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The coloniality of collaboration: sources of epistemic obedience in data-intensive astronomy in Chile

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ABSTRACT

Data collaborations have gained currency over the last decade as a means for data- and skills-poor actors to thrive as a fourth paradigm takes hold in the sciences. Against this backdrop, this article traces the emergence of a collaborative subject position that strives to establish reciprocal and technical-oriented collaborations so as to catch up with the ongoing changes in research. Combining insights from the modernity/coloniality group, political theory and science and technology studies, the article argues that this positionality engenders epistemic obedience by bracketing off critical questions regarding *with whom* and *for whom* knowledge is generated. In particular, a dis-embedding of the data producers, the erosion of local ties, and a data conformism are identified as fresh sources of obedience impinging upon the capacity to conduct research attuned to the needs and visions of the local context. A discursive-material analysis of interviews and field notes stemming from the case of astronomy data in Chile is conducted, examining the vision of local actors aiming to gain proximity to the mega observatories producing vast volumes of data in the Atacama Desert. Given that these observatories are predominantly under the control of organisations from the United States and Europe, the adoption of a collaborative stance is now seen as the best means to ensure skills and technology transfer to local research teams. Delving into the epistemological dimension of data colonialism, this article warns that an increased emphasis on collaboration runs the risk of reproducing planetary hierarchies in times of data-intensive research.

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Introduction

Over the last few years, actors from both the public and private sector have proposed the idea that data collaborations offer means of solving a myriad of issues, from water distribution to epidemiological crises, in both the North and the South (e.g., Verhulst, 2017). In the sciences, the increasing relevance of data sharing has transformed collaboration into a crucial aspect of the 'fourth scientific paradigm' (Hey et al., 2009), which is how US computer scientist Jim Gray refers to the stage of research characterised by the

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employment of methods and technologies focused on the management and analysis of vast amounts of data.

This article puts forward a less romantic take on data collaborations, interrogating how they appear when analysed from the perspective of those who are not at the top of the global data hierarchy. This allows for the constraints that are faced by communities striving to gain access to data and acquire the associated skills to be made visible, especially with regards to the difficulty of conducting scientific research attuned to the needs and visions of the local context. With this aim, this article looks at the perspectives of actors based in Chilean institutions seeking to employ the informational resources of the mega observatories installed in the Atacama Desert, most of which are under the control of scientific organisations based in United States and Europe. Due to its geographical conditions and a series of benefits granted by the Chilean state, official figures estimate that by 2020 this region would concentrate 70% of the world's terrestrial observation infrastructure (CONICYT, 2012, p. 3), transforming it into a peta-scale source of astronomy data. Against this backdrop, the case of astronomy in Chile constitutes a fruitful vantage point for exploring the way local actors involved in data collaborations position themselves and conduct their affairs vis-à-vis the planetary-material imbalances in terms of ownership, access and skills that criss-cross data-intensive research (Couldry & Mejias, 2019, p. 103).

This article converses with three sets of theory – the Latin American modernity/coloniality group, the political theorists Ernesto Laclau and Chantal Mouffe and science and technology studies (STS) – and ties them together through a discursive-material analysis. I situate data collaborations in the context of coloniality, a structure of power enabled by, among other elements, a flawed epistemology that tends to conceal the knowing subject. Here I also draw on Ernesto Laclau and Chantal Mouffe's understanding of subject formation to offer a more textured analysis of the identities of the parties involved in data collaborations. Lastly, the association between collaboration and knowledge production, as drawn by STS, is also discussed. I consider such a robust theoretical framework necessary in order to provide a nuanced and multidimensional analysis of the politics underpinning scientific data partnerships.

One of the observations I make is with regards to an emerging way in which local actors position themselves, which I call the collaborative subject position, that privileges the establishment of egalitarian, reciprocal and technical-oriented partnerships with data rich actors. This subject position constitutes a response to the unequal astronomical assemblage emerging in Chile that has motivated local actors to strive for proximity to the international scientific organisations. My argument is that, despite the agency revealed by local actors, this positionality engenders epistemic obedience by rendering irrelevant questions of *who* and *why* in knowledge generation (Mignolo, 2009). In particular, I examine three sources of such obedience – a dis-embedding of the data producers, the erosion of local ties, and a data conformism – all of which impinge upon the capacity to conduct research attuned to the local needs and visions. These observations reveal that there is a fine line between the way local actors approach collaboration and the adoption of a predominantly obedient stance, a tension that I interpret as a feature of the emerging social order that researchers and activists call data colonialism (Couldry & Mejias, 2019).

The article proceeds as follows. First, it looks at the association between data and collaboration in the sphere of science and technology. After that, it puts forward a theoretical framework based on Latin American decolonial thought and the work of Laclau and Mouffe. Having discussed the data collection and the discursive-material analysis, the article then proceeds to analyse the disruptions produced by data-intensive astronomy in Chile, the emergence of the collaborative subject position, and three sources of epistemic obedience associated with such a subject position. Finally, the conclusion reflects on the relevance of this study for debates on data colonialism and data-intensive research in Chile and Latin America.

Data collaborations in an asymmetrical planetary order

The term collaboration has a long genealogy in the sciences, becoming especially relevant in the twentieth century as a means to depict the cross-national and interdisciplinary type of 'big science' that arose in the West after World War II (Borgman, 2015, p. 3). More recently, collaboration has also gained currency in parallel with the increasing abundance of digital data. In the context of a fourth paradigm in sciences, researchers can collaborate regardless of geographical distances, combine information stemming from different instruments and learn analytical skills that challenge traditional disciplinary boundaries. Astronomy is perhaps one of the best illustrations of this transition since the network of observatories constructed in different regions of the planet constitutes one of the biggest sources of data worldwide (McCray, 2017), with next generation telescopes expected to produce exa-scale[1] streams of information. Attending to the unequal capacity to produce and analyse data, influential actors have argued that data sharing and open access can help solve existing asymmetries (Borgman, 2015, p. 39), not least in the case of astronomy (Peek et al., 2019). However, these frameworks have not been capable of capturing the full complexity encompassed by data collaborations, especially when it comes to accounting for the obstacles faced by data-poor actors and the asymmetrical distribution of benefits between the parties (Abebe et al., 2021).

Rather than inherently collaborative, data has its own built-in assumptions and hierarchies, making it subject to a broad range of power dynamics. As Rob Kitchin argues, data can 'fundamentally change the practices and organisation of research – the questions asked, how they are asked, how they are answered, how the answers are deployed, who is conducting the research and how they operate as researchers' (Kitchin, 2014, p. 24). Furthermore, the role of data cannot be predetermined since factors such as the environment in which it acts and its material-physical properties shape its performance in society (Bates et al., 2016). Because of this indeterminacy, data can act as both 'the glue of collaborations' (Borgman, 2015, p. 3) and the potential source of social, technical and scientific frictions (Edwards et al., 2011). When tied to capitalist logics, data collaborations can strengthen the influence of transnational companies through development programmes in the Global South (Taylor & Broeders, 2015).

In addition, well-established assumptions regarding who can generate knowledge can also shape the power dynamics underpinning data collaborations. As postcolonial STS authors would argue, such partnerships can operate on the basis of the diffusionist paradigm according to which discoveries and technologies are developed in the West and then unproblematically implemented elsewhere, an account that ignores the series of

local translations required to make such discoveries and technologies work elsewhere (Anderson, 2002). This way of thinking persists in Latin America to this day, presenting the region as a mere consumer of 'imported magic' (Medina et al., 2014) and favouring a distribution of scientific labour in which parties from the region tend to adopt a subordinate role (Kreimer, 2006). Similar dynamics have also permeated Chilean academia, where the neoliberal reforms introduced in the 1980s during Augusto Pinochet's dictatorship continue to engender dependency on North American and European research centres after thirty years of democracy (Gibert, 2016, p. 15).

The critical examination of collaboration undertaken by this study takes inspiration from ongoing attempts to unearth the links between data-intensive knowledge production and the social order brought about by European colonialism five centuries ago. For Nick Couldry and Ulises Mejias, the increasing abundance and relevance of data is giving shape to *data colonialism*, an emerging social order marked by the appropriation of the lives of individuals and a rationality which purports that 'there is no other way to imagine the world unfolding and becoming known to us' (2019, p. 203). In the same vein, Paola Ricaurte argues that data colonialism constitutes an 'epistemic order based on data' (2019, p. 353) that is ushering in a 'violent imposition of ways of being, thinking, and feeling' (2019, p. 351). In her view, epistemic disobedience is necessary in order to challenge such a totalising and expansionist epistemology.

The points I make in this article strongly resonate with the discussion on data colonialism, but at the same time they expand the debate by delving further into the epistemological assumptions underlying data-intensive research. The choice of astronomy is particularly helpful in this regard since this discipline is at the forefront of the development of methods that are currently being implemented in a broad range of areas, such as businesses, border control and the welfare state (Ministry of the Economy, 2019, p. 5). From a decolonial lens, the sphere of science and technology is also worthy of analysis in and of itself inasmuch as it has been singled out for decades by Latin American critical thinkers as a crucial site of the reproduction of colonial dynamics (Medina et al., 2014).

Epistemic obedience and scientific integration

The work of the Latin American modernity/coloniality group, also referred to as decolonial theory in this article, proves useful when thinking about the connection between data collaborations and global asymmetries. A central and unifying concept for the members of this group is *coloniality*, which was put forward by the Peruvian sociologist Aníbal Quijano in order to depict the 'power structure' (2007, p. 168) that outlived formal colonialism and extends to this day. The continuity of this heterogeneous structure of power has been made possible by world capitalism, the imposition of racial and gender hierarchies and, in a point that is especially relevant for this article, the internalisation of the idea that a particular rationality – the European model – holds universal validity and is therefore applicable everywhere at any time.

In the wake of Quijano's argument, Argentinian linguist Walter Mignolo (2009) proposed the notion of 'epistemic disobedience' in order to delve into the type of acts required for carrying out epistemological decolonisation. In his view, the epistemology that emerged under modernity tends to conceal the subject generating the knowledge, thereby obscuring the question of '[w]ho and when, why and when is knowledge

generated' (2009, p. 160). This has made it possible for subjects who are part of the European geo-historical context to classify and hierarchise the world from a seemingly detached, disinterested and neutral position. Against this backdrop, Mignolo advocates shifting the attention from the *known* to the *knower* so that the particular histories and visions of the subjects participating in knowledge generation can be critically examined, rejecting the assumption that what is good for a specific group is necessarily good for the rest. Such an act of epistemic disobedience constitutes a necessary step 'to take on civil disobedience (Gandhi, Martin Luther King) to its point of non-return' (2009, p. 173), that is, epistemological decolonisation. For Mignolo, the increasing scientific integration in times of globalisation poses additional challenges since the improvement of material conditions – resources, labs, equipment, data – constitutes a 'growing noise' (2009, p. 168) that can distract actors from questioning 'scientific designs' (2009, p. 167) developed on the basis of a different context. In the vocabulary I employ in this analysis, scientific integration brings about new sources of 'epistemic obedience'.

This article questions the way the form of planetary classification brought about by modernity plays out in data-intensive research by looking at how certain geo-histories – those of developed countries or the Global North – are considered sources of 'universal' knowledge and recipes worth imitating while others – underdeveloped countries or the Global South – are only capable of generating 'local' knowledge (Mignolo, 2009, p. 166). Still, considering that one of the violences encompassed by this classification is the reduction of a rich set of worldviews into a single category, it is important to note that the analysis I carry out in this article might not necessarily speak to other experiences of the Global South.

Incorporating the subjects

Despite its enormous contributions, the Latin American modernity/coloniality programme is yet to provide a solid conceptual scaffolding with which to analyse the construction of subjects involved in knowledge production, a fundamental aspect of grasping the shift advocated by Mignolo from a focus on the known to the knower. For this reason, I have complemented this work with the ideas of the Argentinian and Belgian political philosophers Ernesto Laclau and Chantal Mouffe, for whom the subjects involved in political struggles are not given but rather constructed through the articulation of meanings.

Combining Marxist philosophy and psychoanalysis, Laclau and Mouffe's concept of 'subject positions' points to locations opened up by discourse that allocate subjects within a given structure (2014, p. 101). Subject positions work to structure the way in which people conceive of their role in society and, as a consequence, who should be considered allies or rivals. However, these positions are not automatically imposed since subjects can negotiate which ones they identify with (Carpentier, 2017, p. 27). Thinking in these terms makes it possible to interrogate how the subject positions implicated by coloniality transform over time and materialise in different spheres. In this article, the concept of subject positions is employed to analyse the way members of the Chilean astronomy community position themselves and construct the parties involved in data-intensive astronomy research in Chile.

Some might argue that incorporating Laclau and Mouffe's work and STS into this framework implies compromising the horizon of epistemological decolonisation. An analysis of the coincidences and contradictions between these theoretical frameworks is outside the scope of this article, but it is fair to say that the widespread imposition and adoption of modernity has made 'necessary' (Mignolo, 2007, p. 459) the employment of concepts developed in the West despite their 'partial' (Mignolo, 2007, p. 466) character.

Methods

The analysis carried out in this article is based on fieldwork conducted in the context of my doctoral thesis between December 2019 and May 2020 and draws on interviews held with 26 people based in Chile who work on or are interested in working with astronomy data. They were astronomers (9) and astroinformaticians (5) – informaticians involved in astronomy research – as well as actors from the private (6) and public (6) sectors. Participants were located in Santiago (22), the capital of Chile; La Serena (3), on the Southern outskirts of the desert; and Concepción (1), further south than Santiago. They identified as men (21) and women (5), which reflects the gender imbalances of the discipline in Chile (SOCHIAS, 2019). Before these interviews I introduced myself as a doctoral researcher from the London School of Economics and Political Science. I grew up, studied and worked in Chile but I did not know anyone from the astronomy community before my fieldwork. Given that in this article I discuss some internal conflicts, the names and gender of all participants have been anonymised and changed in order to avoid exacerbating these rivalries. The data collection also comprised a policy report (CONICYT, 2012) and seven conferences and talks that I attended on astronomy infrastructure in Chile.

In the first stage, the empirical data was subject to a thematic analysis, in which words such as 'collaboration' and 'partnership' held qualitative and quantitative significance. Next, I conducted an analysis inspired by Nico Carpentier's discursive-material (2017) framework in order to foreground the entangled and non-hierarchical relation between these two analytical categories. On the one hand, *the discursive* points to the semantic struggles between different actors in their efforts to fix certain constructions of the world (Laclau & Mouffe, 2014, p. 92). On the other hand, *the material* incorporates into the analysis all human and non-human actors (such as data and research instruments) that can 'make a difference' (Latour, 2005, p. 71) in the phenomenon studied. In terms of analysis, the discursive becomes observable in the form of *articulations* through which actors manipulate signs and the material as *assemblages* composed of heterogeneous elements. In the context of this article, Carpentier's approach provides a bridge between Mignolo, Laclau and Mouffe, who focus on meaning, on one hand, and STS, which emphasises agencies whose logics do not necessarily adapt to the rules of signification, on the other.

It is important to note that the empirical observations are the result of a discursive-material analysis but mainly report on the discursive element. One of the reasons for this is because the implementation of data-intensive astronomy in Chile is still underway, which means that many of the practices of local actors have had a speculative character. A second reason is that epistemic obedience certainly responds to material configurations

but nonetheless entails a predominantly discursive shift regarding profound assumptions about knowledge production.

The analysis below consists of three sections. First, I describe the Chilean astronomical assemblage and the arrival of data-intensive astronomy; second, I identify the articulation of a collaborative subject position aimed at overcoming the gaps between local actors and the observatories; finally, I look at three sources of epistemic obedience ushered in by the privilege of collaboration. While the material figures prominently in the first section, in the second and third parts the focus is turned towards the discursive.

The collaborative subject position and its stakes for epistemic obedience

The shifting astronomical assemblage in Chile

Some scientists consider the Atacama Desert to be 'astronomy's paradise' (Silva, 2020, para. 55). As of today, a number of cutting-edge telescopes populate the north of Chile, with a governmental figure estimating that by 2020 the country would concentrate 70% of the world's terrestrial observation infrastructure (CONICYT, 2012, p. 3). This is due to the desert's prime geographical conditions, a number of benefits for international scientific organisation put in place by the Chilean state and the perceived stability of the country. These observatories comprise not only telescopes but also research facilities, data centres and personnel in charge of their operation and maintenance. Such a costly instrumentation contrasts with the setting in which they have been constructed where some poorer villages struggle to access basic resources (Barandiaran, 2015, p. 153) and Lickan Antay Indigenous communities experience difficulty in getting their voices heard in decisions concerning their ancestral lands.

Despite their lack of direct control over the most powerful telescopes installed in the country, local astronomers are guaranteed 10% of the total assignable observation time. This arrangement started to take shape in the 1960s but became the norm for all of the mega observatories in 1997. This measure was meant to compensate for the series of land, tax, diplomatic, environmental and labour benefits for the international scientific organisations that were put in place by the Chilean state (Guridi et al., 2020, p. 7). In addition to this, some observatories also provide funding for local research, which between 2006 and 2011 contributed to around 20% of the average annual budget of the astronomy community (CONICYT, 2012, p. 68). Most interviewees expressed excitement concerning the growth – from 39 academics in 2005 to 163 in 2019 (SOCHIAS, 2019) – as well as the increasing prestige and internationalisation of astronomy research being done in Chile. Conversely, more contested is the discussion regarding the capacity of Chile to take advantage of this opportunity for industrial development (Barandiaran, 2015; Guridi et al., 2020).

In recent years, local actors have raised the alarm about the arrival of data-intensive observatories since they consider that the existing skills and equipment might not be up to the task. Initiatives such as the Chilean Virtual Observatory (ChiVO) and the Automatic Learning for the Rapid Classification of Events (ALeRCE)[2] have focused on building capabilities and infrastructure, but even members of these groups consider that there is still much more to do in this area. The ultimate challenge would be to be able to take advantage of the 16.5 Petabytes predicted to be produced per year in the country by 2021 (Ministry of the Economy, 2019, p. 3).

Besides efforts by researchers themselves, thriving in the context of data-intensive astronomy would also require revisiting broader existing protocols and arrangements between local actors and international organisations. Most observatories publish the data in their archives after a one- or two-year proprietary period (Borgman, 2015, p. 100), but they do not consider solutions for large-scale transfers to local initiatives. Furthermore, the construction of *survey* telescopes is expected to render obsolete the 10% of observation time allocated to local astronomers. The best example of this is the US-funded Vera C. Rubin Observatory Legacy Survey of Space and Time (hereafter LSST), which is currently under construction and will not operate on the basis of proposals put forward by astronomers but rather by capturing pre-programmed portions of the sky that will generate a stream of 10 million alerts per night that scientific teams based in the United States, Chile and other regions will access in almost real time (Gnida, 2019). An astronomer explained to me the new scenario opened up by survey telescopes: 'You don't have that exclusive access anymore. You'll have to compete as equals'.

As these examples illustrate, the arrival of data-intensive astronomy is changing some of the foundations that have allowed the local astronomy community to thrive over the past decades. This shift is engendering a *dislocation*, namely an unexpected 'material change' (Carpentier, 2017, p. 36) that disrupts discourse, demanding a new frame for making sense of social reality. As I show in the next section, the arrival of data-intensive astronomy has produced a dislocation in the way local actors position themselves and seek to conduct their relations with the observatories, with their previous attitude considered no longer apt for the upcoming challenges.

From collectors to collaborators

The arrival of data-intensive astronomy has prompted local actors to rethink their position in the global astronomy community. A shared agreement in this regard is that the attitude that has reigned so far will not suffice for the new context. In the words of an astroinformatician:

> We have 10% of the observation time … It is very comfortable. It is very good for astronomers who are from here, but we are not contributing anything besides 'get installed and give me the 10%'.

The above remarks suggest that the security provided by the 10% rule has made it possible for researchers to effortlessly take advantage of agreements achieved at the political level. For example, unlike colleagues from other countries, the Chilean astronomy community has not needed to go through the difficult processes of consensus-building and public advocacy that are required to ensure the construction and sustainment of costly instrumentation.

In contrast to this attitude, actors based in local institutions are articulating a new approach in which notions of collaboration and partnership acquire a crucial role. Alejandro Aguirre's words are illustrative in this regard. He and his team are seeking to work with the LSST, whose construction works are taking place less than one hundred kilometres away from Aguirre's university in La Serena city.

> If you approach [the observatories] as an educational entity with first-level scientific collaboration teams, the communication is much better. It is one of peers. The

> observatories only did outreach here for a long time. And now that we have a doctoral programme and an astronomy group … now we are partners. We can offer them an alternative route for their networks … and that is not gringo[3] or anything. So when you establish a relationship in terms of 'I give to you and you give to me', their attitude is quite good.

The above remarks advocate for the adoption of a more proactive attitude towards the observatories so as to ensure the establishment of projects in which both parties would benefit. The employment of terms such as 'peers' and 'partners' indicates the intention to approach the observatories from a more egalitarian position, an aspiration that Aguirre's team can strive for only after having achieved the level of scientific research and technological infrastructure required to ensure some degree of reciprocity. In this regard, Aguirre points out that the infrastructure they are offering is not 'gringo or anything', a fact that needs to be highlighted precisely because it is not the norm for local university infrastructure to be used by an international observatory. Importantly, these relationships ought to be channelled within the boundaries of sciences and technical infrastructure, and not other areas of the observatories such as outreach. Thus, whereas for Bruno Latour the production of data constitutes an 'achievement' (Latour, 2005, p. 137), Aguirre's words suggest that for some actors the achievement is the establishment of non-hierarchical, reciprocal and technical-oriented relationships with those producing the data. In Aguirre's view, these collaborative ties ought to be pursued in order to allow his team to thrive in the context of data-intensive astronomy.

Other interviewees expressed similar thoughts, such as policy maker Fernanda Cid:

> It was necessary to abandon the logic of passing the hat around as a poor country and start telling [the observatories]: 'Hey, we want to have a protagonist role, pass us the data. We will be able to take care of your data' … So far, Chile has approached the observatories as a small country asking them for money, and that approach has resulted in a situation where they do not consider you as a potential collaborator.

As with Aguirre's assertion, Cid is advocating for an approach in which local actors are seen as proper collaborators. For her, ensuring mutually beneficial exchanges would allow the Chilean astronomy community to move on from a subject position of a 'poor' and 'small' country, instead, becoming a 'collaborator' with the observatories.

In terms of discourse, the above remarks open up two *subject positions* available to local actors. One of them, the subject position of the *collector*, mainly relies on already existing arrangements. A second one, the *collaborative* subject position, proactively strives to engage in horizontal and technical-oriented partnerships with the observatories. While the former emerged as a response to the 10% rule, the latter is seen as necessary in order to thrive under data-intensive astronomy. This shift draws on local actors' desire to upgrade their status in relation to their colleagues from the Global North, constituting a discursive response to the material conditions faced by the Chilean astronomy community.

Certainly, the rationale underlying the collaborative subject position has a pragmatic dimension in as much as it constitutes a strategy to ensure access to the data, expertise and equipment of the observatories. Conversely, this articulation also has a structural implication that reproduces the hierarchies brought about by coloniality. This is particularly evident in the way a member of the private sector depicted a case of successful

collaboration with an international observatory: 'It was [a work] between equals, not … of "ok, children, go play in the sand pit, but we will manage the actual data here"'. The reference to childhood is reminiscent of Immanuel Kant's conception of the European Enlightenment as a step that would allow mankind to become adult beings, an assertion that automatically transformed subjects in the rest of the world into beings less capable of generating proper knowledge (Mignolo, 2009, p. 169). As the quote above suggests, engaging in collaborations constitutes a form of 'coming of age' for the astronomy community, one that is authorised by the international observatories.

Despite its pragmatic advantages, from a broader perspective the collaborative subject position speaks to the hierarchies encompassed by coloniality. As I argue next, particularly concerning are the sources of epistemic obedience emerging from this articulation.

Fresh sources of epistemic obedience

Having delineated the way local actors are seeking to position themselves in the context of data-intensive research, I now proceed to analyse the extent to which this positionality is capable of generating research attuned to the needs and visions of the local context. Below I do so by identifying three sources of epistemic obedience accompanying the articulation of the collaborative subject position.

Dis-embedding the data producers

The first source of epistemic obedience is present in the way the collaborative subject position constructs the actors producing the data – as following logical and transparent criteria rather than responding to particular visions and interests. This is especially evident when observing the effort made by local actors in demonstrating that they will be capable of increasing the productivity of the observatories, namely, to generate more discoveries with the existing data, as though this would be the only criterion employed by the latter to engage in data partnerships.

The promise of increased productivity is evident in the way policy maker Néstor Fernández explained to me their strategy for becoming a partner of the observatories:

> The idea is to become their partners and, in that exchange of data, to work in a way that can be useful for them too. So, what we have discussed, for example … [is that] one of the ways in which the observatories assess their results, I mean, whether they are doing their job, is by looking at the number of times their data gets cited. So, we told them: 'Perfect. If we get people from other sciences working with your data, they will cite you more and therefore you will increase your KPI'.

In the above quote Fernández is explicitly arguing that partnering with local actors would help the observatory increase its productivity. Implicitly, however, it is also communicating the willingness of local actors to adapt to the needs of the observatories. The fact that Fernández draws on the term KPI, which in business management stands for key performance indicator, illustrates an attempt to master the terminology that, he thinks, governs the decisions of the observatories. This pragmatic choice might allow local actors to achieve some immediate goals, but also reflects an asymmetry in which one party (the locals) adapts to the logic of the other party (the observatories).

Fernández's view echoes that of Felipe Bravo, who grew up in Chile, works for an international observatory and has been involved in different partnerships with local universities. He explained to me his vision about the observatories:

> In the end, this is a factory … There is a demand, a chain of production, a final product, a distribution and, finally, a use. Our product as an observatory is a record of a scientific phenomenon … That product is used by a market, and the market is a scientific community that wants to employ this product.

For Bravo, understanding that the observatories follow operational logics is a necessary step to envisioning and ensuring collaborations with them. Again, the rationale of the observatories is explained by resorting to business terminology such as 'demand', 'chain of production' and 'market'. The reliance of Fernández and Bravo on business management jargon reflects a profound change that took place in the 1990s, when astronomy communities and funding agencies from the United States and Europe put a great emphasis on the optimisation of observation time. The focus on productivity and the introduction of vocabulary and metrics from business management, such as KPI, became strategic for this purpose, giving rise to a vision of the observatories as 'data factories' (McCray, 2004, p. 274). In light of the remarks by Fernández and Bravo, approaching the observatories as data factories and focusing discussions over potential alliances in relation to productivity can yield better results in times of data-intensive research.

Even if unintentionally, the move advocated by Fernández, and Bravo engenders a fresh source of epistemic since one of the implications of their view of the observatories is that they are not regarded as scientific organisations with a particular research agenda anymore but rather as data factories whose decisions respond to the transparent and detached criterion of productivity and the rules of supply and demand. In so doing, the observatories are dis-embedded from any social, historical, political and even scientific context, rendering pointless any interrogation of the motives or rationales behind their decisions. Instead of striving for a horizontal dialogue in which the actors involved would be open about their needs and visions, local actors are invited to internalise the vocabulary of the observatories and to demonstrate the capacity to improve the performance of their potential partners. Approaching the observatories from a different, non-productivity-oriented stance would be read as a failure, as a step back from the collaborative subject position to the comfortable attitude of the collector.

The erosion of local ties

The second source of epistemic obedience emerges when contrasting the effort made by local actors in speaking the language of the observatories with the miscomprehension and criticism reigning in the relations with their local colleagues. Whereas I almost did not hear complaints about the behaviour of the observatories, local actors felt free to express to me their disagreement with the aims, style and impact of initiatives based in Chile focused on the management or the processing of astronomy data. For example, this is how an astronomer referred to a local initiative: 'It is like creating a bureaucracy around something that is unnecessary … It is useless … They set up an artificial idea of something that was not necessary'. Instead of trying to understand their logic and adapt to it, or of even showing some degree of empathy in light of the shared constraints, astronomers and astroinformaticians felt compelled to criticise the

projects of their local colleagues. As an interviewee observed, there is an 'atomisation' in the local community intensifying the already existing competition in Chilean academia due to a territorial approach to the collaboration with the observatories in which 'it is one [local] institution with an observatory, another institution with another observatory'. In the case of the Chilean astronomy community, thus, the sign 'collaboration' acts as a template for data-intensive research that works vertically – when approaching the data producers – but not horizontally – when approaching other local initiatives.

It would be unfair to claim that the concern over the cultivation of local ties is entirely absent in the Chilean astronomy community. In 2012, a governmental report suggested a national survey to define the priorities of the local community as an 'initial significant step' (CONICYT, 2012, p. 10). Despite this, during a workshop hosted by the LSST in La Serena in 2019, eight years after the report was issued, I witnessed the sense of frustration shared by local astronomers in terms of their inability to carry out this study. Members of the community agreed on a budget and a methodology but did not manage to convince the government or the observatories to provide financial resources for conducting a national survey. As an astronomer expressed at the conference, so far, they have not been able to come up with 'a bigger picture of what we want as a community'. The lack of instances of coordination and dialogue thus makes it difficult to envision a way out of the atomisation of the local community.

In the vocabulary of Mignolo, questions about the knower are almost absent when it comes to the observatories but abound in relation to local colleagues. Moreover, the horizontal hostility and lack of formal instances in which astronomers and astroinformaticians from different initiatives and universities could meet and discuss make it difficult to undertake a collective critical examination of the extent to which the origins and priorities of data-intensive astronomy can speak to the local context. Due to this, epistemic obedience in times of data-intensive research gets reinforced as the collaborative subject position strives for collaborating with international partners without having undertaken a prior critical collective reflexivity.

Data conformism

Finally, a third source of epistemic obedience responds to the conformism that has risen in the astronomy community over the past years as actors have opted for concentrating their efforts on the reuse of the already existing datasets rather than on figuring out ways of generating new ones. During my fieldwork, astronomer Jaime Basualto was the only interviewee who brought up this dimension as problematic. In his words:

> The country could make very important contributions in certain areas of astronomical knowledge if it is capable of building specialised instruments … Otherwise, one can only do the science afforded by the instruments that are designed by the owners of the observatories or the consortia. And that is limiting.

Basualto refers to what he considers to be a loss when it comes to working with already existing instruments. For him, it does matter who has the capacity to design the instruments that produce the data in the first place since this choice limits the possibility of local actors to conduct a type of science not envisioned by the data producers.

The dilemma between investing in instrumentation or existing data – or between hardware and software, as some participants put it – has been a recurrent concern in

some circles in Chile over the past decade. Looking at the evolution of the conversation, the prominence gained by astronomy data has come at the expense of instrumentation and coincided with a reduction of awareness over potential power dynamics in the field of astronomy research. For example, the report by Mónica Rubio and her team that I cited earlier proposed 'to deliver a Chilean led instrument' (CONICYT, 2012, p. 11), a suggestion that was accompanied by an important warning: 'We propose that this initiative not be a mere lateral or *subordinate* collaboration with the international observatories' (CONICYT, 2012, p. 11; emphasis added). As the incorporation of the adjective *subordinate* suggests, the advocacy for instrumentation tends to incorporate a concern over asymmetries that can take place within such partnerships. Such a concern has receded to the background as data has gained currency in the debate as a potential tool for economic development, overshadowing concerns pertaining more directly to astronomy research such as the capacity to formulate different research questions.

A form of epistemic obedience emerges in data-intensive research as actors give up the possibility of pursuing research questions and employing methodologies not contemplated in the built-in hierarchies of the existing data. In particular, the focus on ensuring collaborations with the data producers also implies an abandonment of efforts to imagine and generate data that could better respond to the needs and visions of the local context. Particularly relevant in this regard has been the incorporation of concerns pertaining to the economy, where data collaborations tend to be celebrated as a means for development at the expense of concerns regarding subordination in research.

Conclusion

In this article I have drawn on the case of astronomy data in Chile to examine fresh sources of epistemic obedience emerging in relation to data-intensive research. This analysis identified the articulation of a collaborative subject position by actors from Chilean astronomy striving to establish egalitarian, reciprocal and technical-oriented relations with data-rich observatories. Despite the agency revealed by local actors in envisioning a new positioning capable of responding to the shifts taking place in the discipline, this subject position's tendency to dis-embed the data producers from the social context, erode local ties and usher in data conformism impinges upon the possibility of undertaking the type of critical reflection required to conduct research attuned to local needs and visions. As this case shows, there is a fine line between privileging a collaborative approach and adopting an obedient stance in times of the fourth scientific paradigm.

In relation to the Chilean astronomy community, the lack of internal debate concerning the arrival of data-intensive astronomy resembles Jorge Gibert's (2016) observation that, despite some progress in international rankings, the Chilean scientific community has not been able to define the role of the sciences in society. With respect to Latin America, the blind spots of the collaborative subject position are reminiscent of Quijano's observation that the region tends to look at reality from a 'partial and distorted' (Quijano, 2000, p. 556) mirror that reflects back only similarities and not differences with Europe, a problem that has not allowed Latin America to 'identify our true problems, much less resolve them' (Quijano, 2000, p. 556). The absence of questions over the correspondence between the missions of the parties involved in data collaborations can be interpreted as

an effect of the distorted reflection of this mirror in a way that is keeping local actors from taking into account views that are potentially divergent from those of the observatories.

In theoretical terms, the sources of epistemic obedience described in this article illuminate a crucial dimension of data colonialism pertaining directly to the assumptions and practices underpinning data-intensive knowledge production. Furthermore, it shows the heterogeneous character of coloniality – which in this case encompasses subject positions, scientific methods, digital infrastructure, data and financial resources – as well as its capacity to adapt to allegedly novel developments such as data-intensive research.

Finally, this article is also helpful in flagging a vital aspect of the implementation of data-intensive research globally by pointing out that datafication might be acting as a rationality that some communities are rushing to adopt without asking fundamental questions regarding *with whom* and *for whom*. Following Mignolo, these questions are critical to understand the extent to which scientific designs can speak to the needs and visions of the local context. Certainly, this problem is related to material asymmetries, but the collaborative subject position articulated by Chilean astronomy also demonstrates that 'the coloniality of power' (Quijano, 2007, p. 171) reproduces itself not only in the form of unequal access and ownership but also through the adoption of epistemologies that do not make enough room for reflexivity and critical distance.

Notes

1. One Exabyte equals to approximately 1,000 Petabytes, which in turn equals to approximately 1,000,000 Gigabytes.
2. The acronyms of ALeRCE and ChiVO make reference to Chilean flora and fauna. While a 'chivo' is a type of goat, an alerce is a tree similar to the cypress. It is not rare to find such references to national symbols in the acronyms of scientific teams.
3. Gringo is used in Latin America to refer to people from the United States and in some cases from the Global North in general. It is used in informal contexts and not necessarily in a pejorative way.

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