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**SOCIEDAD DIGITAL**  
**ESPACIOS PARA LA INTERACTIVIDAD**  
**Y LA INMERSIÓN**

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# SOCIEDAD DIGITAL: ESPACIOS PARA LA INTERACTIVIDAD Y LA INMERSIÓN

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Línea 5

La Sociedad Digital  
que negocia,  
crea cultura y ciencia

# CONNECTING KNOWLEDGE.

## Innovation through bottom-up collaboration to promote and diffuse cultural heritage

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## Abstract

The World Wide Web, in special the Web 2.0, offers evolved and complex systems to control and manage information. That fact can be seen when we analyze two important features relating knowledge management in contemporary digital society. On the one hand, the emergence of popular taxonomies called folksonomies that supported by social networking tools, help to make visible subjective forms of knowledge classification and interconnection: new classification tools open the possibility to society to manage knowledge by means of a collaborative approach, in a sustainable way. On the other hand, one of the most relevant possibility to further this collaborative approach is the Internet of Things that enables knowledge to be embedded and situated in the physical work by means of different tools.

These two factors, the empowering of personal and situated dimensions of knowledge triggered by Web 2.0 and Internet of Things generated an impact relating knowledge itself: the subjective influx of data between different layers of knowledge embedded in everyday life is shaping a new panorama in which "trusted" categories and concepts live together with subjective, "non trusted" definitions. This situation affects different

research and knowledge fields and requires attention from all disciplines and fields implied in knowledge production, reproduction, dissemination and filing.

This paper will present the contributions of Internet of Things to knowledge construction by analyzing a case study, the development of what we call an electronic margin for the exhibition Condensed Matter in Barcelona. In this sense, the paper will show that it is necessary to develop methods to deal with both forms of knowledge (trusted and non trusted) in bottom-up driven project; secondly, the paper will explore and underline how design, and specially information design, can collaboratively define new guidelines to sustain and facilitate a bottom-up construction of knowledge in a specific field of application.

## Keywords

*Bottom-up knowledge, situated knowledge, web 2.0, Internet of things.*

## 1. Introduction

Our world is living a moment of increasingly complexity; not only things are changing faster but also modifying the post-structuralism ideas of stability, security, and equilibrium. Complex systems- that control and manage information, connections and relationships- are articulating Society of Knowledge and transforming the way we produce, reproduce and distribute culture.

In order to understand how this articulation and transformation is happening it is necessary to consider- among the multiple perspectives of innovation and development in the field of knowledge management- at least two elements: (1) the semantic web (Berners-Lee 2002) together with the creation of ontologies (Davies et al. 2003, 58) and (2) the Internet of Things that enables knowledge to be embedded and situated in the physical work by means of different tools.

These two factors, the empowering of personal and situated dimensions of knowledge triggered by Web 2.0 and Internet of Things generated an impact relating knowledge itself: the subjective influx of data between different layers of knowledge embedded in everyday life is shaping a new panorama in which "trusted" categories and concepts live together with subjective, "non trusted" definitions. This situation affects different research and knowledge fields and requires attention from all disciplines and fields implied in knowledge production, reproduction, dissemination and filing.

## 2. Objectives

This paper will present an analysis the role of Web 2.0 and Internet of Things in relation to knowledge construction by means of a presentation of a case study: the development of an electronic margin for the exhibition Condensed Matter in Barcelona. In this sense, the paper will show that it is necessary to develop

methods to deal with both forms of knowledge (trusted and non trusted) in bottom-up driven project; secondly, the paper will explore and underline how design, and specially information design, can collaboratively define new guidelines to sustain and facilitate a bottom-up construction of knowledge in a specific field of application.

### 3. Semantic web and new ontologies

The semantic web implies a dynamical framework for data (pages, files, images, links...) and to association with specific metadata. This metadata is additional information able to individualize the context and to construct a network of multi-pertinence for information.

Regarding the semantic web's structure is based on ontologies<sup>1</sup>, structures that are able to maintain in hierarchical relation all tagged entities (Nirenburg and Raskin 2004, 353-8) and to offer an exhaustive and rigorous conceptual schema with which to manage specific features of these entities, like their relations, rules, dependencies, symmetries and differences.

Regarding ontologies, they should be reconsidered in face of a hyper-connected and fluid society: greater possibilities for interconnection between people, high speed of feedback related to users's actions and choices and, above all, bottom-up management of data classification, granted by communities. Ontologies support the formation of non-structured taxonomies developed some spontaneous forms of classification and "bottom-up" collaboration that reflect the conceptual model built by users. These contemporary bottom-up processes inscribe social relationships in a network, showing that every phenomenon is interrelated, that nothing that exists is self-sufficient or independent, and that it is possible to manage a sustainable dimension of knowledge by means of a collaborative approach relating to knowledge. And, properly, this different way to configure information and knowledge management starts to show "the space between" the human practices and their translation into a digital framework of actions and relationship.

From a first hierarchical kind of construction based on rigid classificatory systems now we are dealing with a different kind of knowledge management that is more based on popular taxonomies (folksonomy) that without a priori relationships among elements have been growing under the umbrella of Web 2.0. These contemporary forms of knowledge management are based on bottom-up processes are embedded in a complex network of relationships that foster a collaborative approach.

Systemic hierarchies of information today begin to transform themselves into folksonomies, starting from a bottom-up perspective of common collaboration (Tapscot and Williams 2007, 41), to define and classify, by tagging, different kind of data. This perspective has started from a communication necessity and not from knowledge itself, in order to take advantage of more suitable prostheses, more versatile instruments and simpler technologies, just to define with these instruments what can enter in the grid of shareable knowledge.

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<sup>1</sup> Ontology from Greek onto (being, present participle of the verb to be) and logia (science, study, theory) is the study of the nature of being or reality and its relations and categories.

In parallel to this social process the very information processes are changing and emerging as links, deals, bonds and contamination between the different layers of knowledge in everyday life, in special in social networks like Facebook, Twitter or Youtube. Exactly in this space between society, information processes and technology design can develop new of roles: new opportunities are being created for social, political and cultural transformations, new forms of practice based on the wiredness and wildness states of the information.

## 4. Discovering a space for design

In order to have a bird's eye view of the essential features of this phenomenon, we have to formulate some basic considerations regarding the scenario transition in recent years:

- (1) Society of knowledge, as a whole and not only experts, is "immersed" in the information flow;
- (2) Society of knowledge takes active part in the process of construction of knowledge and is not limited to the role of receptor;
- (3) Not only on-line contents but also physical environments, but also objects and all elements involved in different processes of information construction can be tagged;
- (4) Mobility is a central feature of social processes of interaction, information and knowledge;
- (5) Digital illiteracy can be an obstacle to the full development of new processes of knowledge management;
- (6) The lack of an extended infrastructure of Wi-Fi connection makes it impossible to have a democratic knowledge management in the conditions that are proper to the needs of Society of Knowledge;
- (7) Society and users become active promoters of information in the net, free from hierarchies, ethnic, national, gender, age or relational ties.

We claim that Society of Knowledge is facing a different phase in the social use of the semantic web that is a result of the convergence of different elements, among others, the capillarity of the network fostered by the distribution of open-source code, the employment of systems that allow the sharing of any type of resource and the introduction of mass mobile technologies linked to Internet that situate knowledge in the physical dimension of reality.

In order to understand this phase we need to analyse how to support these features the best way possible in order:

- (1) To foster proliferation of indefinite groups (Lévy 1996, 122), that aggregate and separate themselves according to complex and not measurable phases;

- (2) To give answers to the need of creation of ties that are constructed among spontaneous bottom-up and top-down statements, terms, concepts and cluster of data;
- (3) To facilitate the formation of unstable and stable social links;
- (4) To facilitate universal access to “bottom-up tagging” in order to expand universal access to digital knowledge;
- (5) To make the benefits of Internet of Things visible in the physical space;
- (6) To place knowledge.

These aspects cannot be treated only looking at the semantics forms that emerge from users. They also need a parallel treatment that implies to develop a grammar to articulate the digital and the physical dimensions of knowledge. The development of this grammar can contribute to develop a democratic approach to knowledge, on the one hand by incorporating a kind of strange semantics, based both in a bottom-up construction of data and a bottom-up flexible structure in the Internet, and on the other hand providing specific design strategies to situate knowledge in the core of physical reality, if we want to place collective action in both spaces.

Considering the social matrix that triggers aims and the social dimension of information, the problem is to define how these new kinds of practices inside and outside the web can be integrated, and to know which results can be achieved.

Every tentative to translate social needs, embedded in their own environment in something able to fit the web dimension creates a need to consider how to integrate the human layer and the digital layer, distinguished by the two worlds of real life and web interaction. The boundaries of these layers are not clear, and have a sort of space between them, where every process of sharing knowledge and practices is considered as a process of transition, of passage between two different dimensions. By exploring this “space between”, these two different and interrelated worlds, design can try to find frameworks of intervention, not only to eliminate blindspots and missteps that a transition through this space generate, but also to empower tools and systems for everyday’s users. The role of design in such situation is to offer guidelines, visions and project indications facilitate the integration of both layers.

## 5. Roles of design

The rule of design in relation to knowledge sharing inscribed in physical environment becomes fundamental when we need to create an organized and structured grid of contents. Assuming that design, and especially communication design, could trigger new processes to establish a real connection between social tissue and digital information, this step needs also a more informed policy for people and institutions and a more sustainable toolbox for design research. The second issue is related to an epistemological problem and we should admit that we need a theory of knowledge to understand how society builds hybrid knowledge (merging physical and electronic). Turning our attention to pre-disciplinary forms of design

that can shed light on our connective trials of electronic knowledge generation could be useful to find two different and complementary roles for design: design as a cultural mediator in the “space between” and design as a supporter for interaction and creation of knowledge.

Some people feel overwhelmed by the quantity of data available and need of signposts and sensitive ways to make sense of this data. Apart from that, representation and visualization of data on mobile screens can facilitate knowledge management especially for social sectors with lack of digital aptitudes. This requires a change in the direction of sustainability and large scale distribution: offering different kinds of platform design; developing open source tools to facilitate change; producing simple and accessible accesses to manage information and taking part in the process of bottom-up data construction. In this sense mobile technologies should be seen as integrated frameworks for accessing and managing information and to connecting people to the digital environment. It's the “connected matter” (materia conectada) framework of intervention.



*Fig.1 Example of QRcode, in the Arts Santa Monica.*

## 6. Connected condensed matter

One example of this new form of use of web resources is the development of a digital layer to connect the exhibition *Materia Condensada*, in the Centre of Arts Santa Monica, to Internet.

For this exhibition 25 Quick Response codes (QRcodes) with Alphanumeric sub-codes were prepared (QRcodes+: in this case the alphanumeric sub-code permits to browse the electronic content using a traditional computer browser, inserting the alphanumeric code in the webpage of the exhibition website). The objective was to offer the public the possibility to explore the installations, scientific tests and multimedia art pieces by means of mobile technologies in the exhibition room.

The system extended the exhibition environment into the virtual layer and allowed for a bottom-up interaction and sharing of knowledge that integrates the digital environments into analogical frameworks.

The exhibition was transformed into a hybrid environment in which each one of the tagged elements turned into a hyper-node, an interface to access the electronic layer, the virtual place where all the benefits of Internet can be managed.

Connecting the exhibition to Internet unified the cognitive structure and organization of information in a “hypertinent way”<sup>2</sup> (de Kerckhove, 2005:4) completing the cycle of information between two dimensions: the physical and the electronic. The same processes add fluidity and real time-ness to objects, texts or environments.

The process started with the tagging of 25 pieces of the exhibition with QRcodes+. The exhibition room was equipped with devices provided with QRcode readers so that the general public could access the digital layers of the installations in which to browse all related resources and add their own. So, users could either add or browse texts, links, notes, bookmarks, comments, files and geo-referenced information, publishing them directly in the platform.

New data enriches the electronic layer but does not take the place of existing data. A palimpsest of bottom-up and collective shared layers of contents emerges as the extension of the semantic web into the physical world generating a new framework of reference for knowledge management that can be further explored to design strategies to personal learning and knowledge construction processes.

## 7. Conclusions. A different design knowledge management approach

Hybrid design represents a first step to cover all the aspect of relations and interactions in the “space between a ubiquitous and extended environment for a bottom-up interacting and sharing of information that integrates the analogical frameworks into digital environments. It is a kind of augmented reality, a hyper-node, an interface to the virtual dimension. This virtual dimension is what is called the ‘electronic margin’: the virtual place where all the benefits of Internet and of multimedia contents can be managed and customized in relation to the Web dynamics.

Functioning as a bridge between the digital and the analogical dimensions of the product, it enables people to access digital information through popular hi-tech devices and special codes (wired-codes printed, hanged or embedded on the objects) that connect real world with the virtual context. In this sense, the electronic margin is the virtual treasure of any object or environment.

The first step moved by this design approach, based on wired-objects or environments, offers an answer to both the issues on bottom-up knowledge management: which is the role of design and which is the role of users as designers of their own path of shared knowledge. Wired processes adds a specificity to technological convergence, unifying the cognitive structure and organization of information in a “hypertinent way”, completing the cycle of information between two dimensions: the material and the

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<sup>2</sup> Derrick de Kerckhove coined the concept of hypertinence. It can be understood as the most pertinent responses that the software development from Yahoo to Google, Wikipedia and social bookmarking (Del.icio.us, or Flickr) seeks to present to requests in Internet.



electronic/virtual. The same processes, adding fluidity and real time-ness to objects of design, produce augmented objects of design.

For example, a process to create a wired-object or environment starts with tagging a real object or a text on paper by means of an evolved barcode (an evolution of the datamatrix code, called wcode or wired-code). With a device provided with wcode reader (mobile phone, laptop, portable console, etc.) we can access the digital variant of the object and its “electronic margin”, in which we can browse all related resources and add our own. So, users either can add or browse texts, links, notes, bookmarks, comments, files and geo-referenced information, publishing them directly in the platform, assisted by the devices, with a lot of open tools, and without any pre-defined ontological or semantic structure.

Apparently, this happens wiki platforms. The difference between a wired system and a wiki system rests on the fact that no data replaces previously added data. New data enriches the electronic margin but does not take the place of existing data. A palimpsest of bottom-up, collective, layers of contents emerge. This approach permits to change the initial structure of the whole system: design offers only the space for the kick-off of knowledge management and then knowledge grows moved by society.

Democratizing design implies a deep change in the way we consider interactivity. Democratizing mechanisms should be considered from the first phases of design making if we want to be consistent. Design has the possibility to establish a new rhetoric of the project in order to create a dialogue between the social and the technical tissues, and this means not only to produce tools or system to support new scenarios with sustainable models, but also to suggest a vision of a different cultural apparatus, to offer a new way of online interaction, and a new points of access to the knowledge.

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