UNDERSTANDING CONTROVERSIES IN DIGITAL PLATFORM INNOVATION PROCESSES: THE GOOGLE GLASS CASE

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ABSTRACT

Due to their scaling potential and complexity, digital platforms tend to generate massive controversies and paradoxes. Previous research has generated knowledge about controversies in digital platform innovations. However, it focus mainly on the types of controversy and their effects rather than on the *process* of controversy emergence. In this article, we analyze how controversies related to digital platform innovation emerge and how they unfold over the innovation process. We analyze the case of the Google Glass failure to establish this ARSG (Augmented Reality Smart Glasses) extension to Google's digital platform. The paper contributes by analyzing the digital platform innovation process as a process of translation, in which there are possible controversy emergence points originated in types of disagreements among the different human actors involved and their interactions with non-human elements.These disagreements are related to specific features of digital platforms: the digital platform generativity, the multisided market arrangements in the platform; the loosely coupled layers of technologies and applications involved, and the opaqueness that results from these arrangements. The framework proposed can support digital platform scholars and practitioners to better understand and deal with controversies.

Keywords - Controversy, Digital Platform Innovation Processes, Innovation Management, ARSG (Augmented Reality Smart Glasses).

1. INTRODUCTION

Digital capabilities have allowed for the creation of myriad new services and the transformation of traditional products, generating innovative digital platforms and ecosystems (Bharadwaj et al., 2013; Zuboff, 2015; Reuver et al., 2018). Digital platforms are a challenging research object due to their distributed nature, exponential growth, and intertwinement with institutions, markets, and technologies (Reuver et al., 2018).

Digital platforms innovations are created through complex processes involving different types and layers of technologies provided by various actors (platform owners, telecommunication operators, software developers, among others), depending on a business ecosystem rather than on individual firms (Kappor & Agarwal, 2017; Kolloch & Dellermann, 2018). They generate a multitude of interactions and unpredictable interdependencies; problems that are not entirely defined and solutions that can be ambiguous (Dougherty & Dunne, 2012; Yoo et al., 2012).

Consequently, due to their scaling potential and complexity, digital platforms tend to generate massive controversies and paradoxes (Acquier et al., 2017). These controversies may arise from the conflicting interests of the different actors involved in the

platform. For example, digital platforms focused on the sharing economy aggregate different types of environmental, social and economic promises, each one corresponding to different framings, values and debates, which can lead to controversies among the different actors related to them (Acquier et al., 2017; Belk, 2014;).

Digital platforms can also provide new media that expand the opportunities for individuals and organizations to participate in public and private discourses by lowering technological barriers to access content and to produce and publish new content (Vaast et al., 2013). Therefore, these platforms may be focal points for controversies. Previous research efforts have generated knowledge about controversies in digital platform innovations. They have discussed the different interests of key actors involved with these controversies (Colbjørnsen, 2014) and how their positions evolve with them (Panourgias, 2015), also showing that the pathways of controversies affect the innovation ecosystem and the evolution of the technological components of the innovation (Kolloch and Dellerman, 2018). Controversies over digital platforms reveal the complex interplay between actors with uneven distribution of power and the way they create and negotiate the distribution of different resources (Eaton et al., 2015).

However, most of these studies focus on the types of controversy and their effects rather than on the *process* of controversy emergence. Besides that, the current literature on digital platform innovation centers on the characteristics of the digital platforms, and on their technical, economic and transactional aspects (Tiwana et al., 2010; Kenney & Zysman, 2016; Sedera et al., 2016; Huang et al., 2017; Reuver et al., 2018; Yablonsky, 2018 Koskinen et al., 2019). Little research exists on the innovation process dynamics considering the conflicting roles and interests of the broader context of heterogeneous actors involved in digital platform innovations, beyond those directly involved in producing and regulating innovation complements.

Therefore, in this paper, we address the following research question: *how do controversies related to digital platform innovation emerge and how they unfold over the innovation process?* We attempted to answer this question by a detailed process analysis of the controversy related to the launch of Google Glass, applying the method of controversy mapping (Latour, 2005; Venturini, 2010a, 2010b) to explore this sociotechnical debate.

Our analysis explores how the controversy started and how it developed, considering the views of a variety of actors, such as Google, software developers, journalists, bloggers, the general public and bystanders (Ferneley & Light, 2008), who voluntarily engaged in the debate. Therefore, the paper deals with a societal perspective of digital platform innovation. It also focuses on Google Glass as a device for personal use, which affects other people around the users, and not as a workplace technology.

Our findings supported the construction of a framework presenting the digital platform innovation process as a process of translation (Callon, 1986), in which that are controversy emergence points generated by disagreements among the different human actors involved in the platform and their interactions with non-human actors. These disagreements are related to specific features of digital platforms: (a) the platform generativity, (b) the multisided market arrangements in the platform; (c) the loosely coupled layers of technologies and applications involved and the (d) the opaqueness that results from these arrangements. The framework proposed can support platform scholars, organizations, and innovation managers to better understand and deal with controversies

in this context.

Addressing a controversy specifically related to Augmented Reality Smart Glasses (ARSG), is a secondary contribution of the paper. Although previous studies have addressed the benefits and disadvantages of this technology and related controversies, for instance, over privacy issues and interferences it has on social interactions (Hein et al., 2017; Hein, Jodoin, Rauschnabel, and Ivens, 2017; Rauschnabel, He and Ro, 2018; Ro, Brem, and Rauschnabel, 2018), few of these previous studies highlight that ARSGs are not isolated devices, but rather are part of digital platforms, which we consider key to understanding their affordances and risks.

The paper is structured as follows. The next sections review the literature on digital platform innovation, followed by the theoretical approach on controversies adopted, based on the Actor-Network Theory (ANT). Next, we present the research method, followed by the analysis of the Glass controversy. We then discuss the results and make final remarks.

2. DIGITAL PLATFORM INNOVATION

Due to their intertwinement with institutions, actors, and digital technologies, there is not a consolidated definition of digital platforms (Sedera et al., 2016; Koskinen et al., 2019). There is a diversity of platform types, and depending on the field under which they are studied, different approaches can be found to define it (Koskinen et al., 2019).

Tilson et al. (2010) define a digital platform in terms of the basic information technologies and organizational structures, along with the related services and facilities, necessary for an enterprise or industry to function, but point out to the fact that digital platforms are increasingly related to new social behaviors. Tiwana et al. (2010) suggest the notion of software-based platforms that provide core functionalities shared by modules that interoperate with it and the interfaces through which they bring together groups of users in two-sided networks. Koskinen et al. (2019) claim that digital platforms share three essential characteristics: (1) they are technologically mediated; (2) they enable interaction between user groups; and (3) they allow user groups to do certain particular things. Kenney & Zysman (2016) and Sedera et al. (2016) define digital platforms in terms of their technical aspects, while Eaton et al. (2015) and Reuver et al. (2018) emphasize their sociotechnical character.

There are different types of platforms, such as transactional, innovation, and integrated platforms (Koskinen et al., 2019; Yablonsky, 2018). Some scholars classify digital platforms in terms of their type of use, for instance, social media platforms (Reuver et al., 2018; Yablonsky, 2019), operating system platforms (Kenney & Zysman, 2016; Reuver et al., 2018), mobile payment platforms (Reuver et al., 2018; Yablonsky, 2019), retail platforms (Kenney & Zysman, 2016; Yablonsky, 2019), platforms to mediate work (Kenney & Zysman, 2016), peer-to-peer platforms, and service provider platforms (Kenney & Zysman, 2016; Reuver et al., 2018).

We define digital platforms as a layered architecture of digital technology that integrates software, hardware, operations, and networks (Yoo et al., 2010) to enable interaction between user groups (Reuver et al., 2018; Koskinen et al., 2019). It is formed by a sociotechnical assemblage encompassing technical elements (Tilson et al., 2012; Eaton et al., 2015) and the processes and standards that mediate the relationship between the human and non human actors related to each other the platform (Tilson et al., 2012; Reuver et al., 2018).

Research on digital platform innovation processes has been conducted from the

perspective of product development and digitization of physical products (Yoo et al., 2010; Acquier et al., 2017; Parker et al., 2017), and open innovation (Chesbrough, 2003) in order to identify the extent to which openness influences innovation generation (Boudreau, 2010; De Falco et al., 2017), and business strategies (Parker et al., 2017; Yablonsky, 2018). Nevertheless, as previously warned by Tilson et al. (2010) and Eaton et al. (2015) most of the previous research on digital platform innovation processes focus on technical, functional, and economic aspects, and do not take into account how this process unfolds over time, failing to investigate it from a sociotechnical point of view.

Digital platform innovation involves the orchestration of different resources and actors, together with the consideration of the unique characteristics of digital artifacts (Nambisan et al., 2017; Svahn et al., 2017). Digital technologies have several specific affordances, i.e., what an individual or organization - with a particular goal - can do with technology (Majchrzak & Markus, 2013). The digitization provided by these platforms allows artifacts to be editable, reprogrammable, more distributable, addressable, sensible, communicable, memorable, traceable, and associable (Yoo et al., 2010; Kallinikos et al., 2013; Reuver et al., 2018).

With all these possibilities, a key feature of digital platforms is its generativity, namely, its capacity to be used to produce unprompted changes and innovations made by varied, numerous and uncoordinated actors (Zittrain, 2006). It fuels combinatorial innovations, while the boundaries of digital products and services are frequently unknowable: they remain incomplete and subject to future developments (Yoo et al., 2010, 2012). The development and use of digital artifacts created over digital platforms occur across a range of dispersed stakeholders, because most of the digital platform innovations are dependent on network effects: as more services and applications are connected in the platform, the more its value grows (Reuver et al., 2018; Stummer et al., 2018).

The idiosyncrasies of digital platforms make the management of the innovation processes a complex technical and social undertaking (Yoo et al., 2012; Kallinikos et al., 2013; Nambisan et al., 2017). Digital platform innovation involves the recombination of digital components in a layered, modular architecture of software, hardware, networks, contents, and services, which are loosely coupled (Orton & Weick, 1990; Yoo et al., 2010, Huang et al., 2017; Reuver et al., 2018).

The fast pace of development also increases the challenges concerning the orchestration of innovation that is dependent upon business ecosystems (Yoo et al., 2012; Bharadwaj et al., 2013; Svahn et al., 2017; Kappor & Agarwal, 2017), in which the innovation agency is distributed (Yoo et al., 2012; Nambisan et al., 2017). It can require continuous negotiation between the different stakeholders involved (Svahn et al., 2017).

Finally, another important feature of digital platforms is their level of opaqueness. Introna (2007) defines opaque technologies as those that are hidden or embedded and obscure in their operation/outcome, demanding passive or limited user involvement, often being automatic. Digital technologies are increasingly black-boxed; for instance, systems based on neural technology where even the experts might be surprised by the behavior of their own artifacts (Introna, 2007). The same occurs with digital platforms: they are increasingly more complex and sophisticated, with different layers of technologies and applications intertwined, which renders them opaque to some of the actors working over the platform and also to external clients and users. For example, Facebook is an opaque digital platform that came recently under scrutiny regarding the use of personal data by third parties, with even members of the US Congress questioning how it works

(Washington Post, 2018).

Since digital platform innovation processes become increasingly dependent upon distributed collaboration and peer production (De Falco et al., 2017), they can generate a paradox of control versus autonomy by the innovation leader, because unexpected actors with different goals and interests can engage in the innovation process (Nambisan et al., 2017; Tiwana et al., 2010; Eaton et al., 2015; Svahn et al., 2017). To better examine how divergences and controversies emerge in this process is precisely our target, as discussed next.

3. A PROCESSUAL VIEW OF CONTROVERSIES

Controversy is a critical subject in Science and Technology Studies (STS) because many of them approach contested technologies, for instance, new technologies for energy generation (Mulder, 2012; Fatimah et al., 2015; Kolloch & Dellermann, 2018). Technology controversies have been studied within the contexts of politics, health, legal, and environmental issues (Callon et al., 2009; Bogner & Torgersen, 2015).

Controversies are considered here in the light of Actor-Network Theory (ANT), which is frequently used to study this issue in STS (for example: by Fatimah, et al., 2015; Panourgias, 2015; Kolloch & Dellermann, 2018). ANT identifies contemporary society as constituted by heterogeneous collectivities of people, simultaneously with technology, machines, and objects and see this collective framed analytically as a network of negotiated and enforced relationships (Law, 1991; Law, 1992; Knights & Murray, 1994; Chen & Hung, 2016).

ANT is particularly interesting to study digital platform innovations, due to the complexity of the arrangements of human and non-human actors that compose these platforms (as discussed in the previous section). ANT help us to consider these two actors and how they are combined in heterogeneous networks to provide the platforms and innovations related to it, and what sort of phenomena (such as controversies) emerge when the two interact (Hanseth, Margunn & Berg, 2014).

We have chosen ANT as theoretical lenses because it is an alternative to deterministic views of technology, which consider that technology ´impacts´ and define social realities, at one hand (Hanseth, Margunn & Berg, 2014), and theories that emphasize social structures and institutions, but do not approach the materiality of technology, such as Giddens' (1984) structuration theory and Institutional Theory (Greenwood, Oliver, Lawrence& Meyer, 2017). Both of these two theories overlook technology (Hanseth, Margunn & Berg, 2014). As information and communication technologies are becoming more complex and deeply interwoven into the fabric of society, ANT is a theoretical lens that can help us to get a better understanding of the interaction between the social and the technical systems (Hanseth, Margunn & Berg, 2014), such as digital platforms. Besides that, ANT brings a political perspective to innovation processes – seen as a process of translation (Callon, 1986), as explained later in this section - which is not frequently emphasized in previous studies of digital platform innovation; they instead emphasize technical, functional and economical aspects of this process (Tilson et al., 2010; Eaton et al., 2015).

In the process of understanding the sociotechnical world, with the interaction among different human and non-human actors, controversies may arise and need to be stabilized on its course of action to inform how humans might best live together (Latour, 2005). They are essential events to debate the matters that affect society to define technological

developments and public policies.

As previously stated, controversies are events in which an issue or an innovation is subject to interrogation and dispute, when the actors involved with it disagree (Kling, 1996; Latour, 2005; Whatmore, 2009). They emerge because sociotechnical networks have a stability that is always provisional (Latour, 2005; Law, 1992; Venturini, 2010a). In this sense, controversies are at the core of the instabilities in these networks. They arise when the actors do not align themselves, or when there are different and often conflicting interests, goals, identities, or opinions on a subject. During controversies, the contending parties scrutinize each other's arguments with exceptional care (Brante, 1993).

Controversy may arise from something new or some sociotechnical element already stabilized, that is, an existing black box (a complex element whose form of operation is not clear - Akrich, 1997; Latour, 2005; Callon et al., 2009; Venturini, 2010a), which, for some reason, comes to be questioned. Therefore, when a controversy is occurring, there is an opportunity to review and better understand the social reality, because sociotechnical networks are in a state of movement (Venturini, 2010a).

The main features of controversies are: (a) they involve different actors, human, non-human, natural and biological elements; (b) they display the social in its most dynamic form (even unities that seemed indissoluble can be broken into a plurality of conflicting pieces); (c) they are reduction-resistant, such that old simplifications are rejected and new simplifications are not accepted as yet; (d) they are debated, with things and ideas that were taken for granted or considered stable questioned; and (e) they show conflicting worlds, which decide upon and are decided by the distribution of power, as power is the result of social interactions (Akrich, 1997; Law, 1992; Latour, 2005; Venturini, 2010a).

A key feature of controversies is that they are emergent phenomena (Akrich, 1997; Ramani & Thutupalli, 2015). Emergence is defined here as "*the arising of novel and coherent structures, patterns, and properties during the process of self-organization in complex systems*" (Goldstein, 1999: 49). Emergence implies that nonlinear interactivity between certain elements leads to novel outcomes, which are not sufficiently understood as a sum of their parts.

When facing a controversy, different actors start or become attracted to processes of *translation,* in which an actor problematizes a situation and then mobilizes an actor-network to deal with it. Translations can be described as transformations or movements of materials or meanings from one medium or space to another (Latour, 2005). ANT theorists argue that translation is a conceptual mechanism to understand the creation of new technologies and how actors give meaning to them (McMaster et al., 1997).

Callon (1986) describes four moments of translation:

(a) *problematization* – this moment happens when some focal actors initiate the process of network building by proposing a problem on their own terms and start to engage with other actors on a solution;

(b) *interessement* - This is the group of actions by which an actor attempts to define and stabilize the identity of the other actors involved through problematization;

(c) *enrollment* - the actions by which a set of interrelated roles is defined and attributed to actors who accept them. The network builders may attempt to enroll the other actors and coordinate their actions by obtaining their consent without discussion, or by using persuasion, negotiation, transaction, seduction or force;

(d) *mobilization* - This occurs when there is an alignment of interests, goals, and identities among the actors involved in the network. The term mobilization emphasizes all

the necessary displacements of entities through moments of translation, which are reassembled in a specific place at a particular time to form a sociotechnical network (Callon, 1986). The aligned interests and goals of these actors are "transported" through spokespeople and inscriptions - when their interests are represented in material forms or embedded in material artifacts (Akrich, 1997).

At the end of a translation process, a network of relationships has been built, black boxes can be created, and controversies can be closed (Law, 1992; Brante, 1993). Closure indicates that stabilization has emerged, either by factual evidence or negotiations, compromise, or force (Callon, 1986; Brante, 1993). It may also happen that no alignment or consensus is reached; in this case, the controversy "cools down." However, controversies may follow different trajectories: "they may go from apathy to alliance without passing through conflict; they can light up briefly and soon fall back into unawareness; they can burst into full conflict and never cool down" (Venturini, 2010a: 270).

In sum, the processual view of controversies adopted in this paper is a way of understanding "*the social world in the making*" (Venturini, 2010: 263). In this sense, it can help us to examine how digital platforms innovation processes unfold and how the different interests and roles of the stakeholders are negotiated in these processes. Considering this theoretical background, we used the method of controversy mapping to understand the Glass case in a processual way, as explained next.

4. RESEARCH METHOD

To understand the controversies that emerge in digital platform innovation processes, we employed a qualitative approach to study the controversy concerning the launch of Google Glass, a wearable computing device, or Augmented Reality Smart Glasses (ARSG), created by Google, applying the method of controversy mapping, a set of techniques to explore and visualize issues related to sociotechnical debates (Latour, 2005; Venturini, 2010b). According to this method, it is essential to observe a "hot" controversy (when it is at the peak of the debate), that has to be restricted to a specific topic or subject and open to public participation (Venturini, 2010b). We started studying the Glass controversy at the peak of the polemic about this device in May 2013 (see the timeline of the controversy - Appendix 1).

4.1. Data collection

The study was based on the collection and analysis of secondary data from the Web. The sampling of data was theoretical (Eisenhardt & Graebner, 2007), as we aimed to select at least 300 different types of materials (e.g., news, online documents, blog, and Twitter posts, videos) in which the different actors involved in the controversy expressed their points of view. This arbitrary number was defined to gather different perspectives on the controversy, while, at the same time, keeping the data manageable for qualitative analysis. As Bauer and Aarts (2000) caution, researchers can easily collect more interesting material than they can effectively analyze in depth. We attempted to avoid this problem by selecting the materials appearing first in the links returned by the online search, which are publicly available, allowing us to provide links to readers to retrace important information, as shown, for example, in Appendix 1.

First, we collected data via a Yahoo search with the exact expression "Google Glass," filtering the results by language (only English), on May 20th, 2013. We used Yahoo

as the web search engine and not Google to avoid any possible biases in the news about Glass. This search resulted in 6,880,000 links. We then started to select the materials from the first 300 links in decreasing order of appearance. The exploration of these links resulted in a collection of news and blog articles, videos, and tweets (see details in Table 1). Some of the tweets had links to other news and blog articles that were also collected. We created a database in NVivo11© with all these sources of data.

During the data analysis process, which lasted eight months, we systematically followed news about Glass in the press from May 20th, 2013, until October 1st, 2014, which resulted in the collection of 122 news and blog articles, plus posts on the Google+ Glass page (https://plus.google.com/+GoogleGlass). Some documents cited in the news - such as the Law HB 3057 or the US Congress letter to Google - were also incorporated into the database and analyzed. Table 1 shows the details of all the sources of data collected and analyzed.

Types of Sources	Details	Number
Online documents/sites	News/newspaper articles	145
	Blog articles	102
	Magazines	17
	Google sites about Glass (at Google+, Glass terms of use, Glass project page)	14
	Photographs	8
	Commercial sites	4
	Comic cartoon	2
	Investment site	2
	Forums/wikis	3
	Glass patent application	1
	US Congress letter to Google	1
	Google letter response to the US Congress	1
	Law HB 3057 - Prohibiting Google Glass Use in Traffic	1
	Subtotal	301
Tweets	Positive tweets*	85
	Negative tweets*	60
Videos	Several types of videos	93
	Total	**539**
Comments	Comments to online news and blog entries (by the general public)	**1,966**

(*) The Tweeter platform provided the classification in positive/negative

Table 1: Data Sources

It is important to highlight, as shown in Table 1, that commentaries from the general public on the news and blog entries (1,966) were also included in the database and analyzed. The comments on videos were not analyzed because they were too numerous (sometimes, there were thousands of comments for one single video). Table 2 presents the authors of the sources collected.

Types of Sources	Authors	Number
Online documents/sites	Journalists	159
	Bloggers/tech bloggers	84
	Google	16
	Cartoonists/photographers	10
	Companies/group of actors	9
	Glass Explorers	1
	Members of US Congress/legislators	2
	General public	3
	Identity not available	17
	Subtotal	301
Comments	General public	1,966
Tweets	Positive tweets (85)	
	General public	82
	Companies	2
	Glass Explorers	1
	Negative tweets (60)	
	General public	60
Videos	Journalists	40
	General public	15
	Glass Explorers	13
	Google	13
	Tech bloggers	8
	Artists/comedians	3
	Digital creative agency	1
	Subtotal	93

Table 2: Authors of the Sources Collected

4.2. Data analysis

The corpus for the analysis of the online documents saved in the research database in NVivo contains 270,810 words (word length ≥ three). It corresponds to approximately 450 pages. The 93 videos collected comprised a total duration of 8 h 23 s. To analyze these data, we followed the procedures of the method of controversy mapping, as indicated by Venturini (2010b), as a guideline:

- **Documentation repository** - As already explained, the database on the controversy was created using the NVivo11© software, which contains all the data collected and is available to other researchers. After organizing all the documents inside NVivo11©, we proceeded with an initial (open) coding of the data. Initial coding means breaking down qualitative data into discrete parts, examining them, and comparing them for similarities and differences, remaining open to all possible theoretical directions (Saldaña, 2015).

- **Chronology of dispute -** Controversies need to be explored in how they develop over time. We began our analysis by constructing a timeline for the Glass controversy; see Appendix 1. We coded the key events of the controversy, as presented in the data, under a category (an NVivo11© node) called "history of Glass launch".

- **Glossary of noncontroversial elements** - Basic concepts about the technology

involved in Google Glass were considered in order to understand it, then codified in the NVivo11© database under a category called "Glass descriptive features".

- **Analysis of the scientific literature** - We reviewed academic references about ubiquitous and wearable computing, ARSG and about Google Glass to make sense of the data (they are not listed here due to space limitations). However, most of these references only took a technical approach to Glass as a device.
- **Reviews by the media and public opinion** - All the content in the sources collected (Table 1) was analyzed via the initial (open) coding (Saldaña, 2015), generating the main categories and subcategories that emerged from the data, with different issues raised by the actors. The coding process involved four researchers and lasted around eight months.
- **Tree of disagreement** - We analyzed the different arguments related to Glass by considering the main issues in the controversy, e.g., the definition of Glass according to the various actors, technology intimacy, risks, and benefits perceived, contexts of use/non-use and the future with Glass, among other key categories. A sentiment analysis of the 301 documents collected (news, blogs, and sites, saved in .pdf) was performed using NVIVO12©, considering the paragraphs of the texts. Although this analysis looks at the sentiment of words in isolation[1], it evidences the debates and division of opinions over Glass: 1,153 paragraphs were classified as very negative; 1,418 moderately negative; 1,759 moderately positive and 947 as very positive.
- **The scale of the controversy** - No controversy is isolated. It is the case with Glass, which is related to other controversies, such as the power of digital platform ecosystems and debates on privacy rights, which were also identified in the data and codified, as detailed later in our analysis.
- **Table of cosmoses** - Controversies provoke the opposition of conflicting worldviews. In our analysis, we explore the different arguments related to Glass, in terms of the present and expectations, according to the different actors' views.

Finally, after following these steps, and after the Initial (First Cycle) Coding of the data (Saldaña, 2015), we proceeded to the Second Cycle of analytical coding (Saldaña, 2015) of the research results in light of the theoretical background to the research. We organized a conceptual understanding of the unfolding of the controversy by considering the four moments of translation (Callon, 1986; explained in Section 3) and the key features of digital platforms (as discussed in Section 2).

Research validity and reliability were sought through the comprehensive data collection about the controversy, triangulating the various materials examined as authored by the different actors involved. The data analysis (Section 4) attempted to respect this variety by presenting a detailed description of evidence on the different views. The involvement of a research team in the data codification and analysis also increased the internal research validity (triangulation of researchers) (Silverman, 2013). External validity was also sought through the proposition of a framework (Figure 6 in section 6) that can be considered in the future to analyze other processes of digital innovation controversy.

Our work also possesses methodological limitations: we relied only on data from the

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[1] Details about how this analysis is performed can be accessed at http://help-nv11.qsrinternational.com/desktop/concepts/How_auto_coding_sentiment_works.htm#MiniTOCBookMark3

Web, as opposed to speaking directly to the actors involved. As such, we tried to consider as many pieces of evidence and manifestations that we could manage to read and analyze, thus attempting to compensate for this limitation.

5. THE GOOGLE GLASS CONTROVERSY

We begin this section analyzing the different actors involved in the controversy. After, to understand the controversy in a processual way, we follow a timeline (Appendix 1), where some debates were temporally overlapping; however, to organize the description, we provide analytical distinctions between such overlapping debates.

5.1 The actors involved in the controversy

There are many actors involved in the Google Glass controversy, and categorizing them is not an easy task, because they form a complex assembly of human and non-human elements. The main non-human actor is Google Glass, which, like other similar devices, such as the Microsoft HoloLens and the Sony SmartEyeGlass, is an example of Augmented Reality Smart Glasses - ARSG (Hein et al., 2017). ARSGs are "wearable Augmented Reality (AR) devices that are worn like regular glasses and merge virtual information with physical information in a user's view field" (Ro, Brem and Rauschnabel, 2018:172).

Besides the Glass device itself, we can list as non-human actors: Android (the Glass operational system), the apps created for it, and the smartphone (because Glass does not connect independently to the Internet, it needs to be connected via Bluetooth to a smartphone). Other operating systems such as Apple's iOS are important actors, since there is a 'war' between the different platforms (another controversy related to Glass), constraining what can be accessed directly or not through the different devices. Other 'ordinary' objects such as prescription lenses glasses (which where not integrated with Glass at its launch) and also clothes, are all non-human actors related to Glass. Glass is also compared with devices used for vigilance, such as CCTV (Closed-Circuit Television) systems and small cameras, as we will see later in the analysis. One important non-human actor is venture capital since innovations such as Glass are related to innovation ecosystems and also to stock markets.

Regarding the human actors involved in the controversy, the division in categories of actors was done according to the different identities we identified in our data (via open codification). These categories are Google (the company, managers and the Google Glass development team), Government and regulators, NGOs representatives, software developers (especially the Glass explorers, from here all called 'developers'), IT people and experts, business consultants, journalists, reporters and bloggers that produce news about Glass (from here all called 'journalists'). Also, academic researchers, artists, and the general public, who are people that commented on the blogs and news articles that we analyzed; physicians, celebrities and people from the fashion industry, venture capitalists, hackers, and porn industry members.

Some actors have stronger voices in the news and blogs, while others - such as venture capitalists - do not speak directly, but are mentioned by other actors. In Figure 1, we make a synthesis of the main type of actors involved in the controversy. Next, we analyze the roles and different views of Glass according to them.
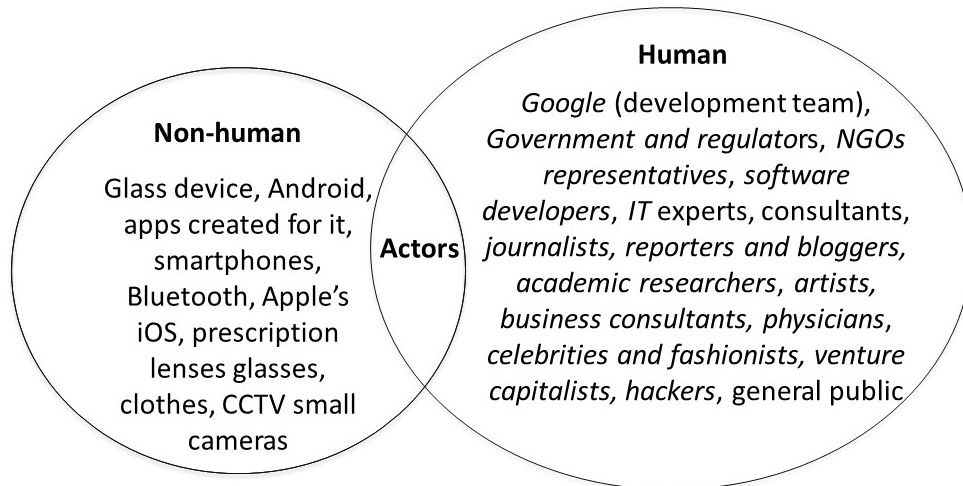
Figure 1. The actors involved in the controversy

5.1. Starting the digital innovation process and recruiting allies

Glass started to be developed by Google X Lab, a department in Google that has been working on futuristic technologies. The media published the first rumors about the project in 2011. Google submitted a patent application (#20130044042) related to Glass in the US on August 2011 (Event #1 - Appendix 1). Glass is defined by Google as a computing device built into spectacle frames, with a high-definition screen in the upper corner of the right lens. The input is made via a touchpad on the Glass frame, the MyGlass phone app and voice commands through a microphone. It also has an accelerometer and a gyroscope (to keep track of where the user is facing and for location awareness). The sound is transmitted via a bone conduction transducer to the user. Glass connects to the Internet via smartphones. It allows the user to take photos, record videos, run Google searches, and answer emails using voice commands or the touchpad. The user can use different apps created for Glass. It is essential to highlight that nothing the user sees and hears through Glass is apparent to other people around them. The link in Event #14 in Appendix 1 shows how Glass works.

On April 4th, 2012, Glass appeared for the first time in a video made with it, showing a first-person perspective of its use (Event #4). The Glass team claimed that they wanted to "start a conversation" and get feedback about what Glass should be. On April 5th, 2012, Google's co-founder and technology chief made the first appearance with Glass in public, during a dinner for Foundation Fighting Blindness (Event #5). The use of Glass to support people with disabilities or to control chronic diseases (such as diabetes) was one of the first arguments about the importance of this type of wearable computing device.

According to Google, Glass was created as a new way to allow access to information and to connect people without shifting their attention away from real life. Google's arguments for creating Glass departed from the distractive nature of the smartphone, which demands one to look down and pay attention to the device. Google's lead designer of Glass affirmed that they wanted to create an original device that could be "intuitive, immediate and intimate", following the design guidelines of lightness, simplicity, and scalability, while providing timely and relevant information. The main idea was that this

technology "don't get in the way", while it was also important to "avoid the unexpected and the unpleasant". However, as we will discuss later, the different actors who get involved in the controversy contested the purposes, affordances, and possible consequences of using the device.

In June 2012, Google made a spectacular presentation with a live skydiving demo of athletes using Glass at the Google I/O Conference, announcing the "Glass Explorer Program" (Events #7 and #8). This program aimed to engage developers and different types of people specially invited by Google (celebrities, artists, researchers, and potential developers) to use Glass and create apps for it. The "Explorer Edition" prototype cost USD 1,500 and was pre-ordered by approximately 2,000 people, all US-based, with Google stating that delivery would be in the first semester of 2013.

Google enrolled several actors in the launch of Glass, alongside with several digital artifacts such as Android (Glass operational system), the first Google apps created for it and the compatible smartphones (to connect to the Internet). The Explorers were expected to be the co-creators of different apps (for music, sports, entertainment, and productivity), which would run on the Glass platform.

In September 2012, Glass appeared at New York Fashion Week, being worn by famous designers and fashionistas (Event #9). By inviting people from the fashion industry, as well as athletes and celebrities, to use Glass, Google attempted to sell it as an innovative, creative, fashionable, and futuristic device. IT people, experts/consultants in the IT industry, business consultants, journalists, reporters, and bloggers produced news and blog entries about Glass. Venture capitalists who were keen to invest in the Glass platform were also involved. Several articles, blog entries and videos, some of which were produced through Glass, were disseminated across the Internet. The *Time* indicated Glass as one of the best inventions of 2012 (Event #10).

In January 2013, Google announced the Mirror API (Event #11), a platform for developing apps for Glass, and promoted the first "Glass Foundry" in San Francisco, a two-day event on coding and testing Glass for developers enrolled in the Explorer Program. An identical event took place in New York the following month (Event #12).

Although most of the first group of people subscribed on the Explorer Program had not yet received their Glass devices, on February 20th, 2013, Google expanded the program and allowed more developers and consumers to buy and test the prototype. Applicants had to post 50 words or less on their Google+ or Twitter pages with the hashtag #ifihadglass (Event #15). During a "fireside chat" at the Google I/O Conference in 2013, the Glass project team affirmed they were looking for different types of people to use Glass, such as "educators, teachers, athletes, DJs, hairstylists". Following this call, more than 8,000 people, including developers as well as a variety of users, got involved.

5.2. The emergence of the controversy

During the process of Glass launch, the media broadcast several reviews of the device (e.g., Event #16), which highlighted Glass' features, the apps created for it and its possible uses. Although Glass was still only being used inside Google and by the Explorers, different and unpredictable actors spontaneously involved themselves with the innovation process, such as artists, government and NGOs representatives, physicians, hackers and, notably, the general public, that actively commented on the Glass reviews, questioning the utility and adequacy of Glass, generating the controversy.

A series of events of Glass banishment in different contexts started to appear in the press and fueled the intense debate on the new technology. For example, on February 20th, a cafe in Seattle banned the use of Glass (Event #17), while, on March 22nd, a West Virginia bill banned Glass while driving (Event #18).

The Glass debate questioned its purposes, affordances, and risks. A key issue was privacy because it was not clear when users were recording or taking pictures of other people around them via Glass. Besides the worries about privacy invasions, there was the issue of technology overload and the role technology plays in our daily life and human relations (see Figure 2).

Affordances	Examples	Risks	Examples
Accessing information on the move to support everyday tasks	"Record your daily habits (…) provides you alternate routes to avoid traffic, and update you occasionally about the weather conditions." (Journalist)	**Privacy invasion by being recorded or photographed without advance notice**	"Glass makes it entirely too easy to capture 'creeper shots' of unsuspecting women. Within seconds of noticing them I was able to capture these lovely young ladies, you know (…) for science." (Glass Explorer) "While the nation frets over privacy Google is working on its next project: Google suppositories." (Journalist)
Support for communication anywhere, with anyone, via translation	"Translate Language in Google Glass - this feature is very handy and very useful if you are traveling outside your country." (Journalist)	**Hacking and having personal data collected without notice**	"It is impossible to guarantee against these devices being hacked, so it would be surprising if people are allowed to wear them anywhere like government buildings or in businesses that handle sensitive intellectual property." (NGO representative)
Having access to news and updates anywhere, anytime	"It's like having Bloomberg 24h a day." (Glass Explorer)	**Distraction (while driving, walking, working, etc.)**	"Just imagine, folks: you're stuck in rush hour traffic, or you are trying to cross a busy intersection, and lucky for you all the other drivers are using (are distracted) with Google Glass (...) 'Glassing' (...) and putting the rest of us at risk." (General public)
Discrete technology that can enhance the experience of living in the real world and human interactions	"You can even chat with your friends via social networks with Google Glass. Maybe you wanted to let someone know of an important event coming up in your life." (Journalist) "As a parent of young kids, I'm often torn between enjoying the moment and capturing it - would love a set just for that." (General public)	**Interference with human interactions/ alienation from reality**	"After the shock and paranoia subside, there is the annoyance. Can a person really be engaged in a conversation if there are e-mails in the corner of their eye?" (Journalist) "I don't like the feeling of being that guy who is less concerned with the people and things surrounding him physically, and who is more concerned with his virtual world." (General public)
		Fear of being manipulated by the technology	"And don't think for a second you're in control of the data from your own Glass. You're just a conduit for data collection." (NGO representative)
		Aesthetic issues (geek, cyborg appearance)	"Now you can walk around all day and look like an absolute prick. Thanks Google. Taking the cool out of society one product at a time." (General public)

Figure 2. Affordances and Risks of Glass

At the end of April 2013, a particular event set the controversy alight. A Google

Explorer took a selfie in the shower using Glass, and his photo went viral (Event #24). Several memes were created about the episode by the general public. It fueled the image of Glass as a "creepy", inadequate device. The event reinforced the term "Glasshole," which became part of the popular tech lexicon:

> *"Noun. A person who wears Google Glass and refuses to remove it when directly interacting with other people, private gatherings, or public events. The general belief is that these people are photographing, recording, Googling, and Facebooking the people they're interacting with instead of focusing on the conversation or acting like a human being. In extreme cases this word is directly synonymous with stalker or creeper."* (Urban Dictionary: https://www.urbandictionary.com/define.php?term=Glasshole)

> *"A Glasshole is an individual who behaves inappropriately while using the Google Glass interface. This new and somewhat edgy term specifically refers to a range of behaviors that shed light on the constantly changing human interactions with technology"* (Techopedia: https://www.techopedia.com/definition/30095/glasshole)

Popular TV shows such as *Saturday Night Live* parodied Glass use (Event #25), while many videos mocking the device were posted on YouTube during 2013. In May 2013, a casino in Las Vegas banned the use of Glass (Event #26), and members of the US Congress sent a letter to Google asking for information about privacy issues (Event #28), especially regarding apps that used facial recognition; Google reconfirmed that it would not approve any apps using this feature. Google's response to the letter from the US Congress was sent on July 2013 (Event #30) and considered disappointing, due to its evasive tone.

In 2014, the development process and the controversy continued. In January, an app for recording sex with a partner was released, which received much criticism from the media (Event #39). Meanwhile, in an episode of *The Simpsons*, the Glass device was again parodied, addressing privacy concerns (Event #41). In February 2014, new events about such concerns happened, including a US senator who raised more questions about facial recognition through Glass (Event #43), as well a late-night physical attack against an Explorer in a club in San Francisco (Event #45). The same month, Google published a list of "dos and don'ts" (Event #44), which addressed Glass etiquette and appropriate places for using it.

Different meanings of Glass emerged from the controversy, alongside different contexts in which it was considered appropriate or not to use Glass. For instance, it was acceptable for it to be used in sports, field training, travel and street photography, and translation, as well as to support people with disabilities in their daily tasks. Some places were not suitable for use, such as bathrooms, casinos, locker rooms, and ATMs, as well as while driving, visiting bars and restaurants, and during sex (Google issued rules to restrict this use: https://developers.google.com/glass/policies).

The discussion of pros and cons of Glass also led to a debate about how the future would be with the use of this technology. It resulted in the emergence of different arguments about Glass. We identified two main ones: the "more of the same" argument and the "we've had enough" argument. In Figure 3, we show evidences about it.

The 'More of the same' argument	The 'we've had enough´ argument
"Honestly, they use our information to help us. Worst case scenario, Google tells all my friends I like cats." (General public)	"Things evolve but at some time people say "stop", it´s enough." (Journalist)
"You can create the laws but at some point technology will break them (…) some people think some things are annoying but young people think it is perfectly ok to share your whole life on Facebook, for example." (Journalist)	"We cannot keep allowing multinational corporations to erode whatever bit of privacy we have left for data mining and for governments to get a hold of this data. Again it's not lost on me that nerds who have never had social skills are at the forefront of all this digital technology." (General public)
"I predict that Google Glass will become the new iPhone-everybody will want one and will be willing to pay a premium price to own one. And like the iPhone, Google will release a new version twice a year and make big bucks like Apple did." (General public)	"Choice is key to trust in the digital economy and Glass doesn't just challenge our assumptions about consent, it challenges whether we even have a choice any more. And that can't be good for anyone". (NGO representative)
"Regarding privacy concerns, yes - that needs a larger debate. But, all of us know that there are devices out there with more hidden ways of capturing videos/images (…). In larger context, CCTV monitoring in all public places needs to be debated as well." (General public)	"I think it's a technology overkill; there are already so much crap happening around us nowadays, do we really need to superimpose an additional layer of information on top of everything to further distract ourselves from the reality? People are going to fuc*** crash their cars and bikes playing with this nonsense." (General public)
"The vast majority of people aren't perverts or creeps, and wouldn't use Glass as a force of evil. Besides, the real stalkers already have better tools at their disposal." (IT people – user)	"There will be an entire new genre of stuff on the internet to join the other secret filming of women in locker rooms, bathrooms, at the beach, in their apartments by their landlords or in changing rooms or up their skirts while they stand in line." (General public)
"How is it any different to mobile phone cameras with regard to privacy?" (General public)	"There is a lot of room for error. Granted, many only focus on convenience these days, and I think a big picture is left behind/side-lined... I'm worried about a lot... Tracking, access, use, privacy". (General public)
"We may figure out to adapt the new technology into our lives without giving up of our privacy. We've certainly done it before." (Journalist)	"I think as a community we are still grappling with privacy and social issues arising from smartphones and I've not seen any real discussion (online or otherwise) thing in the press about the effect that Glass would have on those things". (General public)

Figure 3. Different arguments in the controversy

According to Figure 3, the "more of the same" argument, put forward by some actors, including Google, some journalists, Explorers, IT experts and the general public who were pro-Glass, claimed that it was no different to any other devices and applications already in use. Some journalists reinforced the assumption that society would naturally figure out how to use Glass properly.

On the other hand, the "we've had enough" argument offers a different view. Actors who put this forward, including journalists, the general public and the few NGOs representatives who appear in the data, argued that we are already full of privacy invasions and technology interference in our daily life and it is time to question it. These actors assumed two central positions. First, they claim that it is time for society to discuss what types of behavior should be accepted or not regarding the use of devices such as

Glass. Second, they declare themselves against Glass use on the grounds that it should not be sold as a consumer product or that it was doomed to failure.

Figure 4 shows quantitative data about the two key arguments in the Glass debate, according to the actors that manifested these arguments. Figure 5 evidences that journalists and the general public were the leading voices in this debate.

Types of actors	"More of the Same"	"We´ve had enough"
Academic researchers	1	4
Artists (filmmakers, comedians)	0	4
Business consultants	3	4
Software developers (Explorers)	2	1
General public	35	69
Google	2	0
Hackers	0	3
IT experts	4	5
Journalists	24	47
Regulators (Lawmakers)	2	6
NGO representatives	0	5
Total number of references*	**73**	**148**

Figure 4: Main arguments in the Glass controversy and actors
Source: research data
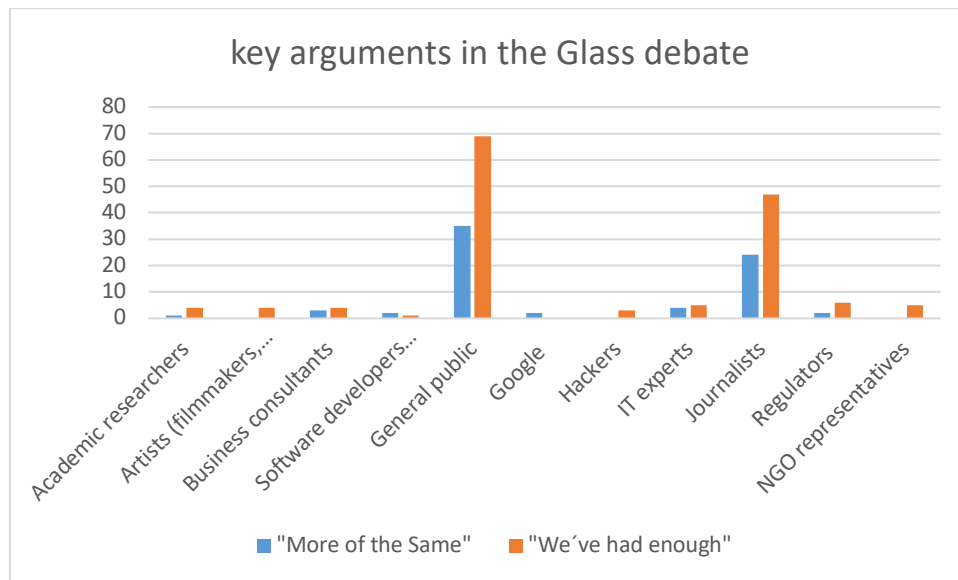(*) Text quotes with the argument, coded from all the documents in the database

Figure 5: Main arguments in the Glass controversy – main actors
Source: research data
(*) Number of text quotes with the argument, coded from all the documents in the database

Beyond the predictions about the failure or success of Glass, the actors discussed the possible consequences of its use in human interactions and daily life. As mentioned before, some actors claimed that this matter was part of natural evolution. Others argued

that it could lead to decadence in human capacities and relationships:

"Is the opportunity to 'wear' a tiny computer a sign of progress, or simply more evidence that culturally we're evolving into robotic consumers with reduced respect for the quality of life and almost no sense of individual privacy? Do we really need the ability to surf the Internet every moment of our lives?" (Journalist)

"Futureworld seems dumber by the day (...) personally, like Gaugin I'd love to escape to an island to make love and eat papaya all day." (General public)

There were "optimistic views" of the future, in which devices such as Glass would succeed, either by evolving technologically or bringing benefits to society; for instance:

"In the future, wearable technologies will help us manage our lives, keep us in tune with our bodies through on-body sensors, augment our minds." (Journalist)

"People is going to use Google Glass to find coffee shops and restaurants, for instance, and Google can get some cents out of each transaction that it helped to be done, and it can be billions." (Explorer)

"Project Glass could hypothetically become Project Contact Lens (…) that has embedded electronics and can display pixels to a person's eye." (Journalist)

There were also "pessimist views", in which devices such as Glass would become successful, but to the detriment of society; for instance:

"We are unwittingly constructing the Matrix. Google Glass is just one more small step in acclimatizing ourselves to being part of a larger organism (...) Tomorrow, you may die without connectivity - Do you want this?" (General public)

"I can imagine politicians in the future being 'plugged into' Google literally, at all times. How handy for them and big CEOs to have speeches and facts (or fables) right there, with no one to know they're even using it. They could change the 'tone' of their speeches as they're talking if their numbers start dropping!" (General public)

"None of you 'tech bloggers' seem to understand that this IS NOT a product that will be aimed at the everyday Joe. Where its headed is Corporate America and law enforcement (…) every cop on the beat will be wearing these one day as part of his job." (General public)

"So, I feel a bit sad thinking of an always-on future in society at large (…). It still feels good to get out onto the street and at least occasionally make eye contact with people you pass (…) It's already quite possible to feel alienated while surrounded by thousands or millions of people." (General public)

On April 2014, Google commenced sales of Glass to the public in the US, and a month later to UK residents, announcing that: "*This isn't the same Glass you saw last April. In the past year, we've released 9 software updates, 42 Glassware apps, iOS support, prescription frames, and more, all largely shaped by feedback from our Explorers.*" However, by that time, the controversy had cooled down, and Glass was

already considered a failure as a mass-market product (Dvorak, 2014; Reynolds, 2015; Nieto-Rodriguez, 2017). Google pushed back the Glass roll out; app developers abandoned their projects, and several Google employees related to the Glass project left the company, although Google insisted it was still committed to Glass (Oreskovic et al., 2014). Recently, it has been announced as a product for enterprise use (D´Angelo, 2019).

6. DISCUSSION

The Glass case reveals several elements on how controversies emerge in digital platform innovation processes. We discuss these elements following a process view through the four moments of translation (Callon, 1986), understanding the main points of controversy emergence and its relation with the features of digital platforms.

As previously explained, *problematization* is a moment when a focal actor initiates the process of network building, proposing a problem on their own terms (Callon, 1986). In the moment of problematization, we can realize two primary sources of disagreement from which controversy emerges: disagreements about the problem and disagreements about the solution proposed by the network builder (platform owner).

Many digital innovations (such as Glass) are "solutions in search of a problem": it is not apparent to all those involved what is the problem at hand and what type of value can be created by some new (frequently disruptive) digital innovation. Besides, the generativity of a digital platform technology such as Glass (Zittrain, 2006; Henfridsson & Bygstad, 2013), to which several different apps and functions can be created, fuels combinatorial and unpredicted innovations (Yoo et al., 2010, 2012).

At the launch of Glass prototype, Google openly declared they wanted to "start a conversation" and receive feedback about what Glass should be. The appearance of the device for the first time at an event for an association supporting the blind population attempted to link Glass with the idea of a prosthetic device; the design team also referred to it as an unobtrusive substitute for the smartphone, with a broad range of possible applications and uses.

The actors who became embroiled in the controversy, on the other hand, debated the hidden intentions of the platform owner (Google) with Glass, for instance, collecting data anywhere, anytime, and using it to sell ads. As an ONG representative stated, Glass could turn every user into a "conduit for data collection". The possible uses of these data were not apparent, as well as the problem targeted by it and its affordances. For instance, as the data show, Glass's capabilities in facial recognition were subject to interrogation (even by the US Congress). Since only the user can hear and see the data accessed through Glass, one of the biggest worries was nonusers being recorded, photographed, or identified without been informed by the users.

Nowadays, digital platforms provide myriad of personal services and applications (Kenney & Zysman, 2016; Reuver et al., 2018; Yablonsky, 2019), created from un-coordinated distributed complements (Eaton et al., 2015). These services and applications gather and use data about what users like, what they do, whom they interact with, and where they are. In this sense, the high level of human-technology proximity provided by the wearable device, combined with the generativity and opaqueness of the digital platform behind it, generated questions about how it can be used, for what purposes and what are the consequences of its use in daily life and human relations, not only for the users but also for the bystanders. Bystanders are people indirectly affected by

technology, either because they have no access to it, or because they chose not to exercise their access (Ferneley & Light, 2008).

The opaqueness (Introna, 2007) of Glass, in this case, stems from the generativity of digital platforms, in which digital data can be shared, sliced, diced, recombined and resold (Kallinikos et al., 2013; Reuver et al., 2018) without the involvement of the originator of the data, in loosely coupled layers of technologies and applications (Yoo et al., 2010, 2012; Kolloch & Dellermann, 2018). For instance, private data collected through Glass (such as the user's location) can be distributed across several layers of hardware and software components (which have an opaque and loosely coupled operation) to deliver personalized services. The forms in which the personal data, both from users and from bystanders, could be used was not clear and led to questioning and debate among the different actors involved. One source of successful innovation is frame sharing, i.e., emerging alignment among social groups about goals, critical problems and problem-solving strategies (Nahuis et al., 2012); it was problematic in the Glass case.

In this sense, the different actors started to discuss not only the technology purposes and affordances of Glass but also its risks to society. Through this problematization and densely webbed narratives, we identified two emerging arguments: the "more of the same" argument about technology evolution and the "we've had enough" argument, which is latent in contemporary society. A controversy is usually related to others (Venturini, 2010a, 2010b) and they may be driven by popular beliefs about an uncertain future (Ramani & Thutupalli, 2015). Glass was created at a time of worries about the abusive use of intimate, opaque and tight coupling digital technologies for surveillance and privacy invasion (Zuboff, 2015). Related controversies, such as the NSA-Snowden scandal (June 2013), also fed the Glass controversy. These elements can be viewed as *interpretive packages*: ideas and concepts that have prominence in the public debate, relating items in the debate to a broader storyline at the societal landscape level, to generate meaning (Mulder, 2012).

The analysis of the Glass case also reveals emerging controversy points related to the definition of identities and roles of those involved or affected by the digital platform innovation. We can link it with two moments of the translation process (Callon, 1986): *interessement* (which consists of a group of actions by which an entity attempts to define and stabilize the identity of other actors involved through problematization) and *enrollment* (the definition of a set of interrelated roles attributed by the network builder/innovator to actors who accept them).

In this sense, many heterogeneous actors need to cooperate in providing digital platform services and applications, for instance, platform owners, developers, and users, together with several loosely coupled layers of technology (Yoo et al., 2012; Kappor & Agarwal, 2017). Kolloch & Dellermann (2018) point out that controversies can arise in digital ecosystems due to disagreements human/human (for instance, in trading relationships), between non-human/non-human (for example: technological protocols for communication between artifacts might not be interoperable) and also non-human actors can trigger controversies with human actors, for instance, users can oppose a technology interface, which happened in the Glass case.

Considering the roles of the different actors in the digital platform innovation process, how Google dealt with the openness of this process gave space to the emergence of the controversy. It attempted to select specific actors through the Explorer Program, which became an "obligatory point of passage" (Callon, 1986; Elbanna, 2012); only people approved to experiment with the device could use and help to develop it. This

decision resulted in the creation of a "tech elite" of chosen people who could access and co-create the technology, increasing the uncertainty about it in society.

Nevertheless, although bystanders were ignored as important actors by Google, the general public manifested themselves spontaneously in response to the innovation. Google's selective approach of Explorers contributed to their criticism, such as the creation of the term "Glasshole."

Interessement, when successful, leads to *enrollment*. In the Glass case, the separation between Explorers and the general public contributed to its failure in terms of technology acceptance, which depended upon the definition of identities and roles of people involved or affected by the innovation process.

The next step of translation (*mobilization*) was not possible, because these disagreements remained unsolved. Without alignments of identities, roles, and interests, the innovation diffusion failed.

Based on the analysis of the Glass controversy, we propose the framework depicted in Figure 6, which helps to explain the process of controversy emergence in digital platform innovation processes. Few controversy studies are focused on how this process unfolds – as we argued before, most of the previous studies related to digital platform innovation controversies are focused on the type of controversy and its consequences/impact, or in economic and technical elements.

In this framework (Figure 6), the digital platform innovation process is considered as a process of translation, which happens in the four moments: problematization, interessment, enrollment, and mobilization. It is important to reinforce that these moments do not occur linearly; they overlap and iterate in practice. In each one of these moments, there are possible "controversy emergence points."

The "controversy emergence points" are originated in types of disagreements among the different human actors involved (platform owners, innovators, developers, IT experts, users, bystanders, and the general public) and their interactions with non-human elements, including the platform and its features, associated devices; other platforms; operational systems and applications. These disagreements are related to the problem/solution debate, the technology/innovation affordances, the identities and roles of the actors involved in the innovation process.
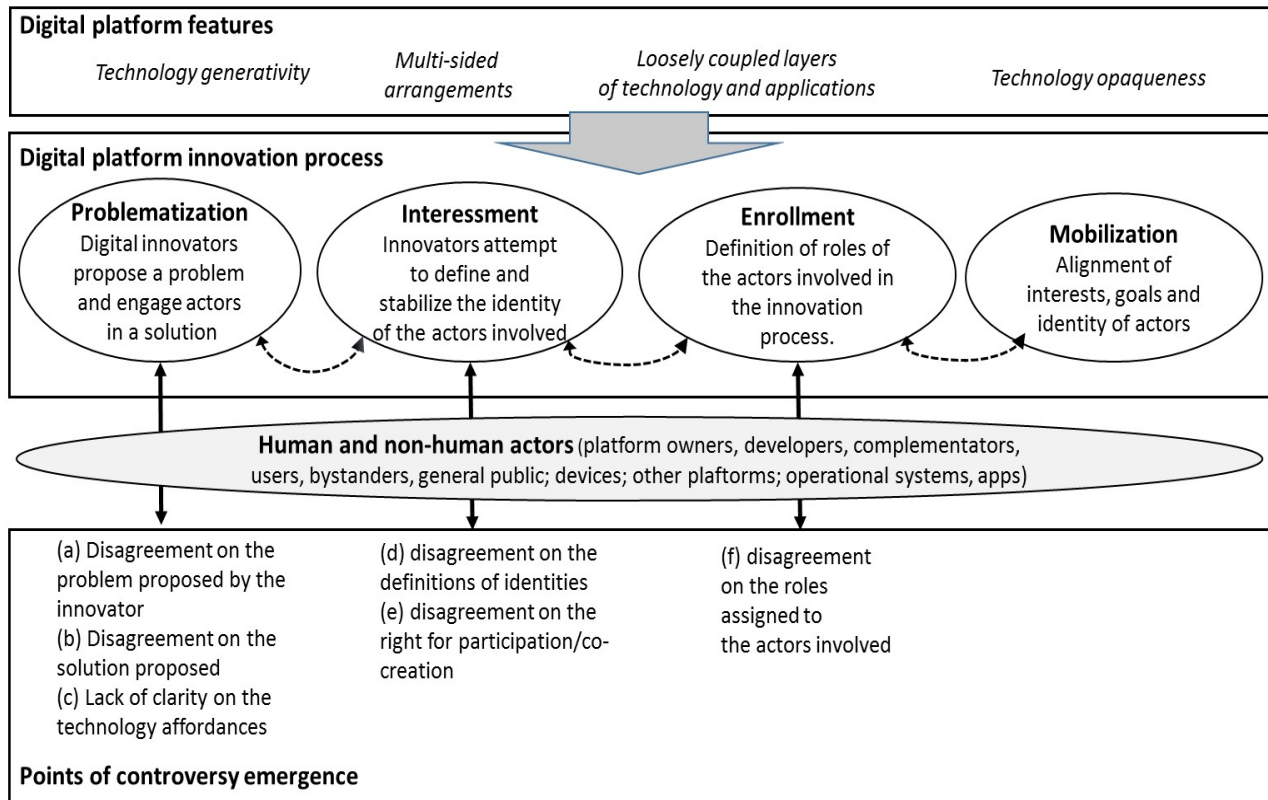
Figure 6. Controversy Emergence in Digital Platform Innovation Processes

These disagreements are also related to specific features of digital platforms, specifically: the platform generativity, the multisided market arrangements in the platform; the loosely coupled layers of technologies and applications involved and the opaqueness that results from these elements. These features turn digital platforms particularly vulnerable to controversy emergence in innovation processes, due to the different actors and interests involved in this complex sociotechnical arrangement.

The development and diffusion of digital platform innovation depend upon the resolution of such points of disagreement, which leads to the mobilization phase. Note that, in the mobilization phase of the innovation process that are no controversy emergence points, because, to reach this phase, conflicts and disagreements have to be already solved. In the mobilization phase, the actor-network has been formed, and the innovation stabilizes. It did not happen in the Glass case.

7. CONCLUSIONS

The rise of digitization has led scholars to question the explanatory power and usefulness of current innovation theory, while studies that explicitly incorporate the variability, materiality, and emergence of digital innovation, as a rich sociotechnical phenomenon, are needed (Nambisan et al., 2017). In this sense, our main knowledge contribution to the existing literature is summarized in the proposed framework (Figure 6), which helps to understand how controversies emerge and unfold in digital platform innovation processes. This understanding brings a sociotechnical, political view to this

process, usually analyzed through technical and economical lenses.

The framework contributes to the literature by highlighting the digital platform innovation process as a process of translation (Callon, 1986), emphasizing the nonlinearity and emergence of this process, which can lead to unforeseeable consequences and controversies. We argue that controversies can help to reveal how opaque technologies, such as layered digital platforms and services, are created, while making the politics of innovation more explicit for scrutiny, as a way of collectively dealing with uncertainties (Introna, 2007; Callon et al., 2009).

Our findings also contribute to practice by suggesting that, although it is not possible to control controversies (because they are emergent phenomena), some elements and potential points of disagreement in digital platform innovation processes (as depicted in Figure 6) can be identified, allowing platform innovators to avoid or to manage them with flexibility.

It is also essential to evaluate the trade-offs between the possible benefits of opening up a digital platform innovation process - realizing that, when it is open, it is always more susceptible to controversies - or "closing" some parts of the process, while, in this case, losing the benefits of the debate and the engagement of different stakeholders. Our empirical data suggest that, sometimes, the very act of closing some parts of this innovation process can provoke the emergence of controversies. It is essential to make clear the rights and forms of participation of the associated actors in the process.

It is also critical to reduce the opaqueness of the digital platform innovation, stating (as clearly as possible) the problem targeted by it and the type of solution proposed - the technology affordances and risks – to the actors involved, especially users and also bystanders. In this sense, digital platform innovators should increasingly focus on real-life problems: the "we've had enough" argument, in the Glass case, may indicate that people are saturated with questionable technology "solutions" invading their daily life, while so many social problems around us, which could be solved through the use of digital platforms, are still neglected.

Besides the understanding generated on the digital platform innovation process and related controversy emergence, the research results also confirm that, as previous studies have shown, functional, utilitarian, and performance benefits are not sufficient to explain consumer reactions to wearable technologies (Herz & Rauschnabel, 2019), and, in particular, ARSG. Few studies explicitly incorporate risk factors as elements that affect the acceptance of wearables and ARSG (Hein et al., 2017; Rauschnabel, He and Ro, 2018; Herz & Rauschnabel, 2019).

Besides, previous literature on ARSG does not approach it as a digital platform technology, and the implications of the generativity and opaqueness of these platforms to the acceptance of the ARSG device. Exactly because Google Glass is a device connected to a digital platform, it was not clear to people in general what sort of use would be made with the data collected through this device and how these data would flow in the platform to third parties.

Finally, it is essential to consider that our work has boundaries and limitations. The framework proposed is suitable for analyzing complex digital platform innovation processes that have some level of openness and a broad audience. Another limitation to consider is that digital/online/secondary data on controversies are not free of biases (Marres, 2015). As already discussed by Marres (2015) there are two different ways to treat the methodological problem of digital bias in online controversy analysis: with a

precautionary approach - that treats digital media technologies as a source of noise that must be neutralized with the use of primary/offline data - and an affirmative approach (which we have followed) that treats digital sources and devices as an empirical resource for controversy analysis. We considered that biases and vested interests would be present in any controversy, and they are part of it. Therefore, the use of secondary data from the web brings a set of limitations, but the volume and variety of the data collected attempted to overcome these limitations.

In future research, we, as academics, need to be more involved in, and attentive to, the debates. The role of "silent" actors involved in digital platform innovation controversies (such as venture capitalists) should also receive attention in the future. New studies focusing on the complexity of ARSG as digital platform devices are needed. The consideration, replication, and interrogation of the proposed framework in future research on digital platform innovation processes and controversies are necessary.

References

Acquier, A., Daudigeos, T., & Pinkse, J. (2017) Promises and paradoxes of the sharing economy: An organizing framework. *Technological Forecasting & Social Change*, 125, 1–10.

Akrich, M., (1997). The de-scription of technical objects. In: Bijker, W.E., Law, J. (Eds.), *Shaping Technology/Building Society*. 2nd ed. MIT Press, Cambridge, Massachusetts.

Aubert-Tarby, C., Escobar, O. R., & Rayna, T. (2018). The impact of technological change on employment: The case of press digitisation. *Technological Forecasting and Social Change*, 128, 36–45.

Bauer, M., & Aarts, B. (2000). Corpus construction: a principle for qualitative data collection. In: Bauer, Martin W., and George Gaskell, eds. *Qualitative researching with text, image and sound*: *a practical handbook for social research*. London: Sage, 19-37.

Belk, R. (2014). Sharing versus pseudo-sharing in Web 2.0. *The Anthropologist*, 18(1), 7-23.

Bharadwaj, A., El Sawy, O., Pavlou, P., & Venkatraman, N. (2013). Digital business strategy: toward a next generation of insights. *MIS Quarterly*, 37 (2), 471-482.

Bogner, A., & Torgersen, H. (2015). Different ways of problematising biotechnology–and what it means for technology governance. *Public Understanding of Science*, 24(5), 516-532.

Boudreau, K. (2010). Open Platform Strategies and Innovation: Granting Access vs. Devolving Control. *Management Science.* 56(10), 1849–1872

Brante, T. (1993). Reasons for studying scientific and science-based controversies. In Brante, T., Fuller, W., & Lynch, W. (eds.) *Controversial science: From content to contention*, New York: SUNY Press, 177-191.

Brown, S. L., & Eisenhardt, K. M. (1997). The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations. *Admin. Sci. Quart.* 42(1) 1-34.

Callon, M. (1986). Some elements of sociology of translation: Domestication of the scallops and the fishermen. In Law, J. (ed.). *Power, Action and Belief: A New Sociology of Knowledge*, London: Routledge.

Callon, M., Lascoumes, P., & Barthe, Y. (2009). *Acting in an uncertain world: An Essay*

on Technical Democracy. MIT press.

Chen, P. C., & Hung, S. W. (2016). An actor-network perspective on evaluating the R&D linking efficiency of innovation ecosystems. *Technological Forecasting and Social Change*, 112, 303-312.

Chesbrough, H. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Harvard Business School Press, Boston.

Colbjørnsen, T. (2014). Digital divergence: analysing strategy, interpretation and controversy in the case of the introduction of an ebook reader technology. *Information, Communication & Society*, 18(1) 32-47.

D´Angelo, M (2019). *Google Glass Enterprise Edition 2*: Is It Good for Business? Available at: https://www.businessnewsdaily.com/10313-google-glass-enterprise-business.html. Accessed: 26th Sept. 2019.

De Falco, S., Renzi, A., Orlando, B. & Cucari, N. (2017) Open collaborative innovation and digital platforms, *Production Planning & Control*, 28(16), 1344-1353

Dougherty, D., & Dunne, D. (2012). Digital science and knowledge boundaries in complex innovation. *Organization Science,* 23(5) 1467-1484.

Dvorak, J. (2014). *Rest in Peace, Google Glass:* 2012-2014, Accessed: Dec 1st, 2014. http://www.pcmag.com/article2/0,2817,2469916,00.asp.

Eaton, B. D., Elaluf-Calderwood, S., Sørensen, C., & Yoo, Y. (2015). Distributed Tuning of Boundary Resources: The Case of Apple's iOS Service System. *MIS Quartely*, 39(1) 217-243.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, 50(1), 25-32.

Fatimah, Y. A., Raven, R. P. J. M., & Arora, S. (2015). Scripts in transition: Protective spaces of Indonesian biofuel villages. *Technological Forecasting and Social Change*, 99, 1–13.

Ferneley, E., & Light, B. (2008). Unpacking User Relations in an Emerging Ubiquitous Computing Environment: Introducing the Bystander. *Journal of Information Technology*, 23(3) 163-175.

Giddens, A. (1984). The constitution of society. Berkeley.

Goldstein, J. (1999). Emergence as a construct: History and issues. *Emergence*, 1(1) 49-72.

Greenwood, R., Oliver, C., Lawrence, T. B., & Meyer, R. E. (Eds.). (2017). *The Sage handbook of organizational institutionalism*. London: Sage.

Hein, D. W., Jodoin, J. L., Rauschnabel, P. A., & Ivens, B. S. (2017). Are wearables good or bad for society?: An exploration of societal benefits, risks, and consequences of augmented reality smart glasses. In *Mobile Technologies and Augmented Reality in Open Education* (pp. 1-25). IGI Global.

Henfridsson, O., & Bygstad, B. (2013). The Generative Mechanisms of Digital Infrastructure Evolution. *MIS Quarterly*, 37(3) 907-931.

Herz, M., & Rauschnabel, P. A. (2019). Understanding the diffusion of virtual reality glasses: The role of media, fashion and technology. *Technological Forecasting and Social Change*, 138, 228-242.

Huang, J., Henfridsson, O., Liu, M. J., & Newell, S. (2017). Growing on steroids: rapidly scaling the user base of digital ventures through digital innovation. *MIS Quarterly,* 41(1), 301-314.

Introna, L. D. (2007). Maintaining the reversibility of foldings: Making the ethics (politics)

of information technology visible. *Ethics and Information Technology*, 9(1), 11-25.

Kallinikos, J., Aaltonen, A., & Marton, A. (2013). The Ambivalent Ontology of Digital Artifacts. *MIS Quarterly*, 37(2), 357-370.

Kappor, R., & Agarwal, S. (2017). Sustaining Superior Performance in Business Ecosystems: Evidence from Application Software Developers in the iOS and Android Smartphone Ecosystems. *Organization Science*, *28*(3), 531-551.

Kling, R., (ed.) (1996). *Computerization and Controversy: Value Conflicts and Social Choices.* (2nd Edition) Academic Press.

Knights, D., & Murray, F. (1994). *Managers Divided: Organisation Politics and Information Technology Management* (Wiley, Chichester).

Kolloch, M., & Dellermann, D. (2018). Digital innovation in the energy industry: The impact of controversies on the evolution of innovation ecosystems. *Technological Forecasting and Social Change*, 136, 254–264 .

Koskinen K., Bonina C., Eaton B. Digital Platforms in the Global South: Foundations and Research Agenda. (2019) Digital Platforms in the Global South: Foundations and Research Agenda. In: Nielsen P., Kimaro H. (eds) *Information and Communication Technologies for Development. Strengthening Southern-Driven Cooperation as a Catalyst for ICT4D. IFIP Advances in Information and Communication Technology*, vol 551. Springer, Cham, 319-330.

Latour, B. (1987). *Science in Action*: How to Follow Scientists and Engineers

Latour, B. (2005). Reassembling the Social: An Introduction to Actor-Network Theory. Oxford: Oxford University Press.

Law, J. (1991). Introduction: monsters, machines and socio-technical relations. In *A Sociology of Monsters: Essays on Power, Technology and Domination*, Law, J. (ed.) Routledge, London, 1-23.

Law, J. (1992). Notes on the theory of the actor–network: ordering, strategy, and heterogeneity. *Systems Practice*, 5(4), 379-93.

Law, J. (2004). *After Method: Mess in Social Science Research,* London: Routledge.

Majchrzak, A. & Markus, L. (2013). Technology Affordances and Constraint Theory of MIS. In Kessler, E. (org.) *Encyclopedia of Management Theory*, Sage, Thousand Oaks, CA.

Mansell, R. (2016). Unpacking Black Boxes: Understanding Digital Platform Innovation, 10.13140/RG.2.2.21710.05442. available at, https://www.researchgate.net/publication/311170700_Unpacking_Black_Boxes_Understanding_Digital_Platform_Innovation

Marres, N. (2015). Why map issues? On controversy analysis as a digital method. *Science, Technology, & Human Values*, 40(5), 655-686.

McMaster, T., Vidgen, R. T., & Wastell, D. G. (1997). Technology transfer: Diffusion or translation? In T. McMaster (Ed.), *Facilitating technology transfer through partnership*. London: Chapman & Hall.

Mulder, K. (2012). The dynamics of public opinion on nuclear power. Interpreting an experiment in the Netherlands. *Technological Forecasting and Social Change*, 79(8), pages 1513-1524.

Nahuis, R., Moors, E. H., & Smits, R. E. (2012). User producer interaction in context. *Technological Forecasting and Social Change*, 79(6), 1121-1134.

Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital Innovation Management: Reinventing Innovation Management Research in a Digital World. *MIS*

Quartely 41(1), 223-238.

Nieto-Rodriguez, A. (2017). Notorious Project Failures - Google Glass. CIO Magazine. June 20th, available at: https://www.cio.com/article/3201886/it-strategy/notorious-project-failures-google-glass.html

Oreskovic, A., Mcbride, S., & Nayak, M. (2014). *Google Glass future clouded as some early believers lose faith*, Accessed: Dec 1st, 2014. goo.gl/PkKQh5.

Orton, J. D., & Weick, K. E. (1990). Loosely coupled systems: A reconceptualization. *Academy of Management Review*, 15(2), 203-223.

Panourgias, N. S. (2015). Capital markets integration: A socio-technical study of the development of a cross-border securities settlement system. *Technological Forecasting and Social Change*, 99, 317–338.

Parker, G., Van Alstyne., M. & Jiang, X. (2017). Platform ecosystems: How developers invert the firm. *MIS Quarterly* 41(1). 255-266

Ramani, S. V., & Thutupalli, A. (2015). Emergence of controversy in technology transitions: Green Revolution and Bt cotton in India. *Technological Forecasting and Social Change*, 100, 198-212.

Rauschnabel, P. A. (2018). Virtually enhancing the real world with holograms: An exploration of expected gratifications of using augmented reality smart glasses. *Psychology & Marketing*, 35(8), 557-572.

Rauschnabel, P. A., He, J., & Ro, Y. K. (2018). Antecedents to the adoption of augmented reality smart glasses: A closer look at privacy risks. *Journal of Business Research*, 92, 374-384.

Reuver, M., Sørensen, C., & Basole, R. C. (2018). The digital platform: a research agenda. *Journal of Information Technology*, 33(2), 124-135.

Reynolds, S. (2015). Why Google Glass Failed: A Marketing Lesson. Forbes Magazine, Feb 5. Available at: https://goo.gl/3Y9Sep

Ro, Y. K., Brem, A., & Rauschnabel, P. A. (2018). Augmented reality smart glasses: Definition, concepts and impact on firm value creation. In *Augmented reality and virtual reality* (pp. 169-181). Springer, Cham.

Saldaña, J. (2015). *The coding manual for qualitative researchers*. Sage.

Sedera, D., Lokuge, S., Grover, V., Suprateek, S. & Sarker, S. (2016) Innovating with enterprise systems and digital platforms: A contingent resource-based theory view. *Information and Management*, *53*(3), 366-379.

Silverman, D. (2013). *Doing qualitative research: A practical handbook*. SAGE.

Stummer, C., Kundisch, D., & Decker, R. (2018). Platform launch strategies. *Business & Information Systems Engineering*, 60(2), 167-173.

Svahn, F., Mathiassen, L., & Lindgren, R. (2017). Embracing Digital Innovation in Incumbent Firms: How Volvo Cars Managed Competing Concerns. *MIS Quarterly*, 41(1), 239-253.

Tilson, D., Lyytinen, K., & Sørensen, C. (2010). Digital Infrastructures: The Missing IS Research Agenda. *Information Systems Research*, 21(4), 748–759

Tilson, D., Sørensen, C. and Lyytinen, K. (2012). Change and Control Paradoxes in Mobile Infrastructure Innovation: The Android and iOS Mobile Operating Systems Cases, In: 45th Hawaii International Conference on System Science (HICSS 45), Maui, HI.

Tiwana, A., Konsynski, B., & Bush, A. A. (2010). Platform evolution: Coevolution of platform architecture, governance, and environmental dynamics. *Information Systems*

Research, 21(4), 675-687.

Venturini, T. (2010a). Building on faults: how to represent controversies with digital methods. *Public Understanding Of Science,* 21(7), 796-812.

Venturini, T. (2010b). Diving in magma: How to explore controversies with Actor-Network Theory. *Public Understanding Of Science,* 19(3), 258-273.

Washington Post (2018). Transcript of Mark Zuckerberg´s senate hearing. Available at: https://www.washingtonpost.com/news/the-switch/wp/2018/04/10/transcript-of-mark-zuckerbergs-senate-hearing/

Whatmore, S. (2009). Mapping knowledge controversies: science, democracy and the redistribution of expertise. *Progress in Human Geography*, 33(5), 587-518.

Yablonsky. S. (2018). A Multidimensional Framework for Digital Platform Innovation and Management: From Business to Technological Platforms Systems Research and Behavioral Science. *Systems Research and Behavioral Science*. 35(4), 485–501.

Yoo, Y. (2010). Computing in Everyday Life: A Call for Research on Experiential Computing. *MIS Quartely,* 34(2), 213-231.

Yoo, Y., Boland, R., Lyytinen, K., & Majchrzak, A. (2012). Organizing for Innovation in the Digitized World. *Organization Science,* 23(5), 1398-1408.

Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). Research commentary—the new organizing logic of digital innovation: an agenda for information systems research. *Information Systems Research*, 21(4), 724-735.

Zittrain, J. L. (2006). The generative internet. Harvard Law Review, 19, 1974-2040.

Zuboff, S. (2015). Big other: surveillance capitalism and the prospects of an information civilization. *Journal of Information Technology*, 30(1), 75-89.

Appendix A. Timeline of the Google Glass Controversy

		DATE	EVENT	SOURCE/EVIDENCE
2011	1	Aug 18th	Patent of Google Glass submitted	goo.gl/xyPDiF (#20130044042)
	2	Dec 18th	Rumors in the press about the Glass project	http://goo.gl/p5QELl
2012	3	Feb 21st	Project Glass first news	http://goo.gl/d5NSNr
	4	Apr 4th	"Glass: One Day" video is released	goo.gl/xju7Bg
	5	Apr 5th	First public appearance of Glass	http://goo.gl/xUoIKP
	6	May 25th	The first video made with Glass is published	goo.gl/GpEYvt
	7	Jun 27th	Live skydiving demo at Google I/O Conference	goo.gl/D8arFc
	8		Glass Explorer Program starts	http://goo.gl/8fwhxd
	9	Sep 9th	Glass is used at New York Fashion Week	http://goo.gl/79GxEA
	10	Oct 31st	*Time Magazine* award (Best Inventions 2012)	https://goo.gl/TP1r23
2013	11	Jan 15th	Announce of the Mirror API	goo.gl/csziV1
	12	Jan/Feb	Glass Foundry events in San Francisco and NY	https://goo.gl/MkJjPp
	13	Feb	The website google.com/glass goes online	http://goo.gl/xbZo1D
	14	Feb 20th	"How It Feels" video is released	https://vimeo.com/78627573
	15		#ifihadglass call is announced	http://goo.gl/4vbHc1
	16	Feb 20th	Media publishes several Glass reviews	http://goo.gl/ZDAFSJ
	17	Mar 5th	A cafe in Seattle bans the use of Google Glass	https://goo.gl/2FDxra
	18	Mar 22nd	A West Virginia bill bans Glass while driving	http://goo.gl/uGueCG
	19	Apr 15th	Google releases the Mirror API	https://goo.gl/RgdmgY
	20		Google bans ads and fees for Glass	http://goo.gl/EuJ8gR
	21	Apr 16th	Glass devices start being delivered to the Explorers	http://goo.gl/FV4hCz
	22		Release of a web-based setup page for Glass	goo.gl/SdwbCd
	23		Google releases the MyGlass companion app	https://goo.gl/Gi7e8v
	24	Apr 28th	Selfie in the shower with Glass ("Glasshole")	http://goo.gl/Nj00L5
	25	May 4th	*Saturday Night Live* parodies Glass	http://goo.gl/dfGKD4
	26		Las Vegas casino bans Glass use	http://goo.gl/nskkGh
	27	May 16th	Glass apps announced	http://goo.gl/ZKt7r8
	28	May 17th	US Congress members send a letter to Google	http://goo.gl/cVEIUy
	29	Jun 3rd	Pornographic app is banned by Google	https://goo.gl/WTtD2g
	30	2nd July	Google responds to US Congress members	http://goo.gl/AQZ8E3
	31	31st July	The UK Department for Transport bans Glass	http://goo.gl/zC7qjh
	32	28th Aug	US summer heat damages Glass	http://goo.gl/cBYoCW
	33	Sep	*Vogue* fashion editorial on Glass	https://goo.gl/F4Bm7y
	34	Oct 29th	A person is ticketed for driving with Glass	http://goo.gl/GhygtX
	35	Oct 31st	Glassware directory launched	http://goo.gl/pUeiMr
	36	Nov 13th	Google allows any person to apply for Glass	http://goo.gl/xp2oFP
	37	Nov 19th	Google releases its Glass Development Kit	http://goo.gl/csQtWZ
	38	Dec 19th	The MyGlass app for iOS is released	http://goo.gl/U0QCPW
2014	39	23rd Jan	An app to record sex is released	http://goo.gl/Ptk7EI
	40	Jan 18th	Explorer interrogated by the FBI in a cinema	http://goo.gl/fgocyy
	41	Jan 26th	*The Simpsons* parodies Glass	http://goo.gl/BxyKa8
	42	Jan 27th	Glass for prescription lenses is launched	http://goo.gl/J9wUQB
	43	Feb	US senator questions recognition apps for Glass	http://goo.gl/YgJdl9
	44	Feb 15th	Google publishes etiquette tips for using Glass	http://goo.gl/f1FQIV
	45	Feb 22nd	Explorer attacked in a bar in San Francisco	http://goo.gl/IhP5zg
	46	Apr 15th	Google sells Glass to anyone in US	https://goo.gl/7akTkk
	47	May 13th	Google sells Glass to anyone in the UK	http://goo.gl/mDm40Q