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THE BEING MULTIPLE: THE BECOMING OF AN OPEN SOURCE PROJECT

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The being multiple: The becoming of an open source project

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Open source challenges traditional ways of production and innovation, and is often considered an alternative to closed source development. This paper explores the key issue of open source as a guiding principle of change. It builds on the theories of Ostrom and Benkler, and some of their assumptions of stability to propose an alternative view of open source as *in-becoming*. Theorising open source projects in such a way implies that these cannot be easily settled, defined, or controlled, which has important consequences when it comes to understand how software is developed. To research this becoming, I analyse how openEHR, a health systems project, comes to understand change by studying how they source and articulate their clinical requirements. openEHR does this by providing directional avenues for participation which alter the way the project is constructed and the spaces in which it can invest itself. Through these avenues, continuous negotiations take place that are not limited to the specific participation of individuals, but involve strategic thinking about the consequences to the project's identity and possible evolution. The result is an uncanny relation between the product, the spaces of production, and the project as a (multiple) 'being'.

Introduction

Open source remains a perplexing field. Ever since its ideological foundation as the Free Software movement, it has continuously challenged its own identity and its relation to that which it originally opposed. Although the notion of *openness* is increasingly nuanced, there appears to be few works which relate it directly with its production. The most notable exception is Ostrom's (1990) who theorised the formation of collectives around shared resources. What happens when resources themselves resist clear-cut definitions? In this paper, I argue that the difficulty for project participants to articulate the notion of openness performatively affects (and is affected by) the produced commons.

Research has tended to pit concepts in open source software against their traditional, closed sourced counterparts. This is despite a growing awareness of the thinness of boundaries between these two worlds (West and O'Mahony 2009).

Every paper in open source centers its explanations around one key concept: the shared resource, which Ostrom (Ostrom 1990) calls the *commons*. Whether this may be... or

Open source software communities have perplexed many researchers because extremely capable people have been participating in the development of complex software code for seemingly no other reason than pleasure (Bergquist and Ljungberg 2001). This voluntary part, though at first difficult to theorise, began to make sense in light of Ostrom's (1990) work, and later Benkler's (2011). Both theories argued that there were rational and strategic reasons for individuals to give their work away as commons. The reasons and motives behind this gift soon became associated with processes of innovation that closely resembled user-led practices in which an itch (i.e. a need) had to be scratched (Krogh, Spaeth, and Lakhani 2003; Urban and Hippel 1988; Raymond 2001).

The theories of Ostrom and Benkler legitimated the existence of open source by showing that collective action could result in the creation of stable institutions (Ostrom 1990). Benkler went a step further than Ostrom and specifically linked the commons (i.e. the product of collective action) with some conditions of ethical production that invite further production, calling it the virtuous cycle (Benkler and Nissenbaum 2006). I do not question either their results or the usefulness of their approach, but debate the coverage of their theories to explain changing phenomena such as the values and meanings in open source productions. To do this, I follow the call to explain *how* open source collaboration takes place (Faraj, Jarvenpaa, and Majchrzak 2011; Krogh and Hippel 2006) by looking at the messiness of the world that is under ongoing construction (C. Ciborra 2002a).

The motivation behind the study of open source as in-becoming is the dynamic movements behind its transformation (Fitzgerald 2006). Open source is thought to have gone beyond its origins as a deviating example of software development and a contemporary cultural critique, becoming an immanent actor that has captured technological jargon, social ideas, and ways of organizing, and made them its own (Kelty 2004). This immanence of is what propels its becoming. By immanence I refer to the ubiquity of open source concepts and their ability to travel between areas and contexts without imposing a transcendental value-system (Deleuze and Guattari 1987; Deleuze 2005a). This capacity of travel through various spaces while adapting its language to local con-

texts (e.g. what does being open mean in this particular milieu?), affects what, how, and why things become produced but also articulates open source. In other words, open source acts both as interpreter and the interpreted. The debates surrounding issues of open access are both similar to open source, yet entirely different, casting a new light on the open source movement itself.

Far from being something evident, something essential, open source challenges conceptions of even those who are experienced practitioners and share its ethical affects (Cornford, Shaikh, and Ciborra 2010). The way things are produced changes the organisation of that production (Ostrom 1990). Beyond purely technical projects, the question of the influence of open source (itself in-becoming) on the processes of innovation remains. How does open source ‘guide’ change? This might appear to be a simple question were it not for the amplitude of behaviour that the term ‘guide’ offers. The case presented here shows how open source does not necessarily impose things—whether ways to produce or ways to be—but instead opens up directions of enquiry that can have distinct effects on the project’s ability to reach spaces and interact with the world.

To reflect upon this question of guidance, the theory I mobilise is one which fits well with the implied critique that open source comes to represent: an alternative to the stereotypically hierarchical models that have been predominant in the assemblage of organisational structures (Benkler 2011). How is this alternative expressed and formed? To study the research question of *how open source guides development in a project*, I treat open source from *the perspective that it is not an obvious thing, but rather an explosive existential questioning* about a project’s position and direction in the world. To approach the constitutive energies of a project as closely as possible, I study the way its community develops and articulates its requirements (i.e. the functions a software system should have), and how these influence the notion the community has over what it means to be and do open source. Because requirements describe what the software should do, their elaboration is intimately linked to the objectives of the project.

Principles of the commons and open source software

The production of open source software

Open source has sparked a lot of interest because of its capacity to create state-of-the-art software without resorting to typical, hierarchy-based organising (Mockus, Fielding, and Herbsleb 2002; Cusumano and Selby 1997). Instead, much of the effort in open source projects tends to be net-

worked and distributed (Benkler 2002; Demil and Lecocq 2006). Hierarchies still exist (De Laat 2012), but the way that they are linked is different: contributors can be voluntary developers who are not held by a contractual agreement (Benkler 2011), who need to be convinced that there is an ‘itch to be scratched’ (Raymond 2001; Iivari 2009). This voluntary aspect persists despite a growing number of developers being hired to work on an open source project (Morgan and Finnegan 2014; Spaeth, Krogh, and He 2015); company involvement is still treated with circumspection (Nyman and Lindman 2013).

The coordination in open source projects is both a social and technical matter (Scacchi 2002). Although access is usually not restricted for use, it can be so for participation and writing code to the project (De Laat 2007). This ‘write-access’ often needs to be earned and technical leaders must maintain their technical reputation (Fleming and Waguespack 2007). Given the shared access to the code, there is a general agreement that the prevalent modular architecture is essential to the development effort (Baldwin and Clark 2006; Midha and Palvia 2012; Subramaniam, Sen, and Nelson 2009). Since many open source activities take place online, projects must cater for and specifically bind the coordination of efforts in time and space (Hemetsberger and Reinhardt 2009; Scacchi 2009).

The ‘open’ in open source allows anyone to trace decisions in time, right down to their origins. This openness is a compelling aspect of the transparency that open source can afford. In development terms, Raymond’s (2001) Linus’s law “Given enough eyeballs, all bugs are shallow” has been seen as a connecting element between various types of contributors (Crowston and Howison 2006). Despite some participants exclusively holding the write-access to the repository code, organisational hierarchy does not resemble that which is prevalent in closed systems (Bonaccorsi, Giannangeli, and Rossi 2006). Instead, open source is usually characterised by a core and a periphery. The difference between the two is not as clear cut as sometimes cited (Dahlander and Frederiksen 2012): it is often a mix between the degree of participation (Rullani and Haefliger 2013), mixed with the historical importance a participant has held (Setia et al. 2012). Although the core and an elevated participation are considered crucial for the development of open source projects (Mockus, Fielding, and Herbsleb 2002; Zhou and Mockus 2015), this does not mean that their role goes undisputed and they can themselves become involved or initiate deep controversies (Cornford, Shaikh, and Ciborra 2010).

In addition, tensions taking place in distributed, non co-located environments are generally seen as problematic (Hinds and Bailey 2003; Hinds and Mortensen 2005), although their (dynamic) resolution can have positive, long-term outcomes when dealt appropriately (Faraj, Jarvenpaa, and

Majchrzak 2011). The lack of co-presence has impelled some researchers to qualify this distributed organisation as virtual (Faraj and Johnson 2011), resolving the apparent contradiction of less presence (because of an increased virtuality or physical ‘disconnectedness’) and more affordances for actors to enact control over routines. This is, perhaps, due to an increased visibility of knowledge and the actor’s capacity to act upon (and profit from) its observation (Daniel, Agarwal, and Stewart 2013).

Beyond the occasional tensions that can arise, along with commons-based systems, open source has traditionally been considered unsustainable in the long run. Primarily associated to economic theories, the rationality of individuals has been deemed to be at odds with collective, strategic actions: an individual maximises his benefit in the short-term even though it is, in time, detrimental to himself and to the group, and ultimately to the failure of the exploited resource (Hardin 1968). Avoiding this failure, according to Hardin, could only be solved through centralised, often state sponsored coordination or private enterprise. Yet, no such tragedy has befallen open source, quite the contrary.

Theorising open source as a stable alternative

Two theories in particular stand out for having advanced research in commons-based production systems, becoming in effect overarching explanations of the formation of collective action and open source. Both Ostrom’s (1990; 2005) conception of the commons and Benkler’s (2006) commons-based peer-production can holistically theorise open source as a viable alternative capable of creating efficient organisations, satisfying needs that both markets and states cannot. Despite their merits, they have tended to favour perspectives that follow explanations of stability instead of incipient change. In this section, I attempt to briefly present the two theories and explain why only looking at the stability (or stabilising) factors in open source may lead us to overlook more complex controversies.

The commons and peer-production

The earliest theoretical conception of open source can be traced back to Ostrom’s (1990) work on the commons. Although she researched problems of scarcity in shared, ecological environments where a failure to organise potentially meant what became known as a ‘tragedy of the commons’ scenario (Hardin 1968), many of her concepts are still in use in contemporary open source research: shared institutions and governance (O’Mahony and Dahlander 2011); collective action

and rules (West and O'Mahony 2005; Ostrom 2005); the relation between commons and public-private structures (Hippel and Krogh 2003). Ostrom's *tour de force* was to show that collectives—sometimes even heterogeneous ones—were capable of organising themselves to avoid the loss of resources from which their livelihoods depended on. Beyond considerations of supply, it is the recognition of the capacity of actors to enter and organise collectives—without direct supervision—that legitimises commons-based systems such as open source. In so doing, Ostrom showed, similarly to open innovation studies, how self-collectivised organisations were able to adapt organisational structures to particular contexts of use, whether commons-resources or workforce attributes (Hess and Ostrom 2005; Feller et al. 2008).

Benkler goes further: he considers open source as a virtuous way of developing quality software where open source acts as a selective process for both code and virtuous people (Benkler and Nissenbaum 2006). This virtuosity creates an organisation where people are attracted to work together. Peers are not told to do things through managerial impositions, but encouraged through “social mechanisms” that open source puts in place (Benkler 2004), similar to a positive *habitus* from which “the most improbable practices are therefore excluded, as unthinkable, by a kind of immediate submission to order that inclines agents to make a virtue of necessity, that is, to refuse what is anyway denied and to will the inevitable” (Bourdieu 1992 p.54). This ultimately questions Coases' view on the nature of the firm as based on the relation between transaction costs and market price (Benkler 2002). To Benkler, transaction costs are not as relevant: there is no clear price associated with the enlisting of volunteers or company backed developers. Instead, costs are associated with the ownership or integration of OS within traditional, Coasian firms (Shaikh and Cornford 2011).

Questioning stability

Both theories hold a reliance on stability: Ostrom's collective action takes place within one or several ‘action arenas’ in which the actors engage in concrete situations (Ostrom and Hess 2011). There is a clear ‘outside’ and ‘inside’ and the need to adapt is usually exogenous (Ostrom 1990). Although such change has to be internalised, thus leading, for example, to the decision of actors to stop participating, there is always an inertia towards a stable organisation; this type of change is considered unnatural (Tsoukas and Chia 2002). The commons itself—especially in digital form—can be highly interpretative (Kallinikos 2006; Aaltonen and Tempini 2014). Ostrom (2011) herself moves beyond defining the commons as only physical things saying that in Levine's (2011) conception of “associational commons, the community is itself the resource.” If the

commons can enter in associations, then, their nature is not necessarily given, but can change into different things depending on the assemblage that ends up being formed. The malleability of the commons could affect what, and how collectives arrange themselves around their use and development, making difficult the explicit creation stable norms and rules (Ostrom 1990).

A similar critique of stability can be made of Benkler's virtuous cycle which entices actors to reproduce that virtuous behaviour over and over again (Benkler and Nissenbaum 2006). But how do the different open source communities understand and enact virtuosity? Benkler's explanation ends up being structural: virtuosity allows the banding together of otherwise heterogeneous groups, but it risks overlooking how these become formed. Coleman's (Coleman 2012) work shows the rich complexity of free software programmers trying to grasp their travails, their effort, and how they affect the world at large. Far from being uniformly virtuous (Morgan and Finnegan 2014; Alspaugh, Scacchi, and Asunción 2010), the communities she studies undergo difficult controversies (Stewart and Gosain 2006), that can, perhaps paradoxically, strengthen the group (Faraj, Jarvenpaa, and Majchrzak 2011).

The controversies are sometimes deep enough to resemble schisms that affect even core principles (Cornford, Shaikh, and Ciborra 2010). The consequence of this foundational instability is a vital desire (based on its potential) for open source to experiment with alternatives. When citing Ciborra and Lanzara (1994), Darking and Whitley (2007 p.28) argue that "once designed and introduced into the organisation, they [the features] tend to evolve along paths that are often unexpected and irreversible, subtly changing the ways people design and carry out their work practices, experiment with alternative arrangements and routines, or implement alternative visions and designs...." By experimenting, a project can attract (if incorporated successfully) new spaces of action, new avenues of participation for open source to invest in. The 'openness' of open source, along with the ability to (re-)interpret its own meaning, values, and purpose warrants an approach that can follow its meandering course, one that purposefully looks to understand how open source projects become in a changing world.

Why talk of the becoming of an open source project?

Becoming is usually counterposed to the stability of the being (Bjerregaard and Jonasson 2014), which is still the prevalent concept used in research (Tsoukas and Chia 2002). Why stability has so much currency is understandable: the world seems to make more sense when explained through the description of lasting institutions. Stability usually either indicates a lack of change or

something that is firmly fixed. When discussing materiality, Faulkner and Runder (2013 p.60) say this: “many, if not most of the boundaries and categories we live by in our day-to-day lives are generally quite stable, at least relative to our life histories, and that the same is true of most of the objects classified within them (Kallinikos 2011). Otherwise, it would be hard to account for the apparent stability of social institutions and our artifactual worlds.” The term “apparent” is key here: institutions need only *appear* stable to *be* stable, nameable objects that can be classified by attributes. This is an example of a lack of change where social actors agree to a consensus on the role and purpose of certain objects, partly derived by the object’s materiality.

Nonetheless, even lasting institutions, seemingly impervious to change or uncertainty suffer from erosion. The lab fly—even if pertaining to a narrow and accepted phylogenetic category of biological genus and upon which numerous studies have been based on—is judged by degrees of purity (Callon, Lascoumes, and Barthe 2011). Even Nature—modernity’s favourite actor—and its role are examined in debates which sometime resemble schisms (Robbins and Moore 2013). Similarly, as an apparently simple instrument, the magic quadrant may seem easy to understand, with clear properties, but its ‘proper’ use, however, is complex and debatable (Pollock 2012).

In some other cases, it is the actors themselves, not just passive occurrences like drifting, who are interested in enacting change in an effort to retain or reach new forms of stability. Work-arounds, for example, have been examined as strategies to maintain a perceived loss of status by actively deviating and resisting original designs (Akrich 1992; Zuboff 1989), or to negotiate relations between users and technology (Orlikowski 2000; Pollock 2005). Stability here is not a state, but a prolonged effort to stabilise relations. Work-routines, for example, are continuously being re-created, supporting the idea that change is pervasive in organisations (Dionysiou and Tsoukas 2013). Change, even when it aims to stabilise, happens in a specific context against which even stable, accepted objects are confronted and disputed, making their existence different depending on the situation (Avgerou 2001). The local instability undermines its prevalent and universal position and puts change in charge of stabilising, making stability an elusive end and change the means to approach it. For something to remain the same, there needs to be an effort in that sense. Consequently, stabilising and change become the object of study instead of stability, ultimately examining “the way in which reality is brought into being in every instant” (Langley et al. 2013 p.5). In this view, stability then cannot be defined as a series of immobility states, or a stopped motion; it could (narrowly) be defined as a repetition of movement which does not change much over time. There is an assumption of order behind this view, the logics of which are repeatedly performed in time. Some have argued that continuity, far from being evident, “requires work,

sometimes hard, itself likely to create dynamics causing dilemmas and challenges” (Hernes 2014 p.185). How difficult (if at all possible) would it be to celebrate the ‘same’ Bastille day in France every year (Deleuze 2004)? The question is whether it is possible to define a being from within, counting its attributes (Smith 2012). A being, if summed up by its attributes would be made up of relations of interiority: the parts, themselves well known, would explain the whole (DeLanda 2006). But just as a body, a being cannot be defined entirely by its organs, and the organs of a body are not defined by the body’s organism (Deleuze and Guattari 1987). Beings are in motion because their existence is associative, creating what DeLanda (2006) calls relations of exteriority: both the parts and the whole retain a certain level of autonomy (indispensable for granular change to take place).

If open source were to be considered within an association of assemblages and that stability were difficult to maintain—both in the sense of the same and the similar—it could be problematic for open source. Coming back to the commons, if access were relatively unrestricted, then it could mean that there is no pervasive ‘identity’ of what is open source because the associative assemblages are open, and may therefore lack internal cohesion (Brown and Toyoki 2013). The quantity of licenses defining open source and their potential conflicts speaks volume to this mutable concept of freedom (Alspaugh, Scacchi, and Asunción 2010). The capability to argue about what should be considered ‘free’ is even an entry exam for prospective Debian contributors (Coleman 2012). Given that open source has invested into many new spaces (Cheliotis 2009), being so forceful in its capacity to attract and alter meaning that it has become almost imperceptible and a natural assemblage to connect with (Deleuze and Guattari 1987). In this sense, open source is becoming immanent to the realities being produced: it does not impose meaning, but provides a logic with which to do things.

As an immanent actor, open source has captured technological jargon, social ideas, and ways of organizing, and made them its own. Open source is not only seen as a deviating example, but as a contemporary cultural critique that proposes alternative modes to engage with the world (Kelty 2004). The immanent actor is not a stable being in the sense that it actively pursues (and is pursued by) change. Far from being something evident, something essential, open source challenges conceptions of even those who are knowledgeable and share its ethical affects (Cornford, Shaikh, and Ciborra 2010). Beyond purely technical projects, the question of the influence of open source (itself in-becoming) on the processes of innovation remains: how does open source guide a project if it is capable of such debated evolutions? This might appear to be a simple question if not

for the amplitude of behaviour that the term ‘guide’ offers. The case presented here shows how open source does not necessarily impose things, but instead opens up directions of enquiry.

Case setting: openEHR and the interoperable electronic health record system

The research is based on the openEHR project, a foundation created in 2000 to develop interoperable Electronic Health Records (EHRs). Although the foundation was created recently, its roots go back to 1992 when the Good European Health Record (GEHR) initiative was successfully launched. The design principles behind openEHR have influenced international standards about the design and development of EHRs (e.g. CEN 13606 (Kalra 2006)). openEHR was formed in an attempt to resolve the many problems that plague electronic EHRs. The development and informatisation of EHRs has generally been problematic. Despite being designed as patient-centric systems (Black et al. 2011), there is little that the patients know about their own EHRs, even where it is stored and who has access to them (Bakker 2007; Kluge 2004; Agarwal and Angst 2009). The implications of problems with EHRs are also unclear (Coiera, Aarts, and Kulikowski 2012; Grogan 2006). Some authors question how their successful adoption should be measured (Vest and Jaspersen 2010). Others highlight that EHRs are not likely to completely drive off non-IT health records (Saleem et al. 2009), suggesting possible ensuing complications and questioning their completeness and consistency attributes. Even the promise of interoperability is questioned when contextual factors are brought in (Torre-Diez, González, and López-Coronado 2013).

The records of an EHR describe a patient’s history recounted from their own view-points (Feero et al. 2008), and represent a fundamental pillar of contemporary medical practice (Ingram and Arikian 2013). It is the doctor’s responsibility to ask for, guide, and investigate this history; an EHR thus forms the first step to a possible diagnosis and creates an initial material bridge between the patient and the clinician.

The records themselves are problematic because there are multiple ways of defining and understanding medical concepts since they hold various semantic meanings depending on the context or profession (Mol 2002). For example, simply defining a patient’s blood pressure requires the possibility of entering information about *how* the pressure was measured (sitting down, laying down). It becomes more complicated when unforeseen elements need to be registered, for example, the various life styles of diabetic patients and how they could be influencing the clinician’s

diagnosis (Mol 2008). openEHR's solution is not to syntactically record every possibility under the sun, but to give semantic meaning to clinical concepts so that clinicians themselves can give interpretative values to them and create more complex meaning on the go.

To openEHR, the records act as requirements which are descriptions of “functions that the software must perform, but not how they must be performed” (Bell and Thayer 1976), or “all aspects of system development prior to actual system design” (Ross and Schoman 1976). To make EHRs interoperable, openEHR defines requirements in a specific way for the software to implement. These requirements represent semantically valid, clinical knowledge and are labelled as ‘archetypes’. These are versioned: they represent in sequential versions the latest clinical knowledge and the various ways to measure it. These clinical concepts, such as blood pressure, are openEHR's requirements and represent the functionality of an EHR system.

The consideration of semantic meaning when articulating a requirements implies a certain element of change in the definition. Instead of constricting that change, openEHR has built an architecture allowing changes in the way clinical requirements are expressed. This architecture, inherited from openEHR's ancestor projects, is termed as ‘two-tiered’, removing some amount of context to the requirement which can then be specialised in concrete settings (Leslie and Heard 2006). In this way, requirements act as vehicles for change that deeply represent coded views about the project's role (the contextualised purpose it tries to fill), and how to fabricate that role (the project's processes). Once implemented, these requirements can express evolving clinical knowledge across disparate systems. It is these clinical requirements, these archetypes, and their semantic meanings that make openEHR's principal contribution to the creation of interoperable EHRs.

To achieve interoperability through the articulation of meaning, openEHR has sought to open up the definition of these records and—most significantly—the way these records (and thus their meaning) should be produced. In opening the definition of these health records, the project members have come up face to face with the difficulties of using licenses and processes that were, until only recently in the health domain, generally closed off and proprietary. The project has known, perhaps because of this openness, an important number of successes such as informing the basis of several international standards such as CEN and ISO (Atalag, Yang, and Warren 2012), but also a certain amount of animosity.

openEHR is an interesting case study for discussing the processes of change behind openness because the project is composed of clinicians that have generally had little contact with open

source. In this sense, there are few points of reference available to them in the field of health or the field of software where open source draws its origins. Further, the politics put forward by the members are generally deprived of the same ethics than those that permeate technologists familiar with free software's history and the hacker ethic (Levy 2010). openEHR represents open source *in the making*, and the discussions that take place concerning what it *means* to do open source can be enlightening to its growing ubiquity. openEHR showed a level of complexity unlike many open source projects. This complexity was its immediate attraction because openEHR had dealings between varied domains: health, informatics and open source. From its creation, it belied a Quixotic attempt at changing healthcare, yet remained lucidly on the ground, weighing issues that more technical open source projects would not reflect on. Health, for example, is a domain agitated by contradictory cultures: the open nature of clinicians' approach to knowledge, and the closed systems many of them work with. It was clear, early on, that open source was to be a controversial matter in openEHR, not in itself, but because of the multiple understandings and application that open source provided to define the project and its requirements.

Methodology

The research that I present here is part of a larger body of work that ultimately formed into a PhD. Three sources of data collection were used: interview data, mailing lists, and participant observation (c.f. table [tab:data-collection]). Both the interviews and the lists were coded using the methods proposed by grounded theory despite using a middle-range approach with Deleuze and Guattarian theory. I used the same codes on both the lists and the interviews. Although the conduction of the interviews was highly influenced by the knowledge acquired in the analysis of the mailing lists, for the purposes of this paper, I will only report on data from the interviews and the participant observations.

The process of data collection was inspired by Latour's exhortation to follow the actors and letting them speak (Latour 2005). Deleuze makes much the same call when he says: "It's not a matter of bringing all sorts of things together under a single concept, but rather of relating each concept to variables that explain its mutations" (Deleuze 2003). This allowed the analysis to be centered around particular movements, as called for by Callon (2002): "to understand the functioning of organisations, we have no choice but to explore the role and the effects of the varied and evolving organisational instruments." So, methodologically, it is not only the actors that should be followed, but the actors through their transformation. There is a performative sense to the

method that echoes the theory's concern for the production of realities. It is both out of respect for the actors' potential for change and to give an accurate account about the forces in play in larger assemblages that their concerns should be followed.

Data collection

Formal (semi-structured) interviews were conducted between 2011 and 2012 after an initial round of informal interviews which helped contextualise the topic and domain. The interviews were as varied as possible to allow an account for a range as wide as possible of perspectives. There were seven distinct sources: technical (3), clinical (2), foundation (2), and people sitting on the fringe of the project (2). The interviewees were active participants in the project, but had come to the project from different trajectories. Some were interested in advancing openEHR politically in accordance with their country's health initiatives, others had a more proselytizing role in openEHR, having been early founders or having recognized its potential.

The participant observations involved the attendance of a board meeting with several members of openEHR (2013) and the attendance of the first NHS Hackday in London (2012)—a twice yearly meeting of clinicians and informaticians with concerns close to those of openEHR.

[tab:data-collection]

Data analysis

[tab:data-analysis]

I analysed the data through three coding processes: open coding, selective coding, and theme building.

The early open coding scheme was drafted before formally coding the mailing lists and derived from the semi-structured interviews, and the early takes on Deleuzian theory (c.f. point 1 in table [tab:data-analysis]). The initial codes were used on the formal interviews and half of the technical list. The main constructs that came out clearly from the already gathered data told a story of balancing control, stability, and drifting. These stories became selective codes inserted in narratives, but lacked perspective. It was not clear, for example, what was emerging, or the role of requirements in that emergence. The open codes were too disconnected from the selective codes, and not contextualised sufficiently. Endemic to the codes' problems was a continuous and evolving learning of the theoretical basis of this research.

Another process of coding was done after refining the codes (c.f. point 2 in table [tab:data-analysis]). Some aspects later evolved into the current themes were already present in these early code, in particular ('protection', 'doers'), or a necessity to both hold requirements down and let them emerge ('rigour', 'constraints', 'engagement', 'emergence'). Nonetheless, the 'why' these codes were important to the participants, and how theory could make sense of them, was clarified in this refining. This 'why?' led to a more concrete question which precipitated the revision of codes: 'why and how are requirements important to openEHR?' This question, in particular, helped contextualise requirements and make sense of the relation between the codes. Taking a step back and going through the old codes and the source material together, several controversies and concerns became apparent:

- openEHR was defining what it was, *who* it was, and what it could do;
- openEHR was careful in what it was proposing and took great pains to document and anchor their requirements;
- openEHR was projecting itself in relation to competition, satisfaction of requirements, how the health domain was moving;
- openEHR was worried about temporal and spatial issues (sustaining innovation, the speed and time to engage requirements, openEHR's actions and external influences on the core.

New associations between codes grew from these concerns and started to take the shape of themes. With the set of growing selective codes on one hand, and openEHR's concerns on the other, their association, their wider meaning, and their relation to requirements took interesting perspectives. For example, why did it matter to openEHR to be part of the world? What were the multiple reasons and logics behind becoming this or that actor? For this, openEHR's requirements needed to be exportable, diffused. In part, this was the attractiveness of open source, but how to do it without hurting openEHR's ability to market itself as the source of interoperable, clinical requirements? Thus, there was a territorial concern about openEHR's ability to deploy its requirements in its own terms. These terms, though, were not stable and were debated by participants, both core and peripheral. To understand the influence of changing assemblages, various actors looked to and interpreted the meaning of open source for guidance.

Avenues of participation and the unsettled open source

‘Openness’ is generally not a stable attribute of open source projects. Even Debian, one of the most successful Linux distributions known for its stability, has seen its share of debate over the extent and meaning of openness (Coleman 2012). The project studied reveals the reach that open source has for guiding the project’s evolution and how it allows or tries to hold back on the potential for becoming that some members ask. These avenues of participation are not clear-cut; sometimes they represent the need for some actors to be seen as legitimate producers, at other times, it is the way people participate—not who—which is debated. Overall, openEHR shows the difficulty of understanding the pragmatic issues and benefits involved in becoming an open source project. The discussion on *how* to produce open source displays the relation between the doing and the instability of being.

Multiple voices

One of the reiterated views of open source is the way it is able to give voice to a number of different collectives. These collectives have not necessarily been present since the beginning of the project, and can come to form part of it under certain conditions. The way they do so matters because these collectives do not pre-exist—at least not in the way that Law (2004) criticises the objective pre-existence of something as having been always coherently present. Perhaps due to the participatory nature of open source, various collectives form and un-form themselves in the assemblage. They must make room for themselves. In this sense, even the actors and assemblages that have been present since the beginning do not have an undisputed coherence.

“Let’s say there are ten emergency departments in ten different countries, and they all want to use archetypes, are you going to say that they can’t make changes until the international organisation say they can make changes? That’s not going to work, so you’re going to have to allow some peer to peer sharing of good quality archetypes.”

Clinical lead

The clinical lead is interested in potential actors involving themselves in the project without prior consent from the international foundation. Instead of depending on some centralised decision system, he believes that there should not be any modification restrictions to new actors to participate in their own way. He proposes new roles for the entrants and existing collectives. He does not speak only for his own collective, but a new way of production for the entire project. There is

an issue of the space new actors are able to occupy in the assemblage and that is, according to the interviewee, too restrictive.

The problem, as others see it, is to end up with fragmented requirements which would in turn fragment the assemblage:

“So it’s all about the discipline and the rigour of it really. Also, the rhetoric of it is fine, in a sense, not fine because it doesn’t implement but, that’s a lot of the fundamental way of doing it, you know, need much more experimental rigour, but the problem is in this sort of contexts, good people end up doing their own thing, because they feel they have no choice. So that’s what happens with local requirements, they then fracture the enterprise and then health care as a whole is lost, because actually that doesn’t help, we end up in the middle of UCLH [University College London Hospital], hundreds of different clinical IT systems, none of which has got any common basis and standardisation of data or anything else, all of which the developers have long since moved on somewhere else, and wax holding it together.”

openEHR board member

If voices need to be heard, they must be heard in specific, and sometimes contradictory, ways. How one way is chosen over the other depends to a large degree on the existence of channels for the collectives to become visible. These provide different ways to legitimise the production of requirements—the commons themselves—and thus those collectives that participate in its production. For the clinical lead, it is about the sharing between peers; for the board member, it is about “experimental rigour”, a collective prototyping which aims to maintain global visibility over requirements. The way production is done enforces certain qualities, a substance, on the commons and its expressive force. A rigorous requirement will travel internationally. Without this rigour, there is the worry that interest will wane because openEHR will only have interested people to “do their own thing”. The point of rigour is both to stabilise some aspects of the requirements, but also to de-stabilise the places it can go (become an actor) and the time it can remain in-becoming.

Time is thus an issue. These same emergency departments need to be able to respond to their changing needs rapidly enough for openEHR to be useful to them:

“It needs to help me at the front-line, to solve a clinical problem, solve that problem now. Not in five years’ time, or in ten years’ time, it needs to solve a problem now. But I’m willing to use it at the front-line, from a bottom-up way, in line with the top-down approach.”

Clinical lead

There is an immediacy to the way some assemblages need to take new participants in, otherwise for them, the project stalls and fails to cater to their ‘front-line’. At the same time, there is a risk of conflict with the overall structure and the way requirements are currently assembled, risking the sacro-sanct objective of interoperability. Reminiscent of the 90’s debates in software engineering between bottom-up and top-down development (Beck 1999). Unlike previous debates, this one is about ownership (and difficulty of sharing) of the space to be articulated into requirements; the intimacy of the ‘front-line’ with their own issues. There are a variety of actors who require their voices to be heard to shape the project’s requirements. There is another way, one that listens to the desires of requirements. Citing Coiera’s (2009) work, some in openEHR argue for the need of a ‘middle-out’ way:

“What we’re trying to find are nuggets, you know, small bits that can be maximised so they can be reused in different places. [...] So the problem with trying to do clinical modelling is the space is vast. It’s huge, it’s very complex, it’s very interdependent. The data types are very rich. Some of the structures are very complex and getting complex timings and something. But the thesis of openEHR is that within that crazy complexity there are actually some islands of sanity where you can get some clinical consensus, there are things like a blood pressure which is a clearly pretty well defined clinical idea or a diagnosis or a procedure.”

Clinical board member

The ‘middle-out’ way that this board member proposes is to give voice to specific requirements (the nuggets) which have specific (and potential) qualities that are not yet ‘actual’, but that need to be discovered, interpreted, evaluated. One such quality is that ‘nuggets’ can travel within the foundation’s various assemblages to be developed. There is a critical mass that the requirement could attract to become further developed and potentially implemented in yet unknown contexts. In this sense, the ‘voice’ of the requirement is there, calling for a specific type of participation around its own becoming. These actors are not human, yet they assemble around them groups of interest that must also align with other existing assemblage (e.g. be interoperable with other clinical requirements). openEHR has to find ways to govern the incorporation of these different needs and their assemblages. Incorporating these groups is no easy task because they bring with them their own complexities.

Possibility space and lines of flight

What the clinical lead above is advocating does not exist officially—those ten emergency department are not affiliated. However, he pushes for the ability, if useful at any time, for emergen-

cy departments to influence the international organisation (openEHR) to autonomously peer-share archetypes. He tries to create a space where that collective could indeed become an actor in the definition of clinical requirements. There is no formal prohibition to create such a group, the brake is more a practical concern:

“So for instance, I would like to have an international group who look after emergency medicine archetypes, but it’s very hard to engage those guys at the moment, because what do they do? There is nothing to do, there is no archetype. Ok, you can agree on an archetype, but then, what do you do? You can’t use it, so... It’s not going to survive.”

A clinical board member

The previous interviewee hints to the need of a material substance around which the hypothetical group could exist: the need to be able to “use” the clinical requirement in context. The board member hopes for a change in focus towards more realisation and less work to increase a clinical requirement’s potential. Once realised, once anchored to a context, he believes the requirement will be in a better place to attract interested assemblages.

The many ways in which groups can be composed in open source are vast and could accommodate the project’s hierarchy (openEHR in its core foundation), and the emergent emergency departments. The problem is that the articulation of common substance of requirements (e.g. clinical requirements as a global standard vs a local standard) also affects the potential spaces of *intérêt* (and thus different ways to assemble) that openEHR can get into. The use of these ‘front-line’ requirements will attract and produce potential assemblages that will help this collective affect their realities. If openEHR finds itself promoting local, immediately useful requirements instead of rigorous, world-spanning ones, it will could change its becoming in no small way.

In this sense, the project *is* not. openEHR does not impose a settled agenda of what it is or a settled way for people to participate in defining its requirements, thus leaving its becoming open to change. It discusses what it wants to become and how it should go about it. Its needs—scientific, organisational, or otherwise—change, evolve, and adapt depending on those that involve themselves in the project and those that could yet get involved. Another participant makes this point when asked about open source:

“There are always different assumptions, different things done, and you can bolt them together, but it doesn’t mean that you aren’t going to get new different behaviours. So you actually have got to have the platform in the space and something that’s fast moving as requirements are changing, you know, all of the

tools of the trade are changing, if the software is all buried in the bake it holds you up in commercial and business ways, but it holds you back in scientific ways as well. So, that's why I think [open source is] important."

openEHR board member

Part of the holding matter, an important connecting node is the platform, and open source allows for the exploration of the requirements space in commercial, business, and scientific ways. There is no contract between a client and its programmers that closes off prematurely the project's nature. Instead, open source allows for the (potential) becoming of various interests and agendas connecting around a platform, which is why the discussion over how to produce requirements has seen such debate in the project. The production of requirements is not the only way to modify the becoming of the project, its ability and potential to control its growth also affects the avenues of participation. The board member specifically talks about the lines of flights, of letting openEHR become... what? There is no answer to this question, only the liberating affect of open source, of not getting "buried in the bake." In this sense, the affects of open source are paradoxical: they both liberate, yet encourage the production of certain ways of production and certain forms of substance to be created.

Open source guiding the project

For openEHR to become (or increase its becoming) and remain an international platform in an open source way, it must find processes to invite people to internationalise the project and diffuse it beyond expected boundaries. However, the internationalisation cannot happen unguided. A technical lead and implementer wondered about openEHR's ability to provide this help:

"We are discussing how we establish localisation chapters system. To be a global standard, localisation is necessary. However, bad localisation would disrupt all."

openEHR technical member and implementer

The difficulty here concerns the degree of autonomy allowed by open source. A false autonomy such as one that would replicate global structures into local situations (Ostrom 1990), could be detrimental to an open source project's ability to create lasting relations with local groups. The emergence of these groups and their own becoming might leave them on the periphery of the older, openEHR core foundation. In this sense, it is not only openEHR's assemblage which moves and evolves, but all the actors within it. This would be detrimental both to openEHR, since it would be losing a satellite assemblage, and the local, emerging group because it would lose

touch with other assemblages. The interviewee, thus, points to the conundrum that open source may not be enough in and by, that it could not be virtuous enough, to warrant the attraction and maintenance of assemblages, echoing Morozov's (2012) critique of the caricature made of internet technologies often thought capable of forsaking more traditional forms of organising. The becoming of open source is thus also dependent on its ability to reach and relate to local realities that may be invisible or move differently to the international foundation. This local reality is unlike the 'front-line', not because it is geographic, but because it asks how the project internationalises itself.

"It's not coordinated, it can't be, because it's all left-field stuff. So GPSoC I knew nothing about.² And I mean quite honestly that's the way I would want it to be because I think a thousand blossoms blooming is really the nature of where we're at, at the moment, because we are not going to know exactly where the whole thing will resonate and where it will add value. We had no idea that somebody in Cambodia was going to download Opereffa [an openEHR demonstrator] and build a TB [tuberculosis] national alert system."

An openEHR Board Member, interview

There is little control possible. Even when assemblages and their spaces are not incorporated, openEHR itself is derived into another assemblage, in both these cases without the knowledge of a board member. This is not a negative outcome for openEHR because it is able to project its identity, its way of solving the interoperability problem in health IT by acquiring allies, much like Latour's (1990) account of Pasteur, rendering visible some yet unseen consequences to the project. It means, however, that openEHR cannot know its potential for creating assemblages; they can happen without its knowledge. In some sense, openEHR does not know itself because it does not know where it could *potentially* be applied to. These properties: to be used as a tuberculosis alert system, to become part of what could become the health equivalent of OpenStack does not need to be openEHR's concern. These aspects which are beyond their control, show how adaptable the project is to lines of flight and emergence (Deleuze and Guattari 1987; C. Ciborra 2002a).

² The openGPSoC (open General Purpose Source Custodian) is an umbrella project that aims to use openEHR. openGPSoC was launched at the NHS Hack Day 2 in Liverpool (a grass-root movement which aims to 'hack' the NHS. A test build is currently being developed.

Instead of controlling openEHR—whether the requirements, the participants, bottom-up, or top-down—and risking suffocating its becoming, a board member carefully explains a way to guide change:

“The analogy that comes to mind is the interaction between publishers and librarians. In the context of librarianships, you have national repositories [...] you have some kind of governance frame-work around the numbering and cataloguing [...] and you have an ecosystem of publishers. You need a new kind of governance which recognises the curation, the librarianship, the skills, is an analogy related to books, there’s going to be a correlate of that in the context of archetypes, templates [specialised archetypes], and there’s also going to be a world of publishers.”

An openEHR board member in a board meeting

The cause of this perpetual re-evaluation of what it should be and how it should go about to become that is openEHR’s plasticity, derived partly by its requirements substance (not forcing a specific implementation). Its place in the world has not been set in stone some years before. Instead, it has been grasping at ways to contextualise the world in accordance to its own set of beliefs. It seems strange to relate beliefs, spaces and contexts, but the absence of an objective truth forces openEHR into evaluating its position in competing realities and how it should apprehend them.³

The competing realities are a primordial and evolving mapping of openEHR’s positioning in the world which makes it all worthwhile. How should openEHR solve this problem? What is this problem? *When* is this problem? *Where* is this problem? Without this evolving mapping of spaces and contexts, openEHR would only be able to give a single answer at a discreet instance of time. Instead, openEHR is *about* building an open source EHR. This *problematizing* by openEHR opens the door to question openEHR’s efforts to contextualise the world. To openEHR, ‘reality’ is an evasive multiplicity, yet these ‘realities’ are worth pursuing. If a space is improperly contextualised, then the project is unreal; it does not represent a purpose and cannot attach itself to existing assemblages.

³ Or more precisely, the production of subjectivisations of truth produces competing realities (Guattari 1995).

Discussion

The point of this article was to understand *how open source can guide and influence a project*. To do this, I looked specifically at requirements because they are intimately related to processes of discovery of what a project should do and how it should go about doing it. Building on Ostrom, Benkler, and the works they have inspired, I developed a perspective in which the production of commons and the values that inspire that production are not evident in open source, but are actively negotiated and discussed. As the findings suggest, it is not clear who should speak, and how they should speak. There are multiple ‘virtuous’ ways for actors to participate which develop commons of different qualities (e.g. interoperable or fast adaptation to emerging realities). As a consequence of this multiplicity, open source can offer ‘spaces of possibilities’, physical, but also social places where the potential of a commons can be developed. In this sense, and assuming that the project tries to remain open beyond the legality of the license, control cannot be imposed. Instead, open source can motivate a form of curation that negotiates the different tensions within the community (Faraj, Jarvenpaa, and Majchrzak 2011).

The concept of becoming is useful to understand the controversies that shape a project’s identity and its capacity to act in particular spaces. This move beyond considerations of internal stability around commons resources points to projects which can be unstable, but also immanent, without particularly prevailing points of reference that impose intentional, or centralised behaviours, or even ways to participate. The advantage of this is that open source does not assume the state of the world; it does not sit waiting for exogenous changes to take place so that it may modify its own ‘action-arena’ (Ostrom and Hess 2011). An open source project in becoming is ‘opened’ to follow directions that have not been set in stone beforehand. This unpredictable emergence has business advantages because unforeseen needs can come to be catered (C. Ciborra 2002b; Krogh and Hippel 2006).

Because there is no dominating pole, no overarching value system, there is an ‘in-betweeness’ that is difficult to understand, let alone manage. The cause of this ‘in-betweeness’ is open source’s own becoming. The immediate consequence is a dynamic instability which pushes one board member to say that “It’s not coordinated, it can’t be, because it’s all left-field stuff.” When there is a general absence of imposing reference points, the coordination of actors and of clinical requirements ‘simply’ happens, as if by accident, with no (single, linear) direct cause (DeLanda 2001; DeLanda 2006). This is reminiscent of Deleuze and Guattari’s (1987 p.23) flat *milieux* in which things are neither “the One nor the multiple”, neither an overpowering entity nor utter cha-

os, but somewhere between the One and the Many. Corsín Jiménez's reading of Deleuze's interest in the baroque period provides an interesting take on this performed 'middleness'. It is not only the lack of reference point that make it difficult to grasp realities, because things (and their nature) are in movement. Instead, there is no "movement of proportional changes through which the world transforms itself, but the *condition of variance* itself [...] Baroque thought, therefore, is no longer interested in the proportions through which the world holds itself together, but in the distortions and disproportions" (Corsín Jiménez 2013 p.76). Different logics are applied continuously: from openEHR's point of view, evaluating its relation to a tuberculosis alert system takes different processes than those needed to evaluate the diagnosis of requirements from an emergency department (Bjerregaard and Jonasson 2014). The spaces in which openEHR evolves can thus become different, needing, if they were to be incorporated, extensive work (Rullani and Haefliger 2013).

The 'in-betweenness' of open source questions the clean, categorical divide between the core and the periphery, between what is inside and subject to institutional rules and what is outside (Ostrom 1990). It is not their existence that is questioned, only the predominance of one over the other and how the periphery can be absorbed into the core. As social movements have shown, especially the recent ones of Occupying Wall Street (another example of the reach of open source into other spheres), the identity of groups is debated and fought against (Corsín Jiménez 2010; Munro 2014; Benkler 2011). It may well be that the core—whether from the insistence of the periphery, or by its own desires—wishes for its own evolution. Deleuze does not deny the existence of the strong, of the well-defined, of the being, but neither does he preclude them from the possibility of becoming (Deleuze 2005b; Massumi 1992).

The reason for this is the associational construction of things beyond their anatomical dimension. A requirement, for example, is not only a statement about what the software should do, but a process of discovery and the construction of an assemblage around it (e.g. whom does it affect, what vast are its relations, etc.). This is why Deleuze so forcefully calls for a 'Body without Organs' where a body is not the mere aggregation of the parts that compose it, and the parts are not explained by the whole (DeLanda 2006). Similarly, for open source, a project is not the sum of its participants, but the spaces it can reach and the potential it can develop. Part of this varying potential that must be sought for actively is the public vocation of open source which allows, and—in some cases—even encourages debate and experiment (Coleman 2012; Mackenzie and Vurdubakis 2011; Cheliotis 2009). This public aspect, often associated with open innovation,

changes the role and predominance of the ‘expert’ (Callon, Lascoumes, and Barthe 2011; Hippel 2005).

By questioning the predominance of roles, open source also changes their meaning and their purpose. For requirements, this has important implications because open source projects must realise the necessity to assemble with actors (or decide not to) who are able to articulate them. In so doing, the sourcing and the articulation of requirements become joined in such a way that projects must open up avenues of participation, even for unknown actors. This opening up may not be temporary: once enjoined, the actors might want to take the project in other directions, meaning that the project itself must learn to grow and incorporate them. This incorporation means that the project must potentially change itself. Requirements, thus—often only described as the needs of a software—show their ability to enjoin the identity of open source projects to actors who can understand their importance. In other words, by *doing* open source, projects change themselves and become.

An open source in-becoming is not a passive ‘receptacle of identities’, but a forceful influencer (and attractor) of socio-technical epistemologies.⁴ The virtuosity of open source production, and Benkler and Nissenbaum (2006) call is neither single nor dominant. The importance of the strength of this force is that open source is not only about peer production any more, but has shifted and travelled to the constituents aspects of the production itself: the assemblages themselves have morphed and accommodated to the production code, knowledge, and other artefacts (Barrett, Heracleous, and Walsham 2013). In other words, open source is no longer an end, but a means as well, and the means are not identifiable as a simple totality. This immanent movement of open source, makes it increasingly difficult to draw the line not only in the organisation’s own boundaries, between what is the bazaar and what is the cathedral (Wesselius 2008).

Open source is difficult to theorise because it is not stable, but a movement of experiences through experimentation (Coleman 2012). Open source forms an assemblage the properties of which are problematic to list and totalise (Deleuze 2004; DeLanda 2001). Both the identity *and* the purpose of open source form an assemblage that is existential and depends in some way on the assemblage’s ability to make sense of its surrounding (both spatial and temporal) (Weick and

⁴ The open access and open data movements owe much to the rhetoric of free software and its open source derivatives.

Sutcliffe 2005; Schultze et al. 2007). Just as Brel said that “Childhood is a geographical concept”, I argue that open source is a nomadology of sorts: guidance (of the project, for example) happens through directions, not intentions. A project is thus approachable by how it evolves and becomes, instead of believing in fixed values. The direct consequence of this sort of directional becoming, is that the way is more important than the political values attributed to the actors involved and the work they carry. There is little inherited value that is not actualised to the context at hand, few overarching moral that deems something as ‘true’ universally. In this theoretical machine, doing open source is a case of identitary schizophrenia (Guattari 1995).

Conclusion

The main contribution of this research is to show how open source and the continuous negotiation of its meaning guides the development of a project. Basing itself on Ostrom’s and Benkler’s theories, but taking an approach that came to consider change as intrinsic, I developed an account of becoming in open source. Looking at the construction of requirements—a commons resource intimately related to the identity of the project—it was possible to narrate the necessity and difficulty to integrate multiple voices—however local or seemingly peripheral. However, doing so without tightly controlling the project could open the door to potential new spaces that could bring unforeseen, but beneficial growth. A perspective of open source in-becoming suggests that directional avenues of participation and diffusion can be used instead of imposing clear cut lines of involvement that could extinguish potential, fruitful outcomes that can make the project evolve and better respond to needs.

Tables

Source	Events	Quantity
Mailing lists	Technical	1376
	Clinical	698
	Announcement	39
		Total: 2113 Word count: 227500
Interviews	Formal	9 formal interviews
	• Clinical core (2)	7 respondents
	• Foundation core (2)	Total: 12 interviews
	• Technical core (3)	Word count: 65000
	• Brazil national health agency (1)	
Participant observation	• Satellite project founder (1)	
	Board meeting (1)	1h
	NHS Hackday (1)	Two days

Table 1: Data collection

Steps	Tasks	Output
1. Formal coding	<ul style="list-style-type: none"> Formal interviews Establish list of codes from theory and grounded codes from informal coding Participant observation (board meeting and NHS Hackday) Start coding technical list and formally code announcement list and interviews 	<ul style="list-style-type: none"> 19 selective codes, 57 open codes. Some hierarchy, but unclear relations Better understanding of contentious issues
2. Revising codes	<ul style="list-style-type: none"> Review relation between emerging codes and theory Identify key themes from the codes (involved multiple starts and stops while coding technical list) 	<ul style="list-style-type: none"> Revised coding scheme (172 codes, 3 principal themes) Clearer relations between codes Emergence of grounded model relating the themes Evaluation of codes and theory Recode all data

Table 2: Data analysis

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