Smart Infrastructure and Technology Systems Ethics

SMART infrastructure and systems are being rolled out without commensurate technology impact assessments and stakeholder consultations. Consequentially, the benefits of innovation are potentially being concentrated to only a privileged parcel of the population and, whether unintended or not, this may create systems of oppression against minorities. The value of inclusive approaches to systems development is not new, and the benefits of user-centered, participatory, and co-design processes have been widely documented. However, the dominant model of systems design remains in support of processes that engineers and technologists largely lead. We have also witnessed a reverse engineering process taking place, a hacking of the populace as a *living lab* to fit the technology we conceive of in our social imaginaries informed by diverse experiences. At times it feels like one giant experiment in the hope of a better future by pursuing technologies and technological progression because the capability and resources exist, and we can innovate "at speed." This speed of progression can often inhibit collaborative and participatory processes, resulting in (un-)anticipated collateral damage.

During the COVID-19 pandemic, the concepts of citizen-centric approaches, societal engagement, user-centered design, and well-being have emerged as major considerations [1], [2]. Well-being, in particular, has become a "thing" [3]. Propelled on by the digitization of *every*-"thing," it has been declared, quite often with unrestricted excitement, that we are undergoing a digital transformation. We now find ourselves in a cyber-physical conundrum, the utter mismatch between pervasive digital systems that act indiscriminately to human pulsations and the analog human who just cannot keep up with the vectors of digital overload. At the very heart of the problem is an attempt to fuse two separate systems—one is social and the other is technological—without adequate knowledge of the complexities associated with discrepancies in data input/output types and environmental variables that define to some degree and influence the interactions between the social and technical [4]. The environmental considerations serve to bridge the gap between the socio-technical dimensions when these subsystems are considered together providing rules of engagement and significant contextual information required for communication, which could be advantageous to humans and machines alike. And here we are, not speaking of shiny gadgetry. But deep system process changes that will help us grow and move together in the direction of collective awareness and action [5].

What we have discovered is that not only are interdependencies crucial but all stakeholders should have a seat at the table to engage in dialogue concerning their role in the evolving and dynamic socio-technical ecosystem that is emerging. The inclusion of customers and citizenry in large scale public interest technology deployments is especially crucial [6], [7]. The keyword to remember here is "human"; existing within the social realm. Ethics takes on meaning when we acknowledge that living things are not merely "subjects" to borrow from the words of philosopher Eldred [8]; humans are people, and they have feelings, and no matter how much we try to imbue emotions in pieces of metal, "machines" do not feel in the same way. Each human has their own unique personal trajectory and hopes, each belongs to one or more communities, and each is an invaluable member of society at large.

Among the most complex scenarios is the packing of different kinds of physical sensors scattered in infrastructure in the environment and embedded in items that people carry (luggables) [9]. Here, we can point to smart city paradigms that rollout smart cameras in the name of care and safety of the populace that end up as surveillance mechanisms discriminating against, for example, indigenous populations; in the rollout of smart lampposts that can watch, listen, and frame people in cities during major protests, identifying dissidents as threats to national security; in the tracking of vehicles and their drivers to ensure convenient end-to-end traceability in the supply chain [10]. In all of these cases, the underlying dimension is control. Michael called it uberveillance [11], and a decade later, Zuboff dubbed the process as surveillance capitalism [12]. Irrespective of the name, we are living at the moment in history where we can actively slow this process down, refute it, and or work toward alternate futures. Beyond the dimension of control, there are implications for privacy, security, and trust that also need to be considered [13].

In this special issue, we investigate smart infrastructure and technology systems ethics. The special begins with a two page research statement on technological capabilities by Lindsay Robertson of New Zealand. The next paper is by Caitlin Grady, Sarah Rajtmajer, and Lauren Dennis of Penn State University, titled: "When Smart Systems Fail: The Ethics of Cyber-Physical Critical Infrastructure Risk." Following a case-based paper on the City of Seattle by a citizen, Cynthia Spiess, titled: "Is That Traffic Light Tracking You?" Ning Wang of the University of Zurich then reminds us of the humanitarian perspective in her expert analysis of the use of drones for delivery in Malawi and responsibility in Africa. The paper by Daniel Schiff, Jason Borenstein, and Justin Biddle of the Georgia Institute of Technology, together with Kelly Laas of the Illinois Institute of Technology, then presents us with a study of findings on "AI Ethics in the Public, Private, and NGO Sectors," the first systematic global analysis of its kind. Finally, an article, "Measuring DAO Autonomy: Lessons From Other Autonomous Systems" addresses decentralized autonomous organizations (DAO). The author, Steven Wright of the College of Law at Georgia State University, notes that the societal impact from the operationalization of these technologies can be significant in terms of safety,

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Fig. 1. Smart infrastructure and technology systems in urban centers: where the cyber-physical meets the socio-technical.

security, privacy, and the consequences of failures. Indeed, the whole special is dedicated to our human responsibility with respect to technological innovations that are considered "smart" and progressive but have a very real potential to impact humanity in ways not yet understood or considered, though the early warning signs are ever-present today.

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