analysis in engineering ethics. Socio-technical systems are by definition value-laden systems and designing such systems is, by definition, a value-laden activity. Value-sensitive-design would explore the consequences of this recognition for engineers. It takes as its starting point the idea that it is possible to pro-actively design social and moral values into technological hardware, for example, designing communication devices so that they safeguard the value of privacy. Such ideas may be familiar in architectural practice but they are relatively new in many engineering domains. One ironic example is the design of household heating appliances in Sweden documented by the social anthropologist Annette Henning. In order to realize the national goal of using more renewable resources for home heating *in lieu* of imported oil, the Swedish government collaborated with industry engineers to design bio-pellet burning stoves and furnaces. Much to the disappointment of all parties, however, this campaign for technological change proved to be unsuccessful because the appliances proved inconsistent with cultural "perceptions of house and home, of private and public space, and male and female space." In response to Henning's findings, the editors of the volume in which this study appears note that "Knowing how to design a heating system that will work mechanically is quite different from knowing how to design a system that users perceive as responsive to their domestic practices and values."[16]

A third new approach for engineering ethics could be derived from recent developments in architectural practice itself. Earlier we briefly discussed the need for the justification of whistleblowers in engineering to unmask design practices that, in the name of efficiency, may ultimately prove to be harmful to citizens or the environment. In this context we can understand a whistleblower as a member of a system but also a citizen of the society served. Part of the recognition of the whistleblower is that citizenship demands a higher order of loyalty than membership of a government agency or firm.

In the world of architecture some have likened Prince Charles to a kind of whistleblower at least in the sense that his activism in the preservation of historic architecture and urban patterns answers to a larger sense of responsibility to the public. But, as the Prince of Wales, Charles is both more than a citizen and less than a participant. He is a privileged observer of the system from the outside. The phenomenon of the "citizen-architect" may, then, provide a better exemplar for engineering practice. In Germany, Peter Hubner; in England, Rodney Hatch; and in the United States, the late Samuel Mockbee (of the Rural Studio), Sergio Palleroni (of the BaSiC Initiative), and Brian Bell (of Design Corps) are such citizen-architects who are engaged in what they call "community design." These design practitioners argue that their authority to design public facilities derives not from their status as licensed professionals but from the local communities in which they build. Rather than resent the eclipse of artistic autonomy that accompanies community design, these designers tend to see expressions of local values as the source of creativity, not its suppression. Design, in their view, is an inclusive social process in which

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[16] See Henning (2005).

people decide how they want to live – it is not an autonomous process in which experts define problems and hand down answers from above. These practitioners are not simply populist order-takers committed to turning technocratic hierarchies upside down. Rather, they are highly skilled architects who hold that design excellence depends upon the creative synergy between the abstract knowledge of the expert and the local knowledge of the user. At its best, value-sensitive-design is not simply the accommodation of local values in the designers' vision of the future, but a transactional process in which designers and citizens depend upon each others' knowledge in the production of a better world.

In sum we believe that design practices in general will improve in proportion to the degree we can distinguish between *efficient* and *successful* technological systems. For any system to succeed it must be sustained – which is to say continually renovated over time – by the citizens whom the system serves and who in turn serve it.

4   The Essays

The ordering of essays in this volume is chosen to reflect the integrated understanding of engineering and architecture as we have characterized it here. The first part contains nine essays on engineering designing in the traditional "nuts-and-bolts" sense. These essays are authored by philosophers of technology and together provide an overview of current philosophical analyses of technology aimed at establishing that engineering is more than an activity only concerned with composing material products. Having been written within different philosophical traditions and with different aims, all nine essays relate engineering design and its products to ethical, political, and societal issues. The section opens with four essays by Maarten Franssen, Wybo Houkes, Don Ihde, and Philip Brey. These essays have in common a focus on the relationship between the products of designing and the intentions of their designers, their direct users, and the communities of consumers that determine their continued existence. The positions argued for diverge, sometimes radically, concerning the influence that the original intentions of designers can have on the characteristics of the products. Yet, regardless of these differences and regardless of whether the focus is on individual products and design process, or on more collective historical developments in technology, a recurrent theme is that for understanding design and its products, a wider focus is needed than one that is limited to the products themselves.

These essays are followed by chapters from Anke Van Gorp and Ibo Van de Poel, Peter-Paul Verbeek, Patrick Feng and Andrew Feenberg, Kiyotaka Naoe, and Paul B. Thompson. All of these essays enrich the analyses of engineering design with more explicit normative perspectives. The focus in these essays ranges again over a wide spectrum, from ethical decisions taken in individual design process, to the way engineering can alter society by changing the economic characteristics of various goods. These essays make clear the position of many, if not most, philosophers of technology that engineering, like architecture, shapes our lives and our societies – a conclusion that becomes unavoidable when new forms of engineering are considered.