

Epistemic living spaces, international mobility, and local variation in scientific practice

Abstract

This article explores local variations in scientific practice through the lens of scientists' international mobility. Its aim is twofold: to explore how the notion of epistemic living spaces may be mobilised as a tool for systematically exploring differences in scientific practice across locations, and to contribute to literature on scientific mobility. Using material from an interview study with scientists with experience of international mobility, and epistemic living spaces as an analytical frame, the paper describes a set of aspects of life in science that interviewees described as being different in different places. These axes of variation were: embodied routines of research; resource levels and salaries; daily or longer-term rhythms of scientific life (and their relation to rhythms of home or family); 'efficiency' and how work time is used; degree of hierarchy; the nature of social interactions between colleagues; the purposes of research; the social and interpersonal organisation of knowledge production; and the scale or ambition of research. In presenting an exploratory overview of these variations, the article points the way for future comparative investigation of epistemic cultures through studies of international mobility.

Keywords: International mobility; Epistemic living spaces; Scientific practice; Discourse; Culture

Introduction

One of the key outcomes of the past decades of science studies scholarship has been to thoroughly destabilise the idea that science is practiced in the same way across different sites. Science and Technology Studies (STS) has explored science's historical contingencies and its diverse cultural and political framings, showing that knowledge is made within non-scientific as well as scientific sites, and that science itself is structured and carried out in very different ways in different disciplinary, national, or regional contexts (Jasanoff 2005; Knorr-Cerina 1999; Shapin 2009; Turnball 1997). This applies to experimental practice as much as to policy, organisation, and funding: even an ostensibly identical procedure may have different results in different labs (Collins 2001). Similarly, conventions about how research is valued, and how it should be reported, vary between epistemic cultures (Hessels et al 2019; Johann & Mayer 2018).

While it is well established that science is always contingent and local, there have been fewer efforts to systematically examine the ways in which scientific practice may vary from place to place. Most observations of difference stem from comparisons of individual labs, or of practices within specific disciplines (e.g. Hessels et al 2019; Knorr-Cerina 1999). In this article I explore the potential of the notion of *epistemic living spaces* to more comprehensively chart how science may be done differently in different sites. I combine this concept with empirical material about scientists' experiences of international mobility, describing the aspects of science that researchers report as varying across the different places they have worked. The aim of the paper is therefore twofold. First, I wish to explore how the notion of epistemic living spaces may be mobilised as a tool for systematically exploring differences in scientific practice across locations (whether geographical or disciplinary). Second, through this exploration I will present material that describes the ways that internationally mobile

researchers experience science as being different in different places, thus contributing to literature on scientific mobility.

The article proceeds as follows: I start by briefly reviewing work on local variations in scientific practice and on international mobility, before discussing the concept of epistemic living spaces and how it can be mobilised within research. I describe my methods and empirical material and then, in two central empirical sections, use dimensions of epistemic living spaces to parse out the kinds of variations that scientists notice and discuss when they reflect upon experiences of mobility. A discussion section returns to the central questions at stake – the value of the concept of epistemic living spaces for systematic examination of variations in scientific practice, and what light it has shed on researchers’ experiences of mobility – before a brief conclusion.

Local variation in scientific practice

The specificities of science’s local iterations can be explored at (at least) two levels. First, attention may focus on the environments in which science is carried out, by looking at national funding regimes or research cultures (Gläser & Laudel 2016; Geuna & Martin 2003, Stöckelová 2012). Nedeva (2013), for instance, discusses how the establishment of the European Research Council (ERC)¹ functioned to bring together diverse ‘research spaces’, which she frames as “funding and policy environments” generally tied to specific national contexts (2013, 221). The ERC was, she suggests, a project of building ‘Europeaness’, but also offered its promoters the opportunity to escape national research spaces that may have constrained their activities through, for example, a lack of access to specialised facilities. A similar concern for resource access and management is found in Sabharwal and Varma’s (2017) discussion of migrant scientists’ assessment of Indian and US “national scientific cultures” (p.776). Sabharwal and Varma focus on how their interviewees fund their research, finding key differences in how those working in India and the US report this: “leavers [who have done a PhD in the US and returned to India] have more research freedom in India because they are not under the pressure to find funds and publish within given time period [sic] to secure tenure” (p.790). Those working in the US, they suggest, spend much of their time applying for grants and work in a funding environment that favours applied research; they are, then, ‘entrepreneurial’ academics (Etzkowitz et al 2000) in comparison to those working in India.

A second line of work is more concerned with research practice as it is experienced at the level of the lab or group. Sharon Traweek’s *Beamtimes and Lifetimes* (1992) explores the cultures of high energy physicists at accelerators in the US and Japan. Though she finds key similarities in the experiences of US and Japanese researchers, including a commitment to “the international, supracultural image of science” (p.126) and a well-defined path from novice to ‘statesman’, she is also able to trace out two distinct styles of physics in her Japanese and American fieldsites, including the respective dominance of communitarian or individualist cultures and differing degrees of hierarchy in lab organisation (the Japanese groups, she writes, “see themselves as much more democratic and less hierarchical than the American groups”; p.147). Working in a similar vein, João Arriscado Nunes (1996) tells stories from a Portuguese lab populated by scientific workers with experience in “multisite laboratory work” (p.4): they have worked, to varying degrees and for differing amounts of

¹ The European Research Council, or ERC, is a European funding programme that focuses on ‘excellence’ rather than on challenge-based research. Its mission is “to encourage the highest quality research in Europe through competitive funding and to support investigator-driven frontier research across all fields, on the basis of scientific excellence”. See <https://erc.europa.eu/about-erc/mission>.

time, in labs around the world (and have thus experienced international mobility). Nunes examines both the national specificities of the laboratory, including the ways in which its semiperipheral location comes to matter, and how workers make sense of these. Researchers not only comment on the various particularities they have encountered – from hidden hierarchies in Brazil to a “rigid and predictable lab culture” in Sweden (1996, 12) – but use these to explain the dynamics of their current lab and the successes and failures of those in other countries.

Importantly, though these latter studies suggest that there may well be distinctive styles of research that can be traced to different national contexts, they also indicate that these are discursive resources as much as stable conditions (Nunes 1996). Felt and Stöckelová (2009) make this point particularly strongly. Discipline matters, they suggest, in that the epistemic objects of social research and the humanities tend to be more explicitly grounded in national traditions of research. Their interviewees (in a large European study) noted both structural differences (for instance in funding schemes) and, at times, differences in how particular local traditions of scholarship are articulated in everyday interactions. But:

using national or transnational reference frames to describe and position one’s research is often *a strategic choice*, attributing or denying value to the research questions posed, comparatively assessing the validity of research practices and constructing the epistemic object as more or less free of local context. (Felt and Stöckelová 2009, 57; emphasis added)

Claims about differences between research cultures should therefore not be taken at face value. As with any kind of talk about science, they can be understood as a gambit within wider sense-making about the nature of contemporary research and one’s own place within it (Billig 1996; Gilbert & Mulkay 1984).

The rise of international mobility in science

Nunes’ ‘multisite laboratory workers’ (1996) are increasingly the norm. The need for ‘brain circulation’ has become a truism within national and international science policy (Cantwell 2011; Flanagan 2015), resting on an assumption that “in order for knowledge-based societies to develop both in societal and economic terms they need to make most of the potential that researchers and research results offer” and that, for such development to happen equitably, “the global research community needs brain circulation” (NordForsk 2014, 4). Mobility, specifically in the form of job-based migration, is promoted by research policy in the shape of funding schemes that enable overseas work or bring research talent to a particular national context, or by incentive and recruitment structures that reward ‘internationalisation’ (Børing et al 2015; NordForsk 2014; Kim 2009; Larner 2015).

Such mobility has attracted research attention, albeit more in higher education and science policy studies than in STS. There has been particular attention to the so-called ‘push’ and ‘pull’ factors that encourage researchers to move, from the comparative dynamism of different research systems to life stage (Appelt et al 2015; Børing et al 2015; Flanagan 2015), but research has also explored the wider implications and meanings of mobility. Researcher experiences have been one key focus: mobility has been described in terms of ‘homelessness’ (Balaban 2018), as a sense that ‘the grass is greener on the other side’ (Sabharwal & Varma 2018), or as involving ‘otherness’ and isolation (Liu & Lin 2017; Morley et al 2018). The promotion of international mobility has also attracted critique based on the figure of the academic that such mobility generally assumes or produces (Ackers 2008; Jöns 2011; Leeman 2010). For Zippel, for instance, the ideal academic is now a “hyperflexible jet-setter” (Zippel 2017, 3) who, almost by definition, has no ties or responsibilities. The result, as Ackers argues

(2008), is a form of discrimination in which those who are unable to work abroad – for instance because of physical disabilities or family responsibilities – become understood as less ‘excellent’. More generally, international mobility has also been discussed in terms of what it can tell us about the nature of contemporary research. Ultimately, “mobility is coordinated through policy that forms national competition agendas, evaluative technologies, and competition discourse” (Cantwell 2011, 441). It is therefore one aspect of what some have framed as the increasing neoliberalisation of the university, or of the rise of academic capitalism (Kim 2017).

There has been less attention to what international mobility might tell us about local variations in scientific practice. Indeed, aside from analysis of different funding regimes and the ways in which these may act as push or pull factors for individual academics (Cantwell 2011; Sabharwal & Varma 2017), mobility has generally been considered separately to debates about epistemic culture or varying modes of knowledge production. In a recent review, Laudel and Bielick (2019) write that existing literature on mobility is “divided on the role of epistemic factors in decisions on organisational mobility” and that it is “characterised by patchy evidence” (p.3). Their own study points to field-specific differences in the purposes of international mobility: the nature of research in a particular discipline may make it more likely that one moves to learn a new technique, to access archives or research materials, or to gain access to a different sub-field (for example). But they also note that “expectations of international mobility ... are only weakly linked to epistemic practices” (p.12). What they term ‘script compliance’ – obeying the increasingly dominant assumption that mobility is the precursor to or signal of excellence and is therefore part of an ideal career path – is equally if not more important. It is also clear that decisions about mobility are never solely about scientific practice: life stage, caring responsibilities, and social networks are all important in decision making about whether to become internationally mobile as a scientist (Azoulay et al 2017; Flanagan 2015; Lee & Kuzhabekova 2018; Leeman 2010). Becoming mobile is therefore triggered by an interplay of epistemic and other concerns. What is less clear, however, is how scientists experience any epistemic differences they encounter as they move from place to place.

Epistemic living spaces as analytical tool

International mobility thus brings to the surface the degree to which epistemic motivations mingle with those concerning one’s values, priorities, and personal identity. At the same time, it offers an under-realised opportunity to gain insight into local variations in scientific practice, in that internationally mobile scientists have first hand experience of research culture in different sites. The question that frames this article is thus: *what can scientists’ experiences of international mobility tell us about the ways in which scientific practice may vary across different sites?*

In answering this question I will use the concept of epistemic living spaces as a frame for analysing scientists’ accounts of the differences between science in different locations. Epistemic living spaces are researchers’ “individual or collective perceptions and narrative reconstructions of the structures, contexts, rationales, actors and values which mould, guide and delimit their potential actions” (Felt & Fochler 2012, 136). They comprise the sphere of action in which a researcher sits, and which defines their imagination of what is possible; they are precisely the space in which one dwells and which incorporates expectations and assumptions about knowing, living and working in the academy (Felt 2009). Felt and Fochler (2012) suggest that such spaces can be characterised along five dimensions. They will have *epistemic* aspects, in that they speak to how knowledge is produced, and what defines good

research. They have a *spatial or material* dimension, incorporating the “spatial and architectural arrangements in which everyday work is done” (2012, 137) as well as the kinds of narratives about the different national locations of science that were described by Nunes (1996). They are *temporal*, incorporating understandings of the rhythms of academia such as ideas about ‘project time’, acceleration, or nostalgia (Müller 2014; Ylijoki 2005; 2014). They have a *symbolic* dimension in that they involve systems of valuation. Finally, the *social* dimension allows examination of researchers’ “forms of togetherness” (Felt & Fochler 2012, 138); these may be organisational, in terms of the structures and norms that bring researchers into particular collectives, but they will also include expectations about other groups of researchers and dynamics of ‘them and us’.

Epistemic living spaces are not static or final. They are a conceptual tool for investigating the lived experiences of scientists rather than a landscape to be comprehensively mapped. For Felt, for instance, part of their appeal as a concept is that they allow exploration of the tensions that many scientists experience between their imagined and actual careers, when the expectations implicit within a (personal) epistemic living space do not align with one’s experiences (Felt 2017; Felt & Fochler 2012). Their particular value for this analysis is twofold. First, they are about knowledge production in its fullest context, allowing attention not only to the practices that overtly comprise science but to its wider materialities, socialities, and rhythms. In the context of international mobility this is particularly valuable given that, as described above, it seems clear that epistemic, personal and social factors intertwine to structure decisions about and experiences of mobility. Second, the five dimensions laid out by Felt and Fochler (2012) offer a clear framework for analysis. In explicating the different aspects of what it means to exist within a specific epistemic living space, these dimensions suggest a set of points for investigation and comparison. Here, I use them to examine key themes in scientists’ accounts of international mobility, as a preliminary exploration of how epistemic living spaces might be used to shine light on local variations in scientific practice. Future work, however, might use them as a frame to compare specific sites or epistemic cultures in more extensive comparative endeavours.

Materials and methods

This research takes experiences of international mobility as a starting point to explore how science is differently experienced in different places. The study used interviews with mobile scientists to elicit accounts of what they noticed as they moved from place to place, and what key differences (if any) impinged on their experiences of science. It is therefore a study of scientists’ *discourse*. The research points to how scientists frame and narrate local variations in science; it is not a study of scientific practice ‘on the ground’.

The research was carried out in Denmark in 2017 and involved 31 semi-structured interviews with natural scientists. Given that there are well established differences in career paths and knowledge producing practices between the natural sciences and social research and humanities (Felt and Stöckelová 2009; Laudel and Bielick 2019), natural scientists were selected in order to focus and streamline the analysis. It was funded through a call from the Danish Ministry of Higher Education and Science to explore research integrity in Danish science.² Interviewees had all experienced international mobility – here defined as a period of work in a different country to that in which their PhD was completed – and were currently

² Information about the call and funded projects is available (in Danish) here: <https://ufm.dk/forskning-og-innovation/tilskud-til-forskning-og-innovation/hvem-har-modtaget-tilskud/2016/bevilling-til-forskning-i-dansk-forskningsintegritet-fra-styrelsen-for-forskning-og-innovation>. Findings specifically relating to research integrity can be found in Author 2018.

working as post-docs or assistant or associate professors at Danish universities.³ The interview guide covered personal and professional experiences of this mobility, assessment of differences in scientific culture in different places, and, finally, whether participants had experienced differences in practices concerning research integrity. 12 interviewees (most of whom were Danish) had done a PhD in Denmark before spending time abroad in post-doc positions and returning to work in Denmark; the remaining 19 (most of whom were non-Danes) had carried out PhDs in other countries and were now working in Denmark (sometimes having spent time working in other countries again: one participant, for instance, had trained in Spain, spent five years in Norway, seven in Switzerland, and at the time of the interview had been in Denmark for four years). Taken as a cohort, interviewees had experience of research in North and South America, China, Russia, Australia, India, and Ethiopia, as well as various countries in Northern, Southern, and Eastern Europe.

Interviews were transcribed, read through, and then coded using the qualitative analysis software MaxQDA, using a combination of codes relating to the research themes (research integrity, experiences of mobility) and in vivo or emergent coding (Coffey & Atkinson 1996). No key differences emerged between accounts given by participants at different levels of seniority, different universities, or working in different fields. The focus here is therefore on themes that emerged across the data set. This research does not attempt to reconstruct the nature of research cultures in specific countries. Instead, using epistemic living spaces as a frame, analysis focused on the *kinds* of differences that participants noticed and described (though, as all interviewees had experience of Denmark as a working environment, this was often used as a reference point).

In what follows I discuss findings from this analysis by exploring the five dimensions of epistemic living spaces outlined above, and the ways that these were described as differing in different places. I organise this in two empirical sections: the first looks at spatio-material, temporal, and social dimensions, while the second focuses on epistemic and symbolic aspects of epistemic living spaces. In describing the themes that emerged across these dimensions I use illustrative (anonymised) extracts from the interviews, which should be read as representing a corpus of similar talk from other interviewees rather than as being comprehensive. Before I move on to outline the axes along which science was framed as varying, though, it is worth noting that interviewees did not *only* talk about local differences in research cultures. Universalism – the idea that science is the same everywhere – was the first of the scientific norms described by Robert Merton (1973 [1942]), and remains an important ideal (and resource) for scientists (Gieryn 1983). It is perhaps not surprising, then, that interview talk involved references to the international and thereby universal nature of scientific practice. In such talk participants emphasised the *continuities* of their experiences rather than the differences, presenting a picture of science as governed by similar principles across the world – the idea that there is, as one interviewee said, a “common culture” of science. The mobilisation of this notion did not prevent interviewees from, at other points in the interview, discussing differences in the culture of science in different places. The continued presence of discourses of universalism and the international nature of science – with the associated implication that epistemic living spaces remain the same across different locations – thus reminds us that talk is always produced in context. Narratives of difference and universalism are not mutually exclusive: as suggested by Felt and Stöckelová (2009), talk

³ Denmark has eight universities; interviewees came from three of the more research active of these. Interviews were carried out with those in both temporary (primarily, postdoc) and permanent (primarily, assistant and associate professor) positions in order to explore whether there were differences in their accounts; in the event, as noted later in the main text, no key differences emerged.

of similarity or of difference should not be taken only as a reflection of experience, but as a strategic move within a particular moment of conversation.

Spatio-material, temporal, and social dimensions of epistemic living spaces

In this section I focus on spatial and material, temporal, and social dimensions of interviewees' epistemic living spaces, grouping these together because of their connection to what we might broadly call the material conditions of science. In examining each of these dimensions I describe the key aspects of scientific life that interviewees framed as varying from place to place. As we will see, focusing on these dimensions leads to interviewees' reflections on their working conditions, the kind of life that was possible under those conditions, and how one related to colleagues.

First, *spatial and material* aspects of science clearly differ between different sites. At the most basic level, laboratories look different to one another, and have different norms and expectations embedded into their use (about, for instance: whose job it is to wash used glassware; how permissible it is to help yourself to others' equipment; the extent to which health and safety rules are present or followed). Inevitably, moving to a new group involves a period of enculturation in which one learns to navigate a new space and the rules that are attendant upon it. This effect is particularly heightened when – as most interviewees had experienced – one is moving not only to a new country but to a new project or research area. For Uffe, for instance, part of the point of his mobility had been to get into a slightly different field of science:

...the most recent stay in the US, I wanted to shift areas a bit, so there I picked up different areas, I went more into microbiology and bioactive secondary metabolites. I think that's also part of the reason I actually went over there, to get a change of research environment and you know, start fresh on a new area. (Uffe, Assistant Professor)

It was therefore not seen as surprising to undergo a period of disorientation or to have to re-learn basic techniques. As well as moving to a new cultural context one might well be moving to a slightly different area of science: interviewees thus found it hard to distinguish between differences that were due to lab or research culture and those that were simply because one was learning to inhabit a new technique, field, or role.

Participants also talked about the ways in which material resources differed from place to place. Leon – an experienced researcher now working in a post-doc position – had spent many years working in Costa Rica, and talked about how the profound disparity in resources for science between there and Denmark resulted in very different practices. In his Costa Rican lab, everything was recycled and re-used, because “it's much cheaper to pay a salary [for someone to wash glassware] than to buy plasticware”, whereas in Denmark “you throw it away”. Many others spoke, appreciatively, about resource levels in Scandinavia, particularly concerning salaries in science. Caspar had spent four years working as a post-doc (on Danish funding and therefore on a Danish salary) in the US with his family; at least part of the reason they had returned was that they simply couldn't afford to live there:

I was offered a position at [a Californian university] which was very prestigious. But the starting salary would've been literally half of what I was making, and we were already spending our savings just to survive. So you know, so we could have stayed, but it would've required a dramatic shift in lifestyle (Caspar, Assistant Professor)

There were similar resource disparities connected to structural differences in national scientific systems, such as whether PhD students and post-docs were categorised as students or as employees (in Scandinavia they are employees, and receive full employment benefits), or in how easy it was considered to be to gain external funding. (In the latter case, this might be understood as participants' folk theories or assessments of the different national funding landscapes that have been described in academic literature; Gläser & Laudel 2016; Geuna & Martin 2003.) Overall, access to resources structured epistemic living spaces not only in abstract terms – such as the kind of science that funding structures promote – but in the deeply material question of how much money one has to live on.

Second, participants made reference to differences in particular *temporal* dimensions of science. One point that almost all interviewees commented on, for example, was the good 'work-life balance' that was present in Danish research compared to non-Scandinavian countries. This was explicitly tied to wider Scandinavian norms: rush hour in Denmark, Leon pointed out, "is from 3:30 to 5.30. In other countries, it's from 6 o'clock or so". Aligned with these norms, Danish science was viewed as subject to a rhythm that was ultimately subservient to that of family, home, or personal life; this was articulated in a daily cycle in which one was in the lab from 8am until 3 or 4pm (and perhaps sent emails later in the evening, after a family dinner). This was contrasted to other contexts in which work days were much longer and where there was an expectation that one's personal life should be secondary to science. In Spain, said Selena:

you're expected to almost kind of want to have a Nobel Prize if you're going to do science, and you're expected to, you know, work without money and you're expected to work weekends and holidays and whatever (Selena, Associate Professor)

These different rhythms, in which personal and family time is either prioritised or rendered unimportant, could be framed in different ways. Though many enjoyed this Danish work-life balance and commented favourably on it – indeed, for some it was presented as a key reason that Denmark was an attractive place to migrate to – it could also be framed as a sign of being lazy or insufficiently committed to science. The key point is therefore not the valuation of these rhythms, but the degree to which working cycles were presented as being different in different contexts. A related contrast emerged around support for parental leave: some contexts (again, particularly in Scandinavia) were represented as allowing time for parenthood, both in terms of extended periods of paid leave and in social approval for prioritising family life, while others negated against it ("I came here" said Iris, who had come to Scandinavia from the US, "and it was just so different and I was a post-doc, and it was like: holy crap everybody's married, what universe is this?").

Many of the temporal shifts in scientific life that interviewees had noticed as they moved between national contexts thus related to the kinds of rhythms were allowed to take precedence, whether that was across a work day or one's career as a whole. But notions of efficiency were also something that was mentioned as being different in different places. 'Efficiency' was about how one used time, but also about how usages of time were differently valued: it concerned whether you were actually working while you were in the lab, or whether you were, like Cecilie's colleagues in her US lab, "just walking around with coffee cups all the time talking to each other". In Cecilie's view this was inefficient; to others such usages of time might be integral to the practice of doing good science.

Third, interviewees suggested that particular *social* aspects of epistemic living spaces differed between contexts. The degree of hierarchy present was key to this. As with work-life balance, Denmark (and Scandinavia more widely) was framed as distinctive in being – generally

speaking – non-hierarchical. Labs in other countries were often presented as ordering relationships in structured and at times unjust ways, such that PIs held a lot of power and “students are just the minions” (Brian, Australian post-doc). In contrast Danish labs were presented as ‘flat’ structures where everyone would make suggestions, interact freely with each other, and see themselves as a valuable part of the group. This also extended beyond the university. Benito, quoted below, is talking about meetings with his industrial collaborators:

...in the meetings you have- even though you are dealing with a boss of [company name] Denmark, your opinion is very important. So the relationships are very horizontal. It’s not like this strong hierarchy you can find in countries such as Germany, or Spain or Portugal. (Benito, post-doc)

The central point is not that particular countries are in fact reliably non-hierarchical (some interviewees suggested that in practice Danish science involved ‘hidden’ hierarchies), but that this axis is one that participants repeatedly pointed to as changing as they had moved from place to place. The same is true for another social aspect, that of the degree of friendliness or sociability within different scientific groups. Again, this could be framed differently: some were critical of labs where social interactions became a distraction (at one lab, said Lidia, lab meetings were frustrating because “we’re sitting an hour and a half or even two hours sometimes and just doing chit-chat”), or where friendships in the lab were important simply because individuals had no time for a life outside of science. But the way in which group members related to one another – whether they saw themselves as friends, how relaxed they were with each other, how much they socialised – was repeatedly presented as something that could shift as one moved from place to place.

In sum, examining spatio-material, temporal, and social dimensions of epistemic living spaces leads us to a set of aspects of life in science that interviewees described as being different in different places: embodied routines of research; resource levels and salaries; daily or longer-term rhythms of scientific life (and their relation to rhythms of home or family); ‘efficiency’ and how work time is used; degree of hierarchy; and the nature of social interactions between colleagues.

Epistemic and symbolic dimensions of epistemic living spaces

In this section I focus on the epistemic and symbolic aspects of epistemic living spaces, and how these dimensions were framed as subject to variation. These dimensions are concerned with ideas about epistemic practice, the nature of ‘good’ research, and valuations and judgements (Felt and Fochler 2012). The kinds of differences described above – in spatio-material, temporal, and social aspects of science – were not generally framed by interviewees as directly affecting the kind of knowledge that they produced. In contrast this second set of differences treats how scientific practice in different sites could involve differing ways of imagining and doing research. In what follows I describe the lines along which such differing imaginations of the research process were articulated.

Epistemic dimensions of epistemic living spaces treat “which kinds of research questions are central, how knowledge should be produced, and which properties and procedures constitute good knowledge” (Felt & Fochler 2012, 136-137). Three key axes of difference emerged from interviewees’ talk about such issues. First, participants spoke about having experienced differences in the purposes of research in different places. A key dichotomy cited here was that between ‘basic’ and ‘applied’ scholarship. Several interviewees, for instance, had spent time not only at universities but at specialised research centres or institutes during their

careers; such organisations were framed as acting as ‘consultancies’ or being reliant on grant income and therefore as being more subject to policy needs than universities. Such funders “might want lots of research”, said Haben (post-doc), “but technically it might not be the research that you wanted”; there were impacts, then, on what one interviewee called the degree of “academic curiosity” that was possible. These dynamics might also be affected by national context. Leon, the researcher who had spent time in Costa Rica, talked about finding the move to Danish research difficult because he had always worked on applied problems. In Costa Rica, “the state is always asking: what are you doing with the money? And then, if it’s too fundamental research, then they will not be really happy”. As with Sabharwal and Varma’s (2017) analysis of Indian and US research, this could have important impacts on how researchers spent their time, with reliance on ‘soft money’ meaning substantial time being spent on proposal writing.

Second, there were different imaginations of the way in which science was and should be a collective process. These differences differ in character from the diverse ways of performing sociability described above, instead relating to how knowledge is best produced. Are projects individual or collective? Does the lab constantly have visitors or is it isolated? How in step should one be with the wider scientific community, as opposed to following your own ideas? In the extract below Mads, an associate professor, is talking about his time at a US lab:

I saw a different side of the science. So he [the group leader] was running the group a little bit like a small family, where everybody depends on each other, we all contribute something. Well, also at the same time more business-like, like, regular meetings and then how far did we get with this during the past week and then what's needed to be done now. So, it was not something that I was quite used to from Copenhagen where everybody was kind of, mind their own business (Mads, associate professor)

The contrast that Mads points to is one concerning the extent to which science – as articulated at the level of the lab – is a collective enterprise. Is it best done through ‘minding your own business’, or through the model of a business or family, where everyone has a specific part to play? These dynamics also emerged in discussions of the independence of one’s scholarship. The degree to which students and post-docs were meant to be scholars in their own right, and allowed space to think for themselves, was often experienced as changing as one moved from lab to lab (“Denmark at least has an appearance that it’s much more up to you to decide”, said Ulrik, speaking about being a junior researcher in the Danish and UK labs he had worked in). Similarly, practices around publication could also look very different in different sites (as has been charted elsewhere; Johann & Mayer 2018). Differing assumptions about whether a helpful conversation should result in an acknowledgement or a co-authorship on a paper could be confusing or frustrating; again, this was linked to the question of what scientific collaboration was expected to look like in a particular place: “that's probably a way of telling you quite subtly that this is how things are done. It's a group effort”, said Susanna, of the decision to put her on a paper that she felt she hadn’t really contributed to.

Third, participants talked about experiencing differences around the ambition or scale of research that a group was engaged in. In some sites the philosophy was something along the lines of: go big or go home, while in others science was viewed as an incremental process where all findings, however unsplashy, were worthy of publication. In the extract below Nadim is talking about the transition he made between two labs, and the different approaches they took:

[In the first lab] even incremental improvements [in a computer model] were considered big. Oh 1% improvement, yay. And 0.7% improvement, yay. And, you know, each one was celebrated [...] But then when I moved to the other lab for my PhD there, these minor improvements were not very interesting for them. They were more into conceptual changes. We want to do something that others have not done. (Nadim, associate professor)

The difference here is one of scale, of making “conceptual changes” rather than small improvements. Others similarly talked about moving into a new context to discover that the style of research was subtly different. Different journals might be prioritised, or ways of publishing. Participants drew a contrast between a “higher drive for bigger impact papers, even if it meant fewer papers” (Georg, post-doc) and publishing more frequently but at a more mundane level. For others the contrast was around ambition. Is the research from a lab seeking to completely change the thinking in a field, introducing new concepts and ideas, or to add to it?

Finally, many of the differing *symbolic* aspects of epistemic living spaces have emerged already, as implicit within interviewees’ talk about other differences. Statements of value, of what is judged better (for the production of science or more generally), and of hierarchies of worth are often present when comparisons are drawn. Such value judgements are particularly key in talk that directly concerns the conditions under which knowledge is best made, as in the epistemic dimensions discussed immediately above. Participants talked about ‘learning from’ other ways of doing research, or about becoming angry or frustrated by what they (now) saw as incorrect practices. “It was just a very different way of thinking about research. It was from the ground up”, said Georg, talking about his experiences at a US lab. As a result, the style of research he had been trained in now seemed “fundamentally flawed”. More broadly, consideration of such symbolic aspects leads us to how science is valued at a global level. Many of the ‘ambitious’ labs that participants had spent time in, where high profile and high impact work was prioritised, had been part of their career trajectories exactly because they were seen as internationally excellent and therefore as important for their CVs and future careers. Not all value judgements are equal, then: while researchers might praise the work-life balance or slower pace of science of some locations for their personal benefits, the very fact that their mobility was targeted towards locations framed as ambitious, hard-working, and highly productive (and that mobility to such locations was often promoted and funded by national research councils) points us to widespread assumptions concerning the nature – and location – of ‘good’ science.

In sum, examining epistemic and symbolic dimensions of epistemic living spaces leads us to a further set of aspects of life in science that interviewees described as being different in different places: the purposes of research; the social and interpersonal organisation of knowledge production; and the scale or ambition of research. Intertwined with these differences, and with those described in the preceding section, are (multiple and at times competing) value judgements concerning which way of doing science is better.

Discussion

Using the five dimensions of epistemic living spaces as a heuristic, the preceding sections have parsed out the aspects of life in science that are described by interviewees as changing as one carries out science in different national contexts. This has been an exploratory analysis, which seeks to examine how the concept of epistemic living spaces might be mobilised in order to systematically explore local variations in scientific practice, as well as how it might give insight into scientists’ experiences of international mobility. I discuss these two aims below.

First, what does this analysis tell us about how the concept of epistemic living spaces might be used as a tool for exploring the ways in which science differs from place to place? Though this study has not attempted to directly compare specific research cultures, but rather to explore the *kinds* of things that scientists frame as changing between such cultures, it has benefited from a framework that encourages sensitivity to diverse aspects of scientific life. Mobilising epistemic living spaces enables attention to spatio-materiality, temporality, sociality, epistemology, and (e)valuation. In this study it has helped to pull out axes of variation from salary levels to authorship norms, from scientific ambition to the friendliness of a research group. In this respect it has brought into analytical view the very different components that make up a life in science, going beyond the mechanics of knowledge production to incorporate its material resourcing and its co-production with ideas of family or home.

At the same time it is important to acknowledge that the way I have mobilised the concept – through attention to its five dimensions – has flattened the ways in which these dimensions are intertwined, and the degree to which epistemic living spaces are always “lived experiential realities” (Felt & Fochler 2012, 136). I want to draw attention to two aspects of this flattening which I view as significant for future research. The first relates to the distinction I have made, in structuring my analysis, between spatio-material, temporal and social dimensions of scientific life, on the one hand, and its epistemic and symbolic aspects, on the other. In practice the distinctions between these categories are not so sharp. Material and spatial conditions rapidly take on symbolic dimensions (this place is better than that); the sociality of friendships affects the norms of collaborative knowledge production; diverse temporalities of research are both value-laden (is one efficient or lazy?) and have quite concrete epistemic implications in terms of how much of the work of knowledge production it is possible to carry out within a particular patterning of time. The inter-connections between the material conditions of science and its epistemic dimensions should thus be a key area for future work. Indeed, this may be one important way that science is, by virtue of different resource levels and priorities, done differently in different sites.

A second reflection concerns the strategic uses of these narratives of difference. Though my analysis has not included charting how specific research cultures are described and compared, it is clear from previous research (Felt and Stöckelová 2009) that such descriptions and comparisons are often mobilised to make a particular point – to, for instance, ‘deny value to research questions’ or “construct ... [an] epistemic object as more or less free of local context” (ibid, 57). I have also observed that, in this material, interviewees mobilised both stories of science’s international and universal nature and of its particular local specificities. It will therefore be important, as the notion of epistemic living spaces is mobilised further as a means of examining local variations in scientific practice, to investigate what scientists have to say about differences between particular sites not only as an indication of different lived experiences of science but as a discursive move in which value is attributed or denied. What are the symbolic functions, in other words, of descriptions of differences between research cultures?

Second, what light has this analysis shed on researchers’ experiences of mobility, and what implications does it have for literature in this area? One thing that we can take from the kinds of differences between research environments that scientists talk about is how profound some of these axes of difference are, and how greatly they will affect the experience of working in science. Science can be a vocation where one is expected to “work without money” (Selena, quoted above) or a job like any other; it can involve days and weeks that are

temporally patterned in completely different ways; and it may mean very different ways of relating to your colleagues (are they your social life or your competitors?). It may operate through a high pace, high ambition logic, or in an incremental 'slow science' mode. One might move from a PhD position where you were considered an independent researcher to a post-doc post in another country where you are viewed as a cog in someone else's research programme. All of these things suggest, in other words, that one's epistemic living space – what it is to live and work in science – may shift quite profoundly as one moves from one context to another. The practice of science may look and feel very different, requiring a period of enculturation; an enculturation that is intertwined with but not confined to the personal challenges of moving to a new country. Existing research in international mobility has noted experiences of isolation or 'homelessness' (Balaban 2018; Liu & Lin 2017; Morley et al 2018). Future research might build on this by exploring how such emotions relate not just to the move to a new cultural context but to a new set of epistemic practices and norms.

Indeed, this analysis also suggests that there is a continuing opportunity for scholarship into international mobility to provide further knowledge about science's local iterations. This study has been exploratory: by using the notion of epistemic living spaces I have scanned the kinds of differences in scientific practice that scientists report. The result has been a set of axes of variation, representing the kinds of things that scientists seem to notice as they move from place to place, from salary levels to how ambitious the research is or what a work day looks like. These points of difference – perhaps particularly those that are explicitly related to epistemic practice – offer a starting point for further investigation of the ways in which epistemic living spaces undergo change as scientists become mobile. Researchers' observations about differences in scale, ambition, or philosophy of research seem particularly significant, and worthy of further study. If mobile scientists are encouraged to travel to sites framed as especially ambitious and productive, what exactly are the epistemic practices that distinguish these sites? And how do these practices travel as researchers move on, either in a return phase or elsewhere again? Exploring such questions offers an opportunity not only to investigate epistemic diversity across contexts, but the ways in which science is valued (and evaluated) at a national and global level.

Conclusion

The question that framed this article was: *what can scientists' experiences of international mobility tell us about the ways in which scientific practice may vary across different sites?* By mobilising the concept of epistemic living spaces to parse out different dimensions of mobile scientists experiences, I have outlined the aspects of life in science that interviewees described as being different in different places. In brief, these things were: embodied routines of research; resource levels and salaries; daily or longer-term rhythms of scientific life (and their relation to rhythms of home or family); 'efficiency' and how work time is used; degree of hierarchy; the nature of social interactions between colleagues; the purposes of research; the social and interpersonal organisation of knowledge production; and the scale or ambition of research. These aspects relate both to epistemic practice and to the material conditions of life in science. All of these axes of variability are intertwined with symbolic aspects, in that they are valued differently: interviewees often expressed preferences for one way of doing science over another, though these preferences were not homogeneous.

In closing I want only to note again the intertwining of epistemic and other kinds of concerns within this list. This further highlights the value of using epistemic living spaces as a framework for the exploration of scientific experience, in that this conceptual tool exactly presents science as something that is dwelt within in mundane as well as esoteric ways. If we

are concerned with the specificities of how science is performed in particular national contexts, then it is important to be as attentive to this mundanity – salaries, friendships, ambitions – as to its expression at the level of policy, funding, or epistemology.

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