and control.[5] This needs to be taken quite literally and distinguished from the cases where technical agency unfolds merely below the threshold of awareness or attention. When we are simply not aware of the operation of a technical system, when we do not attend to it, this may be due to trust in its functioning and routinized use. When technology thus takes on the invisibility of the normal and habitual, this fits easily into narratives of nature becoming technologized. According to these narratives, science and technology progresses just to the extent that we can master nature or count on it. Reformulated in the terms suggested by Max Weber's "Science as a Vocation," science and technology progress just to the extent that a magical relation to occult powers gives way to disenchanted and rationalized control. When a machine works well, we no longer attend to it, and when nature is technologized we can afford to black-box all of the particulars as we simply count on its deliverables.

> Excepting physicists who know the subject, those of us who take a streetcar have no idea how it sets itself in motion. We do not need to know this. It is enough to "count" on the behavior of the streetcar, we orient our actions accordingly; but we know nothing of how one constructs a streetcar so that it moves. Savages know their tools incomparably better. […] Increasing intellectualization and rationalization therefore do *not* imply increasing general knowledge of one's conditions of life. It implies something else, namely knowledge of or faith in the fact that, if *only one wanted to*, one *could* find out any time, thus that in principle there are no secret, incalculable forces entering in, that instead – in principle – the things can be *mastered through calculation*. (Weber, 1988, 593 ff.)

As opposed to genetically modified foods that may or may not be passing through our bodies and whose causal agency may or may not persist, as opposed also to nanoparticulate sensors that might be used to monitor environmental conditions, Weber's streetcar, a desk-top computer, or the heating-unit in our house are perfectly macroscopic objects. We can count on them because we know of their presence, absence, and reliable working. We can switch them on and off, enter and leave them, and even without knowing how they work, we can judge whether they are working or broken down. No matter how much of the inner workings and outer grids are black-boxed by users of those technologies that make for a calculable world, their technical control is attended by more or less schematic representations of how this control is exercised.

In contrast, the hallmark of technology naturalized is not that its use has become routinized, habitual, or "natural" in the sense of normal. Indeed, it is unclear to what extent we can be "users" of it at all. The hallmark of technology naturalized is that it acts below or above the thresholds of perception and control, that we cannot represent its agency as it occurs, that we have no switches to initiate or stop operation, no direct knowledge of whether it is functioning or broken down. As opposed to the case of the streetcar, reading up on genetic engineering does not help.

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[5] In the following, I will focus on technological agency below the threshold of perception. At the end of this chapter, I also consider engineering approaches below the threshold of control. (From the perspective of the user, the two notions are closely associated, of course, in that we cannot control what we cannot perceive.)

Table 1 Four characterizations of "Naturalized Technology"

Qualitative definition:	possibly unbounded technical agency below or above the thresholds of perception and control;
Formal criterion:	when you black-box it, there is nothing left;
Philosophical definition:	noumenal rather than phenomenal, technical agency is not subject of experience;
Exemplars:	smart environments, nanoscale devices, genetically modified foods.[6]

As we come to better understand and even admire the capabilities of a broadly enabling technology, the world becomes not more but less transparent to the individual consumer and it proves harder to maintain a sense of ownership, empowerment, responsibility, and control. When we black-box the workings of a macroscopically embedded device like a radio, what remains are a few buttons, dials, or displays and, of course, the sound that is received. We maintain a representation of a schematic causal relation between an input and an output. But when we black-box the working of a genetic modification or of automatic climate-control in a building, what remains is nothing at all but the technically altered environment itself that is indistinguishable in its mere givenness to a natural environment. Indeed, this might serve as formal criterion for what are here called naturalized technologies: when you black-box it, there is nothing left.

These four characterizations of "naturalized technology" require further clarification, first of all regarding the relation between "qualitative definition" and "formal criterion." The qualitative definition places emphasis on the notion of technical agency, in other words, on the idea that something is working, effecting things, producing technical change above or below the thresholds of human perception and control. Accordingly, the formal criterion should be understood as saying "when you black-box it, there is nothing left of that technical agency or of an input-output causality." This is important to point out because one would otherwise ask whether on this definition pasteurized milk or fluoridized water are nature technologized or technology naturalized. After all, when we black-box pasteurization, we are left with nothing but a glass of milk without seeing in it anymore the technical artifact as distinct from what the cow produced. However, these examples actually help underscore the difference in question. Pasteurized milk and fluoridized water result from technical control that is applied to nature to master it and render it more calculable, in that sense they are nature technologized. I can count on the milk that is pasteurized, and if I envision the technical process of pasteurization at all, I assume that it concluded with the alteration of the milk. While the milk I drink is technically manipulated, I do not imagine that the process of pasteurization has not yet concluded and that my body

[6] The case of genetically modified foods shows that what counts as an exemplar depends on whether or not one regards a technology as meeting the qualitative definition (see below). For example, some consider cell-phone broadcasts or fluoridized water as naturalized technology. The release of chemically engineered substances is only vaguely associated with ongoing technical agency. The effect of pharmaceuticals is usually considered to be restricted to one's own body – and so are our worries about its agency.