Conceptualising a Web of Linked Actors

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ABSTRACT

Whilst it is widely understood that the Web is a socio-technical phenomenon – produced by both human and non-human actors – existing research tends to emphasize *either* the social *or* the technical rather than offering an integrative analytical framework. In contrast, this paper examines the affordances of Actor Network Theory (ANT) – derived from Social Science – in offering a better understanding of the Web as a socio-technical phenomenon. Our case study traces the evolution of the Linked Open Data Community (and specifically the Open Public Sector Community) which promises to shape the next iteration of the Web – the Semantic Web. The analysis highlights the formation of the network and relationships and interaction between important actors. We conclude with some remarks regarding possible disconnects within the network, and discuss the potential future usage of ANT as a framework to inform and analyse the Web as it evolves over time.

Categories and Subject Descriptors

B.3.2 Actor Network Theory

General Terms

Design, Human Factors, Theory,

Keywords

Web Science, Actor Network Theory, ANT, Open Government Data, Public Sector Information, PSI, Linked Data

1. INTRODUCTION

It has long been established that the Web is a socio-technical network [1]; constructed from the mutual shaping of society and technology [2]. In a bid to further develop our understanding of this co-constitutional relationship, Web Science has called for inter-disciplinary research to draw upon a range of methods from a number of disciplines to expand our understanding of Web phenomenon - including its growth, its impact on society and its potential future [1].

Web Science is not building upon unchartered grounds; there is a wide spectrum of research which concerns the Web from numerous disciplines [3-5]. Throughout the variety of research, one commonality can been, the acceptance of the socio-technical nature of the Web. The definition of 'socio-technical' enables us

to consider the Web as the interplay of both society and technology, which actively shape each other [2]. However the complexity of the relationships between human actors and technologies presents us with a problem; we need an analytical method to understand these networks, one which appreciates the complexities of their socio-technical nature and which, enables humans and technologies to be considered within the same analytical platform.

2. AN APPROACH TO WEB ANALYSIS

To address the analytical problems identified, we draw upon Actor Network Theory, a Social Science approach used extensively in the area of Science and Technology Studies (STS). ANT is a theory that explores the socio-technical networks that produce everyday outcomes. ANT provides an analytical framework which allows both human and non-human actors to be studied within the same domain, and which views the relationships that form between actors as the constructs of heterogeneous networks [6].

ANT's epistemological position aims to provide an analytical solution to the debate between constructivism and technological determinism [7]. By offering an alternative to both ANT focuses on how socio-technical networks are formed through the interactions of the actors. No *a priori* knowledge of the actors is assumed and it is only in the context of the network that actors gain agency and action occurs. ANT exposes a balanced view of a socio-technical environment, where all actors, including technologies, are considered equally. Callon [8] argues that ANT provides concepts and a method to describe the formation of a network of actors, which he refers to as the process of translation. He goes on to outline four stages, each corresponding to different activities and ways of interaction between the actors – in this process of translation: Problematisation, Interessement, Enrolment, and Mobilisation. Below we use these four stages to explore the LOD network

ANT has been used for a number of different information systems research studies [9-13] and also as the framework for E-Government studies [14-16]. This research has provided insight into the process of network formations and to demonstrate barriers to the adoption of technology. Within such research, ANT has been used as a method of understanding the interaction of actors, through the application of translation. We aim to take the application of ANT a step further, through conceptualising the process of translation that has occurred within the Linked Open Data Community we will show how ANT can be used as a tool to explore the socio-technical nature of the Web.

3. THE PROCESS OF TRANSATION OF THE LOD COMMUNITY

The Linked Open Data Community comprises a range of human and non-human actors, linked together in a network orientated towards exposing, sharing, connecting and making accessible

Web data. If these outcomes are realized, we may be witnessing a significant turning point in the evolution of the Web, from a system that works by linking documents to one is able to link data from heterogeneous sources to create new value, use and participation.

The linked data community involve academics, commercial and governmental interests, and new technologies such as Uniform Resource Indicators (URIs) and Resource Description Framework (RDF) [17]. An important 'sub' community that has seen recent growth and public awareness is the use of Linked Data within the British government, the 'Open Government data' or 'Public Sector Information' (PSI) community. To explore the formation and adoption of the PSI community, we will use the core concepts of ANT, to documentary research on the PSI community. [17-19].

3.1 PROBLEMATISATION

The first stage of translation involves the focal actor identifying other actors and their potential interest in forming the network. The focal actor becomes the *obligatory passage point* (OPP), making themselves indispensible within the network [8].

Academics are the focal actors in this network, thus we begin by exploring how they came to take this position. Firstly, they are a large number of research groups who are active within the linked data and Semantic Web research community. As part of their work, they seek to explore and push the boundaries of computing, which results in publications and further funding. Although the use of Semantic Web technologies and government data has implemented in countries other than the UK, research is still in its infancy. These countries, including the UK have begun publishing their data for public access, advocating a transparent government to its citizens. In light of this, the academics can take advantage of the circumstances and produce publications which call for the use of Semantic Web technologies in combination with the Open Government data. It is this initial process that defines them as the focal actors, implicitly championing the idea of using Semantic Web Technologies with government data, not only to demonstrate

Figure 1. Obligatory Passage Point

their knowledge and expertise, but also enabling them to identify a number of other actors within this network. The academics are now indispensible, becoming the obligatory passage point, shown in Figure 1.

During the Problematisation section, each of the actors within the network presents some interests and barriers to the overall stability of the network. Figure 1 illustrates these, which can be described as "*a system of alliances*" [8]. It is based on overcoming these obstacles through the relations that form within the PSI community that the common goal - achieving a linked Open Government using Semantic Web technologies - will be made possible.

3.2 INTERESSEMENT

The next stage of translation in the PSI community requires exploring how the entities within the network are come to be interested in aligning together..

The Interessement of achieving linked Open Government data can be explored by looking at how the academics use a number of devices to interest the other actors within the network. For actors such as the government and organisations (i.e. Ordnance Survey), the use of documentation and examples of where using linked data has been successful and less resource (time, money) consuming than expected acts as an Interessement device. The developer's interests are captured by the academics by the demonstration of how the linked data can provide them with a data rich environment, allowing them to develop new applications which were once not possible. Strengthening relations with the media is also performed by the academics promoting the advantages of Open Government data, explaining how transparency will provide the media with the ability to report news based on a wealth of government information.

Although the Interessement between the actors are important, based on the [17,19], an important observation is that a large proportion of the interactions within the network occur between the academics and the government. Academics create strong relations with the government, which in turn makes them more influential within the network. This demonstrates the triangle of Interessement - the strong ties made between actors weaken others. However for all the entities involved, the Interessement stage aims to provide solutions to gaining enrolment of the actors. As a by-product of this, it disrupts potential competing associations which may inhibit the success of the network; in effect it is constructing a system of alliances [8].

3.3 ENROLMENT

For the network to be successful, the actors involved within the network must align together, forming alliances, leading to enrolment. Through successful Interessement, enrolment occurs, which can be described as a "*group of multilateral negotiations*" [8], supporting the Interessements and allowing them to succeed.

In the case of the PSI community, success is denoted by the acceptance of Linked Open Government Data by all the entities that have been identified in the network. Enrolment of each of the actors is required for this to occur. Government employees must accept change, and be willing to cooperate with the new ways of publishing and storing the information.

Resistance was identified [18] as a barrier during Enrolment by the government, stemming from the worry about data misuse, expensive publishing costs, and concerns that changing to the new publishing format would causes inefficiencies and disruption
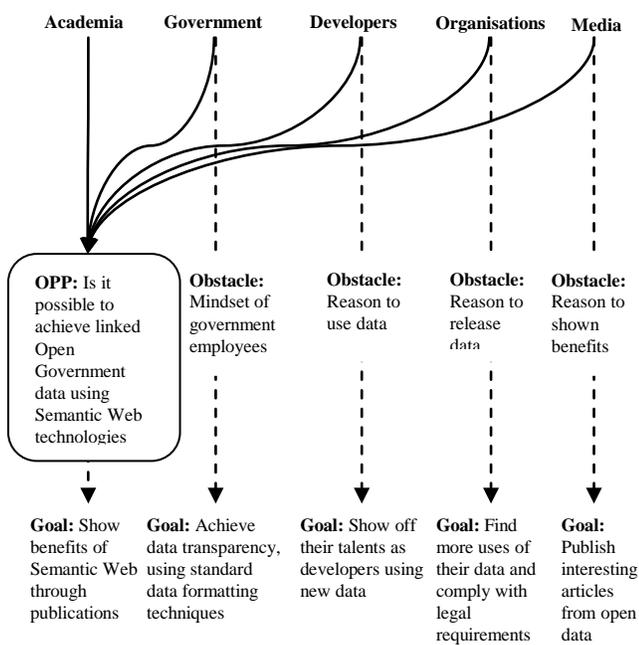
to the existing infrastructure. However, through the devices of Interessement, namely, examples, statistics and software prototypes, the academics gained the enrolment of the government.

Enrolment of the organisations also posed a struggle, financial factors and disbelief of the linked data's added-value presented themselves as barriers. The academics tackled this by demonstrating how linked data provided the organisations with a number of benefits, from consistency checking, lower cost of public data access and also the requests for providing better access to public sector data. Enrolment was also influenced by the immutable mobiles [8] within the network, the government standards/legislation acted as Interessement devices, enrolling the organisations to conform to the new standards of data transparency.

3.4 MOBILISATION AND STABILITY

By gaining alignment of all the actors in the network through different methods of Interessement, the goals that were first identified within the Problematisation stage of translation were met; linked Open Government data was achieved.

Through the alliances of the academics and the government, Data.gov.uk was created, providing a single access point for Linked Open Government Data. Councils were more forthcoming with the requirement to publically release their data, some even employing specific staff for such a task. Furthermore, mobilisation of the network was a result of enrolment of organisations and their relations with the government through the policies that were produced. Ordnance Survey published previously restricted geographic information to the public. Based on this mobilisation, the developers form alliances within the network, demonstrated by a number of applications which utilised the data that was available at Data.gov.uk.

The alignment of the discussed actors gained the agreement of the media to form alliances within the network. Both the '*Guardian*' and '*The Times*' produced a number of news articles based on ministers expenses data and other open public financial data. The release of the Ordnance Survey geographic data in combination with government data provided the media with visual statistics which gained the interest of their readers, thus raising their profile.

The PSI network it seems has reached stabilisation, a process that occurs after translation of the network. There is a continuous growth of linked government data and software being produced by developers. At the same time, the relations between the academics and the government are being reinforced by the release of new policies and legislation, which also strengthens the relations between the organisations and other actors within the network.

4. DISCUSSION

Using the conceptualisation of the process of translation we have uncovered a number of important findings regarding the formation of and relationships between actors within the PSI community, which may extend to other emerging communities forming on the Web. Academics have a much more central role within the network compared with other actors; they appear to champion the majority of discussions and key meetings, spurring on and pro-actively developing the network. Due to their central role, triangles of Interessement occur, notable by the lack of discussion between the government and developers. The strength of the

relationship between the academics-government and academics-developers makes the academics indispensible, but at the same time, limits the government-developer relationship.

Analysis of the Problematisation stage also exposes the exclusion of end-users as potential actors within the network and raises a number of questions about the purpose of the network, and its future stability. The explicit aim of Open Government data is to provide public access to once unpublished or hard to find data. However, it appears that end-users are not considered as important actors, rather as just the end users of the software produced. This potentially threatens the stability the network; LOD may be an exciting research venture for both academics and the government, but without users, it cannot be sustained.

5. CONCLUDING REMARKS

To address the call to understand the Web [1], we must first understand its underlying structure. ANT provides us with an analytical framework to conceptualise the Web, enabling its socio-technical nature to be unpacked. ANT's process of translation uncovers how events happen through the interaction of human actors and technologies. Exploring the UK PSI community through the lens of ANT highlighted potential problems and missing actors, offering a different perspective on how the community evolved and stabilised. The findings it has presented may extend out to other emerging communities that are potentially shaping the future of the Web. By understanding their socio-technical nature, we can make calculated assumptions of future evolving communities on the Web.

Future work includes a comparative study of networks, helping us to further our socio-technical understanding of the Web - a Web of individuals, organisations, and activities, achieving their aims by leveraging Web technologies and standards to provide a Web of data and documents.

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