Preface

A PREFACE IS A short section of a book to tell readers something before the author tells them other things. In this preface, I want to prepare my readers for possible disappointment!

This book is about Christian ethics and engineering. It does *not* cover U.S. law, federal regulations, lawsuits, or state and city codes. This book does not cover complex, convoluted conundrums. Nor does it offer detailed suggestions for a method for deciding when faced by technological moral quandaries. Nor does it offer a systematic account of right and wrong. Nor does it give much advice about deriving moral duties from moral axioms or natural law. Nor does it contain a catalogue of divine commands. Nor will readers find here any extended treatment of what Catholics call Catholic Social Teaching or of what Protestants call the Social Gospel. What then remains?

What remains is everything else, of course. In fact, there is much, *much* more to what remains than to what I have elected to leave out. But describing all that remains is neither straightforward nor easy. In fact, many of the things I have elected to skip over (e.g., moral quandaries, decisionism, legal positivism, etc.) are the very things that trick us into believing that "ethics" is on the whole quite well defined, just needing a little tidying up around the edges. Not at all! The entire field of Christian ethics is as complex as human living. In a word, ethics is our ongoing quest for the less and less trivial.[1] For that reason, if I do my job, my readers are apt to perceive me as pesky: just when they think they've got "it" (whatever "it" is), I sharply prod them to move on. Of course, we have to start somewhere. So I will introduce a topic and describe it in simple enough terms for us to sink our teeth into. However, just when my readers think some topic or other has been nailed down, I may flit off to the margins and ask, "Okay, but what about *this*?"

There are ten different and progressive "thises" that frame the scaffolding of the book. Once a reader comes to see the interconnections among these ten, "the light will begin for them to dawn over the whole."

Chapter 1 reminds readers of the differences between engineering and the hard sciences. Engineering happens in the context of systemic unpredictability endemic to the highly messy real world. If there is such a thing as engineering ethics, it has to function within the same context of this extraordinarily messy world. Chapter 2 proposes engineering *design* as the paradigm for thinking about real-world ethics. The analogy turns on the clear similarity between the following two statements:

- "There is no single right answer in ethics. There may be entirely wrong answers. But within the range of roughly acceptable responses, each proposed answer must be evaluated for its relative satisfactoriness."

- "There is no single, correct design. There may be entirely wrong designs. But within the range of roughly acceptable solutions to a design problem, each proposed solution must be evaluated for its relative satisfactoriness."

The murkiness of "satisfactoriness" entails difficulty with the task of defending a given artifact as "good." Thus chapter 3 takes up the question of how value claims—whether about artifacts or about persons—can be justified, at least provisionally. Chapter 4 extends the discussion of justification to the application of professional codes of ethics as warrants for value claims. I argue that treating a professional code of ethics as a collection of clear-cut stipulations is almost as wrongheaded as assuming scientific laws *determine* the outcome of a design process. What is proposed in place of codes-as-stipulations is a strategy for reading codes as *heuristics*.

The notion of "heuristics" is central for this book. Heuristics require a great deal of specialized skill on the part of the engineer to employ well. Many of these skills are "tacit," which is to say, skills that reside in our fingers, our eyes, our ears, our "noses," but cannot be exhaustibly described in words. Tacit skill plays an analogous role in ethics. Thus chapter 5 compares engineering design with what ancient ethicists called "practical reasoning." Chapter 6 shows how the activity of design, a.k.a. practical reasoning, involves human subjects in a way that transforms the way they experience the world. As we shall see, the quality of one's engineering design is a function both of the designer's technical expertise *and* his or her moral character. Chapter 7 extends the discussion of growth in skills (both technical and moral) by looking at the ancient notion of "virtue" through the lens of contemporary neuroscience.

The final three chapters ask about the *social* dimension of engineering. Chapter 8 compares engineering to other morally formative social practices such as medicine. Like medicine, engineering is a morally formative practice; the one who pursues excellence within the practice is more likely to become a better human being than one who is a trifler in the practice. While chapter 8 considers the social nature of engineering within a given era, chapters 9 and 10 consider engineering as a social enterprise *through* time. Chapter 9 asks whether insights for design problems can come from areas *outside* of engineering. This phenomenon is called "cross-domain transfer." In particular, can cross-domain transfer occur from religion to engineering? I shall argue that religion, in general, and Christianity, in particular, may indeed provide insights for doing engineering design well. If that conclusion is plausible, it makes sense to go one step further and ask whether engineering might qualify as a *religious* vocation. In chapter 10 I trace the origins of the high social esteem enjoyed by engineering in the West to the work of a twelfth-century theologian named Hugh of St. Victor. Hugh was the first to show that engineering, by its very nature, makes positive contributions to the redemptive plans of God.

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Readers deserve a glimpse of where I come from before trusting me to take them on such a grand tour. I am not an engineer. I am a professor of theology. My outlook is strongly colored by my long-term allegiance to Christian practices and Scriptures. Surprisingly, I rarely teach introductory theology to undergraduates. Instead, I was specifically hired to teach Christian ethics to 120 or more *engineering* students every year. I got my present gig, in part, because my undergrad background was science teaching (physics and chemistry), because my dad was a mechanical engineer, because I did a long stint of campus ministry at Michigan Technological University (where I learned by trial and error how to communicate best with engineering students), and because my doctoral dissertation concerned the impact on theological ethics of the work of an aeronautical engineer-turned-philosopher named Ludwig Wittgenstein.

The work of Wittgenstein is almost as determinative for my outlook as my Christian faith. (I was alluding to Wittgenstein above when I said I hope that, for readers of this book, "the light will begin for them to dawn over the whole."[2]) Readers will learn in chapter 6 that Wittgenstein was a

remarkable child who showed promise as a budding engineer by building a working sewing machine out of wood when he was only twelve.[3] Exceptionally bright for his age, he attended school in the Austrian town of Linz (he was in the same class as the young Adolph Hitler; Hitler was a year behind the others, while our hero Ludwig had been advanced a grade.) By the age of nineteen Ludwig was enrolled in a graduate program in aeronautical engineering at the University of Manchester in England. The year was 1908, and the Wright brothers had just toured Europe with their flying contraption, piquing everyone's fascination with flying. Three years later Wittgenstein successfully patented a jet-nozzle propeller.[4] Being fascinated with mathematics, he applied to Cambridge to study mathematical theory. Then came World War I. While in the trenches on the Russian front, he finished a thesis—something like an honors thesis—during his free time. When the war ended he returned to Cambridge, hoping his paper would suffice to finish his degree. The "paper" he had written not only caused a stir in the world of philosophy of mathematics, once he had submitted it, Cambridge University hastily awarded him the highest degree possible, the PhD. Wittgenstein would teach philosophy at Cambridge for several decades. Surprising to many, everything he taught had about it the aroma of his previous engineering experience. His influence in this book is most obvious in my borrowing from him the idea of "dynamical similarity," which is discussed at length in chapter 6. (Readers who are familiar with my published work may catch whiffs of other Wittgensteinian themes as well.[5])

Unfortunately for my readers, I, rather than Wittgenstein the genius, wrote this book. I did have an enormous amount of help from friends who are as smart as they are charitable. I am particularly grateful for Drew Murray, whose insights about design engineering made all the difference for my understanding of ethics. His comments and objections and suggestions to former drafts of these chapters have made this a much better book. Terry Tilley also has his fingerprints on many early drafts of these chapters. I dare not forget the helpful eyes of Derek Hatch, Aaron James, Ethan Smith, Trecy Lysaught, Kelly Johnson, and Ben Heidgerken, who pointed out the many, many clarifications needed in earlier drafts. Special thanks to Nick Mayrand, who not only made comments on every chapter but also helped typeset the entire manuscript. I also want to thank Bingjue Li, whose skill at CAD transformed the figures from chapter 1 into things of beauty. Finally, I am also deeply indebted to the many engineering students at the University of Dayton who since 2001 have patiently endured my halting attempts to make this material understandable.

Notes

1. See ch. 8 for discussion of this line from McCabe, *Law, Love and Language*, 99.

2. Wittgenstein, *On Certainty*, 141.

3. For a biography of Wittgenstein, see Monk, *Ludwig Wittgenstein*.

4. Fuel was pumped to a tiny reaction chamber at the tip of each propeller blade. Upon reaction, the jet gas would escape the chamber tangential to the rotation of the blade, thus spinning the blade faster. The idea was eventually put into practice—years later by Doblhoff in a World War II helicopter and more recently by Fairey's Jet Gyrodyne. See McGuinness, *Wittgenstein: A Life*, 68–69.

5. See esp. Kallenberg, *Ethics as Grammar*; Kallenberg, "Praying for Understanding"; Kallenberg, "The Descriptive Problem of Evil"; Kallenberg, "Phronesis and Divine Command Ethics"; Kallenberg, "Teaching Engineering Ethics by Conceptual Design"; Kallenberg, "Dynamical Similarity and the Problem of Evil"; Kallenberg, *God and Gadgets*; Kallenberg, "Rethinking Fideism through the Lens of Wittgenstein's Engineering Outlook."