *rather than* people with baccalaureates while just the reverse is true of graduation ceremonies. So, once we figure out what it is reasonable to suppose engineers intend by declaring the “public” safety, health, and welfare “paramount,” we should be able to decide whether interpreting “public” so that it includes “employees” is what engineers intend (or at least what, as rational persons, they should intend) and also whether they intend the paramountcy requirement to take precedence over the duty to act as a faithful agent or trustee.

The authors of a code of engineering ethics (whether those who originally drafted or approved it or those who now give it their support) are all more or less rational persons. They differ from most other rational persons only in knowing what engineers must know in order to be engineers and in performing duties they could not perform (or could not perform as well) but for that knowledge. It is therefore reasonable to suppose that their code of ethics would not require them to risk their own safety, health, or welfare, or that of anyone for whom they care, except for some substantial good (for example, high pay or service to some ideal to which they are committed). It also seems reasonable to suppose that no code they authored would include anything people generally consider immoral. Most engineers are probably morally decent people, unlikely to endorse an immoral rule.

But what if that were not true? What if most engineers were moral

12. I am not here committing the “originalist fallacy” common a few years back in debates over how to interpret the U.S. Constitution. Though the first codes of ethics for American engineers were adopted early in this century, all have undergone radical revision within the last two decades. More importantly, as will be made plain below, I use “authors” to include all those who must currently support the code. My notion of interpretation is therefore much closer to that found in Ronald Dworkin, *Law’s Empire* (Cambridge, Mass.: Harvard University Press, 1986).

monsters or just self-serving opportunists? What then? Interpreting their code would certainly be different, and probably harder. We could not understand it as a *professional* code. We would have to switch to principles of interpretation we reserve for mere folkways, Nazi statutes, or the like. We would have to leave the presuppositions of ethics behind.

But, given those presuppositions, we can easily explain why a code of engineering ethics would make holding the public safety paramount a duty taking precedence over all others, including the duty to act as a faithful agent or trustee. Rational engineers would want to avoid situations in which only their private qualms stood between them and a use of professional knowledge they considered morally wrong or otherwise undesirable. Each would, as we saw, want to be reasonably sure that the knowledge of other engineers would serve the public, even when the interests of the public conflicted with those of employer or client. Given this purpose, what must “public” mean?

We *might* interpret “public” as equivalent to “everyone” (in the society, locale, or whatever). On this interpretation, the “public safety” would mean the safety of everyone more or less equally. A danger that struck only children, or only those with bad lungs, or the like, would not endanger “the public.” This interpretation must be rejected. Since few dangers are likely to threaten everyone, interpreting “public” to mean “everyone” would yield a duty to the public too weak to protect most engineers from having to do things that would generally make life for themselves (and those they care about) far worse than it would otherwise be, even allowing for the occasional benefit they might obtain as individuals.

We might also interpret “public” as referring to “anyone” (in the society, local, or whatever). On this interpretation, public safety would be equivalent to the safety of some or all. Holding the public safety paramount would mean never putting anyone in danger. If our first interpretation of “public” made provisions protecting the public too weak, this second would make them too strong. For example, it is hard to imagine how we could have electric power stations, mountain tunnels, or chemical plants without some risk to someone. No rational engineer could endorse a code of ethics that made engineering virtually impossible.

We seem, then, to need an interpretation of “public” invoking some more relevant feature of people, rather than, as we have so far, just their number. I would suggest that what makes people a public is their relative innocence, helplessness, or passivity. On this interpretation, “pub-

lic” would refer to those persons whose lack of information, technical knowledge, or time for deliberation renders them more or less vulnerable to the powers an engineer wields on behalf of his client or employer. An engineer should hold paramount the public safety, health, and welfare to assure that engineers will not be forced to give too little regard to the welfare of these “innocents.”

On this third interpretation, someone might be part of the public in one respect but not in another. For example, the astronauts would be part of the public with respect to the O-rings because, not knowing of the danger, they were in no position to abort the launch to avoid the danger. The astronauts would, in contrast, *not* be part of the public with respect to the ice forming on the boosters because, having been fully informed of that danger, they were in a position to abort the launch if they were unwilling to take the risk the ice posed. This third interpretation of “public” thus seems to be free of the difficulties that discredited the preceding two. We now seem to have a sense of “holding the public safety paramount” that we may reasonably suppose rational engineers would endorse.

On this interpretation, the engineer’s code of ethics would (all else equal) require Lund either to refuse to authorize the launch or to insist instead that the astronauts be briefed in order to get their informed consent to the risk. Refusing authorization would protect the public by holding the safety of the astronauts paramount. Insisting that the astronauts be briefed and decide for themselves would hold the safety of the public paramount by transferring the astronauts from the category of members of the public to that of informed participants in the decision. Either way, Lund would not, under the circumstances, have had to treat his own interests, those of his employer Thiokol, or those of his client the Space Center as comparable to those of the public (assuming, of course, what is not true, that we have considered all the public interests relevant here).

Is this the correct interpretation of “public”? It is if we have taken into account every relevant consideration. Have we? There is, of course, no way to know. But there is good reason to think we have. We can easily show that the only obvious alternative is wrong. That alternative is that “public” refers to all “innocents” *except* employees of the client or employer in question. Employees are to be excluded because, it might be said, they are paid to take the risks associated with their job. On this

interpretation, Lund would not have to hold the safety of the astronauts paramount, since they would not be part of the public.

What is wrong with this fourth interpretation of “public”? Earlier, we understood “innocents” to include all persons whose lack of information, training, or time for deliberation renders them vulnerable to the powers an engineer wields on behalf of his client or employer. An employee who takes a job knowing the risks (and is otherwise able to avoid them) might be able to insist on being paid enough to compensate for them. She could then truly be said to be paid to take those risks. She would not be an “innocent.” But she would, under our *third* interpretation, also not in that respect be part of the public to which an engineer owed a paramount duty. She would have given informed consent to the risk in question. So, the third and fourth interpretations would not differ concerning such an employee.

On the other hand, if the employee lacked the information to evaluate the risk, she would be in no position to insist on adequate compensation. She could not be said to be paid to take those risks. She would, in other words, be as innocent of, as vulnerable to, and as unpaid for the risks in question as anyone else in the public. Since nothing prevents an engineer, or someone for whom an engineer cares, from being the employee *unknowingly* at risk, engineers have as much reason to want to protect such employees as to protect the public in general. “Public” should be interpreted accordingly; that is, according to our third interpretation.

V. PROFESSIONAL RESPONSIBILITIES

Given the argument developed so far, engineers clearly are responsible for acting as their profession’s code of ethics requires. Do their professional responsibilities go beyond the code? The answer, I think, is clearly yes. Engineers should not only do as their profession’s code requires, but should also support it less directly by encouraging others to do as it requires and by criticizing, ostracizing, or otherwise calling to account those who do not. They should support their profession’s code in these ways for at least four reasons: First, engineers should support their profession’s code because supporting it will help protect them and those they care about from being injured by what other engineers do. Second, supporting the code will also help assure each engineer a working environment in which it will be easier than it would otherwise be to resist

pressure to do much that the engineer would rather not do. Third, engineers should support their profession's code because supporting it helps make their profession a practice of which they need not feel morally justified embarrassment, shame, or guilt. And fourth, one has an obligation of fairness to do his part insofar as he claims to be an engineer and other engineers are doing their part in generating these benefits for all engineers.