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Society of things: An alternative vision of Internet of things

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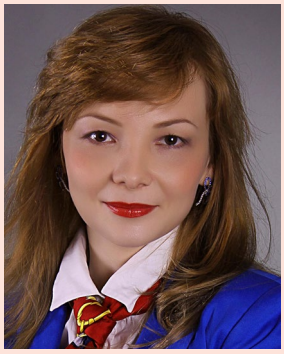
Abstract: The purpose of this paper is to yield insight into the nature of relations between things within the Internet of things (IoT) paradigm and to build the principles that can potentially be used for progressing from IoT into communities of things (CoT). This study engages in rhetorical analysis—a qualitative research technique designed to yield non-quantitative data and to build a strong theoretical foundation for future studies in the field of IoT. It reveals that things can be perceived as beings within the communication networks; IoT can be organized into CoT; and various models of communities can be generated depending on desired outcomes. The findings require empirical implementation of the proposed principles for creating CoT. The direction indicated in this study will help solve a number of technical challenges that IoT faces nowadays, from architecture and communication to privacy and security. Viewing things as beings will encourage a wide-ranging discussion of the applications of social science theories to IoT. This study is a call for building bridges between the social sciences and information technology.

Subjects: Communication Studies; Group Communication; Information Technology

Keywords: Internet of things (IoT); communities of things (CoT); communication; community; ontology of things; being within the communication networks

1. Introduction

In its 2013 report, the McKinsey Global Institute identifies the Internet of things (IoT) as one of 12 technologies that have massive potential to drive economic impact and disruption by 2025



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PUBLIC INTEREST STATEMENT

The purpose of this paper is to yield insight into the nature of relations between things within the Internet of things (IoT) paradigm and to build the principles that can potentially be used for progressing from IoT into communities of things (CoT). This study reveals that things can be perceived as beings within the communication networks; IoT can be organized into CoT and various models of communities can be generated depending on desired outcomes. The direction indicated in this study will help solve a number of technical challenges that IoT faces nowadays, from architecture and communication to privacy and security. Viewing things as beings will encourage a wide-ranging discussion of the applications of social science theories to IoT. This study is a call for building bridges between the social sciences and information technology.

(Manyika et al., 2013). Today, the Internet connects not only people, but also physical objects. Some objects can track the state of human health, some can guide drivers to available parking slots, and others can measure the level of air pollution by performing environmental monitoring. IoT is a paradigm where objects can connect and communicate with each other. It is "a world where the real, digital and the virtual are converging to create smart environments that make energy, transport, cities and many other areas more intelligent" (Vermesan et al., 2013, p. 8). Shaev (2014) observantly comments on the transformation of an object's nature, arguing that "step by step from a kind of subordinate element and representations things become active elements" (p. 877). Moreover, from observed systems objects become observing systems. They become communicative and intelligent objects with their own identities and personalities. They become *beings*. In the same way that a group of human beings connected together with shared values, goals, and interests is usually called a community, are *things* able to form communities by connecting to each other for specific purposes?

Various types of communities such as ethnic, religious, sporting, and business exist in virtual and physical spaces. The manifold existing community types are categorized based on different criteria, for example, location, lifestyle, and practice (James, 1996). In the imagination of both laymen and scientists, a community is associated with a group of human beings or individuals bound together with common values and interests. As Peck (1987) notes, "If we are going to use the word 'community' meaningfully we must restrict it to a group of individuals who have learned how to communicate honestly with each other, whose relationships go deeper than their masks of composure" (p. 59). However, not many people would associate the word "community" with the group of things, and they would not assume that *things* can be bound together with common values and interests. Yet, this study sets out to theorize that IoT can be viewed as the community of things. Although this might seem a far-fetched assumption, it is not beyond the realm of plausibility to suggest that things share certain attributes that enable them to be involved in human-like relationships. A further extension of this thinking leads me to argue that sociological, cultural, communication, and other theories previously developed for, and applied exclusively to, organizing and understanding the nature and dynamics of relationships between human beings can be applied to IoT. Using a theoretical apparatus of both cultural studies and communication philosophy as a conceptual basis, this study posits that the theory of group psychology can benefit our understanding of communication among things and contribute to the developments of principles for IoT. Viewing things as beings opens up a wide range of applications provided by the vast variety of the humanitarian disciplines, including psychology, philosophy, sociology, and communications.

This study advances the following propositions:

P1: Things can be perceived as beings within the IoT paradigm.
P2: IoT can progress to communities of things (CoT) following the models of successful communities.
P3: Various models of communities can be generated depending on desired outcomes.

To examine the above propositions, this study engages in rhetorical analysis—a qualitative research technique, which, according to Berger (2000), is designed primarily to yield non-quantitative and non-numerical data (p. 279). Berger associates semiotic analysis, psychoanalytic criticism, ideological criticism, rhetorical interpretation, interviewing, and participant observation with the qualitative research paradigm. This study employs rhetorical interpretation in order to yield insight into the nature of relations between things within IoT and examines the use of community models for generating a specialized CoT.

I start from the claim that a *thing* can be perceived as a *being* within the IoT paradigm. Such perception enables us to solve a number of technical challenges that IoT faces nowadays, from architecture and communication to privacy and security. Viewing a thing as a being will stir up a wide-ranging discussion of the applications of social science theories to the IoT paradigm. To support this claim, this study begins by providing an overview of IoT and revealing its key features. As

will be discussed later in this paper, these are the very features that enable one to recognize things as beings, namely communication, intelligence, identity, and personality. Furthermore, the study examines the concept of community and its basic characteristics. At the core of this work is a radical new principle designed for IoT based on the conceptual framework of community theories, which opens up a wide venue for future empirical explorations.

2. Internet of things

The term IoT was introduced by Kevin Ashton, one of the co-founders of the Auto-ID Center at the Massachusetts Institute of Technology (MIT) and a creator of a global standard system for radio frequency identification (RFID), in 1999. He imagined a world where the Internet is connected to the physical world via ubiquitous sensors. A few years later, members of the same MIT group defined the concept as: "an intelligent infrastructure linking objects, information and people through the computer networks, and where the RFID technology found the basis for its realization" (Brock, 2001).

From 2005 onwards, the number of definitions increased depending on the discipline investigating the phenomenon. Three categories of IoT visions can be distinguished: things oriented, Internet oriented, and semantic oriented (Atzori, Iera, & Morabito, 2010).

In 2009, The European Research Cluster (IERC) for IoT proposed the following definition of IoT:

> A dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network. (IEEE-SA, 2009; Vermesan & Friess, 2013)

Borgia (2014) fuses various visions of IoT in its revised definition:

> A dynamic global network infrastructure with self capabilities based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes, virtual personalities, and use intelligent interfaces, and are seamlessly integrated into the informational network. (p. 4)

The key features of things within the IoT paradigm derived from the definition proposed by Borgia are intelligence, identity, personality, and communication. What do these features mean?

- Objects are intelligent because they can make "context related decisions thanks to the fact that they can communicate information about themselves and they can access information that has been aggregated by other things" (Vermesan et al., 2013). The objects can "sense, compute, communicate, and integrate seamlessly with the surrounding environment" (Borgia, 2014, p. 2).
- Objects have identities as they are assigned identification numbers and names.
- Objects are engaged in communication as they produce information about themselves and can access information accumulated by other things (Vermesan et al., 2013, p. 8)

These features can be attributed to beings. And yet, doubts might be raised about the features ascribed to the things in the IoT paradigm. Wouldn't it be an excessively grand claim to state that things possess identity? After all, identity is a complex notion at the core of philosophical discourse and should not be reduced to just the "identification number" or "location address" of a thing. The following discussions briefly touch on such notions as identity, personality, intelligence, and communication within the context of IoT.

3. Identity, personality, intelligence, and communication of things

The notion of identity is inextricably connected to questions such as: Who am I? When did I begin? What will happen to me when I die? (see for overview Olson, 2015). Identity is often discussed under

the term "self." This term was given special attention by scholars as Martin Buber, Martin Heidegger, Jean-Paul Sartre, and Mikhail Bakhtin to name a few. In the view of Bakhtin (2003), "self" is defined by "other": "I cannot manage without another, I cannot become myself without another; I must find myself in another by finding another in myself" (p. 287). In order for "self" and "other" to exist, they should exist simultaneously, or, as Holquist (1994) asserts, "self/other is a relation of simultaneity" (p. 19). For identity to exist, existence of the "other" is a necessity. IoT in its essence is designed to connect physical objects and people. An object within the IoT environment is defined by other objects, people, and its environment that exists within a communication network. A thing can be considered part of IoT only while existing in the world of other things and beings within a communication network. This idea is reminiscent of Heidegger's notion of "Being-in-the-world," and total immersion in the surrounding world. With each encounter of a thing with an other (thing, human, animal, or plant), and with each grasp of reality, it actualizes itself by experiencing and measuring the effect of this encounter. It reveals itself in time, acquiring more knowledge, experience, data, information and sense of the environment, world and its own self. The ways, in which a thing reveals itself and acts towards the other being becomes its personality.

A thing within the IoT environment is inextricably connected to the world. It is not a closed, completed system, but open and unfinalized, always in contact with the external world, always merging with other beings (things, humans, animals, or plants) and, therefore, it transgresses itself. It is unfinalized because it knows neither its beginning nor its end. It is unfinalized because it transgresses itself, concealing the potentials for revealing more and more personalities, more and more voices.

It should be fairly plausible thus far that a thing within the IoT environment is a being whose identity is revealed in self/other relationships; an identity that is unfinalized, and one that is revealed in time. Therefore, a thing is self-measuring, self-revealing, and self-managing.

Heidegger (1962) argues that "Being-in-the-world" is "grounded in language" (Steiner, 1978) as a system of communication. Communication implies exchange and interaction between entities of the same community. By addressing the etymology of "communication," the word can be traced to the Latin word *munia/muntare* "a root connoting mutual help, exchange (as in *munus*, *mutuus*), and interaction among those who belong to the same community (as in *communis*, *communitas*)" (Chang, 1996, p. x). The connection between language and community is apparent in its definition of the boundaries of a community. It is not accidental that the idea of IoT encourages an intensive search for standardized communication protocols, and "in order to facilitate interaction between different vendors' products the technology should be based on a standardized communication protocol stack" (Vermesan & Friess, 2013, p. 48). However, a standardized communication protocol does not only facilitate interaction, but yields control over the community of things by those who introduce such a communicative language. By creating a protocol, one creates a common language, and a common language in turn creates a community's boundary.

4. Communities of things

Community "implies that there are relationships between a group of people, in a certain geographical locale or in cyberspace, that go beyond casual acknowledgment" (Bruhn, 2011, p. 12). The term community originates from the Latin root word *communis*, which can be created by combining the following words *cum*, meaning together and *munus*, meaning obligation; or *cum*, meaning together and *unus*, meaning one (Fernbeck & Thompson, 1995). Thus, "a community can be seen as a group, in which individuals come together based on an obligation to one another or as a group in which individuals come together to be one in purpose" (Rothaermel & Sugiyama, 2001, p. 298).

Looking from different angles, scholars bring forward various core community components, such as sustained social interaction, community standards, and membership rules (Lawrence, 1995); consciousness of kind, which "represents the intrinsic connection that members feel toward one another, and the collective sense of difference from others not in the community" (Muniz & O'Guinn, 2001); and locale (virtual or physical), common ties (values, goals, interests), and social interaction

(Bruhn, 2011). Although it might be impossible to trace all these traits in the IoT, and it might be difficult for someone to label IoT a community, nevertheless, CoT can become legitimate forms of community. A community of things is defined by the authors of this study as "any group of things that shares common goals or interests and creates a social universe with its own values, rules, and vocabulary that is in a constant transformation and communication within time/space matrix."

The progression from IoT to an organized community requires raising the organization of things within the IoT paradigm to a new level. In this light, the goal of this article is to develop principles for transforming IoT into CoT that will consider the coexistence of humans and the things of the world, intergroup dynamics between things, and transformation of things from "improvised means" (Zuhandene) (Heidegger, 1978) into "something that is other-being of the human 'I'" (Shaev, 2014, p. 877). The model for CoT is built on the principles of group psychology, advanced by William McDougal. Although McDougal has been widely criticized along with other early contributors to the thematic strand of group psychology, such as Le Bon and Freud (e.g. Allport, 1924; McPhail, 1991; Reicher, 1987), there is much to learn from his work. In the next section, some principles developed by McDougall are laid out in a general way, and then the principles for the CoT are presented more specifically.

5. Communities of things

McDougall (1920) makes a significant input by advancing five "principal conditions" for raising collective consciousness to a new higher level, from disorganized "crowd" to an organized "group." These conditions for raising collective consciousness can be summarized as follows:

(1) The first and fundamental condition is that "there should be some degree of continuity of existence in the group. This may be either material or formal: the former, if the same individuals persist in the group for some time; and the latter, if there is developed within the group a system of fixed positions which are occupied by a succession of individuals" (Freud, 1922, Chap. 3, §13).

(2) The second condition is that in the individual member of a group, some definite idea should be formed of the nature, composition, functions, and capacities of the group, so that from this the individual may develop an emotional relation to the group as a whole (Freud, 1922, Chap. 3, §13).

(3) The third is that the group should be brought into interaction (perhaps in the form of rivalry) with other groups similar to it but differing from it in many respects.

(4) The fourth is that the group should possess traditions, customs, and habits, and especially such as determine the relations of its members to one another.

(5) The fifth is that the group should have a definite structure, expressed in the specialization and differentiation of the functions of its constituents.

Following these principles of group psychology—continuity, relation to the group, interaction, customs, and structure—IoT can progress to CoT. Once things are organized into communities, a wide range of applications provided by the vast variety of the humanitarian disciplines can be explored within the IoT paradigm. The next step is the progress from CoT to a society of things (SoT)—a body of things existing as members of a community.

In order for three or more entities to be organized into a community, the below principles should be taken into account:

Continuity: the system should always support legacy protocols. This means that in order for a group of things to become a community, they should continuously follow a specified set of goals.

Relation to the group: Each entity should understand its position and its purpose within a network/community.

Interaction: Groups of entities should be able to communicate with others either through rivalry or cooperation. These entities create the group based on a common goal and unified idea—a common purpose that unites them.

Customs: There should be a predefined position that the entities can occupy based on changes of specified measurable attributes. This means that entities' roles within groups are not fixed.

Structures: There should be two structures: communication and decision-making structures.

If a group of entities or beings within the IoT environment follows the specifications given above, then that group has transformed into a CoT.

6. Conclusion

This study is a call for building bridges between the social sciences and information technology. Community theories as well as principles of group psychology is a promising framework that accounts for the complex interactions among various parties involved in the IoT paradigm. Once IoT is transformed into communities, following the principles of group psychology—continuity, relation to the group, interaction, customs, and structure—a wide range of applications can be developed by borrowing theories from various disciplines, such as sociology, cultural studies, communication, and psychology.

The transformation of IoT into a community or society of things is simply one amongst multiple possible visions of IoT. The virtue of this vision is that it can initiate a wide-ranging discussion of the applications of social science theories to IoT.

The possibility of progressing from IoT to CoT has been enabled by viewing things as beings, which have identities that are defined by their involvement in self/other relationships; their engagement in the communication process; and their unfinalized nature.

The implication of this idea does not imply solely that things acquire an additional dimension in the virtual world, or so-called transcendence into virtuality; it implies that things acquire their "distinctive ontological specificity" (Shaev, 2014, p. 877). Yet, the transformation of objects into beings does not entitle us to apply social theories to IoT blindly following the particularities of human systems and dynamics, rather it demands adapting theories to the IoT paradigm taking into account "the ontological specificity" of smart things.

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