Calling for a Revolution: An Analysis of IoT manifestos

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ABSTRACT

Designers and developers are increasingly writing manifestos to express frustration and uncertainty as they struggle to negotiate between the possibilities that IoT technologies offer, and the ethical concerns they engender. Manifestos are defining of a "moment of crisis" and their recent proliferation indicates a desire for change. We analyze the messages manifesto authors have for their readers. Emerging from a sense of uncertainty, these manifestos create publics for debate, demand attention and call for change. While manifestos provide potential roadmaps for a better future, they also express a deep concern and even fear of the state of the world and the role of technology in it. We highlight how practitioners are responding to unstable and rapidly changing times and detail what solutions they envision, and what conflicts these might bring about. Our analysis suggests new ways HCI might theorize and design for responsibility while attending to the perils of responsibilisation.

Author Keywords

Ethics; values; design; manifesto; IoT; openness; transparency; diversity; responsibility; control.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

INTRODUCTION

The Internet of Things (IoT) presents promising possibilities and significant challenges. Constituted by a wide range of artifacts equipped with networked sensors, actuators and embedded intelligence, IoT will develop into a network of scarcely fathomable connectivity and complexity, with great transformative potential for civil society, transport, energy, industry, healthcare and every other aspect of the world. This, at least, is the kind of rhetoric that has surrounded IoT for the last half a decade [3,7]. As the concept of "IoT Platform" peaks on the 2017 Gartner curve of inflated expectations [37] such rhetoric is likely to continue. This excitement will drive development and innovation activities of both larger companies and startups as venture capitalists pour money into projects ranging from connected hardware to self-driving cars. Yet forecasts for radical, technologically driven change swing between utopian and dystopian imaginaries, reflecting a growing sense of uncertainty about the future. Connecting to widespread anxiety about technological futures, Light et al. challenge designers to take responsibility for our collective futures, acknowledging their responsibility as its architects [21].

This study is part of a larger project about how ethics is enacted in practice by European IoT developers. In the course of our fieldwork we noticed a proliferation of technology related manifestos in Europe. These manifestos, written by designers and developers of IoT and connective technologies, consistently call for responsible and ethical technologies. If manifestos are, as Caws puts it, "defining a moment of crisis" and "invite us, loudly, to some new way of thinking" [6:xxix] this proliferation is clearly indicative of a need for change. It is as if technological modernism [29] focused on progress, rational planning and improvement through technology is frustrating those charged with changing the world in its inadequacy to address the looming crises. Lyon notes that "to write a manifesto is to participate symbolically in a history of struggle against dominant forces; it is to link one's voice to the countless voices of previous revolutionary conflicts" [24:4] and it is important to ask: what (potential) revolution is called for and underway? A manifesto, generally, is "an exhortation to a whole way of thinking and being rather than a simple command or a definition" [6:xxvii]. What ways of thinking and being underlie the commands of recent manifestos produced by designers and technologists? What are the authors of these manifestos trying to tell others and how?

Across the 28 manifestos in our analysis we encounter Weiser's '91 ubicomp vision in practice and the discomfort that ideals of ubiquity and invisibility bring about from the viewpoints of designers and developers involved in creating IoT and connective technologies. Our analysis demonstrates a diversity of values among practitioners involved in European IoT development mirrored through their critiques of status quo and the alternative visions they present. These manifestos resonate with calls in HCI for critical reflective design and attention paid to impacts, values and anxieties that technologies engender. Although the manifestos clearly express a reflexive moment, we discuss the difficulties of translating reflexivity into responsibility for action bringing about the change IoT developers call for.

CHI 2018, April 21–26, 2018, Montreal, QC, Canada

ACM 978-1-4503-5620-6/18/04…$15.00
https://doi.org/10.1145/3173574.3173876

VALUES AND FUTURES

Digital technology has frequently motivated claims made through declarations, manifestos and other such documents. Calls to take responsibility in the design of common futures have been part of a consistent critique in the "debates (and political struggles) over the conventions and governance of the Internet" as Isin and Ruppert put it [17]. As disparate stakeholders battled for and against each other's future imaginaries of the Internet and emergent network technologies they consistently made and performed digital rights claims [17]. The Internet Governance Forum has convened a Dynamic Coalition in 2009, which identified a set of core internet values: end-to-end access, open standards, universal access and freedom of expression [31]. This declaration of values, like others before it (e.g. the Declaration of Internet Freedom [31]), demands commitment from involved stakeholders to uphold these values. As Isin and Ruppert detail, such declarations speak to an unnamed "we" of stakeholders but in the declaring create particular publics that are willing and able to perform these values [17].

Discussions about disparately defined and designed futures are present in HCI as well and many scholars question the values, ethics and the responsibilities of care embedded in our technologies [4,15,18,20]. As the effects of rapid technological change are felt, scholars increasingly engage with theoretical concepts and tools from a variety of disciplines, exploring the capacity to integrate critical points of view into design as part of both research and practice [9,10,14,22]. Part of this effort has focused on the development of applications of theoretical concepts by distilling principles [30], frameworks [15] and methodologies [5] with the aim of having a direct impact on practice. These tools, such as the principles of reflective design developed by Sengers et al. [30] or value sensitive design developed by Friedman and colleagues [15] call for reflection, reinterpretation and attention to stakeholders and their needs and values among others. Over time, these efforts have indeed had impact on practitioners while they struggle with many pressures and demands as the services and objects they design become ever more broadly consequential [36].

The creation of technology design manifestos shifts both the tone of address and content of the challenge facing practitioners and enables us, as scholars, to see the impact our work has made and the work that is still to be done. What is driving the current proliferation of claims among practitioners working with IoT? What values are claimed, what rights are demanded and who is responsible?

WHAT IS A MANIFESTO?

The manifesto as we know it today is a "fundamentally transdisciplinary device" [26]. Despite its primary presence and function in politics and the arts this genre has been extensively discussed and explored across many disparate fields [6,17,23,24,28,33,35]. The original function of a "manifesto" was as a piece of evidence for demonstration in a court of law, a record of past actions and of motives for future actions by the head of state, a sovereign or an individual of particular public importance. From the beginning a manifesto was less a collection of facts and more a framing or a manipulation of the way the public might view the proceedings. The role of manifestos in the public sphere and their influence has been largely overlooked due to the challenges of clearly classifying the genre [24]. Each manifesto is context dependent, composed under historical and geographical specificities, differing both from other kinds of documents, and from other manifestos [6,24,33].

Nonetheless, as Lyon notes, the manifesto genre in its current form has been an historical "force" in the West [24:10]. Though it may be best known as a "no-nonsense genre of plain speech shooting from the hip", "it is in fact complex, ideologically inflected and has much to teach us about the problems of modernity" [24:2-3]. In Lyon's analysis, a manifesto works rhetorically, including and excluding audiences through hierarchical moves. Not everyone is included in its promises of transformation. The moral high ground, designed to resonate with the intended audience, is reserved for idealists, while others are negatively constructed as "fools" or worse, the hegemonically oppressive forces against which the manifesto sets itself [24].

This attention to manifesto tone, style and design is echoed in Caws's introduction to her edited volume "Manifesto". She identifies a series of features of manifestos across topics: it is a "loud genre" that aims to persuade, to convert the reader [6:xx]. In its demands for attention it uses capital letters, largeness, an oppositional tone and clear positioning [6]. The publication of a manifesto marks and defines a moment of crisis: "LOOK! It says. NOW! HERE!" [6:xx]. Lyon and Caws agree that in their descriptions of a present crisis, manifestos point to the need for action, calling upon readers to take their direction for acts in a revolutionary future: "the old must be pulled down before the unimaginable new can take shape" [24:27]. In what follows, we consider why such a persuasive, transformational style of communication has been chosen by designers and developers to engage with contemporary rhetoric about IoT. What concerns motivate the desire to halt or change the technological development and progress promised by IoT's visions of the future? First we outline the empirical sources that inform our discussion, and introduce our methodology.

EMPIRICAL SOURCES AND METHODOLOGY

A manifesto is not a standardisable document. Indeed, the literature on manifestos sees it as an alternative genre, something that can always be redefined and makes its own definition each time. The manifesto mirrors the personality of the author, single or collective, and can take on as many styles as there are writers and speakers. Caws notes that a case can be made for the "poem-manifesto" or the "essay-manifesto" [6], as long as it catches our attention.

We used two literary sources on manifestos as a basis for developing our methodological and analytical strategy. Caws's [6] take on the rhetorical features of a manifesto

helped us identify what kind of document a manifesto is. Lyon's [24] theoretical engagement with manifestos has offered us analytical tools for attending critically and contextually to the role these documents play in modernity. Based on these works we developed a set of criteria for inclusion based on our review of manifesto literature. All documents in our analysis present the following central manifesto features, although few incorporate all of them: a self-declared manifesto; a document developed as part of an advocacy effort; a document which identifies a crisis and forcefully calls for change; a voice of authority directing those who would act; a bullet point list or framework of directions that claims to improve the practice of design and development and to result in "good" or "responsible" IoT.

Using an approach similar to that of Isin and Ruppert [17], we built our document repository, using an iterative online and offline search process, incorporating the query into early interviews, collecting documents in the course of ethnographic fieldwork with IoT developers and designers and searching online. We also produced an online form inviting submission of manifestos, standards, guidelines and best practices that developers and designers use in their practice of working with IoT. We identified and collected 28 documents, which were published between 2010-2017 and originated in Europe. Among the documents, 24 address IoT directly and four address technological development more broadly. Of all documents included in our (con)textual analysis only 7 explicitly declare themselves to be a manifesto. However, under the umbrella of manifestos we have included texts that, while not self-declared manifestos, embody their main features. Five of these documents were sent to us via the online form (see bibliography for the documents included).

We chose to include a collection of essays – the ThingsCon RIOT report – in our corpus, even though the texts do not stand completely alone. The RIOT report clearly carries other manifesto features, such as declaring a response to a moment of crisis. The publication of RIOT was an action taken by 15 IoT developers, designers, thinkers and advocates, in response to a perceived moment of crisis. As the authors declare in their introduction: '*It's a critical time in the development of the Internet of Things (IoT)*' (RIOT). The essays contained within the report also clearly embody central manifesto features such as critically defining the current state of IoT development in a loud tone of urgency and pointing towards future actions. Another unusual item included in our analysis is produced by Dowse as it is both software and a written statement.

The resulting corpus is diverse, and we do not want to imply that we can treat it as homogeneous. Indeed, what becomes interesting is how they diverge, articulate the same problem in different terms, or produce contrasting recommendations for normative action. Through close qualitative reading and coding, we identify different themes running through the major part of the documents. All quotes are taken directly from the documents using for attribution short-codes that are elaborated in the bibliography.

Coding and analysis

This study is part of an ethnographic investigation with IoT designers and developers in Europe. We use this background to underpin our form of discourse analysis. As leading discourse theorist Fairclough notes, what is socially at stake can be explored through what is going on interdiscursively in a text [12,13]. In our first round of coding, we manually coded all documents using ethnographic open coding techniques [11], reading each manifesto line-by-line, noting recurring terms, topics, concerns, crises, reasons and suggestions for change. From these, we built a thematic table. Using the identified themes, a second round of coding noted common terms that were used without agreement on meaning (e.g. "open"). A third round read for themes that were present but not terminologically identified (e.g. addressing issues of control without using the word control).

In the spirit of "unraveling the assumptions behind, and implicit endorsements in, the writing" [33] we kept several considerations in mind. First, as manifestos are thought of as a battlefield [6], they are written in opposition to something or someone. We noted the criticisms the authors made, and how they allocated *responsibility* and *action* in the texts. Second, manifestos, as speech acts, bring claims into being [17]. We noted how authors made their demands actionable (or did not) and who needed to act. Third, manifestos are generally written in a spirit of a one-time only moment [6]. If the present is being described as a crossroads, then what makes it unique? Fourth, given the response to crisis nature of manifestos, we paid attention to temporal or atmospheric markers and terms such as "a critical time", "radical paradigm shift" etc. Finally, we were inductively open to emergent themes. When manifestos stand alone, a great deal of *certainty* and assertiveness is expressed – they call clearly for change. Yet reading them as a corpus shows that commonly articulated *uncertainties* underlie the manifestos. These documents draw our attention to a general feeling of an impending apocalypse – exacerbated by IoT – a negative picture that becomes the grounds from which to express change for a better future.

WHAT IS THIS ERA OF IOT?

'[*W*]*e're now comfortably in a new technological era* […]. *This is the era of the IoT*" (Robbins, RIOT). The claims made in many of the manifestos suggest that we are in the midst of an epochal shift where IoT technologies increasingly pervade our lives. We find descriptions such as '*the emerging age of IoT*' (TOPP), '*the realm of IoT*' (Robbins, RIOT), '*the IoT arena*' (Scagnetti, RIOT), '*a very hyped 'technological revolution'*' (de Roeck, RIOT) or '*a radical paradigm shift*' (Krajewski, RIOT). If manifestos mark and define historical moments, paradigm shifts and revolutions – indicated through concepts like era, age, realm or a radical paradigm shift – and if they are moved by a moment of crisis it is important to ask: what does this '*era of IoT*' look

like? What ongoing and potential crises pervade the time we live in? The following excerpt draws a picture of the current state of IoT through a collage of concerns that appear in many manifestos:

> 'Reading the news these days, it's easy to believe that we're living in a bad science fiction novel: government agencies openly admit they are using IoT to conduct surveillance at unprecedented levels; a botnet took over webcams and connected devices around the globe and temporarily brought down major websites; irresponsible businesses are leaking their customers' private data and treating digital security as an externality. All of this is happening against the backdrop of rising far-right nationalism, ongoing wars, and climate change.' (Thorne, RIOT).

This quote draws IoT together with dark threats creating an apocalyptic narrative, suffusing anxiety about far-right nationalism, ongoing wars and climate change, with a vision of IoT characterized by surveillance, bots with agentive capacities and leaking data. That Thorne aligns these makes clear the scale of the problems. In his RIOT essay Appiah offers an estimate that by 2020 there might be four IoT devices per human being on this planet. '*Riding along with this growth, the amount of IoT devices compromised by cybercriminal elements is also expected to intensify'* (Uribe). In their manifesto The Things Network futuristically state: '*Everything that carries power will be connected to the Internet eventually.*' Similarly, Arduino expresses concerns about the implications of present and future pervasive connectivity: '*The more connected products become, the more the opportunity for data collection, control and surveillance.*' The Mozilla Open IoT Studio imagines how '*IoT will significantly amplify the security and privacy challenges we currently face.* [...] *IoT also collects more and different data than previous eras of the Internet.*' This sense of the impending is perhaps best summarized by Villum in his RIOT essay: '*New technologies are being developed at a pace which even the most native of digital natives find it hard to follow,*' adding how the future is '*super-digital*, *and we cannot even begin to imagine what our lives will be like in 15 or 20 years, for better or worse.*'

Although futuristic reflections pervade the manifestos we examined, many also point to the past, highlighting a close relation between IoT technologies and the visions of ubicomp dating back to Weiser's original 1991 article. In his RIOT essay de Roeck refers directly to Weiser's introduction of ubicomp as a cornerstone for internet-connected products with a vision of computers disappearing into the background [34]. In another RIOT essay Kranenburg describes his first encounter with ubicomp at a conference named '*Building tomorrow today*' in 1999:

> 'I hear words that are new to me, and take notes: Ambient intelligence, ubicomp, pervasive computing, calm computing... […] When the computer disappears the environment becomes the interface. It took me two years to get it […]. About two decades later the vision the conference guy outlined is reality. It's called Internet of Things. It is about optimization, efficiency and use. And I am part of it.' (Kranenburg, RIOT)

Kranenburg connects the realization of ubicomp's vision directly to IoT. Weiser's 1991 article is a compelling vision of the future measured against the project of realizing it. A quarter century after Weiser originally formulated his vision ubicomp has indeed arrived. The future, though, may not have worked out as imagined as Bell and Dourish observe: "The ubicomp world was meant to be clean and orderly; it turns out instead to be a messy one" [1:10]. There is a renewed interest in ubiquitous computing as IoT becomes more widespread and there are different narratives of process and progress [19]. The original notions of ubiquity are persistent: '*It is clear that few years from now and due to the rapid growth of technology, IoT devices will become a ubiquitous part of our lives*' (Uribe). Yet the authors of manifestos seem worried about what ubiquity means now that it is here and connect it to many concerns.

The messiness of ubicomp is implicated in the broken promises that often drive manifestos [24]. Manifestos raise a critique of the dominant ideal of progress characterizing modernity [24]. Ubiquity is clearly one ideal. In our analysis, we identify the concerns that manifesto authors share including worries about *Ubiquity* and *Invisibility.* We then pay attention to how ideals of *Openness* and *Sustainability* are interrogated, while noticing issues of privacy and control arising in relation to each. These threads merge under the subheading of *Responsibility*, where, having identified key areas to address, manifesto authors begin to nominate normative pathways for specific actors to make changes. Below we begin with a discussion of expressed concerns about hype as a clouding of judgment and the reason for the need for manifestos. We then explore each theme as a problem and consider the solutions the manifestos propose.

Mind the Hype

Across the documents hype emerged as responsible for IoT proliferation and its problems, as IoT for years: '*has steadily climbed up the hype cycle*' (TOPP). Dowse notes that this development requires attention: '*The IoT* […] *hype loves to generate buzz about things that* […] *connect to the internet and talk to other things. This buzz requires attention.*'As companies have developed serious interest in IoT over the past 5 years they have pushed IoT towards '*a very hyped 'technological revolution*'. *Hence it should come as no surprise that IoT startups are sprouting like mushrooms throughout incubators worldwide*' (de Roeck, RIOT).

We interpret hype here akin to a clouding of judgment responsible for the attention paid and space used for argument about hype in the manifestos. Hype precludes the reflection necessary for the development of the kind of technologies that might bring about a better future. This is the reason why the IoT Design Manifesto argues that the IoT hype requires not just attention, but also skepticism:

'*We don't believe the hype. We pledge to be skeptical of the cult of the new*.' Skepticism here is reminiscent of Sengers et al. principles of reflective design [30] and hype precludes the time necessary for reflection to uncover limitations and problems. Hype then is in part a reason for the creation of manifestos. The solution seems to be to "get beyond the hype" as the IoT Design Manifesto advocates, to reengage skepticism and to take the time to think more deeply. What is it that developers claim they need space to think more deeply about in the development of IoT?

Ubiquity

Ubiquity is often seen as the basis of IoT: '*Sensors are added to all kind of products*' (Smit, RIOT). A number of manifestos critique this idea. The IoT Design Manifesto argues that: '*...just slapping the Internet onto a product isn't the answer*'. Krajewski (RIOT) describes '*that we are under the influence of a technology-optimistic image of our future*'. Even though we have reached a lot of defined technological visions, Krajewski writes: '*We obviously never reviewed our vision for the need to be updated*.' Keeping the original vision of ubicomp in mind, what updated technological values are respectively contested and called for in the manifestos?

In our corpus, two manifestos argue for some version of the vision laid out in ubicomp. The Apps for Smart Cities manifesto puts ubiquity as one of the seven elements alongside sensibility via sensors promoted in the design of Smart City applications. Ubiquity allows the user to: '*get access to the information thought web, but more importantly in mobile any time, any place*.' The Ethical Design manifesto promotes the disappearance of technology: '*Technology that respects human experience is beautiful, magical and delightful. It just works. It's intuitive. It's invisible*.'

The rest of the documents however, are more skeptical of ubiquity, especially where disappearance and invisibility are key. Their concerns range from surveillance, manipulation, algorithms, data, privacy, control, ethics and politics to name a few. Notably most of these concerns appear in manifestos coming from the field of design, such as the IoT Design Manifesto, TOPP and RIOT. TOPP treats ubiquity as a potentially manipulative design feature: '*manipulative design (using ubiquitous digital touch-points to slyly influence peoples' behaviour)*.' Scagnetti's RIOT essay connects ubiquity with surveillance: '*Surveillance systems are ubiquitous and more present than we think*,' referring to the Snowden revelations. According to Scagnetti one of the clear indicators that we currently live in a dystopian society is this '*invisible and ubiquitous surveillance infrastructure*.' This connection between ubiquity and invisibility is a central theme in many manifestos. Ubiquity then is made more problematic by invisibility.

The Problem of Invisibility in IoT

According to the Open IoT Studio, as IoT invades our environments with computing power: '*it will inevitably become more pervasive*.' This pervasiveness is problematic and made insidious through invisibility. TOPP notes that the manipulative potential of ubiquity is exacerbated because '*many IoT experiences will be invisible to people*.' Weiser's ideal of technology disappearing becomes something sinister and invasive. Hiding the complexity of technology and its seamfulness is problematic**:** '*Technologies are becoming more complex, but all are also hiding their complexity, making it a little less visible and relatable*' (Robbins, RIOT). This active concealment of complexity enables surreptitious and perhaps threatening communication and exchange with other parties. The IoT Design Manifesto highlights that an IoT product will always be part of '*a complex, ambiguous and invisible network*' and insists that parties associated with an IoT product are made explicit and visible: '*Our responsibility is to make the dynamics among those parties more visible and understandable to everyone*.' With its '*dizzying array*' of connected products and services IoT is hard to navigate, Bihr (RIOT) argues: '*Consumers have little insight into what any one connected product does, or what it even might be capable of — nor if the company employs good, responsible data practices*.'

Ubiquity and invisibility are contested as central values feeding into the development and life of IoT technologies by 13 of the documents. Here invisibility characterizes the complexity of technologies and the processes behind their creation and workings that are difficult to see through. The seeing through then becomes something to enable and transparency is brought up as a way to address these problems. A number of manifestos call for transparency relating to how technologies and algorithms work, what data is collected and how technologies impact our world.

Visioning Transparency

Consumer choice is an important aspect of thinking about IoT, but how is a consumer to make an informed decision? The European IoT community is debating this question as part of the grassroots "IoT trustmark" development [38]. Bihr (RIOT) claims that the problem of choice is exacerbated for the consumer as it: '*has to do with the way connected products inherently work, and with an overall lack of transparency*.' Bihr believes that transparency is essential and possible, suggesting two approaches to be adopted by creators or contributors of IoT devices. One is to design IoT services that are trustworthy and help users understand how they work. Another is to create the "IoT trustmark" that can help consumers make more informed decisions.

Scagnetti (RIOT) notes that a conversation about data and visibility lies at the core of IoT. TOPP expands on this concern pointing out that IoT technologies enter critical parts of life and gather extensive amounts of data and insights about their users, where bad handling of data can have consequences. TOPP underscores that the answer is not: '*offloading the control of that data to the users. Rather, it is about transparency*.' Designers should ask themselves: '*Is it clear when your product uses its sensors and how it processes its data*?'. Robbins (RIOT) shares the concern:

'*Not having transparency into how the technology is working, making decisions, literally moulding our perception of the world, is inherently political*.' Both TOPP and Robbins here touch upon the manipulative capacities of IoT technologies. Masking the workings and complexities of IoT: '*is fraught with ethical and political concerns*', Robbins notes.

Control and privacy in ubiquity, invisibility and transparency

Questions of ubiquity, invisibility and transparency in IoT mobilize questions of privacy and control. Scagnetti (RIOT) reflects on what a ubiquitous and invisible infrastructure entails: '*We are way beyond the Panopticon, of visibility as a source of power and control*.' Now expressions of power and control are about erasing traces of their operation. As IoT technologies embody ideals of ubiquity and invisibility they offer new possibilities. Living in a world where these technologies are ever present yet invisible to most people highlights issues of privacy, data collection, control and processing (TOPP). Curiously, one of the ways of addressing these problems appears to be a call for openness.

Openness

Six manifestos and a number of RIOT essays explicitly claim openness and Open Source as fundamental values. The RIOT collection promotes openness in the introduction: '*Keep it open! We believe there is an inherent value in openness, and in working in public*.' Openness appears as a way to democratize power and control that is necessary to push forward the needed change. Openness is a possible route to a better future but it is open to inspection.

The Things Network is an Open Source initiative and they believe that with the proliferation of connected things: '*Controlling the network that makes this possible means controlling the world*'. They argue that: '*this power should not be restricted to a few people, companies or nations. Instead this should be distributed over as many people as possible*'. Hence, they call for a distribution of power promoting how: '*Anyone shall be free to set up "Things" and connect to "Things Gateways" that may or may not be their own*'. The freedom is, however, somehow limited and very much anchored in following a particular vision. This is clearly expressed in how The Things Network describe "Over the Air" and "Over the Net" networks that: '*shall be protocol agnostic, as long as these protocols are not proprietary, open source and free of rights*'. In this way claims for freedom and restrictions go hand in hand.

Arduino similarly promotes open hardware, platforms and protocols: '*as an alternative to the myriad of proprietary hardware and software platforms each one of the big players are developing.*' They believe open source is better for innovation: '*By giving users the ability to share their work more openly, we share challenges, solve problems and build better connected products together.*' The Open IoT Studio celebrate openness as innovation and local crafts where people create meaningful things that will be shared openly. More importantly, open innovation is a matter of decentralizing power: '*Open innovation at the edges can shift centralised power.* […] *Through inclusive practices, we want to further challenge the centralisation of power and advocate for digital equity, ensuring that the Internet remains a global, public resource that is open and accessible to all*' (Open IoT).

In Ethical Design both open source, accessibility and decentralization are equally central topics: '*Technology that respects human rights is decentralized, peer-to-peer, zero-knowledge, end-to-end encrypted, free and open source, interoperable, accessible, and sustainable*'. Yet it is challenging to extract the exact take on decentralization and open source in this manifesto given its briefness and generic use of big concepts. Dowse, on the other hand, gives more explanation about what open source and accessibility means to them: '*Dowse talks. In open standards: MQTT, Websockets, Open Sound Control*.' Experts can look at how this is done and it is built to be used by everyone.

Control and privacy in openness

In documents that promote openness as a central value in IoT, control and privacy are explicit and important topics. There is an apparent contradiction between these values, but the authors of these documents thread the needle, expressing respect for individual autonomy even as they call for communal efforts to develop open hardware, software and standards. The idea of "access for all" does not preclude keeping secrets as long as these do not entail limiting access to the same technology to others.

Openness in these documents is positioned as a way to combat surveillance and to democratize control. Arduino argues that: '*The more connected products become, the more the opportunity for data collection, control and surveillance. Arduino believes you should have control of your own cloud service and control who access your data always*.' In a similar vein the Open IoT Studio call for privacy controls in IoT advocating that users must be able to control their digital lives, connected products and services while celebrating open innovation and sharing. Dowse also promotes openness and yet it is a software designed to give the user control, '*Dowse keeps your private network private,*' and an On-OFF button that is often missing in IoT allowing people to disconnect.

The ideal of openness carries an overwhelmingly positive connotation across our corpus of documents. It is connected with equality (access for all) and community: '*Community Owned Networks where you can see what's going on*' (Dowse). It is central to challenging dominant power structures and to democratizing control. While these documents argue forcefully for open hardware, open software and open standards, none promote the idea of open data perhaps in an effort to acknowledge the issues of privacy. Yet the paradox of openness is that it is never possible to include everyone. The rhetoric of openness, while positive, does not allow a discussion of exclusion even as its structures exclude those who disagree [25]. Light at al. argue that a "robust and inclusive community is always desirable" [21] yet commu-

nities are always bounded, articulating those who do and do not belong. In the same way, manifestos by their very purpose create particular audiences, excluding others.

Sustainability

At least half of the manifestos express concerns about sustainability in IoT returning us to the question of progress both in the manifestos and in HCI. Environmental sustainability is a major concern for HCI tied to technological interventions [10]. Within sustainable HCI technology design and development is implicated in an impulse to create change [16]. Much of this research has turned problems of environmental action into questions of personal moral choice, often focusing on behavior change as a route to altering individual consumption patterns [10]. An alternative path has focused on 'ecologies of practices' within design and HCI [8,27]. In the manifestos the latter approach to sustainability is more apparent. Just a few documents imagine how IoT could be used to change, augment or improve individual behavior (Krüger, RIOT; Smit, RIOT). We identify three main notions of sustainability in the manifestos: realigning lifetimes of the physical and the digital, obsolescence and locality.

Realigning lifetimes of the physical and the digital

'*Responsible technology needs to work tomorrow as well as today*' Doteveryone writes, arguing that all products and systems should offer: '*necessary updates for a reasonable period, and graceful degradation when necessary*.' Closely related to this claim TOPP highlights that lifecycles of physical objects are longer and do not match that of the software they are using. TOPP calls for designing for '*longevity'* in order to align digital and physical lifespans while the IoT Design Manifesto promises: '*We design things for their lifetime*.' The problems of realigning lifetimes of the physical and the digital and having the right to necessary updates feed into questions of obsolescence.

Obsolescence

Obsolescence is often interpreted broadly as it is attached to business tactics, the ability to repair, recycle and repurpose code as well as materials and design tactics to be employed. TOPP critically describe how the mismatch between lifespans of hardware and software has led toward a business tactic of creating demand for new devices with intentional obsolescence. Arduino shares this critique in their explicit call that IoT technologies should be: '*Sustainable – against disposable design of fast moving consumer electronic goods*.' When products stop getting updated they become unusable and: '*Forcing people to buy a new product every 6 months is not a sustainable solution*' (Arduino). Arduino believes that: '*designing a connected product should be done using design for disassembly, Cradle to Cradle, Open Design or any other methodology to make sure the product can be easily given a new life, upgraded or moved over to other cloud service providers*.' The possibility of giving products a new life is also central for Doteveryone. Overcoming obsolescence requires that hardware should be designed for reuse, repair, recycling, or energy use and: '*Reusing appropriately licensed code is also good practice!*'. Tool repair and repurposing is a solution to obsolescence for the Open IoT Studio: '*We can break horrendously short cradle-to-grave lifecycle that the digital technology industry has artificially generated*.' The Open IoT Studio claims that one answer is in decentralization and empowering communities to be more resilient and make locally relevant IoT. The focus on local solutions becomes a major way to combat obsolescence.

Locality

Similar to the Open IoT Studio, The Maker Movement Manifesto focuses on the importance of locality, but rather than putting an emphasis on the repair and repurposing of tools it urges to '*Tool up*': '*Invest in and develop local access to the tools you need to do the making you want to do*.' This is part of building a maker community, but also entails that not everyone invests in the same tools when these can be shared. In several manifestos locality deals with the contexts, interrelationships and processes that IoT technologies are inevitably part of. Some address the violation of local values when Smart City visions are rooted in Western lifestyles: '*Smart Cities offer generic technologies without really caring about their adaptation to a precise context*' (Flaws Kit). Others point to the importance of taking the systemic character of IoT into account (Krajewski, RIOT), and considering how every technology and implementation differ (Deschamps-Sonsino, RIOT). Some point out the need for a holistic view in order to acknowledge the interrelationships of IoT technologies (TCEM), noting how these include not only humans, but other life forms as well (Uribe).

Privacy and control in sustainability

Few manifestos outsource responsibility for sustainable choices to users, but point to a range of challenges within the IoT development processes they themselves take part in. Uribe opens the notion of control beyond the human as IoT technologies might harm other forms as life, such as animals suffering from heat exhaustion due to a security issue in a farm irrigation system. Together, concerns with lifetimes, obsolescence and locality reflect challenges we are facing in the Anthropocene [21] that relate to privacy and control on a planetary scale. How does an animal living with IoT claim control? How do environments claim privacy and control when actions tied to the development of IoT and beyond clearly impact and intervene in natural processes all over the world? The questions of sustainability in the manifestos tackle global warming and the role IoT technologies play in this scenario. Many implicitly raise critiques of current technological progress wilfully ignoring questions of longevity and obsolescence. An infinite desire for expansion and excursion of control also manifested in technological development is now challenging the future, ironically enough, potentially beyond (human) control.

Responsibility

> 'Making IoT and digital futures responsible is the biggest and most important design brief in the history

> of homo sapiens. Bigger than iPhone and the hover board combined. Bigger than the Trump business empire. […] We need to design the digital futures we want.' (Villum, RIOT).
>
> 'Now is the time in IoT not to ask what is *possible*, but what is *responsible*' (Open IoT).

Most manifesto authors see responsibility as a crucial area of reflection. In line with a manifesto's call for change, a call to responsibility is a call to action raised in relation to specific concerns. Foregrounded over technical possibilities, an emphasis on responsibility prompts a reflexive moment on the part of those being addressed in the manifestos. It is important to address not only the values that calls to responsibility reflect, but also to whom the pleas are directed. Trnka and Trundle note that calls to responsibility pervade contemporary life and often indicate a lack or an aspiration [32]. Instead of approaching responsibility as a universal mode of ethical engagement they underscore the importance of ethnographically analyzing situated enactments and understandings of responsibility. We consider the different understandings of responsibility that manifesto authors put forward asking how responsibility can be taken and who is being called upon to act. We discuss three thematic clusters: Understanding, Developers and Togetherness as we examine the subjects of *responsibilisation* and point to how responsibility becomes codified within practices, external measures, or formalized commitments.

Understanding

The understandability of IoT devices, of their design, data management and potential consequences of their use, is strongly associated with calls for greater responsibility. Across the manifestos the majority of statements are addressed to designers and creators of devices rather than to their users. The following quote from The Flaws of the Smart City Friction Kit allows us to see how the understanding of users, here referred to as "citizens", becomes something a developer may need to be responsible for: '*Smart City also fails at the necessary training of citizens to ethical stakes implied by tech in the city, preventing them from reclaiming control or assessing the smart infrastructure*.' This statement indicates that someone should take responsibility for facilitating, initiating or even driving '*necessary training*' of citizens so that ethical and political discussions can take place. Leaving aside the assumptions here – that citizens are ignorant – this argument mirrors the expansiveness of the opening RIOT quote above: if the implications of IoT and digital futures are seen as the '*most important design brief in the history of homo sapiens*,' the responsibilities associated are equally expansive.

The majority of the documents focus less on the need for citizens to be educated and more on the need for designers to make their products, processes or agreements understandable. As a responsibility, making understandable takes a range of forms especially focusing on clarity of language and explicitness of processes involved in using an IoT device. Doteveryone's take on understandability pushes heavily for clarity about how a product or service works. Considering the complexity surrounding IoT technologies Robbins (RIOT) states that: '*what we need to do is design a language that helps the layperson decipher this complexity*,' approaching language as a design challenge. The responsibility for conveying information about the device is turned into a design problem, one of condensing information that would make sense to consumers. Uribe calls for a classification system that gives '*current users of IoT devices the ability to see and understand the risks and find an effective way to implement security and privacy controls in their IoT environments*.' In these examples, making understandable is approached as a matter of transparency and translation. Slightly differently, Arduino promises '*to make technologies understandable to the most diverse set of people*' to '*make sure innovation benefits most of humanity*,' connecting understandability to diversity and inclusion.

What is interesting about making understandable is that in calling for responsibility on the part of developers, the design challenge of creating an understandable "language" or a "classification system" can become a way to *re-responsibilise* users of IoT devices: with the better designed information provided, it is then up to the users to find an effective way to shape their newly connected environment.

Designers and Developers

Shifting the emphasis from the relationship between designers and users we turn towards strategies oriented explicitly at designers and their activities, from calls for debate to attempts to develop common agreements about norms. Addressing the design community as a whole, with a broadly encompassing "we", the IoT Design Manifesto reaffirms the power of design as an impactful act and asserts that: '*we don't use this influence to only make profits* […]; *instead, it is our responsibility to use design to help people*.' Explicitly connecting awareness with design, Dowse's form of taking responsibility is to '*design for awareness*'. Villum (RIOT) argues that designers must: '*always think about people before we think about technology. That, dear friends, is and has always been design's biggest virtue*.' Krajewski (RIOT) argues that designers must deploy the speculative character of design to ensure a radical update of our vision for the future where: '*No designer should design an isolated IoT object, but rather the process it is embedded in*.' In a similarly future and ecology oriented vein, Doteveryone emphasize that while not all risks can be avoided, they should be anticipated: '*During both design and maintenance, systems effects, side effects and potential harms for different people, stakeholder groups or the wider environment should be considered*.'

While some individuals, communities and companies have a clear idea of what responsibility in the development of IoT technologies might look like, others are more interested in sparking dialogue about what responsibility itself means. TOPP argues that: '*Though it might be difficult to say what*

unknown consequences our designs have today, it is important for us to start examining our designs and practices now.' By invoking '*us*' and '*our*', TOPP sees designers as central to the conversation about '*what it means to be a responsible designer*,' arguing that '[g]*etting IoT right is about more than adding technology to an existing object*.'

If responsible design must be more than merely '*adding technology*,' then how could it be done? The authors of the RIOT collection position their community as responsible for dialogue, arguing that its members have a valuable contribution to make to ensure a future where IoT is '*responsible and human-centric*' and works for everyone. For Doteveryone the next steps involve a '*set of clear and actionable guidelines*' aimed at starting conversations, the creation of standards and best practices that are incorporated into development, testing and operations. Although like TOPP they are interested in developing dialogue around what responsibility means, Doteveryone's document uses responsibility as an attribute of the device itself, hoping for '*more responsible digital products and services*'; '*more responsible and ethical technology*'. This shift creates a different emphasis for the theme of responsibility: '*Responsible technology*,' write Doteveryone, is '*useful technology*.' Yet responsible technology is '*easier said than done*' according to de Roeck (RIOT). The focus on the eventual product leads designers to think backwards from the end result, focusing (as above) on standards, but also on deliberate design processes, and the challenges of incorporating reflection into IoT design processes. This latter ambition takes a number of forms – from dialogue to discussion prompts and toolkits for ideation development.

Togetherness

In addition to promoting debate and dialogue, manifestos invite readers to participate, to commit, to take action and to take responsibility. The Things Network addresses the reader directly, inviting them to *sign* the Manifesto and '*uphold its principles to the best of* [their] *abilities*.' This move aims to create a bond between the individual signatories as a community, a move towards concerted effort and potentially mutual accountability for responsible behaviour. Arduino generates an '*us*' through which the document authors – speaking as Arduino – share the burden for responsibility with '*you*' the reader. While Arduino seeks to take responsibility for making technology understandable, elsewhere, readers, makers and users are made responsible for upholding common values: '*the best hope for improving the world is us, and we are responsible for making a better future*' (MMM). The Open IoT Studio touch a similar question of distribution and the role of design and the empowerment of users. They ask, '*How can we design contextually relevant privacy controls in IoT that are knowable, modifiable and empowering to the people using them*?'. Read with an eye to the location of responsibility, there is a tension in this distribution similar to the one encountered in regards to making understandable. While responsibility is placed upon a '*we*' of designers, there is simultaneously a desire that in taking responsibility for the design, designers have designed in responsibilities for the users.

Paying attention to where and in whom authors locate responsibility complicates the picture of how change can be effected. Krüger (RIOT) argues that: '*Locating responsibility is about designing interventions that help actors to realise their responsibility*.' This comment comes within a framing of IoT as a complex system, wherein it might be difficult for single actors to identify the effect of their actions. The proposal to use IoT to integrate feedback, or '*consequences*', is about the *responsibilisation* of actors using IoT as a conduit. Here authors take responsibility in order to make others take responsibility – the latter in the broadest sense: responsibility for consumer choices such as the environmental consequences of buying a *'*[*b*]*anana in winter-grey Berlin*' (Krüger, RIOT). While responsibility is something most manifesto authors call for, there is little agreement on the nature of that responsibility, the subjects or groups to take it on, or the ends it has in sight.

A CROSSROADS FOR A COMMON FUTURE

> 'While those of us who enthusiastically follow—and create—new tech look to the future with teary-eyed excitement and almost child-like anticipation […] we are all acutely aware that the future can just as easily become something completely different. A future in which privacy and security decisions, made back in 2017, turned out to be devastating. [We must remember that] the future is not set. Multiple futures are indeed possible' (Villum, RIOT).

Manifestos aim to shift the tone of address around change for the future. Each lays out its own version of a hyped present, followed by an anxious, dark future while reminding readers that the future is not set. Their appearance at moments of uncertainty, and assertion of certainty in the face of doubt, places them: "between what has been done and what will be done, between the accomplished and the potential, in a radical and energizing division" [6:xxi]. The crossroads for a common future lies in this division. When the manifestos turn away from doubt and uncertainty to make their claims, to rally their supporters, to create a "we", at stake is a common future. It is a future variably articulated as better and more ethical, but always connected with the responsibilities that manifesto authors invoke in their audiences. As they connect human flourishing to design potentials and decisions, manifesto authors illustrate Lyon's point that audiences generated by manifestos occur "around an identification with virtue […] and its oppression by hegemonic forces" [24:24]. The manifesto and its future orientation require attention for the way the present IoT landscape is conceptualized, and the way a better future could be brought into being. To return to our opening question "what (potential) revolutions are called for?" we consider three points:

First, the manifesto form is an important choice for communicating both the frustrations and the mobilisation of

attempts for change. A re-imagining of the manifesto for its use in IoT reclaims the form of the manifesto for the twenty-first century. Adopted as an urgent genre for technological change, the manifestos in our study are made powerful by the division they paint between problems and solutions. They problematize IoT, its visible materialities and its invisible dependencies, its ubiquity and transparency, and return repeatedly to concerns around control and privacy. As the Marxist historian Hobsbawn remarked at a 2008 Manifesto Marathon, "We know what we don't like about the present and why, which is why all manifestos are best at denunciation. As for the future, we only have the certainty that what we do will have unintended consequences" [26]. The manifestos pay attention to the scope of IoT's unintended consequences, make efforts to think through where responsibilities for known implications lie, and identify (even if those choices are contentious) new sites for responsibility. Yet as they oscillate from the problematic known to unknown futures as-yet undefined, the IoT manifestos of our study also produce the vertiginousness of possibility: the Human(IT) Manifesto places itself as a site of decision at this crossroads declaring itself to be '*humanity's manifesto for choosing wisely.*'

It is difficult to predict or measure the impact a manifesto might have as a study of the Headmap Manifesto points to [23]. Perhaps this is part of this genre's appeal: no longer truly modernist, in their cautionary approach to multiple possible branching futures, newly reinvented technology manifestos are sites where the politics of contemporary IoT are revealed and worked out.

Second, the creation of technology manifestos shifts both the tone of address and the shape of communication. As they move out from descriptive to predictive mode, manifesto authors insert themselves into the reshaping of problems they have identified, and invite readers in, dialogically building a common cause for a common future. The manifesto, in its invocation of a '*we*' and an '*us*', is a remarkable vehicle for this mode of engagement. However, although readers are drawn into the texts addressed as '*you*' and '*we*', it is designers and developers who are lauded as having a particular responsibility at the crossroads we face: they are '*not only best prepared for a redefinition of design services for IoT, they have the opportunity to envision the future*' (Krajewski, RIOT). Thus, the scale of action called for oscillates between the individual developer and a community summoned through the manifesto as a text.

Nonetheless the questions of responsibility in these manifestos are perceived and allocated markedly differently. While responsibility for ensuring understandability is something designers are exhorted to take upon themselves, the very nature of designer and developer responsibility – its potential and its breadth – comes under discussion. Attention to inclusion and distribution within calls to responsibility makes us notice the politics and practicalities of *responsibilisation*, a concept that often refers to how individuals in neoliberal states are under pressure "to formulate themselves as independent, self-managing and self-empowered subjects" [32:2]. While the manifesto authors raise critique of dominant forces driving the development of IoT, the solutions most authors envision place responsibility for action in the daily practice of designers and developers. No manifestos call explicitly for political or judicial reconfigurations. The idealized autonomous, responsible subject is, however, enmeshed in a variety of interdependencies and competing responsibilities working with and against each other, sometimes reinforcing neoliberal responsibilisation, at other times existing alongside or undercutting it [32]. The manifestos express ideals for actions that, however, will play out contextually, occasionally stratified and restricted.

Finally, what are the lessons here for HCI? The manifestos analyzed in this paper share a common purpose: to find ways to relate to an intangible and rapidly developing technological world they are themselves part of creating. Their social imagination forms an important source of data for HCI research, and a lively point of engagement between academic and practitioner discourse. IoT manifestos emerging from design communities create IoT as a *matter of care* [2] for practitioner communities, with the authors of these documents assembling for diverse and overlapping concerns, loudly sharing their uncertainties. This amplificatory tone makes public a space for caring for the future, clears the ground to make innumerable crossroads visible: choices of the everyday concerning connectivity, security and privacy, but also crossroads that face new geographies of exclusion. Authors of manifestos hope to see their words become actions – they are closely attentive to the "how" of their exhortations. If there is a revolution, its character appears in these manifestos as one of responsibilities.

There is opportunity here for HCI to follow the circulation both of manifestos and their authors, attending to the spaces they make in order to express their concern and create spheres of care (whilst attending to the politics of responsibility and responsibilisation). As Light et al. [20] suggest HCI scholars need to expand our boundaries for caring and attending to our relations. As these manifestos move through the world, it is a task of our own future work to engage the communities that create them, and to remain attentive to their post-publication lives as they are circulated, and deployed in sites where their manifesto commitments meet the complexities of the world. Manifestos offer a way in for action research and a multitude of roadmaps for how HCI scholars might theorise about and design for responsibility while attending carefully to the perils of *responsibilisation.*

ACKNOWLEDGEMENTS

We thank the VIRT-EU consortium members and anonymous reviewers for support and constructive commentary. The VIRT-EU project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727040.

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