On the boundaries and partial connections between amateurs and professionals

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Abstract

This paper explores the boundaries and partial connections between amateurs and professionals in the context of a museum of natural history. It examines how these boundaries are made and unmade, paying particular attention to their materiality and their heterogeneity. My aim is to draw the temporal, spatial and material profiles of amateurs and professionals. In doing so, the paper focuses on the partial connections between amateurs and professionals and shows that, in a sense, amateurs and professionals belong to more than one but less than many social spaces. I will further argue that professionalization and amateurisation are not merely historical processes, but also processes that happen in everyday practices in order to demarcate specific identities. While amateurs can be involved in co-producing science with professionals, they still might resist and avoid translation in order to protect their independence and con*centrate* their identity as amateur practitioners of science.

Key words: amateurs and professionals, boundaries, partial connections, Luxembourg Museum of Natural History

Introduction

At the Luxembourg Museum of Natural History[1] (hereafter, the Museum with a capital M), there are, on the one hand, staff members involved in scientific research. For these staff members research is a profession. On the other hand, many, so-called 'scientific collaborators', work with the Museum. These scientific collaborators work on a voluntary basis and most of them are amateurs; for them, practising science is a (serious) leisure activity. Among these scientific collaborators there are all sorts of people: a bank employee interested in astrophysics, a school teacher fascinated with beetles, a teenager interested in – and even publishing about – fossils, and so forth.

As both amateurs[2] and professionals are involved in the production of scientific knowledge at the Luxembourg Museum of Natural History, this seems to be a worthy place to explore the 'cultural boundaries of science' (Gieryn 1999) through examining the boundaries between amateurs and professionals. Rather than being produced only by professional researchers, science in the Museum originates from a close cooperation between specialized people and laypersons – a model termed 'co-production of knowledge' by Callon (1998, see also Callon *et al*. 2001). Thus, rather than demarcating science from non-science, the 'co-production of scientific knowledge ' model includes the activities of lay people who are enrolled in scientific production and who are usually seen as marginal to 'proper' science. The model places the *association* of professionals and lay people at the heart of science studies; it is premised on the idea that scientific knowledge, including that which is realized in academic publications, is actively produced in and through the association of professionals and lay-people.

At the Luxembourg Museum of Natural History, as I discovered, amateurs seem to be doing similar things to those that we expect of professional scientists: they publish articles, do fieldwork, give talks, present posters at conferences. As a consequence, they too come to belong – at least partially – to the world of the professional. To focus on the interrelationships

between amateurs and professionals is a promising and timely exercise. It is only quite recently that the social sciences have started to explore the complex interactions between scientists and non-scientists. Besides analyses of the 'public understanding of science' there has been an increase in the examination of 'the public(s)' as producers of scientific knowledge. There is a trend in 're-thinking science' (see Nowotny *et al*. 2001) in terms of its relation to wider society as Latour and Weibel's recent book *How to make things Public. Atmospheres of Democracy* (2005), for example, suggests. Whether talking about 'agoras' (Nowotny *et al*. 2001), 'hybrid forums' (Callon and Rip 1992, Callon *et al*. 2001), or 'parliaments of things' (Latour 2004), there seems to be a common agreement that science has to occupy a new, more open space (see also Finnegan 2005).

Scientific knowledge should not be produced in ivory towers, in spaces occupied by scientists only, science has to occupy a more democratic and public space. The inclusion of lay people who contribute to the making of scientific knowledge, for instance, holds out the promise of plurality and promises better social outcomes (Pestre 2003: 260). This, in turn, might challenge notions of expertise and may be a third wave in science studies – the study of expertise (Collins and Evans 2002) – needs to be developed. Thus, studies which focus on amateurs and professionals have the potential to contribute to these debates. As contemporary museums negotiate the nexus between expert and lay knowledge (Macdonald 1996: 4), the exploration of the co-production of science in the particular setting of a museum can foster new ways of thinking about, and engaging with, science.

In Social Studies of Science it is commonplace to argue that what demarcates science from non-science is not some set of essential or transcendent characteristics or methods but rather an array of contingent circumstances (Guston 2001: 399, Evans 2005: 3). It is a matter of power and authority, rather than a matter of truth (Evans 2005: 7, see also Halffman 2003). For Gieryn (1983, 1995, 1999) science is a space on maps of culture, bounded off from other territories. He argues that the spaces in and around the edges are perpetually contested terrains and that what is at stake is the credibility and authority of science within 'credibility contests'. These contests divide into three genres, into different sorts of 'boundary-work': expulsion, expansion, and protection of autonomy. Throughout expulsion '[r]eal science is demarcated from several categories of posers: pseudo science, *amateur science*, …' (Gieryn 1999: 16, emphasis mine). Expansion is 'when two or more rival epistemic authorities square off for […] control over a contested ontological domain' (Gieryn 1999: 16). And during protection of autonomy: 'scientists put up interpretative walls to protect their professional authority' especially if outside powers try 'to exploit that authority in ways that compromise the material and symbolic resources of science inside' (Gieryn 1999: 17).

In Gieryn's *Cultural Boundaries of Science* (1999) boundary-work is performed through rhetorical and discursive practices. However, Gieryn's notion of boundary-work does not deal with heterogeneity and materiality (Michael 2002: 370, Kohler 2002a: 14). Taking these criticisms into account, this paper will therefore unpack the notion of 'cultural' boundaries by breaking it up into more meaningful and manageable parts. One way to do so is to focus on the temporal, spatial, and material features of boundary-work. In what follows I look at these features of boundary-work as a means to explore the different places where boundary-work happens and the different forms it can take. I do so in order to shed some light on the heterogeneity and materiality of boundary-work, in other words, to reveal the texture - the 'stuff' - of boundaries and boundary-work. This will allow me to draw the temporal, spatial and material profiles of amateurs and professionals in the context of a museum of natural history.

We can also explore how boundaries are made and unmade by looking at how people and things are connected, disconnected and/or partially connected. Thus, apart from looking at boundaries and 'boundary-work', I will also draw upon the concept of 'partial connections', a concept introduced by Haraway and further developed by Strathern. In her discussion about situated knowledge, Haraway (1988: 586) writes:

> Here is the promise of objectivity: a scientific knower seeks the subject position, not of identity, but of objectivity, that is, partial connection. There is no way to 'be' simultaneously in all, or wholly in any, of the privileged (i.e., subjugated) positions […].

She continues:

> I am arguing for politics and epistemologies of location, positioning, and situating, where partiality and not universality is the condition of being heard to make rational knowledge claims. […] Feminism loves another science: the sciences and politics of interpretation, translation, stuttering, and the partly understood (Haraway 1988: 589).

Strathern further draws on Haraway's work in her book *Partial Connections* (1991). Like Haraway she uses the term 'partial', because 'for not only is there no totality, each part also defines a partisan position' (Strathern 1991: 39, see also Munro 2005). Ethnographic truths are partial, feminist standpoints are partial, and one is always a partial participant in the field. Haraway's metaphor of the cyborg itself – 'a hybrid of machine and organism' (Haraway 1991: 149) – holds together heterogeneous elements while only partially connecting them. In this paper, I use the concept of partial connections specifically to analyze the interrelationships and boundaries between amateurs and professionals.

Here is the structure of the paper. In order to reveal the heterogeneity and the texture of boundary-work, the next three sections will examine in turn the temporal, spatial and material features of boundary-work. In each of these sections, I analyze the kinds of boundary-work performed and how this relates to the identities and practices of amateurs and professionals. At the same time, I explore the nature of the connections between amateurs and professionals to be able to further analyze the ways in which partial connections are articulated, performed, and protected. The research findings that I present stem from a qualitative case-study conducted at the Museum and empirical data are drawn from semi-structured qualitative interviews with scientific collaborators (C) and staff members (S) of the Museum and from a questionnaire sent to the 180 collaborators.

Temporalities

Amateurs have less time, professionals have more time, to do science – this is, in essence, the common answer from the Museum's collaborators when they are asked. In their own words, collaborators possess less time because they must 'sacrifice leisure', because a 'voluntary has to nibble on his residual and spare time' (comments from the questionnaire). Roughly put, amateurs spend leisure-time and professionals spend working-time. As a consequence amateurs don't possess as much time for their scientific activities as do professionals. The difference is a quantitative one of clock time, but it is also a qualitative one of social times (see Sorokin and Merton 1937): different quantities of time are available to collaborators and staff members, as well as different kinds of time (leisure-time and working-time).

Yet in practice, the boundary between leisure and work is not always clear-cut. One collaborator explained that he did his field observations before or after work or during weekends yet

> the evaluation of those things is then done during working time. So that it is partly during my leisure time and partly during my working time (C1).

Another collaborator wrote about the time he invested into research activities: 'cannot estimate, because it overlaps with my job' (comment from the questionnaire).

Thus, we should not regard as an absolute the opposition between amateur/leisure-time versus professional/working-time. For those collaborators whose scientific activities relate more directly to their work, the difference between leisure and work is more difficult to make.

Time operates as a medium of social meaning for science (see Hassard 1990: 5, 14) since it informs the collaborators' and the staff members' definitions of scientific work, identity and activity. The collaborators' and staff members' way of referring to time indicates the kind of attachment collaborators hold to the Museum. It has been argued that the partiality of one's involvement in a role is very often defined in temporal terms (Zerubavel 1990: 169). Having less time and only sometimes doing science is, thus, one way of being 'partially connected' to science.

The Museum works – to simplify a bit – with two kinds of actors: collaborators who are

unpaid, and contractors who are paid for their work. Contractors and collaborators are handled differently. As one staff member explained:

> Somebody who is a contractor of mine has got a date. The 31st of December everything has to be in. This he knows right from the start. But with a volunteer this is not the case (S1).

For contractors, deadlines are written down, sums of money are agreed upon, and the exact work to be done is defined. Here is an extract from the standard contract which both parties (the Museum and the contractor) sign:

> **Article 2: duration**
> The present temporally limited contract starts the ……
> and ends the 31.12.200…..

When the blanks in these lines are filled in, the temporal frame of the activity is established. In total eight articles of contract clearly define the temporality, the cost, and the kind of work to be undertaken. But my aim is not to analyze this contract but merely to point out that for collaborators there are no such formal and restrictive bonds. In a sense, I 'observed' an absence of such written and standard contracts between the collaborators and the Museum staff during my fieldwork. Only a couple of collaborators occasionally do contractual work for the Museum. The vast majority of them, however, don't rely on such 'strong' connections. In general, collaborators are not paid nor given any deadlines by the Museum. Without temporal frames being agreed upon in black and white, the collaborators' activities take place in a more flexible timeframe. One collaborator underlined that he would even refuse projects with time limits:

> [to be independent], well, that's important for me. [...] I just received from [the *Naturmuseum*] *Senckenberg* – I am a scientific collaborator there too – they sent me a huge package with [animals] from a nature-park reserve. And then I immediately said: 'Yes, if you give me the freedom to do things just like I did until now. Which means: no deadline. That I can do it at my pace, with my priorities. And that it is fun for me, the way I want to do it, and then, then I will do it for you' […] If someone tells me 'Here, you have to do this in one year's time' then I say 'No, find someone else' (C2).

In a similar vein, another collaborator argued that being an amateur permits oneself to be 'less constrained by time' than professionals (C3). One staff member characterized amateurs as people with 'less time but without "dead-line"' (S2). A crucial difference between amateurs and professionals appears to be the different time constraints each are confronted with. Professionals are usually governed by schedules – a strong coordinating force that paces, phrases and slates work (Knorr-Cetina 1999: 190-1). They are bound to deadlines, that is 'socially instituted temporal boundar[ies]' (Palen 1998: 25). The collaborators, on the other hand, work within a weakly structured timeframe; they have their own rhythms and their self-determined time constraints – 'only the deadlines that one sets oneself' (C4), as one of them said.

Apart from disliking deadlines, it appeared that collaborators sometimes do not take advantage of all the financial support they could benefit from:

> But as I said, it's not my intention, I don't want any money. Maybe I am some kind of an anarchist. I love my freedom. And I don't want to be [hassled] by administrative stuff [...] I renounce on certain things (C5).

The collaborator who made this comment further added: 'Paperwork [...] No, I've had enough of that during my life. I'd rather renounce on money' (C5). Another collaborator said: 'I feel ashamed to be remunerated […] I cannot exploit the system' (C3).

Collaborators who say no to deadlines and money refuse devices that bond them to the Museum. In a sense, by not 'exploiting the system' they make sure that the 'system' cannot 'exploit' them either. Doing so, they maintain their individuality and their independence in front of the constraints an institution might impose upon them.

For the Museum, money and deadlines are enabling inasmuch they help to produce a certain kind of work during a certain amount of time. More so, both time and money are essential constituents of the definition of professionals; in theory

> professionals are seen […] as people who spend the majority of their working hours enacting their professional roles, roles from which they receive the bulk of their livelihood (Stebbins 1992: 21).

For collaborators, however, deadlines and money can signify different things. For the collaborators they can be disabling since they limit or at least clearly frame their activities. This is why they might refuse to accept them; to avoid to being fully enrolled. This refusal of deadlines and money shows how collaborators might use 'resistive agency' – 'the capacity to act back, granting or refusing translation' (Fox 2000: 863, see also Star 1991: 30) – to maintain their independence and individuality and to avoid their freedom of action being hampered (see Rip 2003: 431). Not only is the allotting of time to activities a demonstration of control over one's time and commitments (Palen 1998: 27), it also manifests, I would argue, the making of 'collaborator time' and an articulation of this kind of time in opposition to 'professional time' or 'museum time'. (The same also counts for money: by deciding whether they receive money or not and by showing a certain indifference towards payment, collaborators retain control over their activities.) In terms of 'boundary-work' this is a manifestation of boundary-work against another kind of boundary-work: expansion. Amateurs might resist against the expansion of scientific schedules and practices over their own practices. They might refuse the (professional) temporalities and sociabilities that would compromise their amateur status.

Staff members and collaborators inhabit, then, different time regimes. Staff members have to stick to deadlines, their time is remunerated, and their future research is already shaped to some extent. They are confined by time, money and contracts. On the contrary, collaborators are not and cannot be forced to stick to deadlines, they mostly spend leisure time and they can plan their future research activities at will. This increases the collaborators' feelings of freedom. As one of them declared:

> I do what I want […] The only thing one can do against me, is steal my time. But during my leisure time, during *my* time, I do what I want (C6, emphasis in original).

The link between '*my* time' or 'collaborator time' and self-determination ('what I want') seemed to be essential and this point was often made by the collaborators during the interviews. Time belongs to the collaborators, not to the Museum. One of the drawbacks for the Museum, therefore, is the difficulty of coordinating research projects when collaborators are enrolled. The presence of collaborators means that projects can only advance at a reduced pace. As one staff member acknowledged: '[t]hen one simply has to ride at their speed and to ask for less than from someone who does it professionally' (S3). However, as another staff member argued, '[i]f we sometimes want to get forward a bit, we have to spend money and to buy people's time [laughs]. In this sense: time is money [laughs]' (S4). If the Museum wants outcomes to be produced faster, it has to pay people for their work. In other words, it has to 'own' people's time by turning it into working-time (see Zerubavel 1990: 171). Doing so, the Museum produces a common and commodified time for science, for *its* science. This kind of institutionalized and objectified time stands in stark contrast to the collaborators' time, which tends to be more individual, gratuitous and subjective.

Temporal boundary-work revolves around several but related issues: different adherences to deadlines, leisure/work distinctions, different quantities of clock time, commodification/gratuity of time, and different predominating orders (self/institutional). It is through temporal boundary-work that collaborators and Museum staff members produce, enact, and protect different kinds of times. And it is through these kinds of boundary-work that distinctions between amateurs and professionals are maintained or blurred.

Spatialities

For visitors the difference between the Museum's front stage and its back stage is clearly noticeable as they are only permitted access into some areas of the Museum. Collaborators,

however, have far greater access to the Museum than visitors. Some have swipe cards to enter the Museum's research building and one collaborator even has a personal office space in this building. With access to the Museum's 'private' space, collaborators can use photocopy machines, study collections, use instruments, make use of the Museum's postal service, etc. Moreover, they have access to the Museum's computer network. Some have e-mail addresses and a homepage hosted by the Museum's computer system.

Collaborators can, more or less freely, move through the Museum and use its infrastructure. The collaborators' knowledge, bodies, and specimens are, then, found in the same spaces that Museum staff use – at meetings, at fieldwork, in publications, in databases, etc. Yet, in practice there are spatial differences between the Museum staff and the collaborators in what is, we should remind ourselves, a natural history museum. The collaborators' fieldwork takes usually place close to where they live. As the following quote reveals, sometimes the private garden of a home is explored in great detail:

> There are places in the country that are badly explored and there are others that are rather thoroughly explored. The place that is most completely explored is my own garden [laughs]. Where I [...] found 141 species of bugs during the last years [laughs]. There I was most often (C7).

Fieldwork does not necessarily have to entail practice in nature 'out there'. It can take place in the bounded, private, and encultured space of the garden, 'right here'. Fieldwork is a 'placed activity' (Kohler 2002b), an activity strongly connected to certain places.

Two rather funny stories further illustrate this point. One collaborator told me that he always travelled by bus, by train, or by bicycle to get to his fieldwork sites because he does not possess a driving licence. The taxa in which he is most interested (Psocoptera, Hymenoptera, galls) are, therefore, 'best' and most extensively studied in areas where the public transportation system is best developed. Conversely, those regions in Luxembourg that are not easily accessible through public transport are not well documented with respect to these species. Second story. As most collaborators do, one of them used to deliver lots of data to the Museum from an area close to his home. Strangely, one day he began to gather data from another area too, quite remote from the one he usually went to. What had happened? The answer is quite straightforward. He now was seeing somebody in this area: his future wife. As we see, the collection of data might even be connected to love!

These two stories reveal that the gathering of data, as any practice dedicated to produce knowledge, is situated, located and embodied (Haraway 1997). Data are not just collected. They are collected by human agents (see Turnbull 1993). Biological records not only reflect how species are distributed in space but also how the actors who produce those records are distributed – where they are situated on the map of knowledge, where they live, where they dwell, where they love. In this sense, every piece of data is in fact an assemblage of knowledge, emotions, interests, and capabilities; every point on a map is a map of its own.

A staff member in charge of the Museum's databases described the local character of the collaborators' data along these lines: 'since we can neither force them to do it, nor to drive a long distance, they stay most of the time in their neighbourhood' (S4). On another occasion he stated that collaborators have a 'limited radius of action' (S4).

Collaborator space is located, concentrated, home-bound. Professionals, on the other hand, like to do complete surveys of an entire country or region. Professional space aims to be national, representative, homogeneous, and ideally without personal attachments. We can establish a general 'spatial profile' of the collaborator. The space collaborators produce tends to be homebound, self-determined and connected to personal interests. This inevitably relates back to time. The collaborators' immediate surroundings tend to be better explored because travelling far costs time and time is what they allegedly lack.

If we compare the spaces that Museum staff members enact to those that collaborators enact, there appears to be a difference between them – in terms of scale, density, and subjectivity. Staff members and collaborators tend to have different spatial and temporal profiles. Yet, their profiles cannot in reality be opposed firmly, they rather represent 'ideal types'. They represent tendencies rather than clearly distinct categories into which collaborators or staff members easily fit. Somewhat in-between the two there are all kinds of configurations:

instances where the collaborators' activities are not restricted to leisure-time only, where they receive money, where they are given deadlines (i.e. giving a talk at a conference), where they travel far to gather data. The same is true for professionals: they also often claim to be amateurs in some domains, they too do scientific activities in their leisure time.

There are many who do not fit into the neat amateur box. There are many who could be called 'amateur-experts' (see Ellis and Waterton 2004, Waterton 2003), 'lay-experts' (Epstein 1995), or 'partial scientists' (Meyer 2005). Yet too often, I would argue, such hybrid identities are taken to be reason enough to argue that the boundary between amateurs and professionals is obsolete. From particular cases where boundaries are crossed, the generalisation is often hastily and simplistically made that there is in fact no boundary at all. But in some instances, there is still a clear boundary. The picture is more complex than it is often made out to be. Neither is there an immutable clear-cut boundary between both nor is there no boundary at all. Neither should we imagine a space that encompasses amateurs and professionals, nor should we imagine two different realms. In other words, amateurs and professionals belong to more than one space but less than many spaces.

Doing science at home

The majority of the collaborators declared that they spend most of their time at home for their scientific activities – more than in the field and in the Museum. Working at home has several benefits. Quite obviously, collaborators can save time. Moreover, as another collaborator argued:

> This advantage I have it too […] I can work at home at 10 o'clock in the evening. I can work whenever I feel like it. What a freedom! I can [work] during my whole weekend. I can work during my holidays. And then, during the day, I can go for a walk in town when other people have to work [laughs] (C6).

At home collaborators seem to be able to work whenever they want. They are not limited by alarms, closing times, or office hours that prevent Museum staff members from working after certain hours in the Museum. The home seems to be a place where official schedules are absent, where time seems less dictated by a collective order. In other words, home is not a very institutionalized space and time; it therefore allows actions to take place in a more autonomous manner. According to Hinchliffe (1997: 205) the home is 'a place where order prevails and time can stand still'. The home is delimited from the public, from the institution, and from temporal constraints. Home is where we can be ourselves: where there exists a centered subject (Hetherington 1997: 192). This also because there simply are fewer people at home than in the Museum; as one collaborator said 'at home […] I am not distracted. In the Museum there are many people' (C6). At home, it might be easier to concentrate. Due to the rarity and, above all, the partiality of interactions with the institution and its ordered times and spaces, the home is a place which permits a more or less individual articulation of time and rather self-determined actions.

In the Museum, time, space and practice unfold in almost opposite ways: there are many time constraints; there are places to which staff members have to go to when they do surveys; and there are laws, contracts, notifications, codes of behaviours and agreements which regulate their activities. When the Museum and the collaborators work together, different spaces, times and practices are also brought together. The following quote points to the difficulty of aligning these three elements:

> That's also a problem I have got with [one staff member]. Because he never wants to understand. He says: 'you can do this in the evening'. He thinks that I do the things the way he does them. He always wants things done his way. [But] everybody has his own pace. I get home in the evening, […] around seven or eight. I also have a family, and I cannot just sit down and seize thousands of data every day (C8).

Since home is the place where collaborators can disconnect from certain daytime activities or duties, they might not necessarily want to do science in the evening. In the above quote the order

and temporal autonomy of the home are disrupted (in theory) by the practice of loading data into a computer. The contrast between spaces (Museum and home), times (on duty and off duty) and activities (scientific practice and family life) is articulated. On the one hand, the Museum wants certain attachments – to science, to computers, to time. But, on the other hand, collaborators can choose to detach themselves from time and computers and choose different attachments, such as spending time with their family. In the above quote the conflict is resolved by the assertion of the interviewee that 'you can't' do it.

'You can't do it' has probably been asserted by many of the collaborators' partners as well. On several occasions collaborators told me that their partners were sometimes frustrated because of their unusual and late activities at home. There seems to be a certain myth that circulates about the amateur who gets divorced because of his or her unconventional activities. One collaborator who declared that this conflict resulted in a divorce, explained:

> Until two-and-a-half years I was a very intense collaborator of the Museum. Unfortunately my divorce from my spouse got in the way of things, partly caused through this intensive work (comment from the questionnaire).

Like amateur theatre practitioners who also sometimes divorce because of their hobbies (Stebbins 2004:110), the collaborators' scientific activities at home sometimes create conflicts with their partners that might lead to split-ups. One staff member acknowledged:

> The family starts to grumble when you disappear behind the magnifying glass every day and evening. This can even lead to serious family problems [laughs] […] And the wife or the husband will say somehow 'hey, I also still exist'. And there we have reached again the limit (S4).

We see that the home is not a totally unconnected space where time can stand still. Although actions might be unconnected to work, they are connected to other things such as the family.[3] The home is a place where one reconnects.

The collaborators' homes are partially connected to the Museum and to science. The degree of connectivity is variable, ranging from those collaborators who are rather unconnected to the Museum – what the Museum calls its 'paper corpses' – to those who frequently and closely collaborate with the Museum. There are, to say the least, weak and strong partial connections. The picture is even more complex as between strong and weak ties there are potentially all kinds of ties. Collaborators are on the 'periphery of practice' (Wenger 1998: 117) and there are, for them, 'multiple, varied, more- or less-engaged and inclusive ways of being located in the fields of participation' (Lave and Wenger 1991: 35-6). In describing some of the most active collaborators the previous Director of the Museum used the expression 'private scientists'. One of these 'private scientists' described his working-space at home as follows:

> At home I have a laboratory which occupies a whole floor in a big house. [I have] a library few foreign universities can compete with; people come from abroad to make photocopies. I have collections of which there are only a few in the world in this domain (C6).

The use of the term 'laboratory' as well as the books, collections, and instruments that populate this collaborator's home turn it into a very professional space, not very different from any other laboratory. For two weeks, the quoted collaborator even turned his home into a kind of university space. He tutored two PhD students registered at a Belgian University both of whom slept, lived, ate, and studied at his home for two weeks. This remarkable story shows that the private home and the more public spaces of science, universities and teaching can be brought together in a single place. The collaborators' homes can be turned into 'border spaces' where 'local and distant contexts, amateur and professional identities, […] and private and public spheres of life intermingl[e] in important ways' (Opitz 2002: upd).[4]

This 'border space' has been an enduring feature of scientific practice since its beginnings. In seventeenth-century England, private residences of gentlemen were the most significant venues of scientific work (Shapin 1988: 378). Also, in the early nineteenth century much knowledge about nature was produced by gentlemanly and gentlewomanly amateurs

working in largely domestic environments (Outram 1996: 249). However, while Shapin (1988: 404) claims that the distinction between places of residence and places where scientific knowledge is made is almost absolute today, this is far from being the case for the collaborators that I studied. For collaborators, the place where they perform most of their scientific activities is their home. Moreover, they tend to actively protect their home by demarcating it from a collective order – an order that prescribes spaces, times, and actions in an institutionalized manner. Collaborators produce scientific knowledge in a space that enables the unfolding of a more autonomous and centered subject; a subject con*centrating* time, space and action. Thus 'protection of autonomy' is not only a strategy used by scientists to protect their professional territory, as Gieryn (1999) assumed. The boundary between amateurs and professionals is partly the making of amateurs; they too protect their autonomy.

The 'border space' that the collaborators occupy – both physically and socially – also shows that the kind of boundary-work performed between amateurs and professionals does not merely safeguard a border; it also enables the crossing of that border. Boundary maintenance and boundary crossing take place at the same time. This is a process through which the 'other' (either the cultural space of amateurs, or the cultural space of professionals) is simultaneously included and excluded, in other words, a process through which the 'other' is 'folded' (Mol and Law 2005: 640). This folding of the boundaries between amateurs and professionals is less radical and more subtle than the kinds of boundary-work described by Gieryn (1999). It does not only 'expel', 'expand', or 'protect' but it allows certain elements to flow while retaining others from doing so. The semi-permeability of the boundaries (Mol 2003) between amateurs and professionals is thus evident. Amateurs both belong and do not belong to science – the spaces and the identities they enact are provisionally and partially connected to science.

Materialities

Having looked at the temporal, spatial, and merely social aspects of the connections and boundaries between amateurs and professionals, I now turn to their material aspects. While in the first part of this section I look at the objects and tools that travel and do not travel between the collaborators and the Museum, in the second part I explore the metaphorical materiality of partial connections through some of the images used by the Museum staff members.

The moving of tools and objects is clearly visible during fieldwork activities. When collaborators come together, different materialities are brought together at the same time. Some of these are brought in by the collaborators themselves: magnifying glasses, pencils and notebooks, field guides, etc. Other things are given or lent to them by the Museum: maps, microscopes, books, nets, traps and so on.

By travelling across time and space, these objects can bring amateurs and professionals, institutions and individuals closer. Objects create and maintain socio-technical links that connect disparate entities. Many objects are exchanged between collaborators and Museum staff including specimens, maps, books, magnifying glasses and boxes. The co-production of science across different epistemic cultures necessitates the simultaneous production of such 'immutable mobiles' – objects such as specimens and boxes which are mobile but also immutable, presentable, readable and combinable with one another (Latour 1990). These immutable mobiles permit the collection of data to take place in an enlarged laboratory. The mobility of these objects enables 'action at distance' (Law 1986), thus permitting scientific discipline to be exported beyond the museum walls.

However, if objects cannot be turned into such mobiles, the co-production of scientific knowledge becomes difficult. The Museum's European Centre for Gravimetrics and Seismology, the only research unit of the Museum without scientific collaborators, can serve to illustrate this point. In this laboratory, experiments take place in an underground facility sheltered from temperature variations and vibrations. Even people are kept out when staff members perform

> experiments not allowing you to enter the laboratory. […] There are certain types of instruments that need to be left alone and visits induct perturbations that will be a problem for these kinds of instruments and these types of measurements (S5).

This laboratory is packed with delicate, costly and heavy instruments, for some of which there are only six across the whole world. These complex machines differ from the kind of materialities used by the collaborators. The complexity of these machines, so it is argued, keeps amateurs away:

> The projects which are treated here are perhaps too technical, needing perhaps too significant means (S5).

A seismology laboratory, just like a laboratory dedicated to high-energy physics or genetics, seems to be out of reach for amateurs because of the technicality and the inherent complexity of the science produced in these spaces – arguments are frequently articulated along these lines.

But the absence of amateurs can be explained in another way too. Some objects, such as weighty, expensive and delicate instruments, cannot travel very far. Their mobility is clearly limited compared to the rather small and widespread tools amateurs frequently use. As a consequence, some objects cannot populate the boundary space in which both amateurs and professionals could co-produce knowledge. Yet, the co-production of science necessitates translational efforts to produce 'boundary objects' (Star and Griesemer 1989). If no such boundary objects can be created, only 'non-boundary objects' or 'immutable immobiles' populate the laboratory, that is, objects that don't have the abstractability and mobility of boundary objects. This, in turn, clearly maintains a boundary between the inside and the outside of a laboratory.

On the other side, natural history practices can more easily take place outside the laboratory and the Museum. Here is the Museum director talking:

> A botanist, an ornithologist, a mammalogist, a herpetologist, needs in principle […] a binocular, a magnifying glass, a couple of field guides, a wind jacket and boots to go to the field. And then he can in principle start working (S6).

Similarly, a staff member argued:

> An amateur in population genetics does not exist. […] An amateur cancerologist does not exist either. That's it. However, an amateur entomologist does exist. And what does he need? A magnifying glass. And alcohol [laughs]. We can provide him with that (S4).

Natural history fieldwork requires only a few tools. And these tools are cheap, handy, and rather ubiquitous, in short, quite mobile. Especially 'proto-instruments' (Callon and Rabeharisoa 2003) such as cameras, written accounts, and letters, are easily available and transposable and enable formalising and publicizing knowledge. These objects and their significant mobility enables the crossing of the boundaries of science. In other words, the transportability of scientific tools and material is one factor helping to explain why some scientific fields are more open to amateurs than others.

Seismology is not only more 'technical' than other scientific domains. A seismology laboratory is a repository of knowledge (Knorr-Cetina 1999) where knowledge is highly embodied in particular skills and connected to specific techniques which are, to put it simply, heavy. The money, degrees, techniques, knowledge and scientists that are put inside a seismology laboratory to perform experiments remain strongly attached to this very confined space. The history of most sciences is that of an extreme confinement that sets laboratories and instruments out of reach of the amateur and the layperson (Callon et al. 2001: 65), in other words that *disconnects* the amateur.

Such a confined space makes it difficult for amateurs to be enrolled into the co-production of science. On the one hand, it is difficult to enter and move within such a confined, dense and weighty space and, on the other hand, the materialities and sociabilities of this space cannot be transported outside. This is quite contrary to the cases of entomology or ornithology, for example. In such fields scientific practice is related to 'lighter' materialities. A field guide or a magnifying glass can easily be transported and the vision of the collaborators can easily be 'disciplined' through experience. The field or the home can be turned into a scientific space

without much money, degrees, and technical equipment. Amateurs can quite easily co-produce scientific knowledge if, on the one hand, the spaces in which they do so are 'light' and 'movable' – if, in a sense, they themselves can move these spaces around – and, on the other hand, if the materialities and sociabilities of the inside of the Museum can be transported outside without too much cost and loss.

Partial connections are fragile connections

Apart from materiality in its immediate sense (the kind of tools and objects described above), another kind of materiality has also been articulated: the robustness or, rather, the fragility of the relation between the Museum and its collaborators. Staff members explained: 'we have to care for them and heed them' (S4), 'contact-care is very important' (S1), '[one] has to deal with them very tenderly' (S7). One staff member declared that they (the staff members) were paid to 'keep [the collaborators] in the bosom of the Museum' (S1). She further said:

> I think you have to have it on the *Fingerspitzengefühl* how you react there. How you can motivate people and keep them going (S1).

While the English translation of the term *Fingerspitzengefühl* is 'intuitive feeling', the German term suggests a more tactile image: the literal translation would be 'feeling on the fingertips'. In a same order of ideas, staff members often mentioned that they had to put on gloves to deal with some of the collaborators. The vocabulary used to describe this nursing and caring of the collaborators reveals the fragility of the connections. Since the connection is not permanent, nor strong, but rather partial and fragile it has therefore to be nurtured and cultivated with care. More so, *Fingerspitzengefühl* indicates that this kind of relation cannot be rationalized, formalized, or institutionalized but that it has to be dealt with individually and specifically. How Museum staff deal with collaborators requires knowledge of people and sensitivity rather than the ability to handle 'de-humanising' devices such as time-schedules, money, and contracts. The Museum cannot *control* – and use technical and 'cold' devices to discipline subjects – but has to *care* by fostering a 'warm' world of people (see Mol 2006).

Although the 'weak ties' (Granovetter 1973) between the collaborators and the Museum seem to be rather fragile, they also exhibit certain strengths. For the collaborators, the advantages are that they are not strongly tied to strict time-schedules, remote spaces and predetermined activities. For the Museum, however, these partial connections make enrolments and alignments difficult. To fully realize its 'panoptical dream', the Museum would have to lock the collaborators into clear positions, discipline them, prescribe their gestures, regulate their times, etc. (see Foucault 1979). The Museum would have to make sure that disciplinary techniques would control bodies, practices, materialities and times in strict ways. But for the collaborators this would be, in a sense, a 'panoptical nightmare'.

Concluding remarks

The boundaries between amateurs and professionals are not only negotiated in discourse. They are also revealed through temporal, spatial and material processes. There are, in fact, many places where boundary-work takes place; boundary-work is interconnected with objects, tools, bodies, and specific spaces and places. In other words, boundaries are not merely abstract lines which divide people or activities, but, instead, they are 'thick' and heterogeneous. It is this substance, the 'stuff' of boundaries, that this paper has seeked to explore.

When they do science, where they do science, how they do science and with what tools they do science is what differentiates collaborators from Museum staff members and, more generally, amateurs from professionals. Time, space and materiality come into play when identities are constructed, when they are compared, opposed, and entangled. Identities are, then, located in space, articulated in discourse, related to materialities, expressed as temporalities, and situated as practices. Defining oneself as an amateur or a professional is not merely a matter of individual or human attributes; it is about situating oneself in relation to these interconnected elements. For amateurs in particular, this means enacting and protecting partial connections – to schedules and deadlines, to distant and institutionalized spaces, and to

predetermined activities.

To study amateurs, one needs, then, to move beyond the simple *a priori* assertion that there is one group of persons that can be called amateurs. Instead, it is through the study of (partial) connectivities, that one can get a better grasp of the identities, practices, and roles of amateurs. This means considering amateurism not as an essence, but as relationally defined through *fragile* connections and demarcations. It means examining the relational complex, based upon objects, places, and collectives that *produces* the amateur (Hennion *et al*. 2000).

I would argue that what has been historically described as professionalization and amateurization (Alberti 2001: 117) also happens on a more horizontal level. The making of amateurs and professionals also happens in everyday practices, through the construction and protection of identities. Professionalization and amateurization are processes that both happened in history and that still happen on an everyday basis. While amateurs can be involved in co-producing science with professionals, they still might resist and avoid translation in order to protect their independence and concentrate their identity as amateur practitioners of science who are only partially connected to an institution.

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Notes

1 Luxembourg is one of the smallest countries in Europe, sandwiched between France, Germany and Belgium. The Luxembourg Museum of Natural History is located in Luxembourg-city, the capital of the country. The Museum celebrated its 150th birthday in 2004, employs around 100 people out of which 16 carry out research activities, and has around 200 scientific collaborators. The research activities undertaken lie within the following domains: population biology, botany, ecology, geology/mineralogy, geophysics/astrophysics, palaeontology, zoology.

2 Some have defined amateurs as any lay-person engaged in a systematic activity, which makes them develop their abilities in a given domain (Hennion 2007: 112) and, further, whose attachments and practices can both engage and form subjectivities (Hennion 2001: 1) – a useful definition which I take as my starting point in this paper.

3 In Luxembourg, the principal limits for volunteers to practice their hobby is 'the difficulty of finding time' due to professional or family reasons (Lejealle 2003: 8).

4 Opitz's (2002) analysis of Victorian country houses is useful here. In another sense, the home is also a border place in the history and sociology of science, since it has not been much explored in comparison to the laboratory or the museum. According to Outram (1996: 253) little attention has been paid to domestic spaces in science.

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