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DIGITAL TOOLS AND USES SET

Volume 6

Ecosystems Knowledge

Modeling and Analysis Method for Information and Communication

Samuel Szoniecky

ISTE

WILEY

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coordinated by
Imad Saleh

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Introduction

The multiple modes of recognition
and knowledge, by analogy,
are inherent to any cognitive activity
and to all thought.
Edgard Morin

It would be quite illusory to think
that we could do without
metaphor in order to qualify
new objects.
Yves Jeanneret

This book presents the concept of the knowledge ecosystem from the point of view of the uses, theory and design of a platform for collective intelligence. The aim is to provide conceptual and computational tools with which we can analyze the complexity of information and communication through a generic modeling of info-communication existences.

The concept of the ecosystem is increasingly used to describe situations in which multiple actors have dynamic relationships. These include the ecosystems of digital economy or those of innovation. The *Société française des sciences de l'information et de la communication* or SFIC (the French Society of Information and Communication Sciences) is positioning itself within the field of digital humanities through the discourse of a "complex ecosystem"[1]. However, to date, there has been no book that presents this

1 The web links for this book were verified on June 26, 2017.
http://www.sfsic.org/index.php/infos/lettres-sic-infos/archive/view/listid-1/mailid-336-flash-infos-manifeste-sic-et-ds-dh

concept in a detailed and critical way. Similarly, there is no book which deals with the use of this concept within a generic method of analysis of info-communication processes.

Nevertheless, the issue is important; it affects all individuals concerned with a "knowledge society" [LYO 79, COL 15], and especially with the intellectual technologies that can manage it [SAD 15, VIE 15]. In this context, where digital data is becoming increasingly important, it is fundamental to understand and manage the ins and outs of these technologies, the information they produce and the communications that they generate. This is one of the main themes advocated in France by the *Conseil national du numérique* or CNN (National Digital Council) in its 2015 report on digital ambition:

"For individuals, this right to self-determination implies that they have access to this data, that they can read, modify, erase and choose what they want to do with it; but moreover, also decide which services have access to it" [CNN 15, p. 50].

Faced with these challenges and with the goal of helping people understand these issues, Joi Ito, the director of MIT Media Lab, offers principles to "live by":

– "disobedience over compliance;

– pull over push;

– compasses over maps;

– learning over education;

– resilience over strength;

– risk over safety;

– practice over theory;

– diversity over ability;

– systems over objects;

– emergence over authority" [ITO 16][2].

2 We are using the translation proposed here: http://www.internetactu.net/2017/02/15/vers-lintelligence-etendue

Even if we cannot eliminate a form of provocation that is inherent to these propositions, we nevertheless wonder about the scope of such a discourse, for instance, when it is presented to a class of primary school children and their capacity to understand these principles, and especially to put them into practice. However, this is exactly our primary ambition: how can we make the mastery of knowledge accessible to as many people as possible? Can we accompany individuals in their discoveries of the world and provide them with the tools that will help them to perfect their learning? Can we design intellectual technologies to collectively increase the power of each person to take action?

To the questions of accompanying humans in their understanding of contemporary worlds through digital technologies, the control of non-biological existences which populate our ecosystems, in particular within the framework of the Internet of Things are added [SAL 17]. As the European Parliament concerns about civil law issues with regard to robotics show and the importance of designing a European agency to deal with these issues, it is important to know about these digital existences that are increasingly autonomous and ubiquitous [NOY 17]. Faced with this proliferation of "living" things, we need generic methods that help us understand what these digital existences are in order to control the consequences of their use, especially when these things are used in knowledge processes that trace the least learning activity. How can we evaluate the power of a digital object to take action r within an ecosystem? How can we control the information that these digital existences draw from our use of them?

The management of knowledge ecosystems by modeling the digital existences that populate them is also an important issue in digital humanities and more generally in the use of intellectual technologies [SZO 17a]. In this field, the multiplication of data and the algorithms that manipulate them sometimes obscures the reasoning and interpretations supported by the researchers. Can generic modeling be used to quantify and qualify the knowledge convened in the scientific discourse? Do these models provide an effective way to compare these discourses and use these comparisons to make recommendations?

In this work, we propose an analytical method of information and communication that uses the analogy of the ecosystem to embrace all the complexity of this field. After a presentation on the uses of the concept of ecosystem and its derivatives (nature, ecology, environment, etc.) on the

Web (Chapter 1: Use of the Ecosystem Concept on the Web), we will detail our method of analysis. This method is based on the generic modeling of info-communication existences (Chapter 2: Ecosystem Modeling: A Generic Method of Analysis), which uses theoretical principles (Chapter 3: Fundamental Principles for Modeling an Existence) and graphs (Chapter 4: Graphical Specifications for Modeling Existences). Based on these principles, we present the technological frameworks that we use to develop a collective intelligence platform dedicated to knowledge management (Chapter 5: Web Platform Specifications for Knowledge Ecosystems). Finally, we will present the research tracks and experiments that still need to be carried out in order to further explore the field of knowledge ecosystems (Conclusion).

1

Use of the Ecosystem Concept on the Web

The animal and the environment
are two sides of the same process,
the object and the subject of knowledge
mutually defining one another.
Humberto Maturana

Without a doubt, ecology drives you mad;
that is where one should start.
Bruno Latour

The concept of the ecosystem only appeared comparatively recently and has since been credited to the British ecologist Tansley, who first used the word in 1935. According to Dury, Tansley defines this concept as "a whole constructed by the relations that maintains the living species and the physical habitat that allows them to develop". Moreover, he highlights the shifting nature of this arrangement: "It depends on exogenous or external factors such as temperature, sunlight, humidity, etc., and internal factors such as the population sizes of the living beings that occupy it. The ecosystem is constantly changing according to these factors" [DUR 99, p. 488].

However, long before this word appeared in the field of ecology, we find intellectual practices that hypothesize a system of relations between living

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populations. Above all, some of these make the link between the organization of living beings and that of knowledge. We think, for example, of the notion of a garden which throughout antiquity up until today has been used as an analogy to reflect upon the human condition in relation to knowledge [HAR 07], or alternatively, to the I Ching, a complex theory that transposed the vicissitude of natural elements so as to model archetypes based on human behavior and the contrivance of these transformations, just as the alchemists of the European Middle Ages did [JUN 88], preoccupations that continue to be prominent in the writings of Haeckel, one of the inventors of ecology that bases this new science on three closely related aspects:

1) "the study of nature as knowledge of the truth (*Das Währe*),

2) ethics as the search for good (*Das Gute*),

3) esthetics as the search for beauty (*Das Schöne*)" [DEB 16, section 24]

This very rapid historical development lays the groundwork for more in-depth research that should be conducted in order to understand the evolution of a thought that associates living-beings and knowledge in the same vision. This work goes beyond the scope of this book which will focus more on the recent usage of the concept of ecosystems in terms of the World Wide Web.

To understand the usage of the ecosystem concept, we began monitoring the Web in 2006 up until now and collected 521 documents which we categorized according to 501 keywords. In the following sections, we will analyze this observation through the themes that seem most relevant to us[1].

1.1. For marketing

The first theme we will explore is the most common found online: it concerns the usage of the ecosystem concept in the field of marketing and business. In this context, the linking of a multitude of products or services around a market is represented in graphs that illustrate the concept of the business ecosystem [ASS 16]:

1 https://www.diigo.com/user/luckysemiosis?query=%23ecosysteminfo

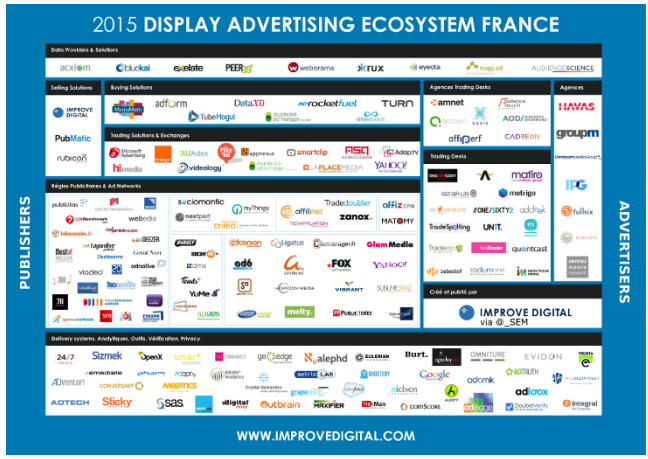

Figure 1.1. *The advertising ecosystem in Europe*

Keeping in the same field, this next example shows how the term ecosystem is used to illustrate the relationships between different actors and how these actors define strategies for the implementation of a marketing campaign:

Figure 1.2. *Ecosystem of a Web strategy*[2]

2 Illustration: https://www.mauricelargeron.com/referencement-socle-d-une-presence-internet/

The final example that we present below highlights one of the limitations of using the ecosystem concept, in that the notion is used here to define a marketing process as well; however, this time, the graphic does not illustrate the complexity of an ecosystem but rather the linearity of a commercial discourse:

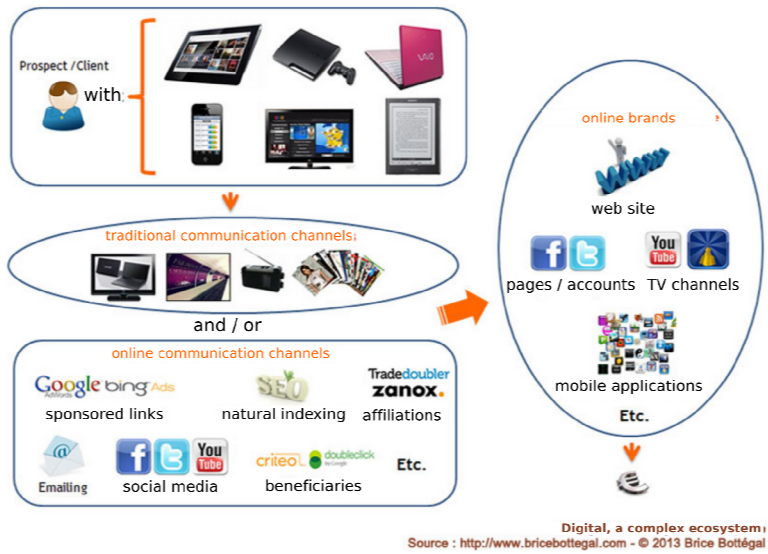

Figure 1.3. *A commercial vision of the digital ecosystem[3]. For a color version of the figure, see www.iste.co.uk/szoniecky/ecosystems.zip*

In Figure 1.3, the ecosystem concept is used only to insist on a multiplication of the elements; however, all the complexity of the processes is blurred in favor of a single type of relation: the production of money.

1.2. For personal data

Another use of the ecosystem concept is the management of personal data and its construction within a space made up of technologies, networks, data and humans. The example below summarizes how an individual is at the origin of a universe of interactions through a "personal cloud". As we can see, the ecosystem of personal data embraces a wide range of inter-connected services where governance forms the basis and the main problem.

3 Illustration: http://www.bricebottegal.com/definition-histoire-web-analytics/

In this illustration, we note that there is no connection that returns to the individual; this feedback loop is nevertheless a fundamental notion of an ecosystem (see section 3.1.3) and even more central to the notion of personal data management. Indeed, how do we give individuals the means to take control of their data without the possibility of reflective manipulation?

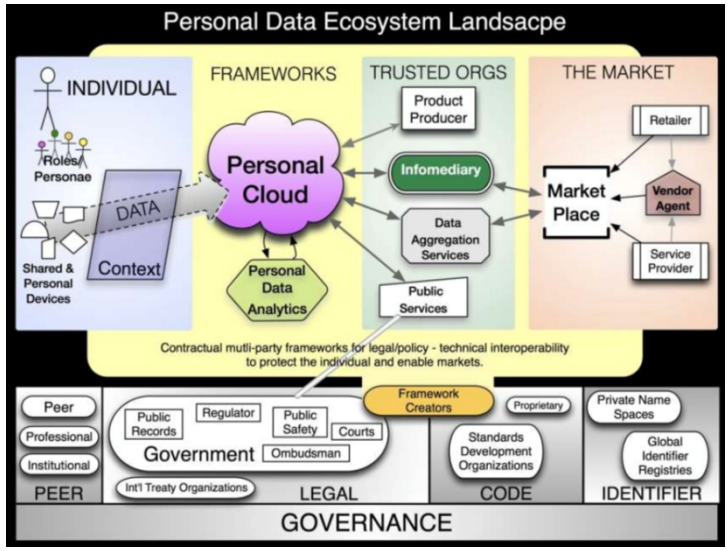

Figure 1.4. *Personal data ecosystem*[4]

The management of personal data and its impact on the construction of a digital identity is becoming all the more important in the current era of the Internet of Things and the quantified self. This is evidenced by the CNIL publication on "the new body as a connected object", and more particularly the section dedicated to the "ecosystem and performance"[5].

1.3. For services and applications

Beyond the business and marketing aspects, the "Web Giants" (Google, Apple, Facebook, Amazon, Microsoft, also known as GAFAM) develop ecosystems through the multiplication of services and applications.

4 Illustration: https://image.slidesharecdn.com/2015-ghc-kaliya-151021184700-lva1-app6891/95/ethical-market-models-in-the-personal-data-ecosystem-31-638.jpg?cb=1445453607

5 https://www.cnil.fr/sites/default/files/typo/document/CNIL_CAHIERS_IP2_WEB.pdf

In order to capture the attention of users, GAFAM deploys a multitude of services and applications whose operation is conditioned with respect to the technical and legal rules of each company. To use these resources, you must necessarily enter the ecosystem of these companies as shown by the popup windows that offer to connect you through your account to a particular company, which thus becomes your identity provider (see section 5.1.2.8).

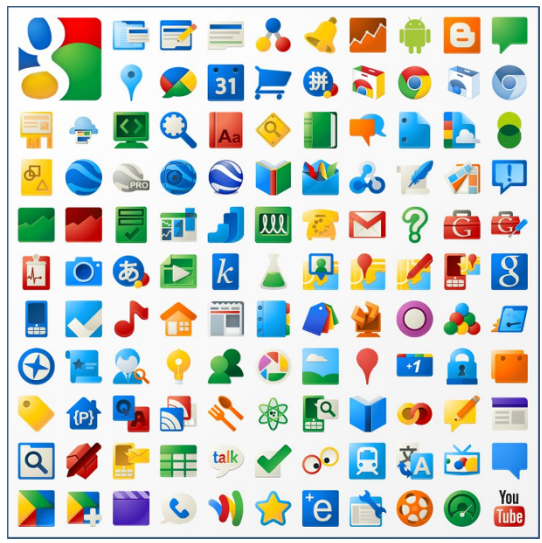

Figure 1.5. *Ecosystem of Google services and applications*

In the case of Google, there are a hundred services that are available to users and especially developers who, by using them, will hybridize the Google ecosystem in other areas. Therefore, Google will multiply its ecosystem by giving developers the means to build their own niche markets (see section 5.1.2.3). This raises the question as to the accessibility of these ecosystems and their eventual transformation into "walled gardens":

> "From an immense open ecosystem, the Web of today is a succession of what Tim Berners-Lee calls '*walled gardens*', founded on proprietary data and the alienation of their users by prohibiting any form of sharing with the outside. The challenge is no longer simply that of open data, but that of *metacontrol*,

that is, the increased control over the migration of our essential data hosted on the servers of these companies, as a result of the trivialization of *cloud computing*: most of the documentary material that defines our relationship with information and knowledge is about to end up in the hands of a few commercial society" [ERT 11, p. 11].

1.4. For dynamic interactivity

Even if today the dynamic interactivity of a web page seems to be commonplace, it is one of the more important aspects that transforms the Web from a simple document into a living knowledge ecosystem. Since the advent of Web 2.0 and the publication of content that is accessible to all through the simple tools that are social networks, that is, content management tools (see section 5.1.2.9) or services and applications, the Web is teeming with knowledge that is constantly appearing, updating or disappearing. What are totally new in the life cycle of the Web document are real-time updates and the possibility of tracing successive updates. As a result of these two characteristics, we can follow the "pulsations" of the Web as if one is observing a living ecosystem.

For example, the "Listen Wikipedia" web application shows changes to Wikipedia in the form of bubbles that appear and produce a particular sound that is calculated automatically:

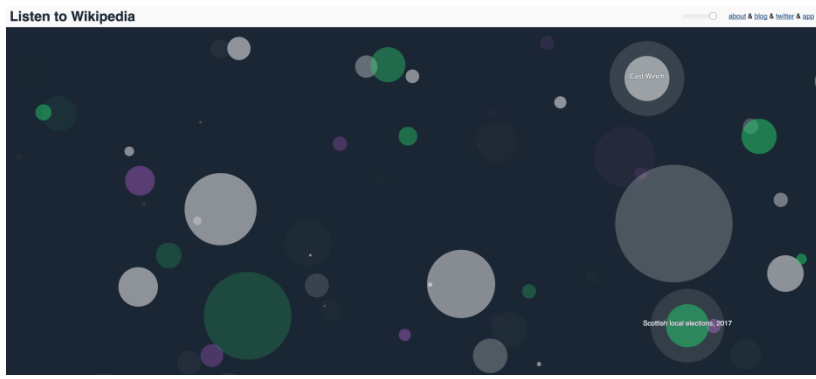

Figure 1.6. *Listen Wikipedia*

1.5. For pictorial analogies

In parallel with the conceptual usage of the ecosystem as a notion, discussed above, our observation revealed instances where this notion of using the analogy with ecosystems was used as a model to organize the graphic and thematic presentation of a site or an application.

The simplest usage is the creation of a domain name related to ecosystems, for example, through the notion of a garden, and to simply use this theme to design an editorial line. This is the case, for example, of a site like https://www.opengarden.com/, which sells an application, allowing the sharing of information between several devices. If we cannot argue that the linkage is actually connected to the ecosystem notion, the analogy is not pushed further than the name and a logo. We could multiply the examples of this type of site that make a very basic use of analogy. On the contrary, there are other sites that go a little further in their use of the ecosystem notion, especially those seeking to describe an organization of work. For example, on this website of a Web agency, we find Figure 1.7, which seeks to highlight the aspect of an ecosystem in its approach:

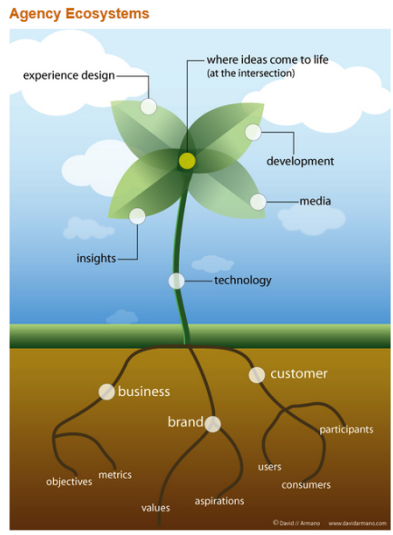

Figure 1.7. *Ecosystem vision of management*[6]

6 http://darmano.typepad.com/logic_emotion/2007/06/agency-ecosyste.html

Figure 1.8. *Ecosystem vision of blogging*[7]

In the same type of use, we find another illustration (Figure 1.8) which explains how the development of a blog is a complex thing that requires different phases of work.

We note that these last two illustrations represent an analogy of the ecosystem given that they use a plant/tree as the core image that is linked to a landscaped context that clearly marks its anchorage in an ecosystem where branches are in contact with the sky and related to the roots that are in contact with the earth. This distinction is important because it makes it possible to not consider all the uses of the tree principle as analogies of the ecosystem. Indeed, even though the hierarchical menu found everywhere on computer screens is probably inspired by a tree structure, this by itself does not correspond to an ecosystem approach.

The analogy of ecosystems is used on the Web not only as fixed representations of concepts, but also in dynamic representations that will "grow" as the image is constructed or viewed:

7 https://visual.ly/community/infographic/computers/blog-tree-new-growth

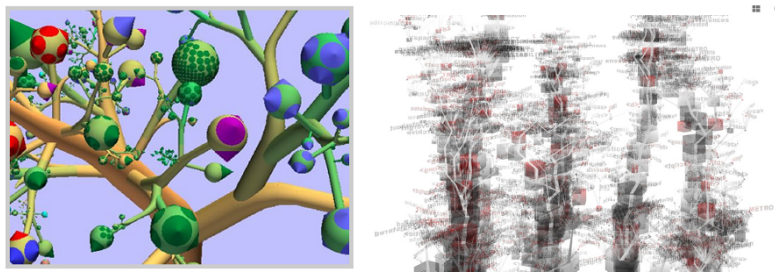

Figure 1.9. *Dynamic representation of the tree*[8]

The example, Figure 1.10, this time shows how to grow an ecosystem forest by proposing that contributors grow trees through the creation of short graphic animations.

The examples we have just presented illustrate how, through data originating from the Web, it is possible to build an ecosystem-inspired representation. It is precisely this analogy that Tim Berners-Lee and Hans Rosling use in their presentation at the TED conference to explain the structure of Web ecosystems and how its future will require the statistical and dynamic modeling of the information environment.

Figure 1.10. *Exquisite Forest*[9]

8 http://www.visualcomplexity.com/vc/project_details.cfm?id=37&index=37&domain=, http://www.riekoff.com/tree

9 http://www.exquisiteforest.com/