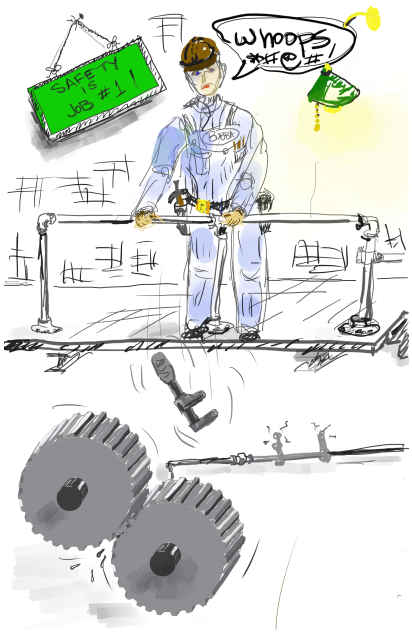
How certain can we be about anything?

In general, we think of risk as some sort of loss that we expect to happen *in the future* although as Hansson points out in "Philosophical Perspectives on Risk", the meaning of the word "risk" can be vague.[1] In Hansson's Rule (5):

> Nobody should be exposed to a risk unless it is part of an equitable social system for risk-taking that works to her advantage. (Hansson 2004)

One way to think about Hansson's rule may be that risk borne by any particular citizen should be balanced between sources of harm and the social welfare realized by those sources of harm; the details may be complicated but the concept is clear. Engineered designs that support the social welfare and carry the potential for harm are overlaid with protection; when protection breaks down, citizens may be harmed and conversely harm is avoided when protection succeeds.

Therefore, it would appear engineers simply need to work out the risk for breakdown(s) that would cause harm, and that for those citizens exposed to the harm, protective system design would produce a balance such that social systems work equitably on their behalf. Easy enough IF engineers had a way to find a probability for a breakdown causing harm and its level of harm from an engineered system.



Unfortunately finding the risk is a phenomenally challenging problem in epistemology and ethical behaviors; the probability for every kind of breakdown in a protection sequence must be foreseen as well as the time it will occur *and* every type of harm must be "monetized" against the welfare realized. Although utilitarianism as an ethical principle may be appealing to the engineer, it has produced some spectacular failures in balancing risk-taking.[2]

Engineers (at least in certain generations) talk about the ubiquitous "monkey wrench" in the "works", or "Murphy's Law", and other euphemisms for unexpected failures that seem to come out of nowhere, an acknowledgement it is effectively impossible to foresee every possible kind of breakdown in any reasonably complicated technological process. Even if it were possible to know *what* breakdowns and harms might occur, *when* they may occur and in what combination(s) is a truly insurmountable problem. Even if probabilities of outcomes could be known, the ethical problem remains as to how one can equitably "balance" the social welfare against citizen's level of harm.

Uncertainty must be faced by every engineer when creating a design, it cannot be avoided. And although the risk can not be known with exactitude, engineers nevertheless consistently produce complex designs with appropriate protections such that equity is realized among citizens. In my opinion, this is one of the great achievements of engineering education and practice in both industry and regulation.

A note about the current world crisis. The recent pandemic is potentially an opportunity for each citizen to reflect on the balance Hansson's rule articulates. Is the risk exposure to world citizens in balance; has the risk-taking been equitable? Citizens who must pay for recovery from the current pandemic, those now living and probably future generations may not think so. Now may be the time to ask the hard questions about who actually benefits and who actually pays when regulatory standards and effective protection systems among world economies are ignored in the interest of greater profit margins and lower priced goods and services. Will citizens now demand trade policies that inure to the benefit of those exposed to their moral hazard?

[1] Hansson, S.O., 2004. Philosophical perspectives on risk. Techné: Research in Philosophy and Technology, 8(1), pp.10-35. https://scholar.lib.vt.edu/ejournals/SPT/v8n1/pdf/hansson.pdf

[2] see for example https://law.justia.com/cases/california/court-of-appeal/3d/119/757.html where legal remedy was sought after harm was caused.