Things Making Things: An Ethnography of the Impossible (draft)

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This paper describes the theoretical and methodological underpinnings of ThingTank, a project in which non-humans write shared futures with humans. Though not design anthropological in itself, this project sheds light on the meaning of the 'impossible' in relation to the current design anthropological discussion.

ThingTank is an Internet of Things (IoT) research project that uses a combination of field studies, object instrumentation and machine learning to listen to what 'things' have to tell about their use, reuse and deviant repurpose, and it harvests this data to inspire idea generation, fabrication, rapid prototyping and business development generation.

Much of the rhetoric for investment into IoT platforms is to identify cost saving and process efficiencies (e.g., vehicle manufacturers), to track goods within large networks (e.g., logistics companies), or to monitor the health and safety of systems (e.g., aircraft manufacturers) within a streamlined process of production. But as networked objects become more common, the massive amounts of data that they collect will soon outweigh what we know about these objects – and thus about ourselves.

As these databases of objects intermingle with our own data shadows, it won't be long before the objects around us begin to make suggestions about how what 'might be' desirable. ThingTank aims to interrogate artefacts' shared use (and abuse) and to elicit new insights outside of a streamlined process of production.

In describing this project, we will discuss the role and challenges of designers and anthropologists in opening up and articulating design spaces invisible to the naked human eye.

1 Researching and Developing the Impossible

1.1 Performing with things as participants to open up the impossible

Designing is about bringing forth something that does not exist (Binder et al. 2011). From an anthropological perspective, this something must be performed in order to be experienced (Bruner 1986, cited in Binder et al. 2011). In line with Binder et al. (2011), in this project we approach design from a performative perspective in which 'things' are considered to have the potential to bring forth a shared design space.

According to Binder et al. (2011), the creation of such a design space is the creation of a 'field work' that does not exist but it is possible. Intended as a possibility, this fictional space emerges out of the ongoing interaction between participants in design. But what if 'things' are to become participants, not just resources?

As an item moves along the value chain from large scale consignment into the hands of someone who values the object from a personal perspective, the definition of what is a 'thing' becomes highly subjective. While many of the definitions of what is an artefact or a product remain intact within different frames of consumption (i.e., manufacturer, distributor, shop and home), we argue that the terms 'thing' and 'object' are consistently being used with mixed meanings, particularly across the broader field of the Internet of Things (IoT) in which this project is positioned.

Coyne (2011) recovers Heidegger's definition of *thing* as "a gathering", and specifically "a gathering to deliberate on a matter under discussion, a contested matter" (Heidegger 1971). Extending this definition, Coyne also reveals that the Oxford English Dictionary supports this understanding: a thing is a judicial assembly, and in Scandinavian countries the Thing is the Parliament (IBID). With this in mind, an invitation to a friend such as "can I buy you a coffee" evokes a context in which the *thing* is evidently the event, and the material object is merely a material focus around which to meet (e.g., what can be seen and touched).

Such a distinction is critical to the development of a design vocabulary for the Internet of Things grounded in a performative understanding of what 'things' can do.

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According to Binder et al. (2011), 'design things' are socio-material frames. They are to be intended as both (a) material constituents of the evolving design object and (b) public things framing and supporting communication and interaction (168). Because they modify the space of interactions and performance, 'design things' can open up new and unexpected ways of thinking.

In this paper, our emphasis on the 'impossible' is to problematize and critically explore the epistemological role of IoT in the shaping of 'design things', beyond an anthropocentric understanding of what is 'possible' and 'worthwhile'. It is to explore the kind of 'unspoken' and the aspects of liminality (Gennep 2004) that are brought into the design process when information and communication technology enable objects that are part of our lives to begin to speak in ways outside a human habitus, and thus participate in the design process on their own terms.

1.2 The temporal frame of designing through performance, and nature of engagement in the context of the impossible

Within a user-centered design approach, things are usually intended as prototypes. Their role is to support people to imagine, discuss, and shape future practices (Donovan & Gunn 2012). By extension, design becomes a kind of stabilizing process, through which imagined future practice(s) are realized (122).

In ThingTank instead, we do not involve 'things' in the design process just as provocative artefacts at project time. We take a general metadesign approach (Giaccardi & Fischer 2008) according to which we consider every situation in which things are used and performed (and in which they can 'speak' as participants) as a potential design situation. We therefore apply to IoT a way of designing (and with that an understanding) that takes place "after", "beyond" and "with" the design work at project time (Giaccardi & Fischer 2008; Binder et al. 2011).

As argued by Gunn & Donovan (2012), engagement in design approaches sensitive to anthropological concerns requires developing capacities to offer people different ways of understanding what they know and do (6). These different ways of understanding allow for reframing and reconfiguring relations, and are inherently performative and transformative.

Giving a voice to things as participants requires this kind of ethnographic engagement. It assumes to 'spend time' with objects and 'work with' them as

participants to exorcise the practices that have accumulated into and have manifested through things 'after design'. By listening to 'things' for an extended period of time, we can learn and reflect on what we usually take for granted, and articulate a design space invisible to the naked human eye.

According to Kjœrsgaard & Otto (2012): *"the role of fieldwork and anthropology within design cannot simply be to provide designers with descriptions of users and use practices as in the tradition of ethnomethodologically informed design; not can it simply be to supply methods and techniques for enrolling users and their knowledge directly within the design process as in the tradition of participatory design"* (179).

However, classic fieldwork based on long-term immersion and participant observation in the field has difficulties dealing with the emergent where there is no stable subject of study (Rabinow et al. 2008, cited in Kjœrsgaard & Otto 2012). On the contrary, design anthropology is concerned with challenging and reframing relations between use and design, and in so doing contributes to the crafting of social and material relations.

ThingTank brings the framing and challenging of understandings at the intersection of practices and contexts of use and design at a new level, and values the role of the programmer of the machine learning code as much as that of the anthropologist.

2 ThingTank as design inquiry into networked objects

2.1 The changing value and interpretation of physical objects

Many contemporary material practices across the fields of produce are beginning to develop artefacts with immaterial accompaniments: barcodes, instruction manuals, connections to social media sites. In general, the relationship between these two parts - material and immaterial - is passive or complimentary but rarely active.

In the past many IoT projects have used the network connection of artefacts to identify cost saving and process efficiencies (e.g., vehicle manufacturers), to track goods within large networks (e.g., logistics companies), or to monitor the health and safety of systems (e.g., aircraft manufacturers) within a streamlined process of production. But as networked objects become more common, the massive amounts of

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data that they collect will soon outweigh what we know about these objects – and thus about ourselves.

2.2 IoT as technological paradigm, and the emergence of networked objects

However within what is being described as the Internet of Things we can anticipate that material objects do not only bring them with them an immaterial artefact but a data cloud which is likely to play an active role in changing the value and interpretation of the physical object.

The phrase Internet of Things is attributed to the Auto-ID research group at MIT in 1999 (Ashton 2009) and refers to the emerging technical system of objects and materials that are becoming connected to the internet. The specific reference to 'things' refers to the principle that physical objects will part of this extended Internet, because they will have been tagged and indexed by the manufacturer during production. It means that the movement of these 'tagged' items can be tracked through the various value chains from natural resource through processing / manufacture, distribution and purchase /application, and this history can be associated with the object at all times. Sterling describes these new types of objects as 'spimes':

"Spimes are manufactured objects whose informational support is so overwhelmingly extensive and rich that they are regarded as material instantiations of an immaterial system. Spimes begin and end as data. They're virtual objects first and actual objects second." (Sterling 2005).

The relationship between the virtual object and the actual object is not always symmetrical, as more or less data can affect the value of the physical object. For example if a piece of furniture carried with it images of how it was made including the handmade processes that were involved in finishing the material surfaces, or the laughter that was caught during the first time it was used at a dinner party. The impact of these immaterial 'things' to transform the value of the material 'thing' is something we are familiar with when we consider old things such as antique artefacts and heirlooms that carry with them details of their provenance that affect both their cultural and economic value. Web platforms such as Tales of Things that allow members to attach stories in the form of text, video and audio to QR tags, that in turn can be attached to physical objects, allow the public to generate a personal data cloud that is associated with an material thing (Speed 2012).

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However, changes in the perceived value of an object does not stop at the recovery of data from the past, any object that is part of an Internet of Things has the potential to share data about itself with another object and begin to draw novel conclusions. In writing on value and worth, Ng describes how companies will increasingly capitalise upon the connections between objects in social contexts to sell us more things (Ng 2012). Described as 'contextual archetypes' Ng suggests that within an Internet of Things, objects can become a point of sale within particular activities, for example, when making a cup of tea, the tea bags will be able to sell you milk because they are part of the same context. This radical shift from vertical lines of consumption to horizontal, means that objects with an IoT are elevated to a role of actors within our networks of distribution and sharing.

Bleeker prepared us for objects developing a form of agency with his Manifesto for Networked Objects (2006) and in recent years designs have appeared that begin to use the connection between a physical appliance and the internet as a means to explore a 'living' identity for that thing. "The Addicted products: The story of Brad the Toaster" by Simone Rebaudengo (http://vimeo.com/41363473) is a domestic toaster that is able to record how often you use it. Based upon this information it decides if you are a good owner, and if not it asks you to give it to someone else. As networked objects become more common, the amount of data that they collect will soon outweigh what we know about the physical device. As artefacts share information with the other artefacts around them, code can be written to interrogate their shared use. Machine learning is being used across a wide variety of databases to identify patterns in order to elicit new insights (Bandyopadhyay & Sen 2011). As the databases of objects intermingle with each other and our own data shadows it won't be long before objects begin to make suggestions about their use and value.

2.3 Performativity of networked objects
This new relationship with physical objects is something that we may increasingly have to negotiate as 'things' are increasingly constituted not just with material and data but computer codes and algorithms that change our assumptions that an object is inert, or in the context of an ethnographic study, that the object is bounded by its physical parameters. This quality to play a role in influencing and producing spaces

may be best described as performative. A complex term that Dewsbury describes as "the gap, the rupture, the spacing that unfolds the next moment allowing change to happen." (2000), performativity is used to explain the capacity of speech and gestures to act and offer emergent structures. The term is attributed to the language philosopher Austin who established that words can be used not only to describe something, but can used to do something. His most poignant example of what he coined as 'performative utterances' being when we use the words "I do" to instantiate an action (such as marriage) (Austin 1962).

In his exploration of the role of computer code as a generative form of media, Cox compares the qualities of speech that were identified by Austin with the emerging performativity of computer programs or algorithms that carry out actions:

"Speech acts come close to the way program code performs an action, like the instruction addressing the file. Programs are operative inasmuch as they do what they say, but moreover they do what they say at the moment of saying it. What distinguishes the illocutionary act is that it is the very action that makes an effect: is says and does what it says at the same time. Such utterances are conventional but performative." (Cox 2012).

As the data that is connected to objects is associated with codes and algorithms to produce 'performative utterances' artefacts around us are likely to tell us what they would like to do, or how they would like to be used and perceived.

3 Consider the Fork, and the Perspective of Machine Learning

3.1 Material practices as patterns of use, and the contribution of machine learning to anthropology

A common view of the fork is as a simple tool used for eating. However, the fork has transformed how we not only consume, but also think about food. Given new technological capabilities the fork may still undergo further evolution, which will have further consequences. Technology in the kitchen does not just extend to fridges and microwaves. Technology also extends to the humbler tools of everyday cooking and eating: a wooden spoon and a skillet, chopsticks and of course forks. Through out the history, cooking utensils evolved around the world providing us with the final form, which we often take for granted. Very few people would questions the utility of

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the fork, but before the fork gained a widespread acceptance it endured centuries of ridicule (Wilson, 2013).

Many once-new technologies have become essential elements of any well-stocked kitchen. Others have proved only passing fancies, or were supplanted by better technologies; one would be hard pressed now to find a water-powered egg whisk. Although many tools have disappeared from our kitchens, they have left us with traditions, tastes, and even physical characteristics that we would never have possessed otherwise (Wilson, 2013).

The ThingTank project identifies that 'things' may soon know more about lives than we do and may also be able to make suggestions about what is missing. The purpose of this project is to explore the potential for identifying novel patterns of use within the data that is streamed through the interaction between people and things, and things and things. Through a better understanding of how what data can tell us about how we use objects in practice, new models of use will emerge and reinvigorate the role of things and people within design and manufacturing.

3.2 Impact of a data perspective on developing the impossible

| Cost | $200 | $50 | $5 | $0.01 |

Fig. 1 Traditional Product Development Approach: example with focus on cost optimization

Traditional approaches develop new products by focusing on the product properties (cost, weight, durability, aesthetics, ergonomics, etc.); e.g. cost / material (Fig. 1). But for digital products, long tail business models - providing a large number of unique items with relatively small quantities sold of each - have become increasingly successful and even dominant (e.g. iTunes, NetFlix). In manufacturing, the adoption of long tail business models have been limited, since for the low-volume products it is difficult to recoup the high costs of: (a) production setup, (b) product discovery. The

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costs of production setup are starting to rapidly decrease due to new technologies such as 3d printing (Ng, 2012). Yet the high cost of product discovery has remained a major obstacle to long-tail manufacturing, amplified by the requirement for a large number of low-volume products, with each product bearing a high discovery costs. The proposed ThingTank platform is able to overcome this obstacle, by automatically discovering large number of product usages that translate into even larger number of novel products; hence making the long-tail manufacturing feasible (Fig. 2).
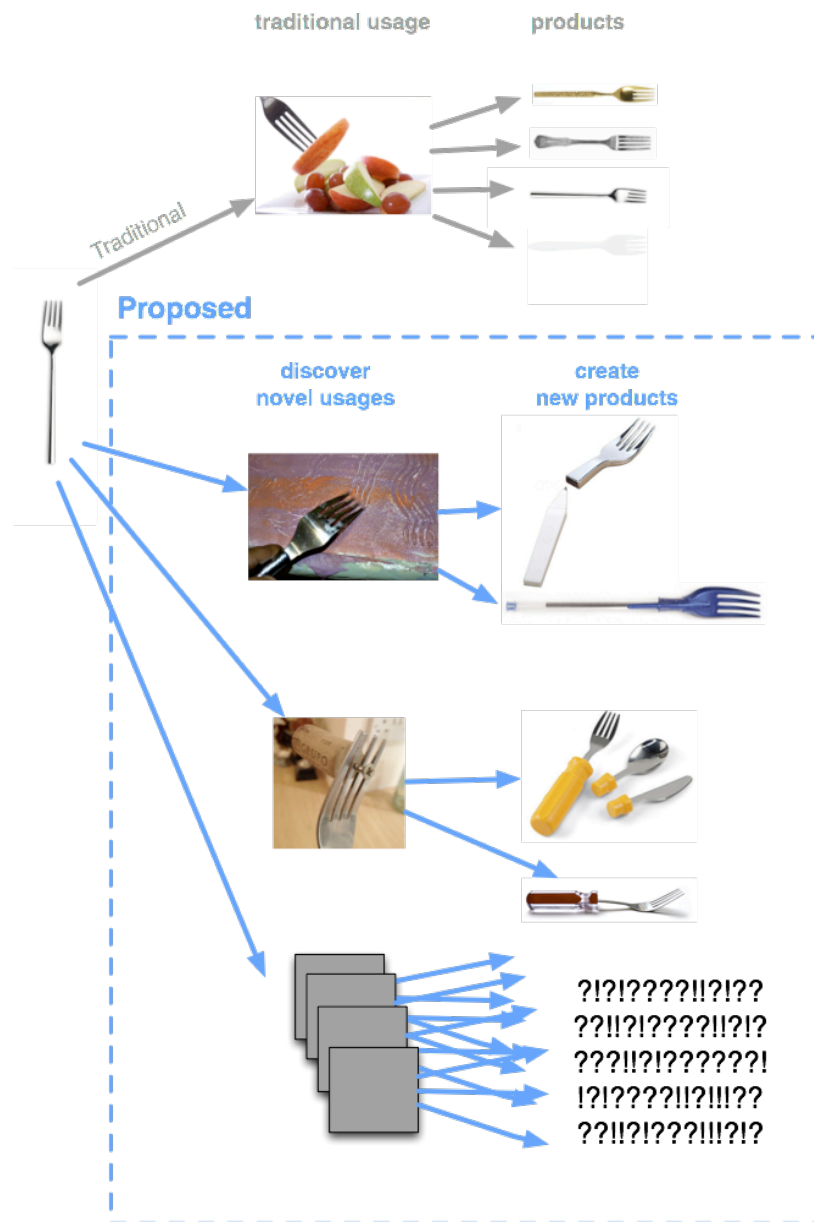

Fig.2 Proposed Approach: Product Development through Novel Usage Discovery

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Consumers constantly invent novel usages of objects, but often do not have needed resources and expertise to develop products with the novel usage in mind. On the other hand, product designers are often not the users of the objects; so it is hard for them to imagine novel and meaningful usages. Our proposal is to bridge this gap: discover novel usages by consumers (by analysing sensor data); and use discovered product usages to inspire product designers.

We propose a new task of discovering novel usage patterns by mining objects' sensors data. The principal challenge is to define a quantifiable definition of usage "novelty". The definition of novelty is complex and could be discussed in perpetuity. We take a pragmatic (instance-based) approach in which we ask participants to evaluate novelty of concrete examples. Based on these judgments the system learns to identify novel usages. The system then presents back to the participants the usages that it considers to be novel; if participants disagree with the system's judgments; system is re-trained (incorporating the feedback); this process is repeated until adequate accuracy is obtained (Rubens et al. 2011).

3.3 Examples of usage categorization in machine learning

We are in the process of gathering large quantities of data on the use and abuse of things. In order to facilitate analysis of this data we are also developing tools that allow domain experts to identify usage patterns of interest. In our pilot study we have focused on various usages of a common fork. Below we discuss preliminary findings which allowed us to create categories for various usage patterns (these categories are non-exclusive, i.e. an object may belong to several categories).

Deviation

In the case of *alternative usage* the object is not modified; however it is used for a different purpose than originally intended (Fig. 3).

Fig. 3 Deviation: using fork for (1) making a bow, (2) painting, (3) weed removal.

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Hybridization

In the case of *hybridization* the object is used for a different purpose than originally intended (same as in the case of *alternative usage*), however in order to perform additional function the object is modified (Fig. 4).

Fig. 4 Hybridization

Partial Hybridization

In the case of *partial hybridization*, the object adopts some of the desirable properties of another object; however its usage is unchanged (not extended); unlike in the case of *hybridization* (Fig. 5).

Fig. 5 Partial Hybridization

Re-Purpose

In the case of *re-purpose* the object is modified to fulfil the new functionality, however unlike in the case of *hybridization*, the object is not longer able to perform its original function (Fig. 6).
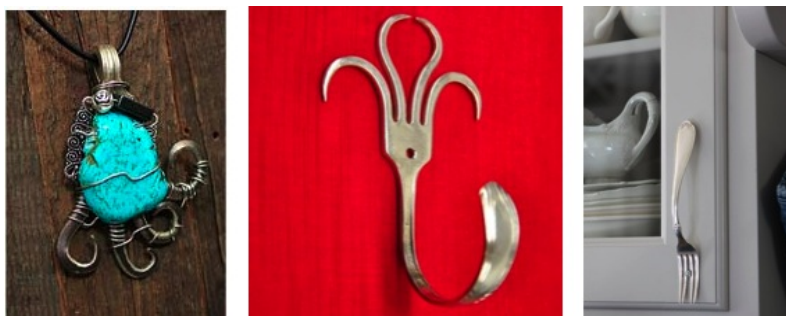

Fig. 6 Re-Purpose: (1) jewelry, (2) hanger, (3) handle

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Instrumentation

In the case of *instrumentation* (Fig. 7), the object is fitted with additional sensors and often provides the sensory feedback to the user; its physical usage is not modified (however via sensory feedback the user's influence patterns might be influenced).

Fig. 7 Instrumentation

4 Implications and Challenges for Design Anthropology

As artefacts within a particular context begin to accrue and share data, and this data begin to be the material basis for computer code to 'speak', we envision tremendous implications for anthropology and all traditions of practice. As objects within the ThingTank system will begin to speak and expose patterns that are outside a human habitus, they might identify what we defined as the 'impossible': liminal design spaces, invisible to the naked human eye.

As argued by Redström (2012), the unpacking of relations between design and use can be done in many different ways. The analogue technology of industrial production, for example, enforced a discrete and static view of design (93). A critical IoT approach can bring the unfolding of socio-material configurations back to design by contesting relations between design and use that become manifested in forms of practice. Such a IoT approach does not just expose and describe the form of a socio-material practice that it is difficult to express in terms of just design or use, but it may reveal "states of being as much as kinds of things" (Redström 2012: 95).

Our approach is contrary to classic IoT, which is paradoxically still positioned within an industrial paradigm of mass production concerned with increased efficiency

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and optimal design, because no changes are possible 'after design'. In fact, ThingTank not only accounts for deviation, but it legitimizes it as part of the design process by revealing through machine learning 'forms' that are time- and difference-generated (Kwinter 2002, cited in Redström 2012).

Design anthropology needs a different notion of form (intended as object of design) to be able to account for emergent forms of practice, argues Redström (2012). "Thus the object would be defined not by how it appears, but rather by practices: those it partakes of and those that place within it" (Kwinter 2002: 14, cited in Redström 2012). With ThingTank we can explore this interplay. In the ThingTank system the form that emerges through design inquiry is preoccupied with the actual material object as much as it is performed and experienced through instrumentation and machine learning.

In design anthropology, emergent forms are usually considered in relation to the making of new artefacts (Wallace 2012); for example, in the form of provotypes (that is, during design) or, in the challenging of assumptions inherent in the design (that is, before design). In other critical design approaches, the questioning of assumptions inherent in the design makes often use of defamiliarization as a means for interpretation and reflection "towards better and more innovative designs" (Bell et al. 2005: 153), or to provide alternative viewpoints in the form of "narratives" (Dunne & Ruby 2013). Instead, we interrogate objects within a performative process aimed to deal with emergence in 'design after design', and to critically articulate objects of design and design spaces invisible to the naked human eye. To listen to the humans we are asking the fork.

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