

Producing a Knowledge Commons: tensions between paid work and peer-production in a public institution

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Abstract

This paper explores peer-production initiated and organized by a public institution. We propose a sort of borderline test case that may shed light on issues surrounding peer-production in a capitalist context. We explore tensions around work and production in the digitization project of the Marie-Victorin Herbarium in which a team of volunteers is working to photograph thousands of herbarium specimens, complete a database entry for each specimen and associate the digital photos with the database. Carried out in the context of a digital infrastructure, Canadensys, whose aim is to make information contained in Canadian biological collections freely accessible online, the project is realized almost exclusively with volunteer labor. This case illustrates how unpaid labor, freely given but organized from above in an institutional context, produces a Knowledge Commons that may be difficult for capitalist forces to appropriate.

Introduction

This paper reports on peer-production initiated and organized by a public institution. We explore tensions around work and production in the digitization project of the Marie-Victorin Herbarium in which a team of volunteers is working to photograph thousands of herbarium specimens, complete a database entry for each specimen and associate the digital photos with the database. Carried out in the context of a digital infrastructure, Canadensys, whose aim is to make information contained in Canadian biological collections freely accessible online, the project is realized almost exclusively with volunteer labor.

We suggest that this case may shed light on issues surrounding peer-production in a capitalist context. The Marie-Victorin Herbarium is a public institution benefits from the freely given work of volunteers in pursuit of a noble goal: the production of an open-access knowledge commons. It is not a capitalist firm and does not seek financial profit. Yet, this peer-production is strongly framed and organized by an institution. Although the situation reproduces some facets of traditional labor organization such as a modular production process and “time sheets” filled out by the coordinator, production output (i.e. number of entries produced) is not the primary consideration. As might be expected in a museum situation, data quality is of much greater concern. Similarly, while they recognize what they are doing as “work”, the volunteers themselves reject any idea of exploitation and regularly point to the benefits they receive from participation, as well as to producing something for the common good or for generations to come. Relationships between volunteers and the two paid employees – a curator and a collections manager – are not antagonistic; in fact, staff try to maximize volunteer choice (of hours, tasks, etc.), are attentive to opportunities for learning, and integrate volunteers’ suggestions for process

improvement. They do, however, mobilize a pool of volunteer labor in order to carry out this colossal project in a context of limited resources. They orient and supervise the project, and are ultimately responsible for the efficiency and speed of the process (i.e. making specimens accessible online more rapidly) and for the quality of the resulting product. In short, we ask in what ways the public character of the institution and the goods produced, and the fairly collaborative process, may influence our interpretations of the relationship between paid work and peer-production.

The paper is organized as follows: First, we review significant literature in order to situate our case. We then describe the work of digitization in detail, with particular attention to who is involved in various stages of the process. A discussion of key themes follows.

Literature Review

Although scientists and amateurs have worked together for centuries, new sociotechnical configurations are changing scientific practice, relations between those involved, and even the very definition of what qualifies as scientific knowledge, as an increased variety of actors are connected and intervene at different stages of knowledge production and dissemination (Baker & Millerand 2010; Hine 2008; Waterton et al. 2013). On the one hand, the digitization and availability of research data on the Internet enables its circulation among increasingly heterogeneous groups of actors – to different research projects, across disciplines, with the public, and so on. On the other, the multiplication of web platforms facilitates the participation of amateurs and the general public in scientific research (Lievrouw 2010).

Projects that invite members of the public to participate in producing scientific knowledge are often classed under the rubric of citizen science. This label masks considerable diversity. In fact, citizen science “encompasses very different degrees of agency with regards to the research process, very different relationships with the professional scientists and very different degrees of influence on policy relevant scientific projects where citizens contribute to as ‘citizen scientists’” (Nascimento et al. 2014, p.5). To avoid misinterpretation, Heaton, Millerand, Liu and Crespel (2014) prefer the term “participatory science” to describe the engagement of non-professionals in scientific investigation, whether by contributing resources, asking questions, collecting data, or interpreting results. Haywood (2014) suggests examining the added value of citizens’ contribution to science from two different perspectives: 1) the public understanding of science and technology tradition that is oriented towards scientific research in which the *external value* of projects is more salient; 2) the public engagement in science tradition that emphasizes an opening up of research and policy, and can be perceived as more focused on the *internal value* of such projects, namely for the participants. He identifies four main goals for public participation in scientific research projects: expanding the scope and scale of scientific research, enhancing science knowledge and understanding via interactive learning experiences for “non-scientists,” increasing environmental stewardship and developing more democratic and inclusive science research and policy processes (Haywood 2014, p.65).

For scientists and funding agencies, cost-effectiveness is often cited as a benefit of citizen science given limited financial and human resources in biodiversity conservation initiatives (Darwall & Dulvy 1996; Miyazaki et al. 2014). Nonetheless, these projects generally continue to require at least some financial support (Thiel et al. 2014), and others costs – such as time and effort in managing people and technological support – need to be considered (Gura 2013). Analyses of the return on investment of these projects suggest that coordination, communication with volunteers, and data checking and compilation imply costs that can be very high in the long run (Tulloch et al. 2013).

Ensuring and improving data quality is an important issue in the citizen science literature since the trustworthiness of a dataset is tied to its credibility and, subsequently, to its scientific value (Darch 2014; Wiggins et al. 2011). The most common method of validation seems to be expert review, which can be performed by professionals, experienced contributors or multiple parties (Wiggins et al. 2011). Care in the preparation of protocols and appropriate training can greatly improve data quality (Cohn 2008; Hochachka et al. 2012; Newman et al. 2012; Wiggins et al. 2011).

Several models propose classifying citizen science projects according to the type of tasks performed by non-scientists and the benefit they may obtain, usually along a continuum (Buytaert et al. 2014). For instance, Bonney et al. (2009) analyze a series of projects according to the involvement and control these participants have, namely whether they are “Contributory” (designed by scientists), “Collaborative” (non-scientists not only contribute, but can also play a role in steps like design, analysis and dissemination), or “Co-created” (designed together and with a strong and continuous involvement of the public).

The ability to learn, to make discoveries and to teach have all been identified as motivations for participating in citizen science (Raddick et al. 2010). Indeed, knowledge exchange or mutual learning seem to play a key role, “specifically, through systems of informal mentoring, where the most experienced teach the less experienced”(Bell et al. 2008, p.3450). Other motivations include the desire to contribute to science, a sense of being part of a community, having fun and enjoying beauty as well as interest in the project, in the field and in science in general (Raddick et al. 2010). The motivations of volunteers may change over time and form a complex framework of both internal and external factors (Rotman et al. 2012; Rotman, Hammock, J. J. Preece, et al. 2014). Studies of volunteering not restricted to citizen science have already demonstrated multiple goals and how more than one goal may be pursued at the same time (Clary & Snyder 1999). Clary and Snyder (1999, p.157) identify six personal and social functions of volunteering: values (to express or act on them), understanding (to learn), enhancement (for growth and development), career (to gain experience), social (to strengthen relationships) and protective to reduce negative feelings or to solve personal problems. Researchers’ awareness of volunteers’ motivations helps contribute to ongoing participation (Couvet & Teyssède 2013), while lack of such understanding and issues of mutual apprehension and mistrust constitute demotivating factors (Rotman et al. 2012). Less hierarchical projects benefit particularly from long-term participation and are associated with the development of personal relationships between scientists and volunteers, promoting trust and communicating goals, acknowledgement and attribution, as well as mentorship (Rotman, Hammock, J. Preece, et al. 2014).

Adler (2007) has argued that capitalist relations of production are in contradiction with the socialization of the forces of production. As technology and organisation become more complex and production ceases to be uniquely an individual matter, the socialization of labor produces a socialized or “collective worker” (Adler 2007, p.1321). Heckscher and Adler’s (2006) notion of “collaborative communities” also points to the idea that social relations themselves might be “productive.” The post-workerist strand of Marxist organization studies emphasizes that “the work of socialization – all that labor does without wage recompense to make this regime [of wage labor] possible both in the workplace and the community - are present from an incipient moment in commodity labor” (Harney 2007, p.148). This socialisation of labor forms the basis of social wealth, but also serves as a source of profit for capital. For post-workerists, the wage relation is only a part of capital’s command over labor, and productive activity is moved outside the contractual employment relationship (Böhm & Land 2012). Analyses of this type point towards a new “hidden abode” of production, where work occupies an expanded terrain of social activity; where management moves further away from direct control of work to more complex practices of governance (Arvidsson 2005); and where collaboration in production is increasingly the responsibility of the workers (Beverungen et al. 2015, p.477).

The need to account for the social aspects of production, such as peer-production, and for unpaid work, is all the more pressing in digital contexts. The idea of freely provided labor justified by the desire to contribute according to a gift logic is only part of the story and can be seen in the context of working relations that are also characterized by capitalist logics and strategies that co-opt peer production. Terranova’s concept of free labor as “simultaneously voluntarily given and unwaged, enjoyed and exploited” expresses the reality of an Internet that “is animated by cultural and technical labor through and through, a continuous production of value which is completely immanent in the flows of the network society at large” (2004, p.74). A critical view on relations of crowdsourcing and peer-production relativizes the exalting discourses of fans and passionate amateurs. One source of such criticism stems from research on digital labor.

In the digital labor literature, the discussion revolves around two main topics: the precarious working conditions of online workers, be they micro-workers or skilled creative industry professionals, and the monetisation of user behavior on the social web (Scholz 2013). In both contexts, the relation of power in place is described as exploitative. The value produced by Mechanical Turk contributors benefit little from the value they generate, their tasks are menial, they often have no knowledge of what exactly they are contributing to given the extreme modular distribution of tasks and there is no recognition of their contribution. Similarly, crowdsourcing projects tend to separate worker and requester as their relationship is solely task-based and limited in time (Aytes 2013).

In the case of social networking sites, with the exception of Google, companies do not share their revenues with their users. This appropriation of value has in fact led to a class-action suit brought against Facebook (Fisher 2015). Companies like Google prefer to downplay their influence, presenting themselves as mere “hosts” (Gillespie 2010), yet these services exert different forms of control: over users through data-mining and profiling; over their practices by determining preferable choices; and

over their content through automatic filtering (Dias da Silva 2014). As forms of immaterial and affective labor, the activities of social web users are often not considered work at all. However, bearing in mind the double role of user as content producer and data provider (Dijck 2009), the concept of exploitation applies more aptly to user-generated data (Andrejevic 2009). Users have very little control and reduced knowledge of the process as well as less to gain from the accumulation of data resulting from their actions online, whereas the creation of content is often associated with deriving pleasure and exploring one's creativity (Dijck 2013). Online contribution can thus simultaneously promote alienation and emancipation (Proulx et al. 2011).

Aigrain (2005) warns against the power of corporations to shape the law as well as to control the sharing of information and knowledge. However, he also evokes another world, one of cooperation and solidarity, in which the commons are enablers of human development. The term "Commons" has become widely used in different contexts, but always tied to information sharing and the reconfiguration of current property systems. Von Hippel's book on the democratisation of innovation is dedicated "to all who are building the information commons" – the result of innovators in a particular field making their developments freely available to all, and hence providing an alternative to information as private intellectual property (2005, pp.12–3). In their study of the Knowledge Commons, Hess and Ostrom (2007) discuss knowledge as a shared resource that is subject to social dilemmas. Knowledge Commons can reside at the local level, the global level or somewhere in between. Wherever it is situated, it is characterized by multiple uses and competing interests.

Benkler (2002; 2006) suggests that commons-based peer production is a response to a set of changes that "have increased the role of non market and non-proprietary production, both by individuals alone and by cooperative efforts in a wide range of loosely or tightly woven collaborations" (2006, p.2). For Söderberg & O'Neil, "the commons and peer production are two names for describing the same thing: a particular kind of labour relation" (2014, p.2), in which work is voluntary, tasks are self-selected and motivations are mostly intrinsic (e.g. peer recognition), rather than extrinsic (i.e. monetary compensation). Building on Raymond (1999), Demil and Lecoq (2006) define a bazaar-style of governance with few control mechanisms that relies on open licences and voluntary participation. O'Neil (2015) refers to ethical-modular organizations (EMOs), which operate in a logic where motivations for participation are ethical, and oriented towards others, rather than towards financial profit. Peer-production can be carried out within a commercial infrastructure, which implies that it is partially subject to the constraints of commercially driven cognitive work, as in the instances of digital labor discussed above. In peer-production, appropriation often looms not early in the process, namely in the definition of the project, but towards the end as the community's output is appropriated by external commercial interests, thus becoming free labor (Söderberg & O'Neil 2014, p.2). Bauwens argues that if nonreciprocal value is indeed captured, this is problematic given conditions of worker's precarity. However, "[u]nder conditions of social solidarity, the freely given participation to common value projects is a highly emancipatory activity" (Bauwens 2013, p.209).

Context and Method

Herbaria are collections of preserved plant specimens, usually dried and placed on sheets of paper and classified according to family, genus, and species. They serve many different purposes, from scientific research on plant taxonomy, phylogeny or evolution, to applied research in fields as diverse as climate change, agriculture, human health, biosecurity, forensics, land management, conservation biology, natural resources, and control of invasive species. By providing a reliable, verifiable record of the changes to our flora over hundreds of years, they are an important source of information on our natural heritage and play an important educational role.

The Marie-Victorin Herbarium in Montreal is an important collection, both in terms of size and reputation. Established in 1920, it contains close to 700,000 specimens of vascular plants primarily from the north-east of North America, particularly Quebec and Newfoundland, with a number of important specializations, making it an important botanical reference. The Herbarium has two paid staff members: a curator and, since 2012, a collections manager. Since 2012, it has been housed in the Biodiversity Centre of the University of Montreal within Montreal's Botanical Garden. The construction of the Biodiversity Centre was part of a larger project that aims to provide Canada with a centre of excellence and a network of researchers in biodiversity, Canadensys. Canadensys' goal is to offer free, universal access to the information contained in biological collections via digital infrastructures. The project to digitize the Herbarium's collection takes place in this context.

Digitizing a herbarium's specimens represents a solution to many of the challenges involved in curating a herbarium (Flannery 2012; Heaton & Proulx 2012). Dried plant specimens are fragile and subject to attack by insects, deterioration due to light or fluctuations of temperature or humidity. Curators are often obliged to restrict consultation and borrowing of specimens. In this context, digitization is both an excellent opportunity to make a systematic inventory of a plant collection, and to greatly increase its accessibility. In the beginning of 2014, a new process based on photography of specimens started, with the goal of increasing the speed of online publication of specimens. Since this work is very intensive in terms of resources, the Herbarium recruited and trained volunteers that are responsible for most of the phases of the process and who supply an important source of labor – the equivalent to 3 or 4 full-time employees.

Our paper is based on regular observations during the first six months of the project in 2014, followed by two months of participant observation and interviews with eight volunteers, the collections manager and the botanist of reference/curator. Each observation period was documented with notes and photographs. The notes contained both objectivist descriptions of activities and spaces and impressions/intuitions (Maanen 1988; Marcus 1995) that subsequently served as a departure point for thematic analysis. Observation notes and interview transcripts were analysed collaboratively in meetings of the research team.

Description of the digitization process

The digitization process implies multiple manipulations, divided into 4 main stages. Firstly, specimens must be mounted (or the existing mounting reinforced) on standard sheets of paper and the information contained on their labels - the name of the plant and the person who identified it, the date and location of the collection, habitat and the name of the collector - verified. This step is fundamental for the conservation of the specimens and is not specific to digitization, although some changes were introduced to simplify the photography process. Volunteers take complete charge of the mounting process: an experienced volunteer trains new recruits and has prepared a reference manual to help with the process. Verification is a crucial aspect of the process, since plant identifications change regularly. Volunteers do much of the work to verify the exactitude of existing labels. They use a panoply of tools, other data bases and online resources as well as books. Any changes in nomenclature will be approved by the curator before new labels are printed and attached. The final result is an up-to-date record, an inventory of the Herbarium's holdings, such as that illustrated in Figure 1.

Figure 1: Herbarium sheet

Before being photographed, the specimen has to have an entry in the database. Most will be classified as “partial entries,” meaning that they have basic information (content of the specimen's label) and an identification number (unique identifier). Volunteers create entries for each specimen and transcribe information contained on the labels. Entries can be completed at a later date with additional information such as geo-referenced data, the history of the plant's name, etc.

The photography stage involves a constant to-and-fro between the image and the database. The specimen is digitized as a photo, the photo is linked to its database entry, and metadata on the photography process is added into the database. This repetitive work, performed by individual volunteers or in teams of two, requires a number of small steps and demands great attention to detail. Another volunteer later verifies that the photos are recorded, that they are appropriately named and that the association with the database is functional – a sort of quality control that was added as an additional step after a few discrepancies were found in the first digitizations.

After photography, the entry has to be completed. This is sometimes done before the entry is uploaded and made accessible, and sometimes after. The form is divided into different coded-coloured sections so that it is easier to understand the different types of information required: history of determinations, location, projects that have used the specimen, etc. Completing an entry may be relatively easy or difficult, depending on the information on the specimen sheet. In every case, this work is done by a small number of skilled, or specialized, volunteers. For example, certain volunteers specialize in determining the precise geographical location (coordinates) of specimens. Georeferencing a specimen's location and habitat is particularly intensive in its use of a variety of sources: satellite images, Google maps, old military maps, coordinate format conversion tools, and so on. Again, this multiplicity of sources requires constant checking and crosschecking in order to ensure accuracy and data quality.

The final step of the process – uploading entries to Canadensys – is not carried out by volunteers, but by the IT team of the Biodiversity Center. Of its close to 700,000 specimens, as of December 2015 the

Marie-Victorin herbarium has 150 000 online entries, 50,000 of them georeferenced, and 7,000 images. All the information regarding the specimen, including a high-resolution photograph, becomes available online and can be downloaded freely. A series of filters facilitate searching the collections made available. Information and image have no restrictions regarding use; their licensing as Creative Commons 0 means that not even attribution is required. They become part of the knowledge commons – to be used by other scientists, hobbyists, government officials, artists, NGOs, whoever, wherever, whenever.

Table 1: The division of labor in the digitization process

Discussion

MANAGER-EMPLOYEE RELATIONSHIPS

For Edwards, “managers and workers are locked into a relationship that is contradictory and antagonistic” (2009, p.16). From a labor process perspective, everything at the Herbarium seems to be in place to support the idea of structured antagonism (Edwards 1986) as integral to the relations between employer and employee. Managerial strategies harness volunteers’ labor to produce digital records, and the volunteers do not determine how their work is deployed to meet the objective: volunteer “workers” carry out tasks to support decisions that have been made elsewhere.

A closer look reveals a more complex picture, however. The concept of structural antagonism rests on a supposition of binary identity formation (employer and worker). While the collections manager and the curator are clearly in a separate category, the volunteers are not a homogenous group. There is in fact a gradation of skills and a certain degree of specialization by certain volunteers. For instance, the volunteer in charge of mounting specimens is the undisputed expert in her field and judged more capable than the collections manager. She has general knowledge of the rest of the process but no interest in doing anything else. Some volunteers specialise in one aspect of the digitization process, while others rotate among several, or take part in the digitization process alongside other duties (such as preparing and shipping specimens on loan to other herbariums or researchers). A number of more skilled volunteers sometimes assume an informal leadership role. They answer questions when the manager is not available, train new volunteers, verify the exactness of database information that has been entered. To further complicate the picture, some volunteers have at times been paid contractual workers, sometimes doing exactly what they now do as volunteers, while others hope that their volunteering will lead to paid employment, either in the Herbarium or elsewhere. This fluidity points to contingent and multiple identity formations (Grint & Woolgar 1997) that are neither antagonistic nor binary.

If the relationship is not antagonistic, is it contradictory? Edwards describes the labor contract as contradictory “... because managements have to pursue the objectives of control and releasing creativity, both of which are inherent in the relationship with workers and which call for different

approaches” (2009, p.16). The collection manager expresses this duality: “I have to grease the wheels so that things run smoothly. And so that people are happy. So that what we produce is useful to everyone in the end.” [1] Managing volunteers has become a significant part of his work. At the start of the digitization process, the Herbarium recruited a large number of volunteers. Consequently, in those early months, the manager spent almost all of his time training the new volunteers and making adjustments in terms of the task distribution. This completely upset the organisation of his own work. I had to learn how to manage a mass of potential volunteers [...] Including the ten who were already working here, there were around sixty! And a lot of them were people who really wanted to help, but who didn’t really know how they could contribute. They checked off all the possibilities: difficult tasks, repetitive and boring ones, the most interesting ones ... They checked everything. And that left me having to decide what they should do, but I didn’t know them.

Controlling the digitization process requires that the collections manager track the progression of the work and that he assign tasks to volunteers. This assignment is done collaboratively with the volunteers, but is also guided by his appreciation of their ability to perform certain tasks, now that he better knows their strengths and weaknesses. Volunteers do not fill out time sheets, but the manager records their hours in a logbook. He was able to inform us that, during the observation period, volunteers supplied the equivalent number of hours of 3 or 4 full time employees. He still finds the work of managing the volunteers taxing, both in terms of the time it takes away from his other, more collection-related tasks, and in terms of the energy it requires, “I’m just one person. If there were two of us, we could do a better job of managing and interacting with the volunteers. I’m completely overworked.”

The manager’s workload is large not only due to the sudden increase in the number of volunteers, but also because he tries to maximize volunteer choice (of hours, tasks, etc.), and is attentive to opportunities for learning. He often invites volunteers to participate in activities he thinks they will enjoy and that also speak to a wider commitment to the Herbarium, Montreal’s Botanical Garden and love of plants in general (e.g. a session on the Garden’s history or an event at a museum). For example, he took one of the volunteers, the mounting expert, with him to visit another Herbarium. Although it was not the goal of the visit, what she saw led her to modify mounting procedures at the Marie-Victorin Herbarium. A doubt expressed by one volunteer can become an opportunity for a short lecture benefiting everyone present. Volunteers recognize and highlight the staff’s responsiveness: “If we have a question, right away they’re listening. We don’t get the feeling that we’re bothering them, ever. But we know very well that we are interrupting, but it’s never the impression they give us” (MB).

The collections manager is comfortable when it comes to channelling the creativity of volunteers, and he seems to have a gift for making people feel appreciated, “The atmosphere is really good. And [the manager] is always available. The relationship with [the curator] is also good: he’s interested in what people are doing. Frankly, it’s a really pleasant working environment”(DC). As the digitization process is still being refined, inventiveness is commended and encouraged: “Any initiative we might take is greeted ‘oh, yes, yeah, yeah, yeah’. So we feel encouraged to have ideas for how to improve quality and the work process” (MB).

THE PROCESS

The digitization process in place in the Marie-Victorin Herbarium reproduces several facets of traditional labor organization. The production process is controlled from the top, with volunteer “workers” executing decisions that have been made elsewhere. Herbarium staff orient and supervise the project, and are ultimately responsible for the efficiency and speed of the process and for the quality of the result. Although volunteers are aware that the staff has to comply with the institution’s own rules, they do not feel unduly constrained by this since there is room for making suggestions to change procedures, “if we have an idea for how to improve the process or something, [the manager] is really open to our suggestions. On the other hand, I know that they also have operations that they need to respect. But I feel more relaxed here [than in a formal work environment]” (MP).

The process is modular, and largely sequential as Table 1 illustrates, with volunteers most active in the middle stages. The description of the process as a series of discrete tasks belies the relationship between them, as well as that between the volunteers, however. While the various tasks can be carried out independently of one another, it is not rare for someone performing one task to consult with another volunteer with another responsibility. For example, a volunteer photographing specimens might visit the mounting room to describe a problem with a shadow caused by the placement of something on the sheet and ask if the mounters might organize the elements on the page differently. Or someone creating initial database entries might inform the photographers that a certain specimen sheet will need three photos because, exceptionally, there are three entries. What is more, volunteers have a sense of where their work fits within the entire process, and indeed, how the process feeds into the project of producing an online resource, “it’s one small piece, a small contribution to [something that] otherwise couldn’t be done. It’s making something that belongs to us accessible, something that’s part of our heritage but that’s unknown because it’s hidden in our drawers. [...] Without the contribution of the volunteers, it would be impossible.” (MB) This appreciation of and adherence to project goals is characteristic of much participation in peer production, such as the open source community.

Volunteers draw on a large number and variety of resources in order to decode and assemble information for a specimen’s database entry. Using specimen labels as their first source, volunteers sometimes appear to be “detectives” pursuing all leads that may reveal the story of the plant: its origins, its identification, the people and institutions connected to it. They may consult resources commonly used at the herbarium (proposed and access structured by the collections manager and the curator, e.g. tabs linking directly to certain databases of plant names or collector information), but they also bring their knowledge of unconventional resources – online collaborative encyclopaedias, different types of maps, a travel-oriented website, virtual foreign language keyboards – to bear on their task. These resources in turn become part of the collective repertory. Driven by curiosity, they continue to search further, even if they already found the information required to fill out the field. This in-depth search is tied to checking and cross-checking – the quality of data is taken very seriously by the volunteers and not only by the paid staff – but it is also linked to the pleasure of discovery and learning, which in turn contributes to

their continuing commitment.

Because when I learned how to enter things in the database, I gained some new knowledge. And that's also very positive. In fact, it's win-win. The Herbarium gets something out of it, and so do I. For sure, if there was only one side that benefitted it would be less motivating. I would still come to the Herbarium but I wouldn't get any - it's not necessarily a tangible benefit – but I wouldn't feel the same personal satisfaction. There would be less chance of me staying. (MP)

The integration of volunteers' suggestions for improvements to the digitization process is a key reason why they feel part of the project. In fact, there were many adjustments and refinements over the first six months of the project. These ranged from the design of the on-screen interface to the database, to changes in the placement of elements (e.g. envelopes containing seeds) on the specimen sheet during mounting, to bricolage of the photography setup. The equipment setup and design of the initial protocol was based on digitization projects underway elsewhere. The collections manager provided initial training to several volunteers, who then started to photograph specimens. A small project (1000 photos) was chosen as a test case. In use, problems or sticking points became apparent at several levels, and volunteers developed tools and techniques to facilitate their work, and refine the process. As the manager points out, "We've discovered all sorts of errors. In the beginning, it was all a bit vague trying to anticipate the kind of problems we might encounter. Now, we've seen everything. Or maybe not, we'll see." He recognises "We're learning as we go along. I hadn't at all imagined the problems we've run into." Some of the problems could hardly be anticipated and only became patent in practice, "When we work in the morning and the sun is in our eyes, when we have to use our hands to block it, then we said to ourselves 'We have to try and do something about this'" (MB). The solution, shown in Figure 2, was the installation of a shower curtain, which required considerable bricolage since the modern building housing the herbarium had been designed with clean lines and floor-to-ceiling windows. After several months, once the process had begun to stabilize, volunteers decided to develop a procedure manual. The resulting workflow and material environment are truly a collaborative undertaking. Knowledge is acquired in multiple ways, through mentorship (by staff and other volunteers), practice, autonomous research, but also in conversation.

We have different approaches and different areas of expertise too. It's as though we put our ideas together, and with the combination we become more efficient. I think it's accurate to say that our manipulations and the procedure we follow improve thanks to our exchange of ideas. (MP)

And I learn from other volunteers too, like how to use the software. We share our discoveries. Sometimes we laugh too, and go into raptures over the things we discover. We can share, people are open. And, like I said earlier, [the manager] is a good teacher, who is receptive and patient. (HS)

Figure 2: Digital photography station with curtain to block the sun

How do volunteers evaluate their experience in the digitization project and the Herbarium? They recognize what they are doing as work, but reject any idea of exploitation, pointing to the benefits they receive from participation, as well as to producing something for the common good and for generations to come. Their participation is "ethical", motivated by a desire for self-fulfillment and in particular by a desire to contribute or "give back." Drawing on the free labor literature, one might argue that they have

bought into their own exploitation, or that their consent at the point of production has been so effectively organized that they do not recognize their objective condition as exploited. We prefer a pragmatic approach and to respect the voice of the actors, however, and suggest that monetary retribution is not the only possible form of “payment”. Pleasure and a sense of appreciation are important:

[The fact that our work is appreciated] is part of the pleasure of coming here. It’s more fun than getting a paycheque. It’s better than money for your health anyway. [...] I know [that I’m appreciated] because the manager is always complimentary. And even [the curator] pays me a compliment from time to time. And anyway, I can see that it’s really appreciated. (RJ)

It’s gratifying and that’s kind of rare. It’s a quality that you don’t find easily. So we take our place without disturbing anything, but we feel that we have our place, that it’s appreciated. They tell us often. And that’s pleasant. With that, we are well-paid (laughs). (MB)

The openness to their suggestions and the leeway provided by the staff allows volunteers a certain degree of autonomy and the ability to shape their work, even if their activities are framed within the demands of an institution. In our view, they are working within a peer production logic that is quite distinct from typical crowdsourcing or micro-working systems such as Mechanical Turk, however repetitive and menial the tasks they perform appear to be. Volunteers accept that they have a role to play, and they are content to take their place in the larger system. The volunteers interviewed generally appreciate not being ultimately responsible for the entire process, although they all feel a sense of responsibility for maintaining quality and doing a good job.

THE END RESULT

In the context of scarce resources, using a pool of volunteer labor allows the Herbarium to carry out projects, such as digitizing specimens, that would otherwise be impossible. What is more, the resulting product is not directly moneyable and there is no thought of capitalizing on it. The idea is to produce a resource that will benefit everyone.

One of the vocations of a herbarium is museal. It serves as a repository for fine quality, well-preserved specimens. In addition to specimens’ utility for scientific, taxonomic purposes, and their use in applied domains such as conservation biology, land use planning or agriculture (Flannery 2012; Lane 1996), they are also a testament to natural heritage and its evolution, and to the history of botany. In this context, the digitization of naturalist collections is not only an opportunity for collections to stabilize and guarantee the permanence of their collections. It is also a move to increase their value (Pignat & Pérez 2013). Long before anyone could imagine online digitized images of plant specimens, Lane (1996, p.536) described this added use value:

Computerization of label data makes such reports on distribution and ecology of species more readily available to potential users; they add value to the data. Interconnecting the databases brings robustness to the information that natural history collections can provide to policy-making bodies; appreciation of robust data will lead in turn to appreciation of the collections from which those data were taken. Interconnectivity requires that collections

personnel abandon competition in favour of achieving a common goal: the discovery and description of the world's biota.

There are two points to be made here. Firstly, the “museum” aspect of the Herbarium requires that the digitization process focus on quality rather than quantity of production. Not only must the information contained in the database be accurate and up to date, the corresponding digital images must also be impeccably rendered and the link between the two well established. This concern for quality permeates the entire process – from the workflow design and establishment of protocols, to careful training with constant checking and rechecking of one’s own work, to validation by more experienced volunteers or the collections manager. While there is a tension between the desire to make images available online rapidly and the need to ensure that the information their record contains is definitive, in every case quality wins. Volunteers are not pressured to produce or to act quickly. Although a few like to count how many records they treat in a day’s work, most recognize that their productivity cannot be expressed numerically: “Sometimes, you can hit on a good strategy or shortcut and I’ll be able to correct the coordinates of a lot of entries. Other days, it’s more complicated and I’ll do many fewer” (DC). Without exception, they feel responsible for doing quality work, “It is the quality instead of the quantity that I think is really important for this type of work, because if you go through too fast, you will miss things” (DP). They understand how each person’s work may affect the other’s as well as its larger impact on the project as a whole: “The people here all feel involved because there is a lot of interaction between them. And they know that what you do has an impact on your neighbour, on others. And everyone knows the final goal” (CL). In terms of accountability, the Herbarium, and its staff, is ultimately responsible, but the names of volunteers are associated with the records they produce, in the metadata or sometimes on new specimen labels. This ensures traceability of any errors, but is seen by the management as primarily a way of acknowledging volunteers’ contributions.

The second aspect is related to the type of value created. The specimens are already in the public domain. If volunteers’ work produces additional value, it lies in creating an additional format (digital from physical) and in associating data that is searchable, filterable, and so on. There is no new intellectual property involved. What is more, the value created is potential, located in possible uses, rather than directly convertible or exchangeable. This parallels the open source movement whose participants typically focus on use value rather than exchange value, “Free Software is produced to be used, not to be sold” (Dafermos & Söderberg 2009, p. 54 cited in O’Neil 2015, p.1636).

The ultimate destination of the digital specimens and their records is Canadensys, a portal whose mission is to make biodiversity information freely and openly available to everyone. Through Canadensys, specimen data are integrated into GBIF (Global Biodiversity Information Facility), a global database of biodiversity data. Both Canadensys and GBIF operate using a CC0 licence, meaning that data is in the public domain. Biodiversity Centre and Herbarium staff express a strong ideological commitment to open data. This is undoubtedly also related to prevailing scientific norms of sharing information. The choice to waive all rights worldwide is also a pragmatic one tied to the difficulty in determining which data might be subject to copyright and what constitutes commercial use (which they would prefer to restrict). When it finds its way into Canadensys, the volunteers’ work becomes part of

the Knowledge Commons (Hess & Ostrom 2007), a shared resource produced when people make their production freely available to all, thus providing an alternative to information as private intellectual property (Von Hippel 2005). Volunteers are very aware of contributing to something larger than themselves, and cite this as one of their motivations.

It's a way to preserve our heritage. [...] It's like contributing to the diffusion of science. I wouldn't be here otherwise. [...] So, it's a plus. And it's the way of the future. (MB)

It [making the herbarium available on line] encourages the exchange of information internationally. I think it will reduce the use of resources to a certain extent, precisely because now we don't have to send actual specimens by mail. It's ecological in a way. I think it will also protect the specimens because they won't be handled as much. So they might be conserved for longer. It's a gigantic task, but I think that if the Herbarium can keep using volunteers to do it, it will happen eventually. I don't really see any disadvantages. (MP)

Söderberg & O'Neil (2014, p.2) note that dangers of appropriation in peer-production projects are often not apparent at the outset in the definition of a project. Participants offer their freely given labor to a common project which produces value, often use value. It is only when external commercial interests appropriate a community's output that it becomes free labor. The digitization of specimens for inclusion in Canadensys is still in its early stages, but we have difficulty imagining how it might eventually be appropriated. The network infrastructure was funded by government grants, and the work is performed in the context of a herbarium affiliated with a public university. In our view, this sets it in a class apart from other digitization initiatives such as the Global Plants Initiative, funded by the Andrew Mellon Foundation and made accessible through JSTOR, a private database (see Heaton & Proulx 2012 for details).

Conclusion

Volunteering for an association or an institution is often associated with doing what someone, the volunteer coordinator or committee, decides needs doing. To some extent, this is the case in the Marie-Victorin Herbarium. Following a traditional labor organization, priorities are determined by the management, and volunteers do much of the work. There is a clear distinction between manager/staff and volunteers. Yet, volunteers are much more than executors. Within the organizational frame provided, the process is highly collaborative. In particular, the extent to which the digitization process has been shaped by volunteer initiatives and suggestions, and the degree of engagement and creativity expressed by volunteers link it to peer production. While the work of volunteers digitizing specimens for the Herbarium may not strictly qualify as peer-production, it does share many aspects of peer production. Participation is motivated by perceived benefits for the collectivity and primarily intrinsic motivations - a feeling of gratification, learning, a sense of achievement - all elements that are identified in the literature on citizen science, open source production or volunteering in general.

Finally, the project goal – making digital specimens available online – sets it squarely in the public domain. Volunteers are extremely aware of the project's finality and subscribe to it. In this context,

financial considerations are secondary, or even absent. The scientific and educational mission of the Herbarium means that things are measured in other terms. Quality, accessibility, the production of a common good are the yardsticks. Is this a utopic perspective? Perhaps. Our case illustrates some of the tensions in the relationship between peer-production/volunteer work and paid work, suggesting that the public character of the institution and the goods produced, as well as the collaborative production process do make a difference.

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[1] All quotes have been translated from the French.