On Being Specific About Internet of Things Users and Non-users

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Abstract

The internet of things is engendering new socio-technical arrangements and forms of interfacing with digital technology. On the one hand, more non-corporate actors and nonexperts are entering the spheres of development, design and implementation with the creation of IoT innovation ecosystems and citizen science initiatives. On the other, the IoT flags the need to account for non-users, incidental users and unaware subjects who may be indirectly captured in smart devices' field of data collection. Drawing insights from the critical scholarship on users, this paper argues that IoT research and practice must begin to problematise the invocation of users as a trivial and universal category and develop new frameworks to grapple with the emerging actor ecologies in the IoT.

Keywords

users, non-users, human-centred design, data-driven innovation, Internet of Things, innovation ecosystems

1. Introduction

The term "users" is omnipresent in the vernacular of information and communication technologies (ICT) researchers and practitioners and generically denotes those actors who are at the receiving end of technology. A great deal of work within computer science, engineering and HCI revolves around users, and this is reflected prominently in academic publications and conferences including the present workshop. ICT researchers, practitioners and companies frequently insist on the centricity of users and humans in design and development. In practice, this translates in efforts to gather meaningful insights about (intended) users to drive technology adoption, for example through user research, usability studies, user experience, use cases, interaction design, end-user development, etc. But limited attention has been given to the changing responsibilities and circumstances of said users and to those who might be left out or marginalized from the systems being designed.

The user is often invoked as a universal catch-all category –a stand in for *people out there*—which glosses over the multiple identities and relationships with technology which extend beyond simply "use". This appears to be particularly crucial in the context of the Internet of Things (IoT). While users have been historically known to shape technology in unexpected ways, the flexibility, scope and scale afforded by IoT technologies are engendering new socio-technical arrangements which call for more nuanced recognition of users' diverse roles and identities. Two such arrangements are salient in this discussion. First, the lowering costs of hardware and sensors, open communication standards, modular technology architectures, and opensource software tools are enabling different forms of organizing innovation where non-corporate actors (including users) are taking a more active role in shaping IoT applications and infrastructures in various capacities. On the other extreme, the growing ubiquity of IoT devices and the opacity of data flows are problematizing the conventional notion of the informed end-user. This inevitably raises questions about consent, privacy and the role of individuals who would hardly qualify as direct users but are nonetheless implicated (sometimes unwittingly) in pervasive data collection infrastructures. How can research and practice meaningfully attend to the plural identities

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and expanding roles of users as well as to those incidentally impacted by IoT systems including non-users, passers-by or bystanders?

2. Tracing user involvement in innovation

To grapple with these questions, it is helpful to trace how users have become central in debates about technological innovation. The idea that users can be more than simply recipients or consumers of technology is not new and has been a focal theme within different academic communities [14]. In the 1970s, 80s and 90s, management science and innovation studies in the US advanced prominent theories of user-driven innovation based on evidence from users making unexpected improvements in hardware and software products [1,10–13]. These studies aimed to be of use for developers and managers who sought to capture the value of users' ingenuity through design, organisational and strategic interventions in the innovation pipeline. Collaborative approaches to software and hardware development such as open source and end-user development have now become largely mainstreamed in corporate spheres and are reflective of the increasing deliberate efforts to involve users (at different levels of technical expertise) in ICT innovation.

Contemporaneously with innovation studies, the view of innovation as a collaborative endeavour involving users was also approached by academics in the then-young field of participatory design who, in turn, advanced an interventionist and politically driven agenda to include workers and citizens in technology design and development. The democratizing thrust behind participatory design resonates with today's civic technology movements, community networks and other efforts to improve access to technical tools and knowledge [2,16].

From a critical stance, scholars in the field of science and technology studies (STS) have also held a lasting interest with users. Feminist STS scholars turned to studying the user in the 1980s and 90s as part of their critique of the dominant discourses of corporate innovation and the underrepresentation of women in technology development [4,24,25]. Foregrounding users was a way to demonstrate how technology could be inscribed with the biases of designers (mostly middle-class white men) and thereby reproduce gender stereotypes and inequalities [19,26].

The critical program of STS has advanced a rich theorisation of user-technology relationships by examining the "downstream" of technology development. STS have convincingly argued that innovation, far from being a linear unidirectional process, is shaped by various actors throughout the life cycle of technology not only in development, but during implementation and use [17,19,28]. It is also within this strand of research that "non-users" of technology began to be taken more seriously, not merely as unattended portions of the market, but as important implicated actors for understanding resistance, rejection, indifference, marginalization and other (non-)relations with technology [29,30].

The field of Human-Computer Interaction –a heavily user-oriented field—has over the years engaged more closely with concepts and methods from STS, feminist scholarship and participatory design [14,15,22]. And while the focus on contexts of use and user interfacing still drives most of the research within HCI, there has been some recognition of other forms of relating to information technology including non-use [9,21].

3. The need for new frameworks around users

It is becoming increasingly important for researchers and practitioners to engage with the evolving relationships with technology in an era of ubiquitous data-driven technologies. Contrary to the common-sense assumption that everyone is a user, a closer look at the proliferation of smart systems and devices shows a much more complex picture. Consider, for example, the emergence of IoT innovation ecosystems and civic (citizen science) initiatives based on crowdsourcing and co-design where users' scope of action is being deliberately blurred with the spheres of prototyping, development, provisioning, maintenance, and operation of IoT infrastructure and applications [5]. Or the mass rollout of smart meters in Europe which laid bare the fact that householders coming into contact with IoT systems might not do so as their primary users (energy suppliers are also users), but as necessary data subjects with very limited control over such systems [23]. And perhaps most strikingly, smart home devices such as smart speakers, sensors and cameras, albeit designed with direct users in mind, are also

incidentally (and covertly) capturing data about others usually without their consent [27]. Concerns over the privacy and safety of unintended "users", passers-by and bystanders who may or not be the ultimate beneficiaries of the IoT products are now growing with the anticipated wave of augmented and extended reality devices which could significantly extend the already vast infrastructures of mass surveillance [18].

4. Conclusion

This position paper aims to be programmatic as it invites readers to develop more nuanced understanding of the emerging complex relations with technology and data when articulating problem statements, methodologies and gaps. There is a pressing need for more precise descriptions and new conceptual frameworks to engage with the actors implicated in IoT and data-driven innovation at large. This need falls in line with any agenda to empower people and speaks to the myriad ethical concerns over harms enabled and aggravated by data-driven innovation, for example in relation to mass surveillance, (in)security, discrimination, unfair value capture and "data divides" [3,7,8,20]. Specific populations may (intentionally or not) be excluded from the purported benefits of IoT— or even disproportionally exposed to certain harms —owing to algorithmic biases, accessibility constraints, information asymmetries, or lack of representation [3,6]. As a result of mounting ethical concerns, technology developers are under more pressure to consider the potential future harms of their creations beyond questions of adoption or usability. Researchers and developers in computer science, engineering HCI need to engage more closely with the rich critical scholarship in the social sciences if they are to meaningfully attend to the contemporary issues faced by a diversity of incidental, intended and advanced users alike.

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