



Having laid down a lot of philosophical groundwork in this space over the last couple of years, I am finally ready to attempt to pull it all together. I will do so under three headings that correspond to the central concepts in Aristotle's approach to virtue ethics.

The "What" of Engineering: *Praxis*

First, "The Social Nature of Engineering" (November 2012) is such that engineers engage in a combined human performance in which they play a particular societal role: the assessment, management, and communication of risk.

Engineers must convince others to hire or retain them, and then ascertain and attempt to satisfy their expectations for each assignment. Furthermore, research has repeatedly indicated that engineers across all disciplines, career stages, and types of employers spend the majority of their time at work interacting with others. Engineering is thus always a collaborative endeavor, assembling expertise that is distributed among multiple participants; someone whose technical activities are self-motivated and solitary is more accurately labeled as an inventor.

Engineers are the decision-makers in situations where members of the general public are usually the potential harm-bearers, even when they are also supposed to benefit in some way. The latter take it for granted that engineering design adequately accounts for all of the applicable hazards, and thus ascribe to engineers the obligation to mitigate them. Embracing this responsibility entails not only recognizing these uncertainties and dealing with them appropriately, but also calling attention to – preferably beforehand – any residual risk associated with an engineered product or project.

The "How" of Engineering: *Phronesis*

Second, engineers are able to exercise "The Intellectual Virtue of Engineering" (July 2013), which is practical judgment – i.e., engineering judgment – while exhibiting "The Moral Virtues of Engineering" (May 2013): objectivity, care, and honesty.

Engineers routinely confront difficulties and predicaments, rather than well-structured problems that have deterministic solutions ("Engineering as Willing," March 2010; "The Rationality of Practice," September 2012). Learning theories, rules, and maxims – i.e., heuristics ("The Engineering Method," March 2006; "Heuristics and Judgment," May 2006) and design procedures ("The Nature of Theory and Design," May 2009) – provides a necessary and solid foundation. However, it is only through experience that someone can develop the skill to discern quickly what is important in a specific set of circumstances, and then select a suitable way forward ("The Nature of Competence," March 2012; "Virtue as a Skill," May 2012).

Risk assessment requires *objectively* evaluating the likelihood and severity of possible threats and identifying alternatives for reducing one or both of these parameters. Risk management requires *carefully* deliberating over multiple viable options and choosing one that rightly balances caution and ambition on behalf of all those who may be affected. Risk communication requires *honestly* acknowledging the dangers that cannot reasonably be eliminated and informing everyone who needs to be aware of them.

The "Why" of Engineering: *Eudaimonia*

Third, engineers fulfill "The Proper Purpose of Engineering" (January 2013), which is to enhance the material well-being of all people, by achieving "The Internal Goods of Engineering" (March 2013): safety, sustainability, and efficiency.

It takes a deliberate decision and ongoing resolve to do this faithfully. Engineers must prioritize it over not only their own immediate interests, but also the external goods that are valued by those who typically make the major decisions and ultimately pay the bills. The prospective reward is the opportunity to escape, at least partially, the "social captivity" that renders engineering largely instrumental, subject to exploitation by managers and clients ("The Social Captivity of Engineering," May 2010).

As a step in this direction, engineers can pursue their most fundamental aims – protecting people and preserving property, improving environments and conserving resources, and performing functions while minimizing costs – for their own sake, rather than merely as means to a separate end. When merged, they constitute an overall notion of quality that engineers seek to incorporate into everything that emerges from their efforts. Erik Nelson hinted at this when he wrote that "design is inherently goalless" because the precise outcome is unknown during the process of creating it ("A Structural Engineer's Manifesto for Growth – Part 1," April 2012).

Virtuous Engineers assert their responsibility for engaging in a combined human performance that involves the exercise of practical judgment to enhance the material well-being of all people by achieving safety, sustainability and efficiency while exhibiting objectivity, care and honesty in assessing, managing and communicating risk.

Conclusion

Uniting all of these ideas in an arrangement that states what engineers do, how they do it, and why it matters in broad terms, and then presents the details in the reverse order, results in a concise yet comprehensive summary of our unique and vital contribution to human flourishing (see box). This formulation is not meant to replace the extensive codes of ethics that engineering organizations have developed over the years. Instead, it complements them by offering an aspirational vision of what it means for engineers to demonstrate genuine integrity: *your practice IS your ethics!*

It also addresses two common and related complaints within the engineering profession – that people do not really understand and appreciate what we do, and that our social and political influence is not what it could or should be. I believe that conscientiously living as virtuous engineers, as described here, would improve our collective status and enable us to assume a more prominent position of leadership in our technologically advanced culture. ■



Jon A. Schmidt, P.E., SECB (cbair@STRUCTUREmag.org), is an associate structural engineer at Burns & McDonnell in Kansas City, Missouri. He chairs the STRUCTURE magazine Editorial Board and the SEI Engineering Philosophy Committee, and shares occasional thoughts at twitter.com/JonAlanSchmidt.

Join the Movement!

For more information and to collaborate on further development and implementation of the ideas outlined in this column, please visit www.VirtuousEngineers.org.