

Unpacking a citizen self-tracking device: Smartness and idiocy in the accumulation of cycling mobility data

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Abstract

Based on the Smart Cities imaginary, the bottom-up project Stgo2020 created a self-tracking device known as Rastreador Urbano de Bicicletas (or Urban Bicycle Tracker) to record the daily trips of cyclists in Santiago de Chile and use the data gathered to help government officials make better and data-driven decisions on cycling infrastructure planning. In this article, we examine the iterative design of this technology as well as its introduction into the everyday practices of cyclists. We argue that efforts to quantify the ordinary experience of cycling were overwhelmed and interrupted by an ecology of breakdowns, everyday contingencies, forgetfulness, and re-interpretations in the assemblage of devices, data, humans, and bicycles. These breakdowns generated incoherent or absurd bits of information that we call them as “idiotic data” based on recent conceptualizations of the character of the idiot. Significant displacements were provoked by these idiotic data, forcing the engineer behind the device to control and purify the sample by design and algorithms, waning the civic nature of the project at the same time. The case shows how new ways of knowing the urban space by smart devices should be not separated from the emergence of idiotic data, putting into question the versions of citizen participation and smartness at stakes.

Keywords

Self-tracking, Smart Cities, data-driven governance, data assemblages, breakdowns, idiotic data

Introduction

In recent years, the development of material conditions for sustainable and smarter mobility has become one of the central goals of cities around the world. In particular, the adoption of sensors and digital applications for bicycle use is now considered one of the most robust strategies for operationalizing a Smart City. Santiago de Chile did not want to miss out on

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this global trend. However, the desire to advance toward a bicycle-friendly city has come up against a series of difficulties. No single government agency has the authority to design an integrated bike lane plan. Instead, decisions about bike lane locations are made by each municipality, often based on the availability of land and partial studies with limited citizen participation. As a result, most cycling infrastructure falls short of basic requirements and standards, which means that cyclists do not use them and more polluting forms of transportation continue to be preferred. For this reason, it has become very important for government officials to obtain representative and real-time data on cyclists' mobility in order to improve cycling infrastructure planning.

In response to this need, in 2014, an engineering student named Sebastián started a bottom-up project as part of his thesis called "Stgo2020." Strongly inspired by Smart Cities projects, the premise of Stgo2020 is that the cyclists themselves, who confront problems on the street every day, are the most knowledgeable sources when it comes to cycling infrastructure needs. Therefore, a smarter city should integrate the cyclists' knowledge and practices into urban planning. To achieve this goal, Sebastián designed and developed a small self-tracking device named RUBI (Rastreador Urbano de Bicicletas or Urban Bicycle Tracker) which collects data from the daily trips of a cyclist. More than 100 cyclists voluntarily participated in the project, making possible to map out the "real" or "objective" cycling mobility of the city of Santiago on a new scale. The aim of the project was to use the data and heat maps of the city to help government officials make better and "data-driven" decisions on urban planning of Santiago. However, the project was scaled beyond the scope of the thesis project once it was noticed by transport experts, public officials and other authorities throughout Latin America. The creator of RUBI has engaged in important partnerships with public institutions, consulting firms, and research centres in urban planning,¹ applying RUBI technology to map and evaluate cyclists' needs in other cities of the region. This device adds an interesting new citizen-driven layer to the ordinary practice of riding a bicycle, turning cyclists into sensors and "co-designers of their own city," to use Sebastián's words.

The datafication of urban space through the use of mobile and tracking devices like RUBI have become increasingly common in many Smart Cities experiments (Gabrys, 2014, 2016; Taylor, 2015). As Marvin et al. (2016: 2) have suggested: "A new language of "smartness" is reshaping debates about contemporary cities." Despite this, only a few studies have explored the social implications of this "smartness" and the embedding of sensor technologies into everyday practices like urban cycling (Barratt, 2017; Sumartojo et al., 2016; Taylor, 2016). There is therefore a need to understand the expectations and agencies that produce and materialize these experiments applied to cycling. This is even more necessary when the case analysed shows us some of the expectations and dynamics regarding how Smart City projects are constructed in Chile, which are usually enacted as "emerging innovations," urban laboratories, pilot projects, prototypes, and test-bed initiatives (Halpern et al., 2013).

Starting from an approach based on Science and Technology Studies, in this article, we explore the assemblage that emerged through RUBI, describing the processes of the device design and its incorporation into the everyday lives of cyclists in Santiago. We followed the case of Stgo2020 for seven months – from December 2015 to June 2016 – conducting repeated in-depth interviews with Sebastián including a visit to his workshop. In addition, we conducted observations and interviews with volunteer cyclists and RUBI users to explore their expectations and experiences with the device in their daily travels. Finally, we also reviewed various secondary materials associated with the history of RUBI (the thesis project, promotional videos, websites, and newspapers, among others).

We will show how a data-driven approach started to enmesh and collide with the original civic nature of the project. In order to obtain scientifically accurate data for government officials, Sebastián sought to ensure that the project had the most reliable and representative sample as possible of the cyclists of Santiago. But, at the same time, this goal was constantly affected by unexpected contingencies, breakdowns, and re-interpretations, resulting in discontinuities in the intended use of the device and the cyclists' daily experiences with it. These social and material breakdowns which emerged in the blending of sensors, bicycles, and cyclists generated a unique type of incoherent or absurd data that disturb the initial programme of objectively quantifying the cyclists' movements.

Based on recent redefinitions of the conceptual character of the idiot (Deleuze and Guattari, 1994; Fariás and Blok, 2016; Gabrys, 2016; Stengers, 2005), we suggest the concept of *idiotic data* to analyse these breakdowns. These data are not just errors – they are indicative of the presence of something more that does not make sense, aspects that are not being taken into account in how is presented the situation, transforming incomprehensible bits of information into generative and inventive events. Rather than giving us evidence or solutions, these idiotic data help us to not precipitate into the definition of what we consider to be self-evident or objective (Stengers, 2005). Through the consideration of idiotic data, we want to problematize the limits of “smartness” and “citizenship” notions underlying this data-driven and Smart Cities projects.

We will argue that the emergence of idiotic data provoked significant displacements strong interrelated in relation to the original data-driven and citizen agenda of the project. The first one occurs when the efforts to quantify the corporeal and urban experience of riding a bicycle are confronted by a number of breakdowns, eventualities, and recalcitrant agencies. Cyclists, digital devices, and urban spaces come together and complicate their categorization as fixed entities, hindering the production of “pure” data that is “free” of external agencies from human and non-human entities. The emerging idiotic data and related breakdowns, in this sense, forced the creator of RUBI to *slow down* and take action. The second displacement happens precisely when the engineer, instead of being open to the inventiveness facet of idiotic data, decides to eradicate them by gradually increasing the “smartness” of the device. As we will examine, the RUBI underwent important changes including additional sensors, algorithms, and automated functions that involved moving from a human user-oriented design to a non-human user, the bicycle. But this movement would generate new uncertainties and digital noises in the process, showing us a dialogue or correspondence between the idiot and the smart. However, as we discuss in the conclusions, the increasing technological smartness on RUBI device provoked a third displacement, related to the civic nature of Stgo2020 project. The active citizenship promoted by the project gradually decreased with the intensification of a technical automatization of the device. The activity of gathering citizen data becomes something unnoticeable and of low effort for RUBI users, re-framing what counts as citizen participation.

Thus, we want to contribute to the Self-Tracking and Smart Cities literature by analysing how sensor technologies are being made in and by urban life in the South and the problems that emerge when the city, citizens, bicycles, and everyday practices are sensed and translated into bits of information. In this way, this paper adds to the ongoing debate over the implications of new modes of knowing, planning, and governing the city through smart and participatory technologies (Gabrys, 2014, 2016; Kitchin, 2014; Klauser et al., 2014; Luque-Ayala and Marvin, 2016; Taylor, 2015). We want to broaden this debate by reflecting on how the emergence of idiotic data manifests the need to seriously consider the recalcitrant agencies at stake and complicates the specific modes of smartness

commonly invoked in data-driven projects. In other words, the case allows one to slow down and critically examine the assumptions of a Smart Urbanism, problematizing their repeatedly negation of idiotic manifestations, and asking what other forms of smartness and citizen involvement are annulled under its technocratic logic.

Datafication of urban everyday life

The sensorification and datafication of the urban environment by mobile and ubiquitous computing technologies are phenomena that have become part of our societies. It is estimated that by 2020 there will be as many as 50 billion connected objects (Vans, 2011), with all kinds of infrastructure and devices quantifying urban life, generating large amounts of data popularly known as Big Data. According to Klauser and Albrechtslund (2014), this trend can be found on two levels.

On a macro level, digital technologies have been deployed in urban systems or infrastructure as part of what is called “Smart Urbanism.” The exponential growth of urban areas and resulting negative externalities (pollution, congestion, insecurity, segregation, etc.) have positioned the project of Smart Cities as a salvific programme (Kitchin, 2014; Marvin et al., 2016). The promise of Smart Urbanism is that information and communication technologies will solve some of the key problems of contemporary cities, making more data-driven decisions in areas like urban planning and city governance. A more efficient, responsive, and fluid coordination of city resources, operations, and services would be possible through the embedding of sensory devices in urban infrastructure and the mining and processing of data collected in real-time through multiple urban events such as urban mobility, pollution levels or even bureaucratic processes (Batty, 2012, 2013; Campbell, 2012; Goldsmith and Crawford, 2014; Nam and Pardo, 2011).

Under the same principle of using sensors to quantify and generate large volumes of information, Klauser and Albrechtslund (2014) situate self-tracking technologies at a micro level. These include apps, platforms, websites, and wearables that use a series of miniaturized sensors to monitor a variety of body movements and daily activities. There are diverse types and functionalities ranging from measurement of sleep phases to heart rates, blood pressure, glucose levels, running distance, calories burned, and ovulation cycles, among others. Through these self-tracking technologies, all of these everyday activities are transformed into data which can then be analysed and reinterpreted for numerous purposes, some of which are even unknown to the user (Lupton, 2016c; Neff and Nafus, 2016).

In this context, the ordinary practice of riding a bicycle has been increasingly measured and quantified by a variety of self-tracking technologies. Because of its benefits for health (reduction of obesity-related illnesses), the environment (reduction of CO₂ and noise pollution), and urban planning (decreased congestion and lower road maintenance costs), cycling mobility has acquired greater political prominence in discourses about cities and sustainable development (Furness, 2007; Rosen et al., 2007), constituting a “green” alternative that is highly functional for a Smart Urbanism. There are currently no Smart City projects that do not include technological solutions oriented towards bicycle use, whether for quantifying travel, improving performance, gamifying, rewarding good habits, etc.

The case of RUBI is particularly interesting in this respect because it shows that these apparently two levels are highly imbricated in practice. The aggregation of data generated by self-tracking devices about mundane practices like urban cycling allows for new ways of visualizing and knowing the urban space, creating relationships and operations that escape

micro–macro dichotomies. Therefore, the case analysed is not a micro illustration of a bigger paradigm of Smart Cities, instead it manifests specific modes in which the discourses and expectations of Smart Urbanism are unfolded in the urban space by everyday practices and experimentations.

Self-tracking discourses and practices

In the sections that follow, we will explore two positions that in our judgment tend to generalize and overestimate certain experiences of self-tracking technologies (for a more in-depth overview of this “polarized debate,” see Sharon, 2017). We then develop an approach that emphasizes the breakdowns and flaws that emerge in the embedding of these technologies in everyday practices.

Self-tracking technologies have been heavily promoted by the Quantified Self movement, which comprises technology enthusiasts, entrepreneurs, and programmers under the *leit motif* of “self-knowledge through numbers.” This movement defends self-tracking practices as a form of reflective measurement that results in more efficient bodies and healthier lifestyles (Wolf, 2009, 2010). Individuals become constant data producers as well as objects of self-intervention to the extent that people change their habits and routines based on the data obtained (Licoppe, 2014; Lupton, 2016a, 2016c). In this sense, self-trackers would privilege data-driven knowledge of themselves over other kinds of knowing (Neff and Nafus, 2016: 186). With these data, it is argued that bodies would no longer be a domain reserved for doctors and laboratory science, allowing for greater autonomy of patients by monitoring their health status for themselves (Pantzar and Ruckenstein, 2015; Swan, 2013).

Similarly, Smart Urbanism promoters take a positive view of these self-tracking technologies as new mechanisms for the empowerment of citizen in planning and building their cities. If it is difficult to physically engage large numbers of people in public meetings through traditional methods, several authors have suggested that the use of smartphones, web-based platforms, or civic apps with crowdsourcing models could allow citizens to take a more active role in decision-making processes, producing relevant volunteered geographic information and data-based arguments about their needs and demands for urban planners and public officials. This would help to overcome traditional information asymmetries and establish more horizontal relationships between authorities and citizens (Brabham, 2009; Burke et al, 2006; Ertiö, 2015; Evans-Cowley, 2010; Goldsmith and Crawford, 2014; Kamel Boulos et al., 2011). Participatory sensing technologies also have been considered as a key source of support for a new “incarnation” of “citizen science” projects, collecting and processing more accurate data from the affected and non-experts (Haklay, 2012; Heyen, 2016). Thus, citizens could become voluntary observers and “sensors” of their own cities (Goodchild, 2007; Kamel Boulos et al., 2011; Kitchin, 2014).

However, self-tracking technologies also have been harshly criticized as an invasive form of “participatory surveillance” (Klauser and Albrechtslund, 2014) where people voluntarily provide assistance to surveillance systems (Lupton, 2016c; Whitson, 2013). From a perspective of Foucauldian biopolitics, these devices would enable new spatial modes of governance of lives by sensors and programming environments (Gabrys, 2014, 2016), where the limits of what is healthy, positive, optimal, or normal would be given by metrics and algorithms. These technologies would enable a more flexible and contextual mode of “government through code” (Klauser et al., 2014). Furthermore, based on the works of Foucault (1988) on technologies of the self, self-tracking devices could be considered a continued radicalization of the Greek principle “know thyself,” a technique of verbalization and disclosure of the self in order to more profoundly expose and subject

individuals. These technologies would present normativities based on a neo-liberal, autonomous, and entrepreneurial subject who must continuously self-examine and exercise maximum control over the body. The sick or deviant individual would be one who does not practice constant self-control or lacks the self-knowledge offered by these sensor devices (Granjon et al., 2012; Lupton, 2016b, 2016c; Sadin, 2015). Thus, the individual becomes *responsible* for monitoring and delivering their data to achieve better health, surpass his or her goals, and even be a “good citizen” (Crawford et al., 2014; Fox, 2017; Gabrys, 2014).

From a more political-economic critique, self-tracking technologies have been viewed also as silent and invisible regimes of exploitation. Replicating a sharing economy discourse, the companies behind these technologies maintain a commercial activity or monetize the data generated by users, who are often unaware of this (Barta and Neff, 2015), converting data about the body and self into a type of “lively” capital (Lupton, 2016b, 2016c). In this sense, recreational activities or physical exercises become profitable practices for these companies by using user data for product marketing, even coming to persuade and distort the reasons for performing such physical activities in some cases (Till, 2014, Whitson, 2013). For example, Paul Barratt (2017) examine how cyclists became more competitive and risky in their commute to earn badges and achieve top positions in virtual scoreboards in the self-tracking app STRAVA.

This discussion suggests a vivid academic interest in self-tracking practices. However, certain “effects” of these self-tracking devices – whether positive or negative – have been overestimated and sometimes lacks of empirical support (Sharon, 2017). Furthermore, the analysis has concentrated on early adopters or technology enthusiasts like the QS movement. Here, we seek to move beyond the duality of techno-optimists and techno-pessimists, recognizing the material practices and re-negotiations enacted by each self-tracking technology in different spaces. One of the pending tasks is to open the “black box” of these devices and explore the design processes as well in how they are domesticated, re-signified, and embedded into daily life in complex ways (Lupton, 2016c). These devices have diversified substantially and are being deployed in very different social domains, so it is not possible to refer to a single form of doing self-tracking. Authors such as Fox (2017) and Deborah, Lupton (2016b) have presented different typologies that manifest the variety of discourses and assemblages that materialize in different contexts with these technologies. In effect, self-tracking practices range from modes of exploitation and neo-liberal individualism to practices with a more citizen or activist significance.

The case of RUBI can be included in the latter group, as far as the gathering and “sharing” data to advance cyclists’ demands could be considered a citizenship practice, in what Lupton (2016b) has called a “self-tracking citizenship.” This would imply a redistribution of agencies and a perspective of resistance to traditional forms of developing public policy (Fox, 2017) when this kind of data-driven and bottom-up projects are invoked as mechanisms for citizen empowerment and to promote environmental causes. Nevertheless, as Tenney and Sieber (2016) have put it, the datafication of urban planning and governance could also shift citizen participation to more passive forms of indirect interaction between authorities and citizens and subject them to logics of data-market economies and corporate interests. Therefore, the emphasis on citizen participation through self-tracking practices must not assume a stable or clear intentionality on the part of users, nor should we overlook the programmes and versions of users, bicycles, and spaces inscribed in these devices (Akrich, 1992). This is one of the contributions of this article, as it seeks to describe and link the operation of enfolding certain expectations and normativities by design into the practices that unfold with the

device within the urban space, trying to show that the expected commitment of citizens in the project is changing in the development of RUBI.

Prototyping a self-tracking device for bicycles

The sections that follow seek to open up the RUBI device, examining the programmes built into it and a progression of socio-technical transformations that illustrate the emerging character of the technology, which means that it is never completely finished and is constantly undergoing testing.

A scientific and citizen device

The development of RUBI began as part of Sebastián's final project for his engineering programme. He found that bicycle use in the Metropolitan Region is increasing, but that there is a "lack of data" on cyclists' journeys. According to Sebastian, the government has focused exclusively on face-to-face surveys that ask cyclists about their points of origin and destination while ignoring what happens in between. Therefore, he proposed the design of a technology that would allow researchers to capture "real," "clean," "scientifically accurate," and "representative" data on the use of the bicycle in order to better inform urban planning and public policies. Because of this academic origin, the development of RUBI was articulated in a markedly scientific orientation and heavily influenced by Smart City discourses:

An increasing number of people are riding bicycles; there are more stakeholders. And like all new things in this digital era, decision-making requires data [...] To be able to say that you made an informed decision, to justify something, you need scientific data, clean data. (Sebastián, interviewed 13 January 2016)

The goal was to guarantee that the data would not be distorted by exogenous and subjective variables, and conventional self-tracking apps and wearables technologies would be unable to generate such data for Sebastian. Not everyone has a smartphone or can afford a data plan. In addition, the "dirtiness" of the data was mainly associated with human use: "When you start a bicycle trip and you're in a hurry, you're not worried about turning on the app. But if you don't do it, the sample becomes dirty; it's no longer an accurate reflection" (Sebastián, interviewed 13 January 2016). For these reasons, the engineer decided to develop a piece of hardware, a palpable device that solidifies a connection with cyclist and bicycle.

Based on this scientific approach, Sebastián tried to calculate how to achieve a representative sample. Initially, he planned to track 60 cyclists for a long period of time. However, the first heat maps generated using the data collected visualized a very unequal use of the bicycle in spatial terms. Cycling was most common in the north-eastern sector of the city, where the wealthiest districts in Santiago are located and where there are more resources for bicycle lanes. This version of the city justified a stratification of the sample and forced Sebastian to increase the number of cyclists necessary for the project to more than 1000. However, he lacked the capacity to produce 1000 devices and the visibility needed to recruit such a large number of cyclists. He had to look for volunteers through various means of communication and adopt a loan model. Each time he made a contact, Sebastián met with them in person and loaned them an RUBI for 1 or 2 weeks, so the same device could be used by different cyclists, generating a type of "technical solidarity" (Dodier, 1995) between each user and the project. The aim was to rotate and circulate the RUBIs

throughout the city, thereby connecting with different types of cyclists without necessarily knowing them.

But the motivations and interests of the cyclists were more varied than the goal of a representative sample, emerging a sense of citizenship in the data collection. This is observed by Sebastián in the feedback of cyclists provided on the project's website:

Some simply want to make their mark, others truly believe that these data are going to be used by someone to make a change. Others simply want to test something they've heard about. [...] Others also simply didn't understand the project and just used it, thinking that this was like a GPS that told you which roads to take and how to optimize your route; there were several of those. Others just wanted to help the cause, they wanted to help something new. And then there was the other type of extremist cyclist who supports anything, and says let's go, and supports you unconditionally. (Sebastián, interviewed 13 January 2016)

We were able to confirm this range from “not understanding” what the device does to citizen and activist pro-bicycle motivation among the cyclists interviewed for this study. Some cyclists justified the use of the RUBI with the argument of “marking” new routes that did not exist on the map (Cyclist 1, interviewed 20 January 2016), while others wanted to contribute to public policies oriented towards developing bike lanes (Cyclist 2, interviewed 22 January 2016; Cyclist 4, interviewed 2 March 2016). This activist or civic motivation was far removed from the common use of self-tracking technologies for individual purposes. Although a web platform (RubiApp) was created to provide visualizations and metrics of each cyclist's trips, most of our interviewees did not use it. Some were unable to log on to the platform and others did not know how to use it. As one cyclist told us: “I didn't understand [the platform]. I remember that it showed me millions of simultaneous trips taken by people using the RUBI, but I didn't see mine” (Cyclist 3, interviewed 25 January 2016). In fact, on the *Stgo2020.cl* website, it is easier to access the aggregate heat maps of all the anonymous cyclists' trips. In this sense, the RUBI device did not generate a practice of individual discipline or a self-knowledge as enthusiasts of the Quantified Self have proposed. Because the primary focus was on the collective contribution rather than individual achievements, participation in this project generated a greater sense of civic belonging to the cyclists collective. As one cyclist said: “One might feel more included in the system... I feel like I contributed a little, but I contributed” (Cyclist 3). In Sebastián's words, the project formed spontaneously a community or “neuron” contributing and working towards the same goal: making the city friendlier for bicycles within an urban system that excludes them. Actually, conceptualizing the project as a neuron is connected to common metaphors used by Smart City promoters, as Nam and Pardo (2011) suggest, seeing cities as organisms that develop their own nervous systems in order to act in smarter and more efficient ways. In this case, the spontaneous assemblage of cyclists, political convictions, bicycles, sets of knowledges, web interfaces, etc. is an unexpected result for its creator and adds a civic component to the practice of tracking urban cyclists.

The embed of RUBI in an ecology of breakdowns

In the next sections, we describe the introduction of the RUBI devices in the streets of Santiago. At facing the eventualities and contingencies of the urban space, different breakdowns and flaws started to emerge to the *Stgo2020* programme, hindering the collection of data free of exogenous influences.

The first prototypes of RUBI were large, open, and fragile and depended in various ways on the actions of the human user – RUBI's creator even “humanized” the object by drawing

a human face on it. The cyclist had to carry the device and turn it on when they started a trip and then turn it off at the end of the trip. The bits of information gathered had to be uploaded to the RubiApp website, where the data was automatically processed to display the routes, kilometers, speeds, and duration of the cyclist's trips on a map of Santiago.

But the norms of "proper use" expected of the device and technically programmed by Sebastián are exceeded or resisted in the cyclists' daily practices, producing a first displacement in the original agenda of the project. More than a political form of resistance to commercial use of data (Nafus and Sherman, 2014), we understand this as recalcitrant or mundane breakdowns that arise from the fragile and temporal assemblage inherent to the character of this bottom-up project. The cyclists who had used the first prototypes often forgot to turn on and off the RUBI device. This implicated that the device would gather "wrong" data that did not correspond to a cyclist trip or some trips would not be recorded. For example, one of the cyclists interviewed said that he often left his house in a hurry, and that he turned RUBI on several blocks later or left it on all day long, running out of battery quickly. Additionally, the early RUBI prototypes stored the data on a micro SD card that had to be removed manually by the user and connected to a computer to upload to the RubiApp platform. This was particularly problematic, since some users did not understand how to do it or lacked the necessary adapters. These "problems" forced the engineer behind RUBI to respond.

Making smarter: The eradication of human intervention by a bicycle-oriented design

As part of the goal of ensuring the validity and representativeness of the data, the engineer redesigned the RUBI to close the intromission of exogenous agencies and breakdowns, adding a technological version of smartness to the device. In this second displacement, specific visions of what is human or smart were inscribed in the device, changing the roles that each entity plays in the accumulation of cycling data.

The main transformation that RUBI underwent in the iterative redesign process was the elimination of the on/off button. The original design was found to be counterproductive to Sebastián's scientific objectives because forgetfulness or lack of care of human-users intervention became "a source of data contamination" that had to be eliminated for its creator. For that reason, Sebastián decided to make *smarter* the RUBI device, adding an accelerometer that could determine whether or not the bicycle was moving, so the device would automatically turn on when the bike began to move, extending the battery life and providing greater control against human forgetfulness.

When you put a button here, you're inviting the user to push it, and that invitation may be accepted or rejected. So what you want is a device that is oriented to the bicycle, but if you put a button on it, you're lying because the bicycle doesn't have hands. The new device is much smaller because it is truly oriented towards the bicycle; it doesn't have buttons because the *bicycle doesn't have hands*. (Sebastián, interviewed 13 January 2016)

The distinction that Sebastián makes between a device designed for the human user and one for the bicycle was not something determined in advance, but rather a demanded response that emerged when RUBI was tested in the scenario of bicycle-cyclist movement. Such testing revealed the need to radicalize the idea. For the problems of data upload, Sebastián added an internal memory and a Wi-Fi module to the device so the data could be uploaded automatically through a connection to an open Wi-Fi network, without any action of the cyclists. In addition, the device underwent a curious process of reduction and "uglification." The first version of RUBI was very noticeable and the likelihood of theft

was high. Therefore, the RUBI's size was reduced and its functions were enclosed within it, becoming a tiny grey box, achieving with that the least possible interaction with the environment and cyclists. Aware that making it smaller and more invisible to the human eye would make it more likely that users would forget to turn it on and off, the idea of automating the device became even more important.

Therefore, the everyday cyclists' experiences start to be considered not only as citizen intelligence but also as circumstances that "contaminate" the sample that must be eradicated and cleaned by design, requiring a particular kind of "smartness" to do that, one that would allow this device to operate as an autonomous and independent entity, outside of human control: "so you don't have to turn anything on, you don't have to oversee anything" (Sebastián, interviewed 13 January 2016). By increasing the "smartness" of the device, cyclists could be relieved of some responsibilities on the data collection, and some volunteer cyclists actually forgot the existence of the RUBI altogether in their trips. This second displacement led Sebastián to refer to the bicycle with RUBI as an authentic "mobile laboratory" where what is important are the "pure" datasets that the device gathers autonomously. However, such smartness, emancipated from human hands, is still in beta or emergency mode, as something that has to be manufactured and improved, as we will see below.

Everyday use and the persistence of breakdowns

Despite the initial redesigns and technical changes of the RUBI device, the discontinuities and breakdowns were persistent. The self-tracking device faced contingencies arising from the daily lives of the cyclists: some were sick and therefore unable to record their trips for several days, and there were also work obligations or rainy days that prevented them from riding their bicycles. The "smart" innovations generated new troubles too; for example, the new versions of RUBI could not find open Wi-Fi networks in the city to upload the datasets. All of these elements – which are what make cycling a practice subject to mundane experiences and contingencies of the urban life – began to re-emerge with intensity when the experiment met the street.

In particular, there was one practice that openly led to deprogramming the scientific agenda of Stgo2020. It revealed an asymmetry between what was planned and what actually occurred in the streets. Some RUBI users decided to subvert and appropriate the functioning of the technology in unexpected and very creative ways. Fascinated by the possibility of seeing their bicycle trips visualized on a map, these cyclists began to take "artistic" trips through the streets in an effort to create certain shapes on the map. For example, Sebastián told us that some cyclists began to project phallic shapes onto the map by following particular routes on the urban space just to demonstrate wholly singular forms of appropriation and representation of the data. Thus, the script of the digital technology was "desecrated" and "displaced" (Akrich, 1992) through new uses that emerged from the users' motivations. However, confrontation to intended use not only came from the cyclists but also from the RUBI device. A percentage of the trips were "incorrect," showing lines that did not follow the city's streets or that connected two distant points with no sense. These errors were due to failures in the GPS connection, interference in the urban environment, or incorrect calibration of the satellites.

Therefore, this ecology of breakdowns cannot be reduced to a purely social or technical domain, they are disruptions that arise from the interweaving of agencies that converge in the daily cyclist–bicycle–device intersection. Thus, what we see emerging is a hybrid concept of the use of this device, where entities such as climate, humans, ordinary situations, the city,

bicycles, and sensors participate in a process that can be referred to as a de-purification of the intended “mobile laboratory” of the Stgo2020 project.

Responding with more “smartness”

For the scientific orientation of the project, the data produced by the ecology of breakdowns and exogenous forces are considered “errors” or “stupid” trips and have to be explainable and manageable. In fact, these “distortions” or “digital noises” of user-bicycle-device practices appeared on Sebastián’s screens in spaces and at times that were quite different from the trips and experiences of the users on their bicycles. From his workshop, which had been converted into a true “calculation centre,” the engineer had to make sense of these spillovers, building stories of daily life about lovers or sports activities in order to explain the anomalous data.

At the same time, Stgo2020 adopted a “precautionary” approach to the digital noises in the data (Marres, 2015), developing an algorithm to automatically filter and “purify” those anomalous trips to automatically filter and purify those trips from the sample. Sebastian explained that this consisted of a simple list of operations to resolve a cost function that weighs the properties of each trip, such as speed, variability, distance, among others. With this, the RUBI’s smartness was again increased to the point that it now automatically discriminates between the data and typifies a human riding on a bicycle or in a car by establishing specific thresholds for the score obtained in the function, although some trips are still “uncertain” (Sebastián, interviewed 13 May 2016). These efforts to address the presence of “wrong” data show how the project gradually generates mechanisms for sorting out and controlling the data, giving more visibility to some practices and ontologies, and removing others from the sample (Bowker, 2014). In other words, the urban space and its ecology of mundane practices that confronted and exceeded the scientific programme of the project, drove the engineer to respond or take an action once again. So, he developed more complex and automated codes in order to manage – always partially – the collected data.

In sum, through this prototyping process, we observe the recruit and co-production of different entities (sensors, users, bicycles, Web-based platforms, algorithms, the city, etc.) and the roles of each one in the quantification of cycling were gradually redistributed, seeking formats, technologies and designs that would increasingly displace, limit or neutralize the intromission of human users as much as possible. To achieve that, RUBI went from a friendly and “humanized” product to being moulded by and for the bicycle, with more networked and automated functions. But this movement provoked the emergency of breakdowns not considered previously, expanding the hybrid character of this digital quantification project.

Idiocy in the data

In this section, we condense the revised results to offer the concept of “idiotic data” in an effort to understand how the smartness is co-constituted with the ecology of breakdowns that emerged from embedding RUBI into cyclists’ everyday lives. As we saw, all of the unexpected disruptions, errors, ignorance, forgetfulness, and spillovers illustrate interesting forms of recalcitrance by different entities (human and non-human). Furthermore, the cyclists who did “not understand” the purposes of the device or created obscene figures as a kind of “urban hacking” show how the technology was reinterpreted over the course of the project. These breakdowns and everyday contingencies produced incomprehensible or nonsense data for Sebastián that counter and slow down the scientific-citizen agenda of the project. It is in this sense that we conceptualize them as *idiotic data*.

Here we do not want to refer to the idiotic as something pejorative, but as something inventive and generative. Authors such as Deleuze and Guattari (1994), Isabelle Stengers (2005) and, more recently, Michael (2012a; 2012b) have been reformulating this concept in this sense. The conceptual character of the “Idiot” would be someone or something in the plane of immanence that refuses to accept indubitable or (at least) consensual truths and “always slows the others down” (Stengers, 2005: 994). The murmur of the Idiot is the unexpected and disturbing noise that reminds that there is always something else that breaks or escapes on how it is defined a situation. It reveals that the definitions, frames, or methodologies of technicians and experts are always limited and partial, forcing to act or respond in more open and inventive ways to redefine the situation. Going back to the etymology of the word, the Idiot speaks a meaningless, private, or absurd idiom different from the language of the community (Fariás and Blok, 2016; Stengers, 2005), an idiom that reminds us of the incommensurability of otherness.

The conceptual character of the idiot has gained prominence in recent years and has been considered in different cases and contexts, from the use of bots on Twitter (Wilkie et al., 2015) to unexpected behaviours in a science communication installation (Horst and Michael 2011), and, more recently, in discussions of Smart City proposals and digital participatory urbanism (Gabrys, 2016). On this last topic, sociologist Gabrys (2016) has remarked that the Idiot challenges the ideas of intelligence, engagement, and politics assumed in many Smart City proposals. Digital technologies would not necessarily “fix” urban problems or enhance participation as running a line of code. The execution of programmes of sensorization would be always confronted with idiocies, discontinuities, and breakdowns of urban life.

Our case allows us to advance these points further, contributing the theorization of the idiot to problematize how digital data is commonly considered in various Smart City projects. The idiot calls into question the validity of the “healthy” truth that the engineer claims to obtain from more and more data. The unexpected “misbehaviours” – or “idiotic behaviours,” to use the term put forth by Horst and Michael (2011) – openly de-programmed and re-invented Sebastian’s initial scripts. Now, idiotic data are not simply data generated by absurd behaviours. They also provoke thought and new actions that were not initially considered. The importance of these data lies in their capacity to *indicate* that something is making noise or no sense, revealing the always partial or limited character of datafication, and the need for reframing the situation. In this regard, we can say that idiotic data is connected to the speculative experiment of Taylor (2016) on London’s bike rental data: there is data without an explanatory power that does not “add up” or perform a story that coheres to what we know. In the case of RUBI, precisely, the incoherent data forced Sebastian to speculate and imagine possible explanations and stories related to the digital noises that emerged in the sample. But his mayor answer to the idiotic data was to automate the processes of RUBI and to create algorithms to re-purify and “sanitize” (Michael, 2012a) the sample from the apparently meaningless bits of information. In this sense, the intended “smartness” of the RUBI device is “brought to life,” mobilized and augmented to eradicate the idiotic data and breakdowns that constantly resist leaving the limits of the mobile laboratories. This answer, very common in smart city initiatives, is always partial and leave space for new sources of unexpected breakdowns, uncertainties, and contingencies of urban life.

Therefore, this case shows us how smartness and idiocy emerge together and become enmeshed in the process of quantifying the urban mobility of cyclists, in a sort of dialogue or mutual “correspondence” (Ingold, 2016). Rather than reject the ecology of breakdowns, peculiar appropriations of the device and idiotic data generated, here we exposed the fundamental role of these agencies in the experimentation. Moreover, instead of thinking the

technological smartness as fixed or autonomous, it reveals as something adaptive that increase only in the hybrid interrelation with the idiocy of cyclists, the device itself and the urban space.

Conclusions: Designing an effortless mode of citizen participation in the Smart City?

Throughout this study, we wanted to explore on how Smart Urbanism is enacted in practice in the South, empirically examining the expectations, materialization, and relevant displacements that occurred in the development of a bottom-up project Stgo2020 and RUBI device. We analysed the path of modifications made to the device, an ongoing effort by its developer to “purify” the mobile laboratories from the emergency of idiotic data. As we have shown, the first human-centred versions of this device were constantly affected by forgetfulness and disruptions that their creator had not expected. In response, RUBI was redesigned by orienting it to the bicycle, black boxing it, and increasing its smartness through more automated and networked functionalities to diminish and displace the affordances for the human user. However, the ecology of breakdowns and contingencies appear once again through the flaws in the GPS, uncertain trips, and playful re-interpretations that cannot be reconciled with our engineer’s modelling.

Here we tried to expose and re-thought the resulting idiotic data, these emergent forms of meaningless and incoherent bits of information that permeated the sample, which are frequently made invisible, filtered out or cut off by algorithms in many data-driven projects. We suggested that idiotic data would not be just bias, but that it would also be *inventive* and force an answer. In this case, it is augmented the digitally enabled smartness to confront those overspills and noises but open us to question of what other kind of responses could be developed to “affirm” (Marres, 2015) the role of idiotic data in the enactment of this digital quantification project. If, as Stengers (2005) says, the “idiot demands that we slow down”, in our case, the idiotic data complicate and drove a rethinking of the Stgo2020 project and some of the assumptions of Smart Urbanism and data-driven solutions. The emergence of nonsense information pushed to engage new repertoires of data processing and to become more sensitive and open to the uncertainty inherent in any urban event.

The multiple breakdowns and idiotic data that we found in the embedding of RUBI in cycling mobility make clear an initial displacement in the original agenda of the Stgo2020 project: that neither humans nor bicycles, nor even the device itself, fully obeyed the rules of the game that had been preconfigured and inscribed by design. Instead, they engaged in constant negotiation, “concretizing” and actualizing together (Gabrys, 2016) in the emergent “neuron.” More than just a measurement of “out there” phenomena, the sensor becomes entangled in an ecology of unexpected and contingent relationships, creating new issues and practices of visualizing the city. The quantification of urban mobility does not generate a pre-established “self” relating to a small and finished machine, but rather heterogeneous linkages that generate a “data-human assemblage” (Lupton, 2016c). An amalgam of socio-technical entanglements among various actors such as engineers, urban planning, bike lines, design, hardware, cyclists, expectations, and algorithms that become interwoven for purposes that are not always predictable or stable. In this sense, sensors and the data recollected do not constitute neutral entities or merely technical objects that provide an unquestionable “matter of fact” (Boyd and Crawford, 2012; Latour, 2005) that changes the urban planning of Santiago. There is never any “raw data” (Gitelman and Jackson, 2013); rather, we have attempted to show how data is a fragile socio-cultural achievement placed in complex processes and entanglements of devices/humans/bicycles/cities.

Thus, we believe that the case described here situates the assumptions that underlie Smart Urbanism and brings up questions about the limits encountered by efforts to quantify the urban assemblages. The set of practices, affects, bodies, and personal stories that converge in the act of riding a bicycle make the datafication and algorithmic rationalization of urban space more complex and put in question the efficacy of design in this kind of projects. The desire to laboratorize the bicycle, as we have shown, faced a series of eventualities and re-negotiations that generated idiotic data and forced a slow-down of the expectations of a “clean” translation by computational nomenclatures. Certainly, there were attempts to manage behaviour and orient the experiences in one direction by design. Nevertheless, some users did not follow the “proper use” or even re-adopt the functionalities of the device in creative ways.

Returning to the discussion above, our work also allows us to problematize the two argumentative strategies that tend to circulate in Self-Tracking literature. On the one hand, we have the idea that these smart technologies will allow for an augmentation of the subject’s senses and capacities, with technical correction of human misjudgement. This is far removed from what occurred in the case analysed here. Cyclists who used RUBI devices did not find a “self-knowledge through numbers”, they did not reflect on their data or felt some degree of accomplishment through them. As we mentioned above, the main focus of the project was not individual progress,² but the collectively accumulation of data, which reveals how diverse and multi-purpose the self-tracking practices can be (Lupton, 2016b, 2016c).

On the other hand, there was the hypothesis that self-tracking devices entail the introjection of neo-liberal and individualist principles in self-management and the promotion of silent forms of control of the subject for the benefit of large corporations and surveillance agencies. From our empirical case, some continuities and discontinuities emerge in regard to these criticisms. Although RUBI is not able to fully materialize forms of self-control or environmental governance, it could be thought of as a Technology of the Self (Foucault, 1988). This device presents an orientation towards disclosure, not of an individual self but of a collective self of cyclists. Also, due the goal of the project of obtaining a clean and representative sample, a great deal of effort was made to ensure the “recognition of a fact” and “telling the truth” about how that collective moves in the urban space. Moreover, this technology continues to be based in ideas of purity and promises of a better life – like changing and becoming “co-designers of their own city” by sharing data of the self, as Foucault saw with older technologies. This could lead to a process of subjectification in which the desired civic behaviour or a “smart citizenship” would imply the necessary disclosure of data, being more visible and constantly emitting information about oneself, as can be seen in the underlying rhetoric of some technocratic projects of Smart Urbanism.

However, this approach towards disclosing data is materialized by promoting the automation of the device rather than appealing to the motivations and conscience of the volunteer cyclists. In the process of RUBI becoming smarter to purify and eradicate the idiotic data from the sample, the device becomes more autonomous and independent of human interaction, thus the human user becomes “less in charge” of the accumulation and processing of their own data, something that Schüll (2016) had found while exploring the development of wearable self-care technologies. Therefore, the second displacement towards an intensification of the device’s smartness short-circuits the argument of a complete introjection of neoliberal values or self-responsibilization through the use of self-tracking devices (Lupton, 2016c). On the contrary, in this case, the data collection becomes an activity performed more and more in the background and unnoticed by the cyclists, diluting the individual agency and participation in the project.

This relocation of agencies, motivated by the automation of RUBI, we believe that generated a third displacement related to the civic nature of the project, because it

ends up re-shaping what counts as an engaged citizen (Gabrys, 2016). The waned responsibility of human user by design softens the initial active role of the cyclists in the data collection, resulting in a more technocratic project than politically committed. In this way, the constant disclosure of data about one's mundane life not only could become something "enjoyable" through gamified-style apps or a requisite for achieving healthier lifestyles through health apps -as can be seen in the literature- but also could be rhetorically considered now as a "smart and participatory solution" to urban governance issues through devices like RUBI. In order to be heard by public authorities, the citizens would have to constantly produce accurate data, even in passive, indirect, or unnoticed ways. But is this a mode of citizenship we want to encourage? What forms of citizen involvement through these technologies could be considered as a political agency? Which other responses to idiotic data or other kinds of "smartness" could be enacted, instead of the automation of these devices?

These questions invite us to take both the design processes and expectations involved in these devices quite seriously as well as their uses and implications in their contexts. The rhetoric of Smart Urbanism is usually contrasted with the daily experiences of individuals trying to coexist in the city with these technologies. It fails to see that, on a material level, citizens merely gather data and act as sensors for free; they do not become "co-designers of the city" or participate in any decision-making regarding where to install the next bike lane. Moreover, the data gathered by RUBI became one input among other databases about cyclists in Santiago. The supposed scientific orientation of the project was in part a way to convince public officials of the accuracy and representativeness of the data compared to other sources of information like cycling apps, wearables technologies, or even traditional surveys. Nevertheless, neither Sebastián nor the volunteer cyclists knew whether the data gathered was useful or impacted any level of cycling infrastructure planning. The link between the production of this kind of citizen data and final and concrete political decisions is still vague and needs further examination. There is a need to explore how policy-makers are interpreting self-tracking data, and the mechanisms, incentives, and discourses used to promote and convince public officials of the efficacy of this data-driven projects. In short, the free labour of data-gathering provided by cyclists, which is supposedly legitimized by the good cause of making Santiago a more bike-friendly city, did not ensure active citizen participation or even real use of the data in urban planning, problematizing the promises of Smart Urbanism that we saw above.

Finally, this case allows us to state that citizen empowerment or self-surveillance programmes made possible by digital technologies do not manifest in a pure and unidirectional manner. On the contrary, when these projects are analysed on the basis of their design and uses in their local contexts, unanticipated failures and idiocies are observed compared to the intentions inscribed in the technology. The breakdowns and idiotic data examined here not only generate situations of recalcitrance and overflows, but also force us to respond to and redefine the very idea of "smartness" that is at stake. Thus, in terms of the implications for "smart city" debate, the idiotic data allows us to interrogate the constant omission of the idiocy and the limits of a data-driven decision-making present in the smart narratives, forcing towards new ways of attention of the urban ecology.

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Notes

1. For example, RUBI has been tested and used in research by the Centre of Urban Sustainable Development (CEDEUS) and its developer is working as a consultant at the Inter-American Development Bank.
2. Commercial apps and wearable technologies more interested in achieving a large mass of consumers than advancing scientific or citizen purposes like RUBI would be developed to generate such individual self-monitoring with functions of tracking in real time, social networking possibilities, gamification styles, and design oriented towards the human user.

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