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Communal work and professional involvement: The balance of open source projects.

Abstract

Most of the framework about open source individuals' commitment requires the possibility to exchange professional time with free time. Through a case study, we will show the difficulties that people face when merging their professional activities and their work in the open source community. This balance takes different forms depending on contributors, but it also depends also on the stage of the project's maturity. To broadcast the contents the community specialize the work in its organization. The partnerships established to obtain resources like hardware, economic capital or specific social network may change the collective activity.

1 Introduction: theory and context.

The individuals' involvement in open source projects is debateable. Some economists summarize the open source commitment by individuals' strategies in the IT job market. However, the traditions in the sociology of work and, the observation of a community outside of this field highlight the influence of the professional context on the individual's involvement.

1.1 Theoretical framework and fieldwork

Why are people involved in open source projects? Mainstream economic literature proposes an answer based on individual career strategies in IT companies (Lerner and Tirole, 2002). We can summarize this approach by stating: the better their contributions are, the better their professional future will be. The efficiency of this open source model in the software industry's job market is due to the lower cost of contributions and takes into account the contributors' skills and the learning mechanism in the open source community. This analyze is attractive because new technologies are cost effective and present at home and because the young developers look like expert very demanded on the job market. However, all developers are not young, and sometimes they face structural difficulties on the job market (Stevens, 2012).

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We can complete this analysis by crossing the open source involvement with the issues of work at home (Lallement, 1990) framed by at least five theoretical traditions.

- The strategic agent theory embodied by Gary Becker is directly linked with the individual strategies on the job market to explain the rise of free software projects (Lerner and Tirole, 2002). However, this approach is very specific of the software industry context and doesn't take into account the context of other activities where open source appears also.

- The historical approach inspired by Michel Foucault insists on the influence of institutions and the market structure on the individuals' activities and inequalities. This analysis cross the Manuel Castells approach in matters of job market in the networked society (Castells, 1998), digital labor analysis (Scholz, 2012) or online collaboration (Benkler, 2006). However, this point of view doesn't give the tools to analyze a specific sector of activity. It creates a large frame of analysis but no specific ideology related to openness in technology for example.

- The third approach is linked to the work of Pierre Bourdieu. The gender attitudes and the social habits constructed through socialization are important factors in the labor. Neil Fligstein complete this view and highlight the importance of institutions and relation between economic and politic actors in IT industry (Fligstein, 2008). However, this framework neglects the influence of material things, like technological progress or legal tools, important in open source.

- Engineers have analyzed and measured the labour comprising relationships between human beings and machines. This approach between physics and economics concerns the automation of activities (Von Neumann, 1951), the reduction of pain at work, the increase of performances (Brooks Jr, 1956) and the institutional embedment of informatics work (Conway, 1968). These analyses created abstractions which should be complemented by socio economic contexts as Fred Turner did to understand the rise of technological ideology (Turner, 2010).

- The last perspective about labor is related to the works of Max Weber. In this view, the work is an integration means and plays an important role in the structure of communities but forgets some hierarchical effects. This approach looks like the initial work about hackers activities (Himanen, 2001) and improved by social network analysis (Wellman et al., 2001) .

Work in open source projects cross these five traditions. The individual strategies, the institutional structures, socialization, the technical environment and the influence on the community frame the individual involvement. It is difficult to make a career in open source projects to notify its skills in a long term sustainable project. The large number of abandoned projects compared to those that remain active, implies that the open source organization is not more efficient than any other way of collective action (Healy and Schussman, 2003). The individual and collective economic performances cannot be at the roots of the involvement

because of the uncertainty of the projects' future where people are involved. To complete the first analysis about individual strategies, other analysts mention the importance of collective ideology in the individuals' motivations in addition to the individuals' economic calculation (Ghosh, 2005).

This microeconomic analysis is completed by macro studies. Some authors acknowledge the compatibility between the capitalist system and the open source sharing ideology. They insist on the likeness between the proprietary business model and some open source companies' strategies (Bonaccorsi and Rossi, 2003; Fitzgerald, 2006). Free licenses make it possible to decentralize the development process and the reinvestment of a part of production in other cycles of creation. This compatibility gives the opportunity to traditional Information Technology (IT) economic actors to invest money, hardware and skills in open source projects and hire contributors. This activity from companies in the software industry fosters individual involvement.

The mainstream approaches insist on the professional involvement of contributors. The production of communities is not only the result of hobbyists. Free software are mainly produced by professionals. Some economists underline that the open contents are the result of a valuable activity in the job market. However the collective project is not always the main employer and some of the contributors are hired by companies to participate. The others are volunteers and contribute in their free time. A previous work show also that contributor participate officially as a volunteer but are hire by companies to developed some free software. These hidden contributions are due to conflict in the matters of copyright between companies. The cohabitation within the same projects of both paid and unpaid work remains not well known because of the lack of ethnographic data. Most of the studies work on the assumption of the substitutability between professional involvement and the free community's work. The embedding of computers in professional and domestic life, reinforce this idea further.

Our fieldwork highlights the differences between professional activity and work in the community. On the one hand, professional activity is a part of a collective identity built by a political claim, common history, formation and ideology. The ideal pattern of professional activity is framed by laws and diplomas and it benefits of a social prestige because it protects individuals and ensures some social and economic rewards. On the other hand, the work refers to individual characteristics built by skills and tasks used in a professional or domestic context. This specialization is symbolized by the expert who needs formal and informal training in a risky career but which can provides instant wealth. To understand the articulation

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between these two levels of activity we use interviews and analysis of mailing lists a professional publishing experience transformed into a new communal work activity. Our case studied is a collective of French mathematics teachers in high schools involved in the production and the broadcasting of educational software and textbooks online. They are organized with paid and unpaid contributors. This case provides the opportunity to examine the typical open source framework. It makes possible to see what happens in another field where the job market is less flexible and the IT sharing ideology less noticeable?

The organization of open source collectives faces some technical and economical constraint that weigh on the individual strategies and practice of ideologies. Open source contents, as software or online mathematics exercises are intangible goods. That means they are common goods. The work and the capital used to produce them cannot be recompensed in a marginalist way (Hill, 1999). The last produced unit's cost is near zero and the value of the contents cannot be due to a price on a goods market. Others social conventions explain how individuals' work is rewarded.

Individuals' strategies and ideology are not sufficient to explain the existence of more than fifteen years of collective action. If we can imagine how the work is paid (by money and/or social recognition), the mainstream approaches do not supply the source of capital that supports open source projects, nor the origin of the investments needed to produce and broadcast billions of contents. The communities need hardware to support their intangible activities (personal computers, servers, cables, printers, meeting places, transportation fees). In a project with several production cycles, the organization needs different steps of investment to support its growth and to renew its production. Like other raw materials, information and digital contents are perishable, and need to be updated to stay compatible with the new norms and formats. These institutional and technological transformations forced the open source organization to renew its action and its form of work.

In the case of Sésamath, the collective faced many ordeals, many transformations, which can make and break partnerships, and the activity was supported by different generations of contributors. Since 2001 the group is still active and continues to grow. Its capacity to produce contents and impose norms on other organizations is a sign of its institutionalization (Zucker, 1977). In our view, the collective rules and routines created in an organization are a means to initiate and maintain individual involvement according to the institutional and technological changes. The French open source project named Sésamath uses and circumvents the French teaching institutions' rules and routines to produce and broadcast a textbook.

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Each year, between 70 and 130 teachers in high school are involved in the Sésamath nonprofit organization. They produce and broadcast freely educational software and textbooks online. The organization in partnership with editors sells also in traditional bookstores their contents. The free access to the online exercises maintains the teachers' prestige, and respects the French Service Public framework of gratuity, equality in education, and proximity (Thévenot, 2001). These values are opposed to the "proletarization" of teaching" initiated by the textbook publishers transcribing the educational practices without having being tested as part of a school activity (Chevallard, 1985). By this ideology, the Sésamath contents have become very popular in a social network of authors and users, including nearly 50% of the mathematics teachers in France.

Since 2002 the rise of the users has been supported by investments from the French government in informatics hardware in schools. However, the teachers have never received an economic reward despite strong claims about specific skills in the use of digital contents in class. In France, since the year 2000 and the birth of digitalization of knowledge, the basic salary of the teachers has barely increased compared to the average in the nonagricultural sectors. In the context of an economic crisis, direct access to the contents via the Internet and the diffusion of technology has decreased the social prestige of a knowledge based professions. Their specific skills are hidden by the online abundance of the school contents. The strict division of work and profession between teachers and editors implied incompatibility between the rewards of these professions. On the one hand, teachers are no longer seen as editors because publishing required specific skills and capital to legitimate broadcast contents. In the other hand, publishers are not welcome in classroom because they cannot produce contents adapted to the teaching contexts.

Despite the unattractive economic and institutional signals in matter of digital classroom publishing initiatives the contributors of Sésamath have turned the characteristic of the internet to their advantage. The community found a way of social recognition online and into the offline school contents market. However the selling of the contents makes the organization dependent from the logic of accumulation related to the sale of textbooks in the bookstores. The contributors need the economic income of the sales to realize the other resources in a non-market way and maintain the effectiveness of their ideology. The change from an experimental logic to a market dependency changes the logic of the professional commitment in a collective work and transforms the structure of the relationships between contributors.

1.2 Context.

The French academic contents market has some particularities vis-à-vis other countries. In most countries, only the state is authorized to distribute such contents. In France, the offer is open to the private sector, and the teachers are free to choose the textbooks in their educational institutions. The establishments buy the textbooks from bookstores and provide them to students. This market is very structured and has specific criteria. The mimesis of the economic actors in the field of textbooks and the rise of colleges of expert using the legitimate practices, the institutionalized formats and regulations have been observed in the United States (Coser et al., 1982). The long history of school publishing in France (Deceuninck, 2004) creates the same situation of a structured market with some companies concentrating economic and social capital.

Despite a very old and structured textbook market the members of Sésamath have obtained 14% market share in a few years. As in the case of the canteens market (in school and companies) studied by Sophie Dubuisson-Quellier (Dubuisson-Quellier, 1999), the members of Sésamath had first to convince the end consumers: i.e. the teachers. In this market, the consumer is different from the buyer, and Sésamath occupies a strategic position compared to its competitors given its proximity to the schools and teachers. The access to a large set of contents is an opportunity for the new teachers to find a support and for the more experienced to break the routine and find a solution to teach a public more and more diverse. The democratization of the main curriculum brings new publics with specific social or health handicap which had excluded them before of the general academic culture.

The economic context, the technological changes and the new types of children have created specific needs in the classrooms. The teachers have an obligation to teach the content of the official curriculum set up by the government at the beginning of the school year. Each year the Ministry of Education changes the curriculum of one high school level. At the start of 2006, the 6th grade was renewed and then, in 2007 the change was applied to the 5th grade, and so on until 2010 when the 6th grade program is renewed again[1].

The 6th grade textbook was the first sold in fall 2006 by Sésamath. Every year the collective produces a textbook and workbook for the reformed level. The year 2009 was a turning point in which Sésamath moved from publishing to reprint activity. The 6th grade contents, made in September 2006, had to be adapted to the new curriculum. We have observed a transformation of the online practices by a study of the archives of a mailing list before and after the first online cooperative experiments, emphasizing a new frame for the communal activities (Figure 1).

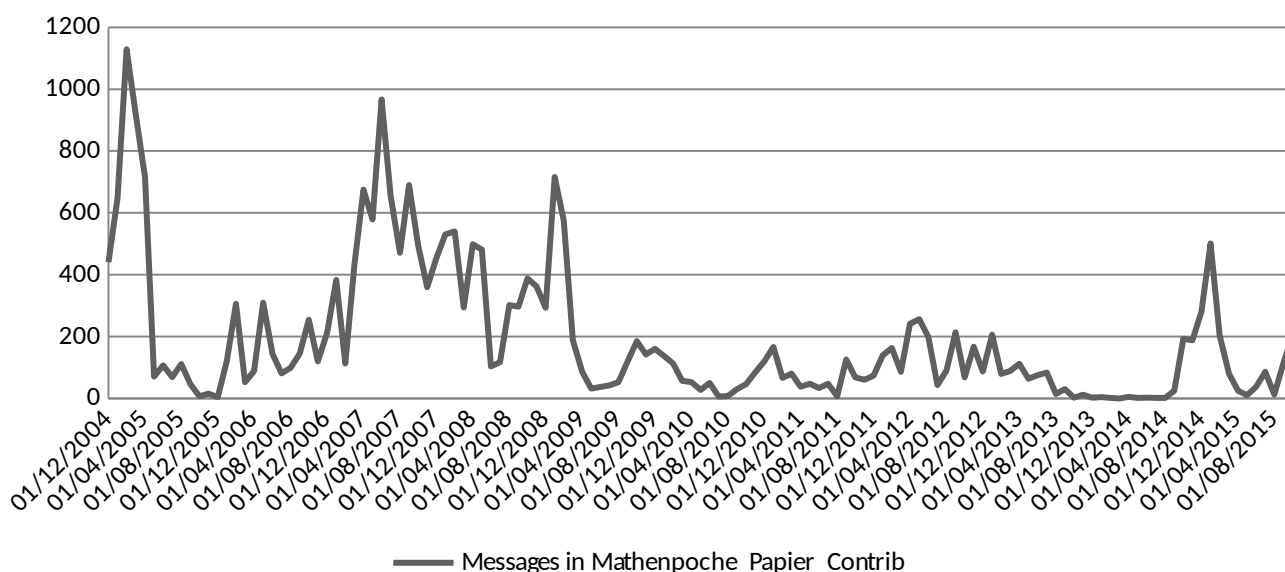1 The French high school is composed by the 6th, 5th, 4th and 3th grades.

Figure 1 Number of messages in the mailing list of the textbook project

The rupture in the dynamic of accumulation in an open source project is quite common, but challenges the theoretical framework of the career strategies. Usually the slowdown of the accumulation is explicated by a process of rationalization. In other words, people have better skills in the project matters and they can fix easier problems. We prefer the word of specialization because it indicates a new way of organization rather than a better one. The higher division of labor is not necessarily a solution of happiness and can create boring tasks which is opposite to the motivation of fun mentioned in the open source literature. The term of rationalization hides a hypothesis of homogeneity between contributors and their activities. However, different social statuses exist and are not necessarily influenced by the efficiency of productive activities. Traditions, authority, routine or lack of competition can explain why people continue to contribute.

In Sésamath the new economic and organizational arrangements permit to a team six times smaller than the previous team to perform similar goal: produce a textbook. From an economic point of view, the second team obtained better results than the first. The publisher paid in 2008, 92 481 Euros to Sésamath (92,481 copies sold for 1 euro each) for the first edition. In 2011 the benefits were around 103,500 Euros (34,501 copies sold for 3 Euros each) for the reprint. The economic gains can be explained by the shifting of the culture of work in the collective rather than by a new individual's calculation.

At the time of experimentation the contributions of teachers in the organization was an activity seen as the expression of a professional application. The second period marked by a

high division of labor. In the organization the work becomes means production, grouped under the trademark of Sésamath. This brand is used strategically to raise the collective means in the organization. To manage this resource, a part of the organization is dedicated to this task and stops the activities of teaching or contents production. In other words, the deep involvement implies a distance with the starting motivation of involvement. Even if individuals made a strategic calculation at the beginning of their involvement, the original strategy will be challenged by the growth of the collective and the new need of the organization.

The specialization process in the collective is due to connections with organizations in edition market and the scholar institutions. The definition of new status in the organization created interfaces to communicate with other organizations. In 2007, the commercial success in the bookstores and online of open source textbooks has allowed the leaders of Sésamath to purchase equipment for its members, to finance meetings between contributors to design projects and to create six jobs held by teachers for communication tasks and software development. The arrival of employees has reinforced the labor division within the organization. The paid work allows the organization to carry out technical infrastructure that is able to support the demand created by the textbooks. By providing educational contents for a million unique visitors per month, the organization is able to respond to the governmental calls for tenders concerning the production and distribution of digital educational contents in the worldwide French schools.

To understand the different institutional dynamic at the roots of the individuals' involvements, we analyze the two periods of production in Sésamath. The first period is marked by experimentation, and a professional claim. This first community produces textbooks and is organized by a horizontal hierarchy. Then we show how the community has evolved when the organization chooses to make the second edition of the textbook. During the second period, the hierarchy is more vertical. The core community of the second period is characterized by a strong involvement of the management team of Sésamath, reflecting the importance of the project for the rest of the association's activities. This second organization is marked by different categories of contributors with paid and unpaid work. The organization works with free, volunteers and paid employees, but also with professional editors in publishing companies through trademark agreements.

2 First years: claims and specialization.

The Sésamath organization gives an example of the distinction between profession and work. The dominant economic point of view about open source commitments implies proximity between commitment activity and the contributor's labor. But the community can shift its goals. Teachers began to be involved in the collective because they wanted to preserve as a public service activity. Finally, their involvement in the publishing market makes them work as editor. This shifting is not defending the school publishers' professional identity, but supports the pedagogic experimentations enabled in a new technological and economic context. The interdependence between these activities creates different profiles of contributors between teacher and editor.

2.1 research and professional claims

In 1998 some French mathematics teachers in high school participated to a research program in an academic laboratory about the uses of new technologies in the classroom. This research was not inspired by the peer production theories, but by pragmatic psychology (Bronckart et al., 1985), the contemporary American mathematicians like Norman G. Lederman (Lederman, 1992), and the use of the video format popularized by Tom Apostol (Apostol, 1976; Borwein, 2002).

However, this partnership failed because in the program settings, high school math teachers do not have access to the symbolic or economic rewards obtained by academic researchers such as operating budgets or scientific publications. The Ministry of Education refuses to integrate online contributions in the teachers' working time. The professional online activity has solely has been seen as "another database" in the mass of digital contents. The extract (below) of an email written by a mailing list administrator, initiator of Sésamath, illustrates the demand of teachers for recognition from their hierarchy.

"*It seems urgent to me, like many others, to federate the actions and support mathematics teachers who are committed in their discipline. Individual actions realized on the Internet by math teachers must be recognized and supported (by significant means) by our institutions. The online teachers bring a lot to those who are looking for information, dialogue, etc., and contribute to the training of teachers*. "(January 2002).

After a few online experiences with free software to propel their websites, these mathematics teachers created the Sésamath nonprofit organization in 2001. Members of Sésamath considered their online practices as an extension of their Public Service activity, but they face to economic and political challenges. The Sésamath contents are in competition with other producers of educational contents. The extract of the email (below) from a member of the organization explains the consciousness of the economic effect of the collective action.

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"I see (and I'm not the only one) that we are engaged in an economic process which, although very different by its origin and its project puts us in competition with market standards."(November 2001)

If the production of teaching content is not a teacher task, it should be another professional issue. By this way, the members of Sésamath have started a new economic activity. In this competitive market, the use of free licenses by members of Sésamath becomes a distinctive sign. The contents are freely available online in Public Service logic. Richard Stallman (see below) has already underlined the proximity between source code and mathematics textbook.

"Translated, this treated a program much like an algebra textbook: its author can claim copyright on the text but not on the mathematical ideas of algebra or the pedagogical technique employed to explain it."(Williams, 2002)(p123)

Then, in 2006 the first Sésamath printed edition is conducted with a publisher. During this period the contributors used their personal rules about the time spent on the association activities or about the production process. This organization is strongly marked by the specialization of each contributor. Between 2001 and 2006 each contributor had developed its own hacking skills in the matter of online school contents. This atomized specialization limits the interchangeability of contributors and creates more a patchwork of personal projects rather than a one collective. These commitments are not motivated by a short term career calculation between costs and benefits. Most of teachers consume their exercises and use those of the others, day to day.

Like in the market of contemporary music (Born, 1995) or in the publishing market (Bourdieu, 1999) the contributors of Sésamath experiment the economic competition process. They start a self-exploitation to be competitive and skirt some rules on the market. A contributor tells us in an interview the forms of self-denial in Sésamath.

"She was still pregnant and she was making corrections on her hospital bed. She had the final responsibility for the publisher. "(March 2010)

The first contributors have chosen by them self their tasks taking into account their tastes and abilities. This management boosts the production and modifies the rules in the school contents market. However the first organization of Sésamath has shown some limitations because of the horizontal hierarchy. Even if the community aspect of trust and informal routines had dominated, the control of members on each other is limited because of the distant and mediated communication. A contributor explains in an interview how the effects of the routines and the influence of leaders fade.

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"*We trusted a contributor. It was fine before, and then he completely stalled the process of production. After his first contribution the only message he sent was "Can you do this for this date." And he did nothing by himself. When you say to do something and you do nothing ... the people did not want to contribute anymore.* "(March 2010)

In this organization the rules of reciprocity and authority are depending on the domestic settings rather than on common conventions. A contributor recalled in an interview (below), that the organization of the first manual have benefited of couples' involvement.

"*I think she worked a lot with her husband. He has never been part of Sésamath. Overall, he gave a lot of advices. He was not responsible for a chapter, he had no official role, but he was very much involved. But that, it was only in the fifth grade because then she had problems. After, we had to find another system.*"(March 2010)

Between 2007 and 2009, the contributors have formalized a new way to produce textbooks. They point some factors in the success and failure of their practices. An employee of the organization described in an email (below) the ideal pattern of the organization to carry out the reprint: a hierarchical and specialized organization with regular turnover, plus some online and offline meetings.

"*In 2009, some errors were committed (mostly due to some project managers, but not only) in addition to the process of production issues (last manual of the set implies fatigue, no real change in the official curriculum, intrinsic difficulty of 6th level):*

- No renewal of the authors (no call made earlier this year on the list)

- No project meeting (except the meeting of Chapter leaders in July 2008)

- Non mastered edition calendar.

- Lack of unity of the whole editorial:" (April 2010)

Despite the lack of a highly formalized organization, the collective provides to publishers a new textbook during four years, distributed in schools and online. After these early years, members must choose between abandoning the textbook project or rework the first edition. The only volunteer activity does not seem a viable solution for the most committed contributors in the project. A contributor explains (below) during an interview the incompatibility between teaching activity and the textbook production.

"*Three years ago, it had become unbearable, it had become impossible. I had to make a choice. Either, it was more work on Sésamath, and I don't know ... to no longer do my job of teacher properly. Either it was stop working for Sésamath. There was no medium choice.*" (February 2009)

The domestic practices, with a succession of tests and errors, required a lot of time from contributors during the first edition. The large labor division in a big community does not necessarily reduce the individual participation costs for coordinators. An editorial project is more powerful with a limited number of electronic exchanges between a limited number of contributors. This observation goes against the hypothesis of positive externalities of the digital contents linked with the freedom to share information with a large number of contributors. The evaluation of online productivity does not result from an intensification of the labor division. A mature project is structured around a college of experts with professional skills in the matters of legal and economic management.

2.2 Transformation: specialization of the community

The qualitative and quantitative changes can be observed in the participants of the textbook mailing list of the project (Mathenpoche_papier_contrib) between the first and second paper edition. On the mailing list, we analyze the creation or modification of the categories of contributors. These changes reflect the different forms of organization adopted over time.

The shifting between professional and specialized organization can be observed by the different categories of contributors in the collective. Under the effect of the labor division, three types of contributors are involved in the organization's activities. These categories are similar to the well known organization of open source project described in concentric circles (Crowston and Howison, 2005). The community has a core of managers and a large group of contributors and users. Our categorization is more a continuum between professional commitments and specialized work, rather than a strict set of categories. A member can play several roles each year and combine some roles around its trajectory.

The most important category of contributors in the project, regardless of the year, is the group of the external contributors (Tab 1). These teachers estimate conduct and disseminate exercises and software as part of their mission of "Service Public". As often in the open source project they contribute for free because the ideology of Sésamath looks like their own. This profile is little bit different than the career concern one. The teachers contribute because they think they have to. They take into account their training and their teaching mission. However Table 1 shows that the external contributors participate less in the reprint project. The skills required for these tasks imply long time training in the publishing task. The specialized work limits the learning community effects and the renewal of contributors.

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To continue certain projects other ways of commitment exist. Some contributors respond by the gift of their work to specific calls as part of a collective effort to achieve editorial or managerial tasks like in the Board. The Board members have an executive role in the project following their election by the members. This council is composed of six to eight members, depending on the year. These people are long time contributors. They adapt and rephrase the ideology of the organization by taking into account the growth of the community and the new possible partnerships to fund projects. The involvement in these tasks is motivated by a will to defend the symbol of Sésamath as independent agent of Service Public. These contributors also want to shift their activities from professional production to specialized tasks. They follow an internal volunteer career from the contributor to the organizer. The economic and political tasks realized by these people are far from the first motivation of the self consumption of exercises in the classroom. The time to learn the specific skills to lead legal and economic missions implies collective meetings, readings, far from the low cost involvement in a career concern strategy (Lakhani and von Hippel, 2003).

The third type concerns the organization's employees who execute the orders of the Board and realize production tasks, informatics development and communication activities. The people hired are longtime contributors specialized in key activities for the organization, like software staff. Employees see their hiring as an opportunity to turn their activities of contributor to a new occupation. Their wages are teacher's wages and not one of an engineer or a communication specialist. The Board takes into account the seniority as teacher and the lost wages because of the hiring in Sésamath when the teacher will return as full time teacher. In most of the cases, these positions are terminated by a turning point where the employees stop their teaching activities or quit the Sésamath community to continue to solely teach. These breaks in personal trajectories show the difficulties to combine specialized community work and professional activity.

Tab 1 The Mathenpoche_papier_contrib composition

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Manager	0	2	9	15	5	11	4	5	6
Board members	6	5	4	7	5	3	4	3	4
Employees	0	0	1	3	4	2	2	2	1
Other members of Sésamath	16	15	23	12	18	2	4	7	4
External contributors	33	35	98	60	38	17	8	24	17
SUM	**55**	**57**	**135**	**97**	**70**	**35**	**22**	**41**	**32**

These changes in the list are symptomatic of the renewal of the organization, after the commercial success of printed contents. The reprint project has emerged in the organization, but didn't attract new participants. The employees and the Board members activities increase in reaction to the low involvement of new members. Before 2009, to contribute in the textbooks was unavoidable to be co-opted in the organization. Now new projects rise and attract the newcomers motivated by developing professional skills rather than specialized work in the community.

3 Paid and unpaid work?

The different profiles linked to the shift between the profession of teacher and the work of editor, are organized by a labor division. This organization creates a shift in the contributors' trajectories. The hiring of employees required to produce and to broadcast contents change the time scale of the involvement and highlights the non substitutability between teacher involvement and the editing work. The publishing activity is mainly framed by trademark agreements. The brand of Sésamath created equivalences between the community contents and the publisher's capital.

3.1 Volunteers and employee?

With the development of the commercial activity of the organization, the contributors are facing the assessment of broader audiences such as teachers, school organizations, customers, students, or parents. These relationships are not only forms of competition or trade relations but also political and symbolic alliances. The identification with the business model and the political activity is expressed, in an interview conducted in 2009 by a contributor to describe both commercial and non-market activities and both closeness and independence with the State institutions.

"In 2007 on an internal mailing list of Sésamath I said that we are a start-up of Public Service to describe our business model."(February 2009)

Successive leaders of the association have set up internal regulations prohibiting individual remuneration. This rule ensures economic solidarity between the emerging and mature projects in the collective. It also ensures that volunteers' participation is supported technically and politically by employees. This organization allows contributors to carry out projects that they could not implement without the support of a vast political and technical network. The new feasibility and the growth of the social network beyond mathematics teachers change the scale and the sense of commitments. A former employee of the organization expressed in an email to the contributors (below) how the new specialization of

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labor changes the professional commitment. In the first step of Sésamath, the teaching perspective dominated while in the second step the teaching and the collective commitment have become discordant because of time needed.

"*Being a part-time employee for Sésamath sends us a distorted idea of Sésamath. It makes us forget the rest are volunteers cannot (re)act in the same time frame. The gap is even larger with a full-time position, which is why I proposed to delete it. Living Sésamath, eat Sésamath, sleep Sésamath do not necessarily help Sésamath because we forget the sacrifices made by those who spend as much time as us, but have no free time to do so. Also, I am also to decrease the number of employees. If we have to spend money, I prefer to organize meetings and to buy the members' hardware.* "(April 2009)

Even if the salaries' wages are established on the teacher's wages grid, the time and the nature of the tasks are not substitutable between paid and unpaid contributors. The mail of this employee underlines that the teachers do not contribute during their free time, but their professional activity ("*we forget the sacrifices made by those who spend as much time as us, but have no free time to do so*"). The demand of users and the technical and temporal standards in the economic market require specialized work. Some teachers have been taken away from the classroom to realize these tasks. The individual monetary payments for employees no longer reflect the culmination of a career as a professor of mathematics on the Internet. These rewards reveal a turning point in the professional activity incompatible with the teachers' timetable. The individual incentives mobilized to express the reasons for collective action are not sufficient to explain its maintenance.

The individual strategies cannot explain the duration of the collective, because the successive rules during the history of Sésamath (education, research, domestic activities, public policy, and publishing) appear incompatible. The contributors who are only led by their own economic or symbolic rewarding have quitted the collective. They have not contributed to the stability of the community. The open source project has need different forms of commitments. People contribute through their professional ideology. They adapt their actions to specific needs and the realized specific orders. The incentives are different. For some of them, it's the in extension of the everyday work, for others it's the perspective of a new activity, and for the others, it's the temporal possibility to be paid for a previously unpaid work.

3.2 Trademark and editing contracts.

The specialization of some activities is due to new partnerships bringing some economic and social capital in projects. The publishing contracts are the most important of

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them. The creation of the brand Sésamath to sell the textbooks in the bookstore and the use of free licenses to broadcast online contents base the economic and political model of the organization. Sésamath stayed a nonprofit organization, even if the Board manages more than 300 000 Euros every year. With the benefit of the sales, the organization is no longer just a nonprofit organization, but the collective is also associated with the category of international foundations specialized in the management of large open source projects such as the Wikimedia Foundation, or the Mozilla Foundation. However Sésamath cannot produce nor distribute, by itself the print version. The organization had never invested in hardware and depends on partnership to broadcast contents in high school.

The first publisher chosen by Sésamath in 2006 has never done any previous activity in the field of the printed textbooks for high school, and has never even use the free licenses. Without the cost of contents' development the publisher has seen an opportunity to occupy a new market. This partner has to review and distribute textbooks in the bookstores networks. Furthermore the publisher has to support the entry cost into the market by sending a copy of the textbook to each French high school. For this work the publisher keeps 95% of the revenue and gives 5% to Sésamath. The sharing of the income is decided by taking into account the teachers' will to sell their textbooks half-price than their competitors. The publisher can also use the brand of Sésamath on his website beside its other products.

In 2009, during the implementation of a new curriculum, the Board of Sésamath decided to gradually change the publisher. For these new editions, the organization starts a new publishing agreement with a dominant company in the school printed publishing. The demand for textbooks and exercise books remained strong for the second edition, and the Board negotiates a tripling of copyright. The fee for the exploitation the Sésamath brand and its content changes from 1 to 3 Euros for each copy sold. In compensation the publisher has risen the retail price. This agreement shows the new face of the organization. Sésamath keeps a professional identity but adds logic of economic calculus to optimize a specialized activity.

The case of Sésamath shows that the sharing of value is linked with a balance of power between the community and the capital owners. Some Marxist authors such as Tiziana Terranova (Terranova, 2000) see the voluntary free contributions as an access for economic actors to free work, or a form of capitalist exploitation. The recovery of this work by capitalist actors is due to the provision of significant economic and material resources to broadcast free contents. The work of contributors is collected and enlisted under the trademark banner. This created a negative pension because each added contents required more resources for its organization and dissemination than to produce it (Gensollen, 2004). However, the

concentration of free resources related to an expert network created a symbolic value. In this way the value is not due to the reuse of the contents. The wealth comes from the assimilation between the daily activity of the professional contributors and different commodities and services.

The use of the free licensees by some new economic actors to benefit of the betweenness effects is a kind of investment (Thévenot, 1986). These contracts allow both formalizing new alliances and protecting the investments made in management to adapt classic organization to new media (hardware equipment, staff training). These trademark agreements create equivalences between economic and hardware resources required to broadcast contents and the broadcasted contents. This systematic use of law deletes the ideological differences. The free licenses offer a mode of accumulation and consumption, and they protect the ownership of the means of production and they do not prevent the profits in the capitalist production cycles.

Conclusion

There is no complete definition of work, and the arrival of computers in the domestic area has increased the complexity of the phenomenon. Open source contribution updates the question of work at home and informal work. Individual strategy, institutional structure, social habits, technical constraints and community practices frame the contributors' commitment. Our ethnographic research challenges some economic hypothesis about free work. The homogeneous approach of the work shows some limitation in a real situation. The professional activity and the communal specialized work are different. The use of the same digital instrument hides the different time frames, the institutional norms, the political issues; which are participating to the specialization of activities.

The existence of a break in the dynamic of accumulation highlights transformation in open source organization and the rise of tasks specialization. The specialization is done to optimize the economic resources and focus the contributors' activity in a collective way.

The contributors can present some rationality but the continuity of the collective action can become incompatible with these first individual motivations. The individual career strategies framework requires the substitutability between free work time and the professional time. This assumption implies closeness between online commitment and professional activity. In our case, it appears that the substitutability disappears with the growth of the community. To conciliate the decrease of institutional supports and the digitalization of society teachers invest in new skills far from the mainstream way of pedagogic

experimentations in the universities and academic institutions. Our fieldwork also shows that the work increase as publisher is done at the expense of traditional teacher activities. In other words, what appears first for a renewal of professional practices results in a change of work which can be irreversible.

The professional turning point does not concern all the individual trajectories. The balance between very specialized work in project management and an individual's professional commitment is a strategic point in a collective open source project. The work in the open source projects has many forms linked to the step of the community institutionalization and linked with the need of capital in the community. We can observe three steps which are points on a continuum between professional commitment and communal work. Each form of activity can cohabit, but one dominates the others according to a time frame.

The first step is marked by self exploitation motivated by personal and professional experimentation. This kind of activity outside the market challenges the standard rules of competition, and creates a specific activity in front of the economic insiders. During this stage people start to work collectively and they defend a new form of their profession. The choice of the free licenses creates opportunity for other actors to join the first projects.

The second step implies a specialization of labor to face to some economic and social partnerships following the market rules. This moment is marked by the rise of a vertical hierarchy to limit the expenditure of time implied by professional self experimentation. This vertical organization replaces the professional commitment by organized work with specific tasks. A trademark is created that embodies the collective identity and maintains a link between different types and generations of contributors. The brand summarizes the contributors' network connections and the results of the collective activity.

The third step is marked by the rewarding of the work and the setting of different types of commitments. It can be a direct wage, or the opportunity to do renew the day to day tasks, or obtain social and professional recognition. An economic model is managed to share the value between the community and other traditional economic actors. These partners own some hardware, skills and professional networks required by the community specialized in the production of intangible goods. The trademark agreements create a common unit of value to share the benefits between the community and external partners.

The teachers' community provides an alternative point of view on the free software communities. Other types of community can be investigated to complete our approach like open source journalists, or the open source advocates. These groups also can have different

steps of growth and their needs could change if there communal activity is specialized. An interesting approach would concern successions of time frame between the professional activity and the specialized work in the community. Is it possible for an already specialized community to create an organization dominated by the professional rules rather than by the communal ones?

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