From the Assessment of Spatial Data Infrastructure To the Assessment of Community of Practice: Advocating an Approach by Uses.

Matthieu Noucher[1], François Golay[2]

[1] IETI Consultants, France, matthieu.noucher@ieti.fr
[2] EPFL / IIE / LASIG, Switzerland, francois.golay@epfl.ch

Abstract : Spatial data sharing mechanisms are an important asset to territorial communities. They help them understand and control their long term development. In this perspective, this paper suggests a novel approach of geodata appropriation processes based on diverse socio-cognitive theories. This approach suggests that the evolution of spatial data infrastructures from rough data exchange platforms towards geospatial learning networks, also termed "communities of practice", and towards geo-collaboration platforms supporting co-decision may be a significant driver of added value. Thus, it is important to consider these new perspectives in the evaluation criteria and processes of spatial data infrastructures.

Keywords : assessment, spatial data infrastructure, community of practice, learning network, appropriation.

1 CONTEXT

Spatial Data Infrastructures (SDI) are transcending national levels, and also developing on departmental, local and regional scales across a varied backdrop of legal statutes (simple partnership agreement, association, public interest group, etc.). These statutes make no guarantee that their financial backing will last. Thus the implementation of regional SDIs is often funded by grants that are unstable by nature. To facilitate their renewal, it is then necessary to plan to assess SDIs in order to take stock of actions already performed as well as plan for future needs. Thus, assessment-related issues of SDI have already attracted much attention from the scientific community over the last decade (see for example Georgiadou & al., 2006, Crompvoets & al., 2008, or Craglia and Campagna, 2010).

Most of the early studies have focused on efficiency and effectiveness criteria, often applying cost-benefit analysis principles. Beyond the economic aspects however, the SDI assessment measures must allow a better understanding of the motivations of those participating and the ways in which the operators' individual

expectations match the overall endeavour of the considered SDI. Evaluations are also a vector of recognition and motivation for the actors involved in the process, and may foster the development of the infrastructure at hand.

Indeed, as tangible benefits of geographical information systems are difficult to identify and to measure, the assessment of spatial data infrastructures accentuates this difficulty because, from an initially data-focused point of view, the SDIs are becoming more and more oriented toward the implementation of services. These mostly recent, composite-style platforms that share information do not have standardized assessment tools yet (Crompvoets & al., 2008, conclusive chapter).

In addition, beyond assessment efforts that often concentrate on spatial data or even spatial services, classical assessments (especially based on technical and economical performance) quickly reveal gaps in terms of the assessments of the organizational aspect of emerging collaborative systems around spatial data infrastructures (Georgiadou & al., 2006).

2 FROM SPATIAL DATA INFRASTRUCTURES TO COMMUNITIES OF PRACTICE

Moreover, recent developments of SDIs show a progressive shift beyond their original function of base maps diffusion toward the actual coproduction of thematic data within thematic communities. A certain number of local, departmental and regional SDIs are trying to encourage the sense of belonging to these user communities and actor networks to develop the geographic information culture (Noucher, 2006). These *communities of practice* that are forming around the sharing of knowledge and know-how especially via harmonization, generalization or coproduction of spatial data must also be taken into account in the evaluation measures of the SDIs that support them.

Recall that a community of practice is defined as a group of individuals linked informally, working in a network united by common interests and similar projects, cooperating and exchanging their knowledge (Wenger, 1998):

- ♦ to create collective value useful to each individual,
- ♦ to share common resources (knowledge, experience, etc.),
- ♦ to work together in a collective learning process,
- ♦ to combine a common culture and a cohesive system of individual interests at the same time.

In France we can cite CRIGE PACA (Centre régional pour l'information géographique de Provence-Alpes-Côte-d'Azur) as an example, which, in parallel with its geoportal, leads ten "poles metier" as thematic groups (urban planning, seashores, forests, public safety, agriculture, etc.) whose objective is to

encourage the harmonization and coproduction of thematic spatial data. In Canada, the CGDI (Canadian Geospatial Data Infrastructure) has been seeking since 2005 to develop "communities of practice" related to diverse issues as public safety, or even to indigenous people. In Switzerland the INDG (Infrastructure Nationale de Données Géospatiales) has been calling for participation in "thematic interest communities" since the beginning of 2010.

Thus, although the names may vary, the issues remain the same: to go beyond the simple goal of sharing base maps to encourage the development and use of spatial data matching the regional players' business practices (or e-governance practices, as addressed by Georgiadou & al. (2006)).

3   TOWARD AN ASSESSMENT FRAMEWORK OF COMMUNITIES OF PRATICE

From a sustainability perspective, the assessment of Spatial Data Infrastructures must therefore include the observation and the evaluation of the communities of practice that emerge from the shared processes. An ambitious evaluation cannot merely be limited to counting the number of spatial data downloads or even an ROI study (Return on Investment) and must consider the dynamics of the users network who, at the boundaries of traditional organizations, are investing in the development of new uses of geographical information.

Millen, Fontaine and Muller (2002) group the impact of communities of practice into three categories:

- ♦ Individual benefits: better understanding of the work of other operators, enhanced professional reputation, higher confidence level, learning of new techniques and new tools, etc.
- ♦ Community benefits: increased problem-solving capacity, idea generation, vigorousness of the exchanges, etc.
- ♦ Benefits for the organization: openness toward new activity areas and new techniques, reduction in time needed to find information, reuse of existing items, use of previously proven solutions, etc.

To this we add one other dimension inherent in the context of spatial data infrastructures:

- ♦ Territorial benefits: pooling of resources, knowledge, know-how, institutional connections, harmonization of regional management policies, increased capacity to "decide together", etc.

In order to assess the added value of those impacts for the communities of practice, various types of evaluation can be conducted by independent experts that relate to existing or emerging communities. We will cite, for example:

- ♦ Cross-sectional assessments of the value added by a community of practice in fostering networking, awareness, and competences of its members and staff (for example: going from professional isolation, to experience sharing, an to collective learning approaches) – *do we have something to share?*
- ♦ Assessments of community work results. The objective is to take stock of the group's effectiveness in terms of participant satisfaction, achievement of goals, learning and usefulness for the organization after several months of existence – *do we get substantial results?*
- ♦ Assessments of the community work process. We analyze the exchange dynamics that have been developed within the work group, relying especially on the use of available communication channels by the group members – *do we support sound processes*?.
- ♦ Assessment of the of the community members' commitment to effectively contribute to the common endeavour (involvement of every member in the common tasks, provision of supporting and skilled human resources, etc.) – *does the community get the necessary backup from its members*?
- ♦ Prospective assessments identifying actual consolidation processes to be developed to strengthen the community – *what to do next?*

Such criteria do not anymore assess the productivity or the usefulness of a SDI, but its ability to support sense-making processes ("zone de la compréhension" in Rodriguez (2005)) and to eventually build upon those processes to develop and strengthen. Research on communities of practice is therefore more about revealing the whole complexity of the emergence and stabilisation of the production processes considered (the practices) than about assessing the usefulness of SDIs. Moreover, according to Breton and Proulx (2002), the appropriation of such processes by the community members seems to rely more on their sense-making value for the users than on the quality of the underlying technologies.

4   AN APPROACH BY OBSERVATION OF COMMON USE PRACTICES

Since the communities we want to assess are focused on practices, it seems necessary to link the assessment to the observation and analysis of the related appropriation mechanisms. Proulx (1988) emphasizes the creative dimension of the appropriation. It would be effective only to the extent that the individual integrates the object of knowledge acquired in a meaningful and creative way into his daily tasks. It is there where all of the difference between the ideas of consumption and appropriation lies: one can buy data off the shelf (highway map background, socioeconomic statistics, land use, for example) but not use them or make a counter-use of them and therefore never appropriate them.

Appropriation for a given operator means a change in his capacity to complete a task. Evolution of use practice is the evidence of this. The study of the use of spatial data generated by the related communities of practice can thus allow us to evaluate the effects of SDIs. Now, as Millerand (2002) points out: "*it is by focusing precisely on the mechanisms of appropriation of technical objects that the research has shown itself to be most fruitful for getting to grips with the question of the development of use practices*".

We have therefore endeavoured to study the actual practices applied by SDI users (Noucher, 2009), i.e. what they *do* with spatial data, what *uses* they *make* of it and how they *appropriate* it. To this end, we have observed interactions between users within communities of practice then we proceeded to study individual uses of spatial data from SDIs to attempt to understand the complexity and better determine the consequences of their dissemination. These exchanges between collective (group meeting) and individual (routine use of SDI) allowed us to better understand the mechanics of practice formation. Mainly relying on theories of Paul Ricoeur (individual projection), of Etienne Wenger (collective negotiation), and of Edwin Hutchins (social cognition), we have shown that the individual and collective involvement in spatial data appropriation processes relies on 2 different dialectic processes: the individual projection based on expectation and experience process and the collective negotiation based on participation and reification process, as illustrated in figure 1 (Noucher 2009). This overall appropriation process is applied to facts and artefacts of our geographical space that can be seen as *boundary objects* according to (Harvey & Chrisman 1998).
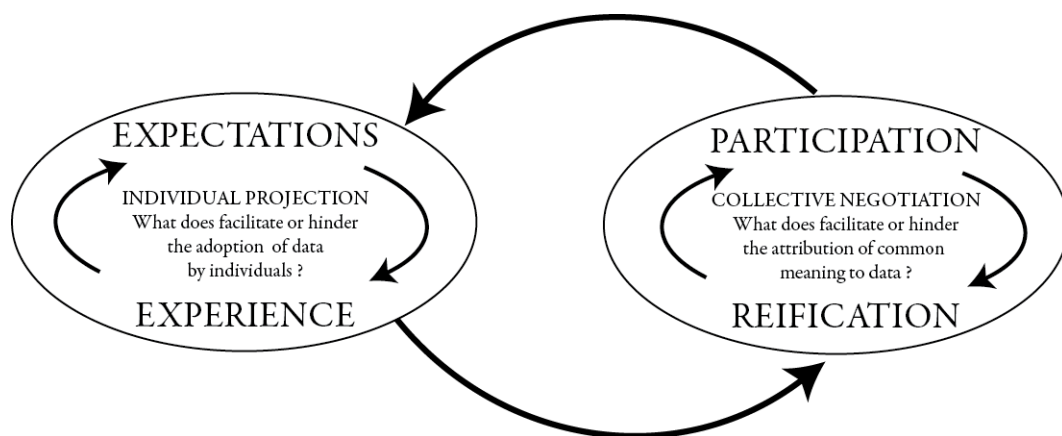

Figure 1:
Individual and collective appropriation processes of geographic information
(Noucher 2009)

To better delineate the range of uses framing the appropriation process, Michel de Certeau's thoughts appear essential. His work has shown, notably, the *"own share"* that comes back to each individual in the construction of use practices (de Certeau, 1980). With his subtle descriptions of users' *"art of doing"* and *"ways of doing",* Michel de Certeau demonstrates how user practices diverge from the program that the technocrats and cultural industries seek to impose. Regular people, he claims, show creative abilities unsuspected by manufacturers: through tricks, tinkering or diversions - that Michel de Certeau combines under the term *"poaching"* - they are capable of inventing for themselves a unique way of travelling in prefabricated universes. This work allowed the expansion of the viewpoint beyond the individual interaction of people with technological interfaces. They introduced time and learning dynamics as key factors in the appropriation and stabilization of practice in habits or routines.

If Michel de Certeau's contribution to the debate on uses is significant, it is, according to Florence Millerand, because he allowed us to investigate the independence of users facing technical systems: *"On one hand, he refused to consider their use as being self-evident; on the contrary, he questioned it. On the other hand, he focused his study on "actual practices" rather than on structuring dimensions of social, political, or economic nature"* (Millerand, 2003). In doing so, the creativity of user practices that had been ignored until that point has eventually been understood as the very process of appropriation (Perriault, 1989).

5   EARLY EXPERIMENTS: OBSERVATION AND EVALUATION OF APPROPRIATION TRAJECTORIES

After describing and analyzing actual uses of spatial data in different communities of practice (8 case studies, 20 observations, and 80 interviews – 3 examples are synthesized in table 1), we became interested in the related appropriation processes. We applied the analysis framework presented in the previous chapter to identify and characterize the appropriation trajectories of spatial datasets (Noucher, 2009).

We saw that the interaction between both projection and negotiation processes of figure 1 is controlled by an overarching cognitive adaptation process as defined in Piaget's (1975) theory. Cognitive adaptation emerges from the attempts of individuals to match their cognitive structures to their environment: individuals change their environment, and conversely the environment frames the individuals' development. Cognitive adaptation relies on 2 main mechanisms:

Name of the case study	SITL Système d'Information du Territoire Lémanique	CRIGE PACA Centre Régional de l'Information Géographique de PACA	APEM Assemblée Pyrénéenne d'Economie Montagnarde
Territory	Boundary between Switzerland & France	Provence Alpes Côte d'Azur (France)	Pyrenees (Spain, France, Andorra)
Geoportal	http://www.sitl.org	http://www.crige-paca.org	http://www.apem.asso.fr
Spatial Data Infrastructure Components *(technical & organizational)*	- Geospatial data catalogue - Based map acquisition (orthophoto for example) - Partners convention - Technical comity and Decisional comity	- Geospatial data catalogue by GeoSource (ISO 19115) - Geospatial data access by online mapping (under construction) - Geospatial data visualization by Web Services (WMS / WFS) - Base map acquisition (SCAN IGN for example) - Partners convention - Technical team, executive board, supervisory board and annual general meeting	- Geospatial data catalogue by EasySDI (ISO 19115) - Geospatial data access by online mapping (EasySDI) - Geospatial data visualization by Web Services (WMS / WFS) - Partners convention - Technical secretary and annual general meeting
Communities of Practice Productions	**Spatial data harmonization :** *Public equipment, road network, administrative boundaries…*	**Spatial data co-production :** *Public equipment, road, land uses, urban sprawl, forestry, scholar equipment…*	**Spatial data analysis :** *Observatory of climate, Observatory of forest, Observatory of craft activities, Observatory of pastoralism…*

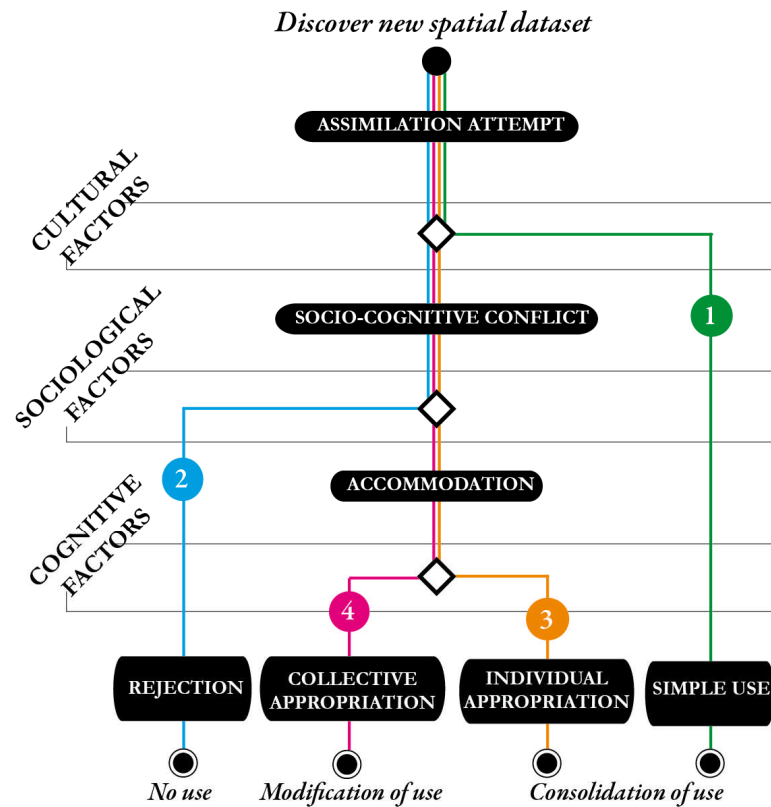Table 1: Overview of 3 among 8 case studies selected for our research

- the *assimilation*, by which an individual incorporates external information into his cognitive structures, without necessary modifications of those structures, but possibly with a restructuration of the external information;
- the *accomodation*, by which an individual adapts his cognitive structures in order to incorporate external information.

If a first assimilation attempt fails because of irreducible differences between the considered information and the individual's cognitive structures, the individual is facing a *cognitive conflict* that will eventually lead to a *socio-cognitive conflict* by entering a negotiation process with other actors to reduce the differences. *Cognitive decentration* is then required from the participating actors to accept the legitimacy of other actors' points of view and to *accommodate* their own cognitive structures to a consensual, new definition of the information at hand.

Many events all along the individual and collective appropriation process may foster or hinder the resolution of emerging cognitive conflicts. By observing the information appropriation processes in our case studies, we could synthesize 4 typical appropriation trajectories of new spatial datasets (figure 2):
1. a direct consumption of the considered dataset, especially taking place when the considered geodata are already known to the users. Thus, there is no occurring cognitive conflict and no need for accommodation. The added value of the new data is immediately available to the user.
2. a rejection of the considered dataset, that implies no use at all. This often occurs when users are not ready to any cognitive decentration. Thus, the occurring socio-cognitive conflict cannot be solved, and the dataset is rejected, or it is used with downgraded semantics (i.e. as a cartographic background). We encountered many examples of such rejection in our case studies, for example by 2 utility management companies that did not agree on a common model of pipe sections, apparently worried by a possible loss of control on their infrastructure.
3. a consumption of the highest common divisor, ending up in an individual and partial appropriation of the considered dataset. In one of our case studies, the users were city planners working in a thematic group aiming at a common definition of urban land cover categories. They succeeded in adopting common definitions, but they accommodated their own semantics according to their individual needs.
4. a collective appropriation, leading to a modified, value-added use of the considered information. The actors are looking for common meanings of the identified boundary objects, making new uses of the data possible, especially around common goals. For example, the trans-boundary partners of the Lake Geneva Land Information System (SITL) ended up with integrated definitions of land planning zones, allowing for improved land planning capabilities.

We might further understand the latter trajectory type as a clearly more *identity-building* case for communities of practice, bringing all partners toward a consolidated perception of common ends. Thus, communities of practice could emerge as a step forward from the paradigm of SDI, relying on the individual re-use of geodata produced by others, toward a true case of *geo-collaboration* supporting collaborative decision-making activities (Noucher 2009).

Figure 2: Typical information appropriation trajectories.

6 CONCLUSION

This research offers a different vantage point on spatial data sharing issues. Systemic and socio-cognitive approaches suggest a new integration of knowledge and information in the context of rapidly spreading geographical information technologies. It advocates a progressive evolution of spatial data infrastructures toward geomatics-oriented learning networks, also termed "communities of practice" (Wenger, 1998), and toward geo-collaboration platforms.

Let us finally suggest that the observation and analysis of the presented appropriation mechanisms and trajectories could constitute a novel step toward the implementation of indicators of the use and value of spatial data infrastructures. It seems to us that it is in the interest of national and regional SDIs to foster assessment methods and tools able to express formalized measures of their added value for government agencies, private companies, and citizens. That should provide them with a solid asset to claim the necessary resources for their sustainable development.

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