On the Internet ~~No~~ Everybody Knows You're a Whatchamacallit (or a Thing)

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Abstract
The Internet of Things (IoT) is fed by, and feeds into, flowing data streams. Through these flows, servers, sensors, humans and alike are networked together, data and networks mediating between physical and digital realms. 'Things' of all types, toys, lights and kettles, are tangible. On-view-but-unheard, they do their jobs. All the while, in the unseen digital domain, data flow, gush, and bubble, for the most part imperceptible to the human contingent of the all-encompassing menagerie of stuff. Here in the kingdom of TCP/IP, the atmosphere is thick, packets of inter-machine chatter commute back and forth around the network stacks, a tidal race of datagrams pulsate, whilst somewhere - far away? - a 2D image is painted on a 3D screen. '*Connected!*' Chirps the dialog box. The poetic tension betwixt an apparent calm in the physical world, and an obscured complexity in the digital otherworld, sets the scene for the argument we present in this paper: The IoT's objects, entities, or stuff makes up constellations; Human Centered Design methods are constrained by IoT constellations' complexity and multiplicity; by building from Object Orientated Ontology, IoT designers may cast multiple data, devices, corporations, and humans as equally significant 'actants' in a flat ontology. Here we pose this argument and propose ways to explore it.

Author Keywords
Internet of Things; Human Centered Design; Object Orientated Ontology.

ACM Classification Keywords
K.4.d. Computers and Society: Design.

Background
The IoT is an ill-defined construct. We might say it is a network of heterogeneous interconnected objects (or 'things') that are readable, recognizable, locatable, and/or addressable [4], yet beyond the gamut of possible devices and functions it is important to consider the range of perspectives from which each device may be observed. This is important because the factors which are relevant to different stakeholders - for example, users, manufacturers, cloud providers, policy

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This work builds upon their program of research into design fiction and applies it specifically to the adoption and acceptability of domestic Internet of Things devices.

This research was made possible through the support of RCUK Cyber Security for the Internet of Things Research Hub, *PETRAS* (petrashub.org) under EPSRC grant number EP/N02334X/1.

makers, and ISPs - differ drastically dependent on their unique perspectives and thus alter each actor's conception of what kind of value proposition the IoT presents to them. In addition, every part of the IoT is networked, and hence complexity relating to the interdependence between nodes must be acknowledged, a complexity which scales geometrically per the number of nodes. Finally, traversing digital and physical realms - typical of IoT devices - brings with it unique ontological intricacies.

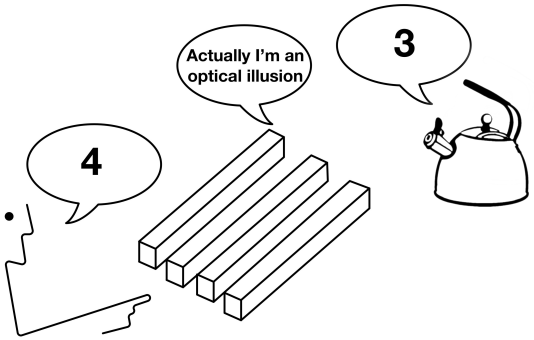

Figure 1. As with this image, in an IoT constellation, what you see depends on the position from which you look.

To articulate the entanglement of these situations we introduce 'IoT as constellations'. Inspired by Benjamin's discussion [1] the essence of this metaphor is that the appearance (or 'apparent meaning') of any given collection of IoT devices depends heavily on 'where you stand'. To understand any given device or network, it is crucial to accept that one's perspective plays a hugely significant role in producing that understanding. For example, the value of a 'smart meter' differs drastically if you are the energy company or the consumer. The consumer may be primarily motivated to reduce their energy consumption, thus contributing to a reduction in environmental damage whilst saving money. The company, on the other hand, is likely to be motivated by the ability to maximize profits by leveraging the data collected by smart meters [8]. The constellation metaphor acknowledges these concurrent yet incongruent perspectives. The provocation detailed in this abstract leverages this framing of the IoT.

While Human-Centered Design (HCD) predates the Internet, it has become the de facto modus operandi of many IoT designers. HCD has been positively applied for personal devices such as the mobile phone, and helped to produce a myriad of products that are efficient and rewarding to use. However, interpretations of HCD's simplicity axiom [9] tend to disguise underlying complexities from users, and in doing so virtually all traces of the often intricate and entangled mechanisms that underpin function, are made to disappear. Per Arthur C. Clarke's widely cited '3rd law', sufficiently developed technologies are said to be indistinguishable from magic. Amidst the constellations of the IoT these 'magical' technologies, which are forged in the name of human-centeredness, in fact disempower users. As with stage conjurers, the 'magic' at work here is, arguably, a trick. An important contrast, however, is that whilst one expects Penn, Teller, or Blaine to be manipulative, one does *not* expect the television[1] to behave in such a way. Hence, we argue, HCD can unintentionally reduce the acceptability of IoT devices, particularly when its simplicity axiom is interpreted in an extreme. Due to

[1] See https://www.wired.com/2017/02/smart-tv-spying-vizio-settlement/

Polly, Put the Kettle On

Designing a plausible website for Polly begins to craft the world and provides us with a 'zoomed out' view of the world that Polly exists within.

The packaging Polly is shipped in allowed us to add more texture to Polly's world including creating a fictional regulatory body (OfIoT), a division of the Amazon corporation specifically for selling and managing IoT products, and a data protocol ('Minimum Necessary Datagram Protocol') which supports a variety of privacy features.

the confines of this abstract our critique of HCD must remain somewhat reductive, yet this brief precis is intended to frame a potential need for 'constellation centered design'. We turn to a branch of contemporary philosophy know as Object Orientated Ontology (OOO) to shed further light on how this contention can be explored.

OOO is a manifestation of Speculative Realism, a branch of contemporary philosophy which takes its name from a 2007 symposium. Speculative realism and OOO are united by a common rejection of 'correlationism'. Correlationism takes the view that things are only 'real' insofar as they are relevant to a human subject. Hence by rejecting correlationism, agency can theoretically be assigned to non-humans. Discussing OOO, Harman challenges Heidegger's consideration of tools, suggesting that objects are not merely defined through human use but through *any use*, including 'object to object' situations [6]. OOO puts objects at the center of being, where all objects, thingamajigs, whatchamacallits, and other entities, are equal within a 'flat ontology'. OOO is not without its critiques, the most prevalent of which is that if we abolish subject-object hierarchies then are we not by extension simply avoiding any responsibility for action?[2] [3] As with our critique of HCD, a deeper exploration of this space is beyond the scope of this abstract. However, we wish to draw attention to the work of Ian Bogost, whose *Alien Phenomonology* asks 'if ontology studies the nature of being how do you practice ontology?' He says the answer is to become demurgic via the practice of video game design, and thus creating an ontological sandbox by building artificial worlds [2].

Hence, we wish to explore some of the following questions: Is the constellation metaphor a useful means to meaningfully represent the heterogeneity of the IoT? Does the nuance and complexity of the IoT's constellations underpin our alleged shortcomings of HCD? Is it possible to practice OOO to build new design discourses that may empower designers to act powerfully within the connected frontier of the IoT? In the following we describe a design fiction centered around an IoT kettle. As a 'world building' endeavor [5] we contend that design fiction may be employed consonantly with how Bogost invokes video game design; to 'practice' OOO.

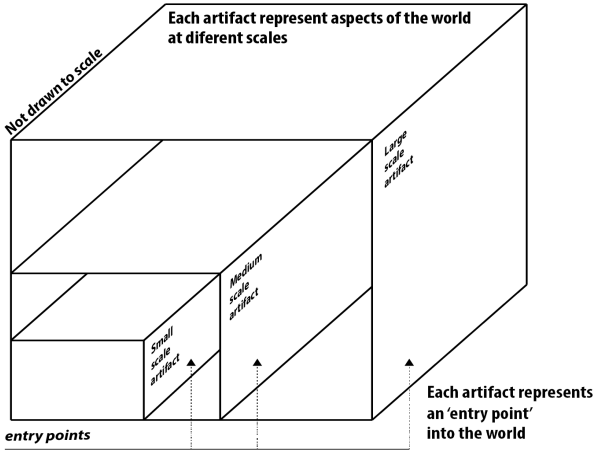

Figure 3. Representing the artifacts which together help build a design fiction world. Each artifact is an entry point to the inner workings of the world and also represents the world at a different scale.

[2] To illustrate how OOO may absolve humans of any responsibility to act, consider the following: *"Given that I am but an object, should it not be the tea cozy's job to clean the dishes and the dish's job to take out the bins?"*

Sukey, Take it Off Again

A 'machine readable data policy' may contribute to safer IoT networks and reduce opacity vis-à-vis what data is shared between devices and their manufacturers.

Polly's smart threat detection – one of several features which together mean Polly meets the requirements for platinum level OfIot accreditation – means the kettle disables its own networking stack if any malign activity is detected on the host network.

The purpose of the design fiction is twofold. First, to demonstrate how design fiction may be used to experiment with OOO-inspired design patterns for the IoT. Second, to open a discussion around the specific features and attributes which are included within the example. The Polly design fiction explores – informed by OOO and IoT constellations – issues such as privacy, trust, policy, regulation and security.

Polly, The World's First Truly Smart Kettle.

Our work adheres to a specific approach to design fiction practice which characterizes design fiction as a 'world building' [5]. Working in this mode involves creating a series of artifacts, each of which provides an 'entry point' to an artificial world. The world itself is an emergent property of the artifacts. Each artifact may also be described in terms of what 'scale' it represents the artificial world at. Polly's website, merchandizing, and packaging may be said to provide 'zoomed out' representations of Polly's world. Other entry points, for example photographs that illustrate features and a press release which describes them, provide more zoomed in impressions of Polly's world (figure 3).

The zoomed out 'overview' entry points into Polly's world primarily exist to bolster the world building exercise and provide a plausible canvas upon which more critical provocations may be crafted and tested. In contrast the zoomed in 'detail' entry points are intentionally critical and exploratory (e.g. a reference to 'OfIoT accreditation' in the press release, and the inference that accreditation is dependent on adherence to various IoT specific standards). Specific detailed ideas we explored include concepts such as a machine-readable privacy policy, smart threat detection, employment of the 'minimum necessary datagram protocol' and an activity timeline which reveals *all* data transactions Polly is involved in and specifies what data are transmitted, where, and what for. As with all design fiction, this example does not intend to prescribe or predict the future, but accepts a plurality of futures and hopes to use the specific future depicted as a means to facilitate rich(er) discussions about the full gamut of possibilities [7].

Contribution to Making Home Workshop

This abstract intends to act as provocateur around several contentions and questions: the IoT is best described in terms of constellations; applications of HCD can be problematic in IoT contexts; OOO-inspired design patterns may be beneficial for the IoT; design fiction is a useful tool for testing these hypotheses; the potential usefulness of the features and attributes of an IoT kettle articulated in the design fiction.

Artifacts for Making Home

A range of 2D imagery will be presented covering the design and worldbuilding process for Polly. Specific imagery includes websites, a press release, merchandising, advertising, and interaction prototypes, and a user instruction manual.

Point of Debate at Making Home

By appreciated the variety of perspectives harboured by multiple actants involved in the constellations of the IoT, Object Orientated Ontology inspired design strategies can help mitigate the problems associated with overzealous interpretations of Human Centered Design's simplicity axiom.

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