

Sociological ontology of the digital public sphere: the case of Web 2.0/3.0

Pedro Andrade

pjoandrade@gmail.com

Centro de Estudos de Comunicação e Sociedade

ABSTRACT

Digital public sphere is immersed in the present conjuncture of accelerated transformation and probable rupture, which certainly will affect the way we exercise our citizenship in contemporary times. This social and political tsunami is partly based on the change of paradigm of Web 2.0 or Social Web to Web 3.0 or Semantic Web. To clarify such a process, this paper discusses some of the key issues and theoretical positions on public space, from seminal Habermas's perspective to new problematics raised by the networked society. The author suggests the construction of a *Sociological Ontology of Social and Semantic Web*, based on a *Semantic-Logical Sociology and Methodology*. These procedures are applied through the analysis and hermeneutics of a *Wikipedia* page entitled 'Web 2.0', where sociological experimental tools are used, as *Semantic-Logical fields, trees and networks*, central and peripheral concepts, and *trichotomies*.

KEYWORDS

Digital public sphere; Sociological Ontology; Web 2.0/3.0; Semantic-Logical Sociology/Methodology; trichotomies

1. INTRODUCTION

The public sphere has been problematized in recent years, in particular in an attempt to meet the new needs emerging within the network society. In this new social paradigm, the public sphere, in some of its traits, is reconverted into a digital public sphere. However, this concept is susceptible to ambiguities, acquiring different meanings within the Internet in general, or specifically inside the Web 2.0 or Web 3.0.

It is known that Web 2.0 (also named Social Web), developed in the first decade of the 3rd millennium, allows more active activities and strategies by the cyberspace user, when compared to the initial period of the Internet, during the last decade of the twentieth century, which some authors came to call 'Web 1.0'. In the Social Web, the user is not limited to retrieve information but also writes it, and does so especially in the context of social networks, eg. *Twitter* or *Facebook*.

For its part, in Web 3.0 or Semantic Web, internet sites or other virtual places include not only information, but focus essentially on knowledge. In other words, the information provided by producers and writers of a digital site inside the Semantic Web, is not primarily presented in a somewhat descriptive way, as in previous information systems. In addition, in a Web 3.0 site, there is the concern to provide explanations, clarifications and interpretations about the content, in order to turn it into knowledge which can be shared globally in a more effective manner.

For this purpose, Web 3.0 uses specific instruments, such as Ontologies. The original meaning of the term takes 'Ontology' as the domain of philosophy dedicated to the reflection on the essence of being and reality. Especially in the last decade, a new connotation arose in the area of Information and Computing Sciences, where 'Ontology' signifies a set of concepts and relationships that define the meanings within a specific field of information and knowledge, as will be explained in further detail.

2. A 'SOCIAL' AND / OR 'SEMANTIC' DIGITAL PUBLIC SPHERE?

Under such perspective, the aim of this paper is to investigate how the public sphere has been metamorphosed or how it can be transformed in the context of both Web 2.0 and Web 3.0. For this aim, the first step is to discuss some recent theoretical and empirical perspectives on public space, particularly those that come closer to the three ages of the reticular internet.

WEB 1.0

Jeremy Riel (2012), based on a national survey in the U.S., concludes that social actors that have better technological skills and a refined digital literacy develop a more participatory citizenship. In Europe, an essential question is to know how institutions, media groups and NGO's working in the area of communications, may constitute themselves as agents embedded in the European public space (Bee & Bozzini, 2010). Some comparative studies at a global level conclude that engagement with digital environments influences citizens' political orientations (Anduiza, Jensen & Jorba, 2012).

In what concerns education and culture, a digital public sphere introduces a new media literacy, which must be analysed from a 'global mediagraphy' (Gripsrud & Moe, 2010). More specifically, one of the most central territories of the current global political economy of knowledge and of its digital public sphere is the university. There, the 'academic capitalism' and the democratization of communication, among other factors, encourage academic forae, where the relationship between private and public interests is discussed, more than anywhere else. The university is established, then, as a 'global public sphere' that includes a huge potential for democratic transformation (Pusser, Kempner & Ordorika, 2011).

WEB 2.0

With regard to Web 2.0, Howard Rheingold (2012), one of the gurus of virtual communities, believes that digital media have to be used in a smart way, as necessary condition for achieving success in the public space. In other words, 'networks smarts' or 'net smarts' produce better 'netizens' or web citizens, particularly in the case of digital social networks, where the accumulation of personal power can be transformed into a collective public asset.

Targeting these common citizens, the political classes of advanced modern democracies, and especially Western societies, develop political campaigns that increasingly

utilize new media, such as social networks, compiling huge databases and investing extensively on strategies based in multimedia (Howard, 2005).

However, the disenchantment with the action of professional politicians seems to lead to some civic apathy. Or, more precisely, the phenomena of public interest in the blogosphere, in net activism and news online, show that citizens are not exactly indifferent to the *res publica*. What is happening is that the convergence of technology, practices and digital spaces, transforms modern public sphere into a sphere somehow private, where a unique way of exercising citizenship emerges (Papacharissi, 2010).

Concerning the world of media, digital journalism questions a number of practices and standards of its profession, such as the legal regulation of online journalism, the conditions for veracity in the news, the journalist's identity and his relations with the audiences, etc. (Jones & Salter, 2012). The places where news are produced daily (newsroom, etc.) also undergo remarkable transformations, e.g. in these aspects: production of multimedia information, redefinition of journalistic genres, management of the content generated by readers, relationships with bloggers, etc. (Paterson & Domingo, 2011).

The digital public sphere also includes its own utopian space. This dimension of utopia, according to Habermas, constitutes a possible development of potentialities neglected during the Enlightenment (Johnson, 2012). In general, the Internet, and Web 2.0 in particular, create favourable conditions not only for the participation and organization of anti-capitalist political agendas and for the production of unprecedented cultural alternatives, but seems to be also vulnerable to the growth of the extreme right (Atton, 2005). More specifically, 'digital rupture' (Lindgren, 2013) unfolds in forms such as digital piracy, online activism, remix culture or other social and cultural movements. Such alternative strategies, founded in the seminal movement of social criticism within the blogosphere (Ringmar, 2007), recently moved to one of the most influential digital fractures, the WikiLeaks case. This digital social movement shook the very roots of international strategies of political communication by sovereign states. Furthermore, it contributed significantly to changes in the news world towards a global network system (Beckett, 2012).

However, the freedom promoted by the internet is accompanied by a 'dark side', such as the threats to political dissidents inside social media sites in countries like Iran and China (Morozov, 2012). In the latter, internet cafes (Sun, 2010) emerged as one of the places in cyberspace where civil society, and especially young people, resist, in a more viral way, to regulatory policies enforced by the government. Nevertheless, in such an E-public sphere, cyberplaces enclose a dual nature: the singularities and ubiquities of the Internet Cafe are appropriated and utilized by state bureaucracy to exercise a deeper control over its citizens.

Likewise, in Islamic countries, the young have developed an online political communication and digital citizenship, in so doing seeking to emancipate and escape from the control perpetrated by religious elites (Howard, 2010). There, new technologies are one of the most indispensable means of democratization and revolution, through the internet, blogs, mobile phones, etc.. Besides the massive street protests broadcasted by

Western media, activists in Muslim and Western countries are now using digital tools to revisit the interpretation of Islamic texts, male and female gender roles, etc.

In short, today we are witnessing a paradigm shift in public space: in the traditional hierarchical public sphere, media help citizens to discuss ideas that support their decisions. This model is being replaced by a networked public sphere, where all agents (newspapers, organizations and citizens) acquire power to communicate and discuss. Some examples of this current paradigm are BBC international journalism, Guardian's Open Journalism, media initiatives from the Syrian opposition, online advocacy groups, among others (Beckett, 2012b).

WEB 3.0

And what is happening in Web 3.0? Take the case of Google. Although this service has been established for years, it has characteristics that bring it closer to the not yet fully deployed Semantic Web, eg. the various strategies enabled by its search engine. Recently, Google announced that it will introduce a semantic search engine, more 'intelligent' than previous ones.

We are testifying even a 'Googlization of everything'. That is, our way of thinking is more and more governed by the need of a relentless search, which may be opposed to an ecosystem in the Internet which takes into account the interests of all citizens (Vaidyanathan, 2012).

In addition, we have verified in the above sections that one of the most important Semantic Web instruments are Ontologies, which have received, besides its seminal philosophical connotation, a meaning originated in Computer Science. A collective study on this genealogy was published recently, clarifying the similarities and differences between the two areas, regarding the historical and methodological dimensions, in terms of interdisciplinarity and in the context of current research (Poli, Healy & Kameas, 2010).

Another area where Ontologies are heavily applied is Information and Documentation Sciences, particularly in the management of libraries, mostly digital libraries, which now also call themselves semantic digital libraries. Such libraries articulate Web 2.0 social networks to specific Web 3.0 semantic instruments, in projects and prototypes such as *Greenstone* or *BRICKS*. This strategy for research of information sources, and especially knowledge, is already proving to have a profound influence in teaching methods at universities and international scientific centers (Kruk & McDaniel, 2010).

Social sciences sometimes adopt this term in specific analysis, or at least in their works titles, producing interpretations of ontologies that lie between Philosophy and Sociology, but that rarely include articulations with Computer Sciences and Multimedia. Some examples are the following studies: the 'ontology of present' by Frederic Jameson (2013), the 'ontology of objects' (Olsen, 2010), the 'ontology of garbage' (Kennedy, 2008), etc.

An exception to this deficit is the proposal of a new paradigm of knowledge, Semantic-Logical Sociology, developed since 2007, which interprets social processes occurring within Web 2.0 and Web 3.0, using methodologies such as social and sociological Ontologies, content and discourse analysis of web pages like *Wikipedia*, etc. (Andrade, 2011).

Another contribution to this alternative direction is the set of texts coordinated by Gilles Falquet (2011) on the application of Ontologies into the urban fabric, in areas such as urban mobility, the development of the city, road systems and cultural heritage.

3. A SOCIOLOGICAL ONTOLOGY OF THE SOCIAL AND SEMANTIC WEB

The referred promising contribution of ontologies to research in the Social Sciences and Humanities may be materialized through the development of these hermeneutic instruments in several specific areas of knowledge. We said above that an Ontology, in the context of Information Sciences, is a set of concepts and relationships within a particular area of knowledge and the reality it refers to. A Sociological Ontology means a network of concepts and relationships included in sociological knowledge, which deal with the social reality.



Figure 1 Corpus: Page entitled 'Web 2.0' in Wikipedia

We present below a draft proposal of a Public Sphere Sociological Ontology, but for now, only in the area of public cyberspace represented by Web 2.0 and Web 3.0. Concretely, one of the prototypical exercises for this goal consists of a case study that focuses on the extraction of concepts and their relationships in a Wikipedia page, which features distinctive traits of the Semantic Web. Indeed, this digital encyclopaedia rests on the production and revision, by end-users, of semantic definitions of concepts related to universal knowledge. The page used as *corpus* is named 'Web 2.0' (cf. Figure 1), it was consulted on 01.16.2013, and also contains information about Web 3.0, a subject that does not have its own page on *Wikipedia*.

SEMANTIC-LOGICAL FIELDS, TREES AND NETWORKS

Content analysis performed on that page indicates that the more frequently significant terms occur in the semantic-logical field of ‘Communication and media’, that sums 324 occurrences within the various phrases of the text (see Fig.2). A semantic-logical field is a sub-area of knowledge within a Sociological Ontology. This field appears to be quite relevant to the study of the digital public sphere. However, in this restricted space of a magazine article, we include only an introductory analysis, on this and other substantive areas. In fact, it is more important to show here the usefulness of the semantic-logical methodology.

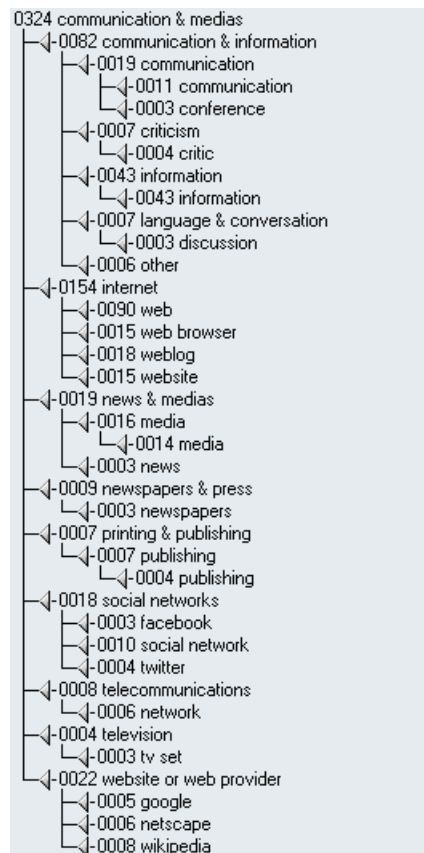


Fig.2 Semantic-logical field ‘Media and Communication’ (semantic-logical tree including concepts’ hierarchical structure and frequencies)

Figure 2 translates the semantic-logical field ‘Communications and Media’ into a semantic logical tree. This hermeneutic instrument represents a conceptual organization that highlights the most relevant semantic meanings, establishing logical relationships between its terms, like the hierarchical relationship between more general classes and more particular categories. In the case in question, and within a preliminary general reading, digital public sphere is more represented than traditional electronic media, both regarding the variety of concepts and the frequency of references. In a more specific analysis, the bottom of the tree shows that mentioned ‘websites’ (a broader class) are mainly “Google”, “Netscape” and “Wikipedia” (more particular categories).

“Specialized protocols such as FOAF and XFN (both for *social networking*) extend the functionality of sites “

“Web 3.0’s (...) webs are an extension of Web 2.0’s participatory technologies and *social networks* (Facebook, etc.) “

Specifically, some textual instances regarding *Facebook* are the following:

“Inspired by interactive websites such as *Facebook* and ebay, Zidisha’s microlending platform facilitates direct dialogue between lenders and borrowers and a performance rating system for borrowers. “

“critics have argued that sites such as Google, *Facebook*, Youtube, and Twitter are exploiting the free labor of user-created content., “

Compare the previous mentions to quotes on *Twitter*:

“Networks such as *Twitter*, Yelp and Facebook are now becoming common elements of multichannel and customer loyalty strategies “

“Furthermore, the financial services industry uses *Twitter* to release ‘breaking new’ and upcoming events, “

“For example companies use *Twitter* to offer customers coupons and discounts for products and services. “

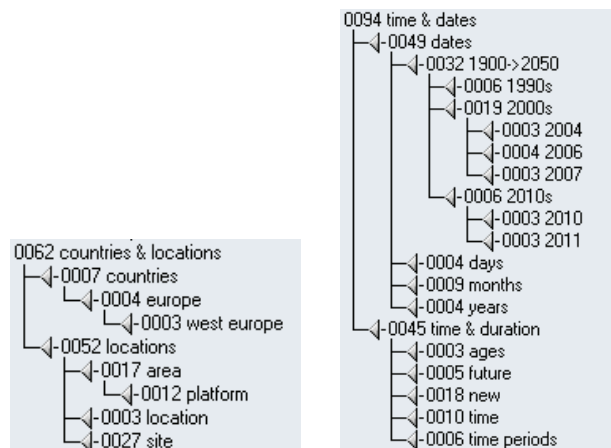


Fig.4 Semantic-logical trees on space and time, mentioned within public cyberspace and cybertime

Next, relating the quantitative and qualitative analyses: we saw above that Wikipedia is a site that features important programmatic and constitutive components that belong more to the nature of Web 3.0, such as definitions of concepts. In Figure 2, we see the prominent position of Wikipedia in terms of (8) discursive quotes in relation to each

of the other sites and social networks mentioned. This socio-discursive indicator, if it is articulated to others, shows that the presence of Web 3.0 continues to grow and emerge as an alternative to those social networks within Web 2.0 that do not stress the importance of knowledge for the development of citizen participation in the public sphere.

Another possible representation within Sociological Ontologies is semantic-logical networks. These are networks that highlight the semantic meanings of the sources selected, as well as the logical relationships between them. We can analyse a large *corpus* or just a semantic-logical field inside this *corpus*. In either case, the network is presented in a visual form including nodes (spheres) linked by relationships (lines). Figure 3 depicts a semantic-logical network representing all the notions and connections included in the semantic field 'Communications and Media', whose concept and its direct relations with other notions are noted in blue.

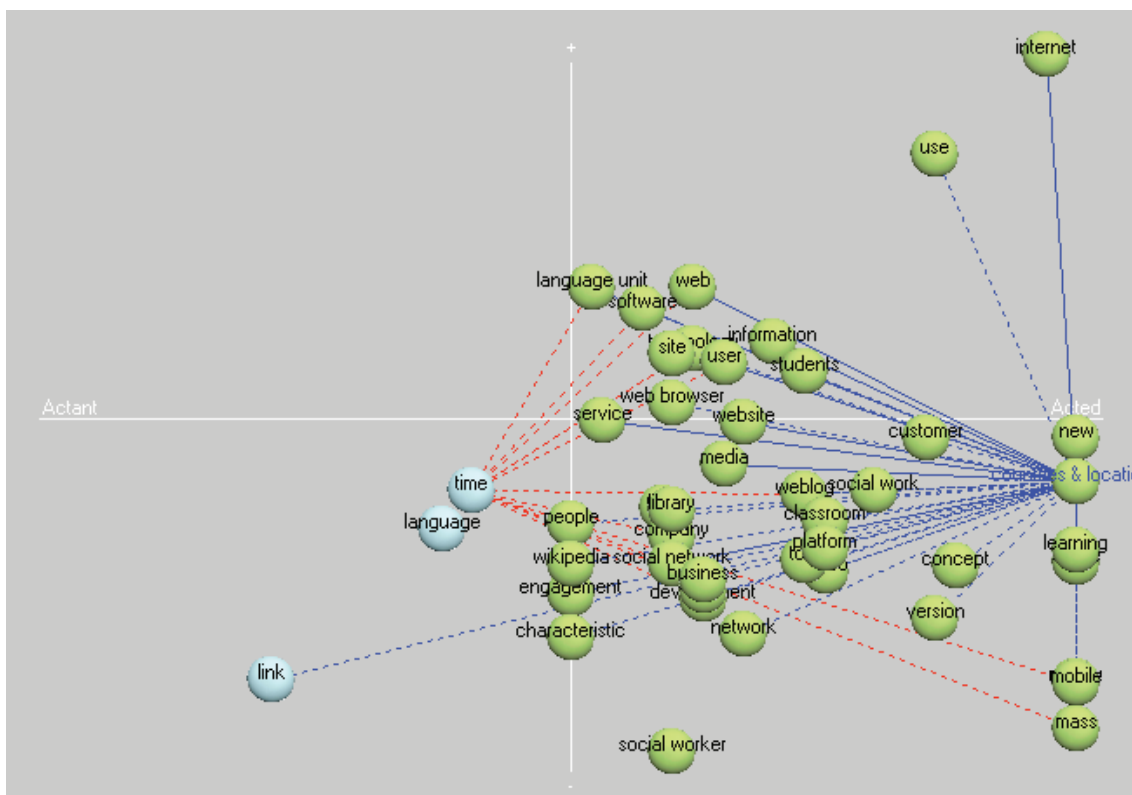


Fig 5 Semantic-logical network representing time and social spaces and the corresponding associated concepts

Considering that the general view of the network is difficult to read in detail, let's analyse now some particular networks where specific concepts and relationships associated with the digital public sphere are pointed out, as we proceeded in the analysis of the semantic-logical trees.

First, note that digital public space is associated with cyberspace but also with cybertime. This last notion means the set of temporalities activated by users when they travel across cyberspace. For example, if two infonauts consult a web page at different times, the time of both persons does not coincide. Therefore, this is an *asynchronous*

time. However, in a chat dialogue, their time overlaps and thus this means a synchronous time.

The 2 semantic-logical trees inside Figure 4 show the concepts mentioned in the analysed page which relate to the social space (countries and other locations) and to social time (time and dates). Here there is an articulation between, on the one hand, space and time represented in the *Wikipedia* page and, on the other hand, cyberspace and cybertime mobilized by users browsing this page. For example, the ‘time and dates’ section includes more references to the period covering the emergence of Web 2.0 (19 entries for the 2000s) than to the time lapse related with the expansion of the first age of the Internet (6 occurrences for the 1990’s). The present decade, where some disappointment towards social networks like *Facebook* begins to appear, and where the Web 3.0 paradigm emerges with more strength, the 6 entries for only 3 years, show the relevance of present times for rebuilding the cyberspace / cybertime arena.

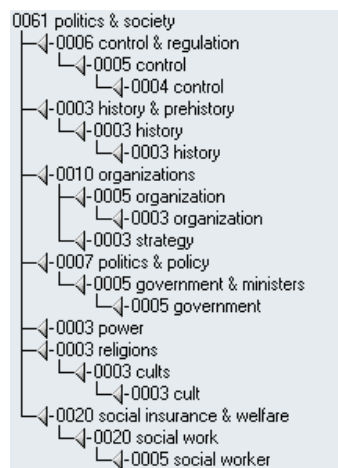


Figure 6 Semantic-logical tree representing semantic-logical field ‘Politics and Society’

In section ‘time & duration’, the 18 references to ‘new’ and the 5 quotes on ‘future’ dominate the discourse on the temporalities in this *Wikipedia* page.

Regarding the public space/locations spoken within public cyberspace, *Wikipedia* discourse neglected, in part, the contributions of North America and South America, as well as other non-western societies and cultures, in the development of Web 2.0/3.0.

Such societal spatialities and temporalities can also be displayed through semantic-logical networks, presented in Figure 5 in a simplified version, with fewer concepts and relationships for better readability. In general, the terms on the left, in blue, are those that work as previous ideas within the text phrases (conditions, causes, activating ideas, etc.). In turn, words on the right, in green, refer to the posterior terms within the propositions across the page (consequences, effects, activated ideas, etc.). In addition, the most relevant concepts and relationships are situated at the upper part of the network.

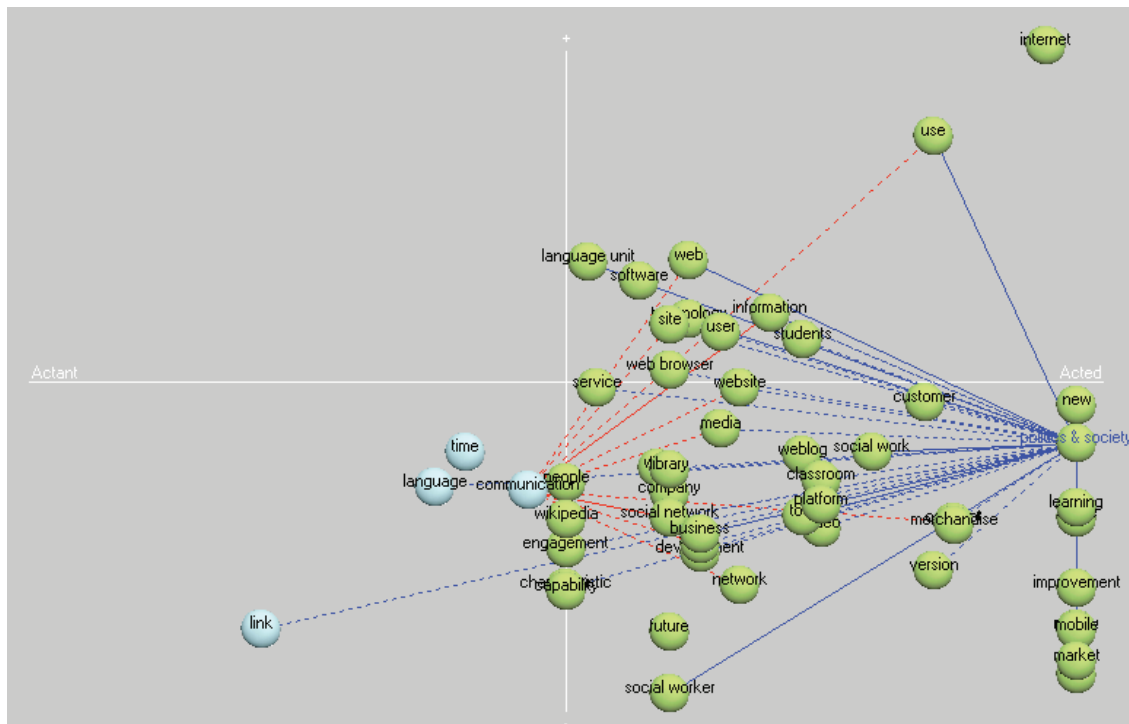


Figure 7 Semantic-logical network representing relations between central concepts 'communication' and 'political'

In this logical-semantic space, we find two central concepts: time, represented by node 'time' (see the blue homonymous sphere on the left in the image), and space, through the node 'countries & locations' (cf. blue sphere on the right section of the network). Such key terms are related to each other and to other peripheral concepts via various modes of articulation. In addition to the 'horizontal' and 'vertical' connections between the concepts described above, it is possible to note 'oblique' relations, those that link each peripheral concept to the two main terms. The first of these two central concepts, 'time', connects to other concepts through the lines marked in red. And the 'space' node is in contact with other ideas across the blue lines. Solid lines signify a strong connection, and the dashed lines reflect a weak one.

Another semantic-logical field relevant in the page refers to politics and society. The respective semantic-logical tree is in Figure 6. Notice the prominence of actors in civil society, such as organizations, within the public digital sphere (10 occurrences). However, state intervention is also remarkable, particularly through public policies (6 references). The discourse of *Wikipedia* also emphasizes the leading role of policies and practices on social solidarity (20). Using semantic-logical networks, one can relate every concept in the text with the political public sphere, for example through the connections between the idea of 'communication' and the notion of 'politics', as shown in Figure 7.

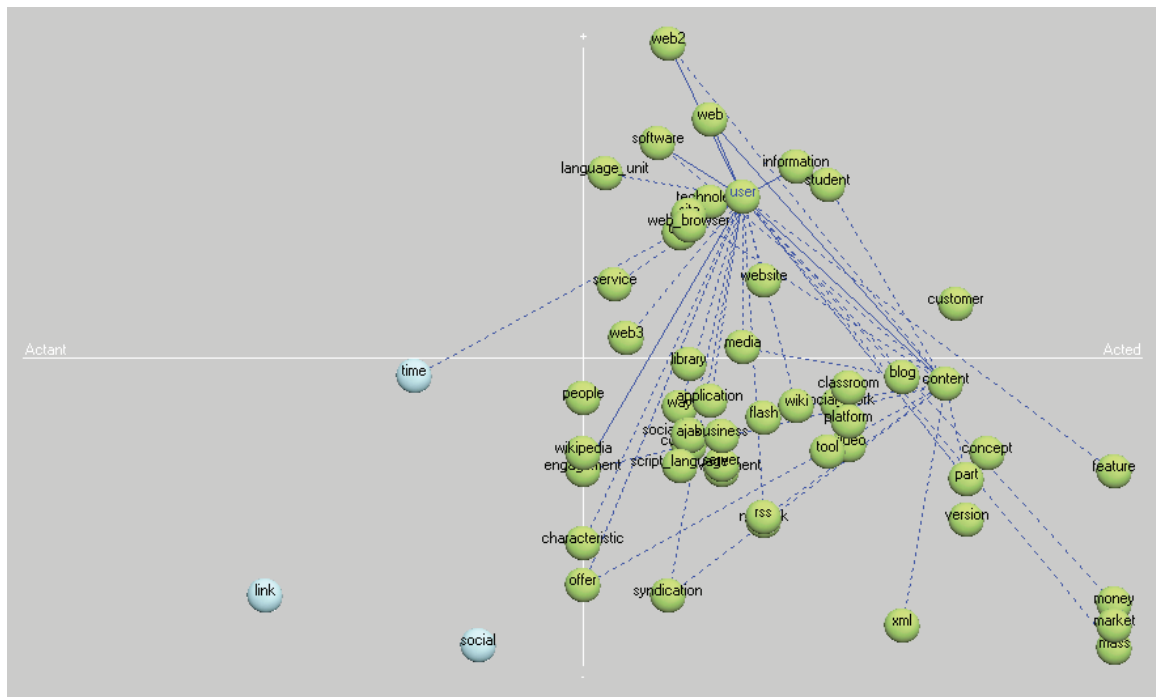


Figure 8 Trichotomous semantic-logical Network representing links among central concepts 'user' and 'content' articulated with Web 2.0/3.0

TRICHOTOMIES

In addition to the previously stated, one semantic-logical alternative way for relating ideas extracted from the *corpus* is the use of *trichotomies*. A trichotomy is defined as a set of three ideas associated with one another. I.e. it is possible to exchange ideas in an even more versatile way than using 2 central concepts connected with each other and to other peripheral concepts, as discussed above.

For example, consider a research on how the discourse inherent in the analysed *Wikipedia's* page, enunciates the relationship between Web 2.0 and Web 3.0. For this aim, we may consider the following starting question: how do users relate to these two ages of the Internet, within a network of social and semantic meanings? Looking at Figure 8, whose central concepts are 'user' and 'content', it is visible that the line between them is continuous, expressing a solid dual relationship.

However, it is possible to extend this connection to three concepts in order to establish a deeper hermeneutics, through a **trichotomous semantic relationship**. In this case, the researcher takes, as a third (peripheral) concept, the dominant paradigm in the Internet, in its 2 values of Web 2.0 and 3.0. Note that the link between the node that represents the 'user' and the node 'web 2' is a solid line, which shows a strong connection. Instead, the link of 'user' with 'web 3', a dotted line, means a weak bond. In other words, nowadays the internet user still produces little information and especially insufficient knowledge in Web 3.0 sites, according to *Wikipedia's* implicit discourse, which in this case seems to reflect reality.

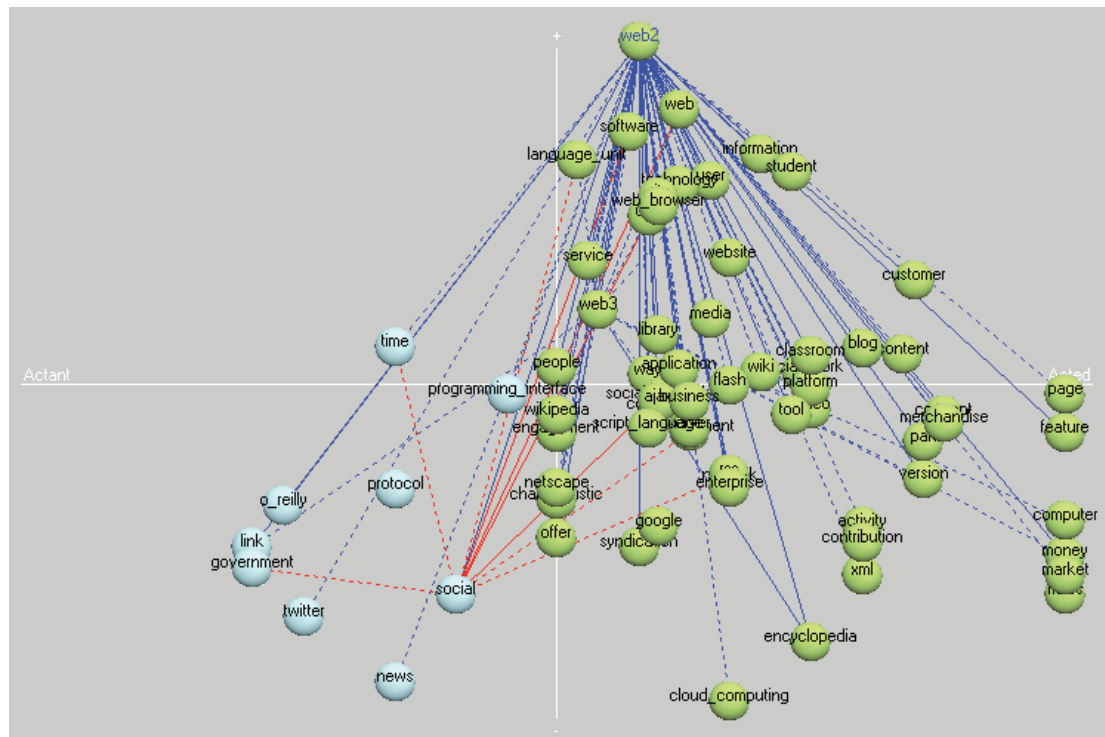


Figure 9 Trichotomous semantic-logical network representing links among the central concepts 'Web 2' and 'Web 3' according to its 'social' meaning

Here are some illustrations of text phrases that express these relationships summarized and outlined in the precedent semantic-logical networks. The phrase “all opinions and user-generated content are equally valuable and relevant” clarifies that the exercise of citizenship in the digital public sphere is one of its key pillars. An instrument that provides this mode of intervention is Google, that, as noted above, in the process of transforming its search engine into a semantic tool, is at the forefront of the turning of the Social Web paradigm into that of the Semantic Web: “Google exploits this user-generated content to offer Web search based on reputation through its ‘Pagerank’ algorithm.”

Web 2.0, and Web 3.0 in particular, are associated with the following trends: “rich user experience, user participation, dynamic content, metadata, web standards and scalability.” That is, Social Web invests more on user experience and participation, while Web 3.0 seeks to convoke such collective participation, in alliance with experts, for developing dynamic web content, for example through automatic contents extraction from sources structured through standardized metadata that provide scalability.

Finally, a more visible illustration of this trichotomous relationship between three concepts: the articulation between the central concepts ‘Web 2’ and ‘Web 3’ according to its ‘social’ meaning. In the semantic-logical network in Figure 9, the third concept is highlighted in blue, and its relationships with Web 2 and Web 3.0 are marked by red lines, for more visibility.

4. CONCLUSION

This paper intends to draw attention to the fact that the digital public space is immersed in a full metamorphosis, and such a process entails profound consequences for the exercise of citizenship. In fact, for building a democratic digital public sphere, it is not enough to use a Social Web interactively. In addition, it is necessary to know how to produce knowledge in a participative way, so that the digital communities' opinions can be based on a clear knowledge and shared through this citizenship knowledge.

In short, the announced change in our paradigm of digital social life is transiting from Web 2.0 to Web 3.0 or is being built by the hybridization or both. Such transformation can be detected by sociologists through the use of theoretical and methodological tools that translate properly the digitality of the contemporary public sphere. Some of these instruments are Semantic-Logical Sociology/Methodology (using Ontologies extensively) and other emancipatory proposals regarding collective and common knowledge. ✍

Translation of the author

BIBLIOGRAPHY

Andrade, P. (2011) *Sociologia Semântico-Lógica da Web 2.0/3.0 na sociedade da investigação: significados e discursos quotidianos em blogs, wikis, mundos/museus virtuais e redes sociais semântico-lógicas*, Lisboa, Edições Caleidoscópico.

Anduiza, E., Jensen M. & Jorba L. (eds.) (2012) *Digital Media and Political Engagement Worldwide: A Comparative Study*, Cambridge University Press.

Atton, C. (2005) *An Alternative Internet*, Edinburgh University Press.

Beckett, C. (2012a) *Wikileaks*, Polity Press.

Beckett, C. (2012b) *Communicating For Change: media and agency in the networked public sphere*, Polis, 2012b.

Bee, C. & Bozzini, E. (eds.) (2010) *Mapping the European Public Sphere*, Ashgate.

Falquet, G. et al. (2011) *Ontologies in urban development projects*, Springer.

Gripsrud, J. & Moe, H. (eds) (2010) *Digital Public Sphere: Challenges for Media Policy*, Nordicom.

Howard, P. (2005) *New Media Campaigns and the Managed Citizen*, Cambridge University Press.

Howard, P. (2010) *The Digital Origins of Dictatorship and Democracy: Information Technology and Political Islam*, Oxford University Press Inc.

Jameson, F. (2013) *A Singular Modernity: Essay on the Ontology of the Present*, Verso Books.

Johnson, P. (2012) *Habermas: Rescuing the Public Sphere*, Routledge.

Jones, J. & Salter, L. (2012) *Digital journalism*, SAGE.

- Kennedy, G. (2008) *An Ontology of Trash: The Disposable and Its Problematic Nature*, State University of New York Press.
- Kruk, S. & McDaniel, B. (2010) *Semantic Digital Libraries*. Springer-Verlag Berlin.
- Lindgren, S. (2013) *New Noise: A Cultural Sociology of Digital Disruption*, Peter Lang Publishing.
- Morozov, E. (2012) *The Net Delusion: The Dark Side of Internet Freedom*, PublicAffairs.
- Olsen, B. (2010) *In Defense of Things: Archaeology and the Ontology of Objects*, AltaMira Press.
- Papacharissi, Z. (2010) *A private sphere: Democracy in a Digital Age*, Polity.
- Paterson, C. & Domingo, D. (eds.) (2011) *Making Online News: Newsroom Ethnographies in the Second Decade of Internet Journalism*, Peter Lang Publishing.
- Poli, R., Healy, M. & Kameas, A. (2010) *Theory and Applications of Ontology: Computer Applications*, Springer.
- Pusser, B., Kempner, K. & Ordorika, I. (eds.) (2011) *Universities and the Public Sphere: Knowledge Creation and State Building in the Era of Globalization*, Routledge.
- Rheingold, H. *Net Smart: How to Thrive Online*, MIT, 2012.
- Riel, J. (2012) *The Digitally Literate Citizen: How Digital Literacy Empowers Mass Participation In The United States*, lulu.com.
- Ringmar, E. (2007) *A Blogger's Manifesto: : Free Speech and Censorship in the Age of the Internet*, Anthem Press,
- Sun, H. (2010) *Internet Policy in China: A Field Study of Internet Cafés*, Lexington Books.
- Vaidhyathan, S. (2012) *The Googlization of Everything: (And Why We Should Worry)*, California Univ. Press.
- 'Web 2.0', In Wikipedia, [on line], consulta em 16/1/2013, http://en.wikipedia.org/wiki/Web_2.0