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Latour's Hotel Keys: An Actor-Network Ontology

Abstract

This project is a reintroduction of an illustration used by Bruno Latour in the essay "Technology is Society Made Durable," of a hotel manager who creates programs to increase customer compliance in returning their room keys. Verbal reminder, signage, and a weighted key fob are non-human actants that relate to customers such that customers either return keys (i.e., follow the program) or fail to return keys (i.e. follow the anti-program). Latour's network description is not grounded in an ontology, and we propose to create a small ontology using the open specifications of RDF, OWL, and SKOS in order to model it. The point of this project is to provide a robust, usable, and versatile framework for doing actor-network analysis, and to champion an approach to non-human actants characteristic of Actor-Network Theory (ANT) as also helpful for understanding systems. The interaction between knowledge organization and ANT has been limited, but should be explored further. ANT operates under certain implied ontological commitments concerning common properties of human and non-human entities as actants, and of relationships as formative of actant identities. In our project we will explore an ontology model for Latour's Hotel Keys and briefly discuss the lessons that this simple actor-network model provides for knowledge organization.

Introduction

During the last two decades of the previous century, the sociology of translation and eventually what came to be known as Actor-Network Theory (ANT) was developed most prominently by the French sociologist Bruno Latour, along with Michel Callon, Madeleine Akrich, John Law, and others. ANT has been employed primarily in the field of science studies, as a way to analyze the relationships and processes of human and non-human entities (actants) within research programs, and more broadly in any domain where actants form and re-form the social.

Actor Network Theory originated in the field of science studies to better analyze the way that technologies interact with humans. It rejects strong material dualisms between nature and culture, and also more conceptual dualisms that tend to frame sociological research, including structure/agency, and macro/micro levels of scientific investigation. Mike Michaels identifies three tenets of ANT as a *generalized symmetry* between all aspects of the network, especially between human and nonhuman actants; *generalized agnosticism* as to the merits of the winners and losers of any interaction that is modeled; and *free association* that does not harbor prior commitments as to what constitutes the social, the natural, etc.. (Michaels 2017) ANT has been criticized by its creators (Law 1999 ; Latour 1999) and taken up by new fields (primarily in anthropology), yet remains serviceable in its original vision as a framework for mapping complex human-technology relationships.

In this paper, we present an ontology for representing actor-networks. The relationship between ANT and ontology in a broad sense has long been apparent, from the intense discussion it has initiated concerning its ontological and even metaphysical implications, (Harman 2009; Hämäläinen and Lehtonen 2016; Jensen 2017, 2021) to its recognized potential for moving beyond various impasses (Cordella and Shaikh 2006 ; Hämäläinen and Lehtonen 2016), and finally its real-world applications (Priyatma 2013). However, very little if any attention has been directed toward the development of an actual ontology for ANT, in the sense of a formal representation of potential classes, properties, etc. of a domain as deployed within information science. Also, the methodology of ANT is long on conceptual development but often short on rigorous and robust frameworks for social analysis that allow for reproducibility or comparison. An ontology can incorporate the same empirical data with which ANT is interested, but do so in a way that is more generative of useful inferences from the data than the merely expressivist narratives that tend to define ANT literature.

ANT lends itself in certain obvious ways to modeling using ontologies. The symmetry between human and non-human actants in particular is a vitally important insight for network analysis, which seeks to model systems that are usually not purely human, but mediated or even initiated by technologies and other material forces.[1] Latour, in comparing ANT to perspective drawing, writes that "ANT does not tell anyone the shape that is to be drawn—circles or cubes or lines—but only how to go about systematically recording the world-building abilities of the sites to be documented and registered. In that sense, the potentialities of ANT are still largely untapped." (Latour 1999, 21) An ontology offers precisely this knowledge-how for registering world-building capacities in a way that can be standardized and expanded.

There are also interesting problems/challenges related to the creation of an ANT ontology. First, ANT is known for championing a "flat ontology" against conceptual hierarchies, while IS ontologies are usually dependent on hierarchy. There is no concept of *Class* assumed in ANT, for instance, under which entities can be subsumed. The ability to map actants with RDF triples allows for a description that is nimble enough to accommodate Latourian social assemblages, as well as the gradual emergence of sociotechnical entities.

Second, the nature of an actant is not necessarily the same as that of a person or object as typically represented in an ontology. Latour's definition of actant formalizes the person (or non-person) by defining it first in terms of a list of responses, which then is associated with a persistent identifier: "An actant is a list of answers to trials — a list which, once stabilized, is hooked to a name of a thing and to a substance. This substance acts as a subject to all the predicates — in other words, it is made the origin of actions." (Latour 1992 122) The actant can alternatively be defined in a more active sense but still in connection with trials: "whatever acts or shifts actions, action itself being defined by a list of performances through trials; from these performances are deduced a set of competences with which the actant is endowed [...] an actor is an actant endowed with a character (usually anthropomorphic)." (Akrich and Latour 1992, 259) This assembled nature of the actant seems at first to present problems for representation using an ontology, but properties can easily be defined as relations to programs. So, a customer *ant:hasProgramDisposition*, which both describes one aspect of its relation to the

[1] For a recent example of a situation of largely nonhuman initiation of an actor-network in the form of microchip floorplanning using AI, see (Kahng 2021).

program, but in doing so constructs the customer as customer (at least for a given version of the program of action, which is the extent to which an actant can ever be essentialized as such).

The Actor Network Ontology can be used for any actor-network analysis, but we have developed the ontology using a simple illustration from the ANT literature as a prototype case from which to generate data: the hotel key illustration, from Latour's 1992 essay "Technology is Society Made Durable." In this example a manager wants to retain as many room keys as possible when a customer checks out of his hotel. He therefore initiates a *program of action* to persuade customers, who each have their own dispositions toward this program from willingness, to carelessness, to outright savagery. Versions of the program include a progression of innovations such as oral reminders, instruction on signage in various languages, and finally a cumbersome weight attached to each key. Each new version of the program (transition through which is usually called *translation* in the ANT literature), adjusts the relationship of each customer to the program or the anti-program (i.e., non-compliance on key return). Each new version also includes technologies that can be represented as objects related to other objects, all of which—whether human customer or weighted key fob—are actants that persuade, acquiesce, or resist in relation to the program of action.

Latour uses a simple drawing to illustrate this situation, with a numbered row for each program version, each consisting of a queue of customers bifurcated by a line, the program adherents to the left and the anti-program adherents to the right. Such a diagram works well for conveying a very basic actor-network, and especially for highlighting the divisive nature of a program, how it persuades actants, iterates, and creates difference based upon dispositions, responses, and formations. At the same time the diagram is completely inadequate to ANT. It is static, two-dimensional, and does not map in any detail the relationships that are integral to the emergence of the actor-network. Our ontology was a response to irritation at the limitation presented by Latour's diagram, and seeks to replace it with a more dynamic model for the hotel keys actor-network.

Method

The two primary technologies that we relied on to create our ontology were SHACL and OWL. SHACL is a newer addition to the semantic technology stack, started only in 2015, and adds the ability to provide constraints to a set of triples.[2] We first generated a list of all of the different actants involved in Latour's hotel key example. As we went through the list, we created a SHACL shape that defined the component parts of each individual, what data needed to be recorded, and how these individuals would interact with other individual actants. As we went through this process we relied on the upper ontologies provided by both Gist and DBpedia.[3] Relying on upper ontologies allows our work to both reuse the work of others, and make it more shareable and reusable by others.

[2] https://www.w3.org/TR/shacl/.
[3] For an overview of the Gist ontology, see https://www.semanticarts.com/gist/. For the DBpedia ontology see https://www.dbpedia.org/resources/ontology/.

In the process of making and defining what each instance should look like with a SHACL shape, we filled out the OWL ontology, defining the classes and properties that were necessary to model Latour’s example. We created some example instances to both validate these with SHACL and to make sure that the ontology was complete. In the process of creating some test instances, we were able to both improve, and supplement the ontology and the SHACL shapes in order to fully cover the example. The dialogue between constraint and ontology allows for important critical feedback to flesh out the example in better detail. One other advantage to using SHACL with an OWL ontology is that the examples can be validated to make sure that they fit. One helpful component of OWL/RDF/SPARQL is the open world assumption. The open world assumption means that the triples that we create are not the only ones that could be created; this ontology, the related data, and the SHACL shapes are extensible, and reusable.[4] However, SHACL adds the ability to ensure a minimal valid set of instances. For example: a hotel key only fits one room, and if the data and the ontology allowed for more than one room to work with a hotel key, that would be a significant problem. With SHACL constraints, our hypothetical hotel keys are assured of fitting only one hotel room door.

We also made sure that we relied on OWL for the ontology, because OWL provides a necessary *semantic* layer to our model. OWL provides an important inference that we think is essential for illustrating one of the main points that Latour was making in his example of the hotel keys. One of the key parts of Latour's work is that as the program changes, all of the actants in the network also change. In RDF, each actant is a set of triples, a single identifiable instance with a series of predicates and objects that describe and clarify the instance's role in the graph. By using OWL’s inference capabilities, triples can be added to the instance based solely on the changes made to other triples. A simple example of this is the predicate *ant:hasAdherent*, which is a predicate added to a particular program. When a program adds an adherent, and someone begins to follow the program, OWL’s inference will also create the triple on the new adherent that she *ant:adheresTo* that particular program. The definition of the instances grows and changes as the program changes and OWL’s inference runs. The network grows, changes, and adapts as it is explored, and the program changes.

The ANT Ontology can be accessed at: https://e2dubba.github.io/latours-keys/

Discussion

One of the key components of ANT is the *program*, or *program of action*, which inscribes instructions for a desired end state from the perspective of one of the actants in an actor-network (namely, the architect of the program). The program of action, and significant nonhuman actants tied closely to program intentions, are what make ANT a

[4] The open world assumption is also important for ANT because the boundaries and domains of inquiry are never fully established, but always developing via open relationships between actants. (Tummons 2021, 5; Cordella and Shaikh 2006, 10)

unique theoretical approach, and any ANT ontology needs to make the program a central concept. In our representation, programs of action have the following properties:

ant:hasIntention: The intention is the goal or behaviorial change the program architect of the program wishes on the system
ant:hasAdherent: Adherents include both human and non-human actors, as well as the program architect
ant:hasVersion: The number of iterations a program goes through and the changes these iterations make
ant:hasPreviousImplementation: A link to the previous version of the program.

Each version of a program has at least one intention, at least one adherent (the program architect), and an enumerated iteration to indicate the extent of translation that has occurred within the network. Adherents are accumulated by the program as it is able to persuade actants to adopt its intentions and an amenable disposition toward the program. The intention of the program defines the program in relation to its surroundings, and has the following properties:

ant:fromPerspectiveOf: the architect(s) of the program.
ant:concernedAbout: An actant that the program intends to exist in a particular end state
ant:desiredEndState: The end state has both a ant:State class as well as another class distinguishing its character

ANT programs evolve as they recruit or repel actants toward/from the desired end state, and this change over time must also be representable in the ontology. This central aspect of ANT is called *translation* and has been defined as the "socialization of nonhumans whereby scripts for social action are embodied and performed by nonhuman entities." (Shiga 2007, 48) Our ontology uses *ant:hasVersion* and *ant:hasPreviousImplementation* to link each iteration of the program back to its previous forms. However, this could be implemented with RDF*.[5] RDF* allows for each triple to be the subject or object of another triple. However it is not yet fully supported by OWL or SHACL.

Programs in translation create actor-networks. In ANT an actant is the current assemblage of predicates, as they have been formed within the actor-network. As stated above, Latour's understanding of actant is empirical in the sense that it draws definition not from some inner essence, but rather from the observed responses to other entities. The ANT ontology therefore does not foreground the human so much as it does the trials, or programs, through which actants interact. Also, the key actants of an actor-network are not always human. In the hotel keys case study they are, in fact, the keys themselves. In other cases they may be shellfish which evade the best laid plan of conservationists and fisherman (Callon 1986). The centrality of these sometimes-simple actants is often elided by models that are concerned with intentionality that is assertive like human agency. An ontology that defines its humans in response to keys and their desired end state, however, allows us to refocus on the technologies that ANT was developed to better understand.

[5] For the W3 standard on RDF-star/RDF*: https://w3c.github.io/rdf-star/.

Conclusion

To what extent is our ontology itself (to borrow from the ANT glossary) an immutable mobile, which endures across contexts where actants are themselves formed and reformed? Creating an ANT ontology sets its own actor-network in motion by presenting its own program of action. Will researchers take this ontology as a point of entry for organizing knowledge about assemblages? Will information scientists and sociologists converge on new problems, using a new ontology alongside an older social science method to explain domains of interest?

Our own purpose in this short paper was to build an ontology that would help us to understand Latour, and that would also be useful for future research projects. Our own *ant:desiredEndState* includes actor-network analysis of the Amarna Letters with the ANT ontology.[6] Actants for such a project include 14th century BCE cuneiform tablets, diplomatic and military agents, ancient cities, trade routes, and 21st century CE digital humanities technologies for transcribing and representing these older actants, as well as the human actants who used these technologies.

Our ontology could just as well, though, be developed for new hotel key situations using hotel key cards, customers and their persistent identifiers, and dispositions of social trust necessary for such constellations of actants. (Keymolen 2018) On the other hand, fields related to knowledge organization and information science could benefit from ANT: human-computer interaction (Storms 2019), information behavior, user studies, and other areas of research all consider assemblages of technical and human interaction as they relate to programs of action.

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[6] For Goodwin’s past work creating a graph of personal names from Shlomo Izre’el’s transcriptions of the Amarna Letters, see https://e2dubba.github.io/linked-amarna/

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