Digital Circulation: Media, Materiality, Infrastructures. An Introduction

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Abstract The concept of "digital circulation", together with the idea of 'social life of digital things', is highly evocative. Yet science and technology studies have not addressed it in depth to date. This introduction looks at the major converging dimensions examined in the papers in the first part of a special issue focusing on the notion of digital circulation. Specifically, if focuses on digital circulaton's material ontology and on the infrastructures that sustain the processes of circulation, seeing them as pivotal points in theoretical considerations aimed at bridging science and technology studies, media and communication studies and other neighboring fields. This introduction also provides an overview of the articles that make up this issue of Tecnoscienza.

Keywords: Digital circulation; media; communication; materiality; infrastructures.

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1. A Double Special Issue on 'Digital Circulation'

This issue of Tecnoscienza is the first part of a special double issue devoted to an interdisciplinary exploration of the notion of 'digital circulation'. This notion is highly evocative and frequently adopted in science and technology as well as media studies yet its development has remained largely generic. To cite a single example, Adrian McKenzie (2005) used the notion of circulation in vague terms to address the fact that the creation of meaning has not been as central as patterns of circulation through software versions, distributions and reconfigurations in the case of the Linux operating system. David Beer (2013) introduced the notion of cir-

culation in a more forthright way, as a starting point for an analysis of intersections between popular culture and new media. He suggested that our understanding of popular culture in the digital media realm should not be archived without a consideration of the ways in which media as objects and infrastructures influence this circulation. Specifically, he claimed that it is precisely "by bringing to the fore the material dimensions of everyday life, embodied in these infrastructures and data circulations" that "we are able to see how culture and media combine and fold into ordinary routine life" (Beer 2013, 2).

But digital circulation should not be confined to studies of media and cultural industries. 'Digital' and especially 'digitization' related processes have constituted critical change in almost all realms of modern everyday life enabling processes involving the circulation of content and meaning, objects and technologies, competences and embodied knowledge to be generally reconfigured. The analysis in this special double issue is not limited to the empirical sphere of media content. It attempts to develop theoretical connections between fields, concepts and approaches that have been triggered by the rise of digitization processes and the emergence of technology as an intrinsic infrastructure in modern times.

An accessible introduction to an understanding of digital circulation processes is the work of social anthropologist Arjun Appadurai (1986) who highlighted the ways in which things acquire meaning and value through a process of circulation between worlds, individuals and social contexts exactly 30 years ago. Reflecting more recently on globalization processes, Appadurai (2010) distinguished between "the circulation of forms" (meanings and contents) and the "forms of circulations", i.e. features pertaining to content circulation trajectories including speed and scale. While Appadurai is reflecting on the circulation of cultures rather than media technologies, the consequences of this distinction for digital circulation studies are clear: patterns of circulation represent a crucial dimension in media cultures, as digital things – files, standards, data and codes – have biographies and life trajectories, travel across different spaces and are governed by specific politics according to distinct forms of circulation. Far from standardizing the meanings and materialities involved in the circulation of things and objects, contemporary digital media-driven society has added new layers of complexity to it. Thus, a foundation perspective adopted in this special issue is that studying circulation in contemporary societies means focusing on the nexus of digital materialities, techniques and infrastructures that generate an accelerated, globalized, and pervasive circulation scope. Contemporary social and cultural flows are facilitated by digital technologies and these are in turn increasingly embedded in everyday life and human relationships. Yet, a more multifaceted understanding of the specificity of digital things and their biographies is still needed.

Focusing on digital circulation and the social life of digital things has several further implications. One of them is that the politics of digital cir-

culation is shaped by power struggles in the digital realm, as regulation of digital objects' trajectories takes place in the institutional and political spheres. Many of the supposed 'revolutions' generated by digital media technologies are actually a matter of some kind of circulation, as in the case of peer-to-peer networks, social networking sites or the digitization of cultural items. Social and collective practices on the Internet rely heavily on exchange and social relationship circulation metaphors. Sharing, for example, plays a center-stage role in multiple social media activities. It is through the sharing of objects such as pictures or videos that social and political relations are built and maintained and personal identities are constructed in the context of continuous and pervasive connection. In turn, this allows for shared meaning creation. Furthermore, the political economy of digital technologies is based on the circulation of digital objects such as films streamed on Netflix, financial data used by trading bots and personal social media data managed by web companies through cloud computing. In the contemporary digital economy, value is created through the circulation of bits.

2. Media, Materiality and Infrastructures

If these phenomena have being studied extensively by media studies and political economy scholars, science and technology studies approaches allow for a stronger analysis of the technological and material facets of digital circulation. Contributing to an emerging thread of STS scholarship on the subject, in this special issue we focus exactly on the study of the material technologies that allow and sustain contemporary forms of digital circulation. Thus our privileged, even if not exclusive, focus is a specific terrain of connection between contemporary media studies and STS: the material ontology of digital circulation and the infrastructures that sustain it.

The relevance of the materiality of social life can be considered a major backbone of STS, at least since the work of – quoting just two amongst many – Madaleine Akrich (1987) and Bruno Latour (1992) on topics such as "technical objects", missing masses" "non-human actors" and other definitions that account, in the very end, for the active role played by the "physical" within the social environment. In recent years, the interest in the material dimension of media technologies has prompted what has been defined "material turn" in STS, but also in other perspectives and approaches including different branches of media and communication studies (Gillespie et al. 2014), not to mention other disciplines such as anthropology, religion studies, and art history. As Leah Lievrouw has traced in detail, the focus on the materiality of media technologies has represented a contested terrain of intersection between STS and communication studies: "on the one hand, two decades of debates have encouraged STS researchers to theorize technology as simultaneous-

ly and inextricably social and material, to see both aspects as co-determining". On the other hand, communication scholars tend to assume that "the physical, material features of technology are still more likely to be explained as outcomes or *products,* of abstract social forces, cultural discourses or economic logics" (Lievrouw 2014, 24). However, this distance does not mean that media studies have not engaged seriously with the physical and material dimension of communication. For example, media historian Lisa Gitelman, who has focused in the phonograph and the internet (Gitelman 2006) and more recently on paper documents (Gitelman 2014). On the side of more philosophically-oriented media studies, the work of Jussi Parikka on media archaeology (Parikka 2012) and on the geology of media as a form of new materialism (Parikka 2015) clearly moves in the direction of a more substantial integration of the physical and technical dimensions of communication in the study of today's era of digitization.

If data are stored in identifiable physical locations, networks that carry them are so entrenched and tangible that some scholars have proposed to put them at the center of reflection on digital media (Musiani et al. 2015). For example submarine cables, which are in fact linked to the history of electric telegraphy and colonialism, host 99% of the international Internet traffic and will be extended over the next decades. With digitization, space and geography acquire a second life. Towers for the collection and distribution of rainwater have become ideal sites for mobile phone antennas. Remote regions in Finland have been transformed from places of paper processing into ideal areas to locate Google servers – enjoying low temperatures and geographically strategic regions for efficient data distribution. Natural paradises in Hawaii continue to be hubs for the flow of data, from the first telephone cables laid in the Pacific Ocean in the 1950s and 60s to the optical fibre for Internet traffic in the 21st century.

The materiality of the digital is perhaps even more evident if we consider consumption processes. Contrary to what claimed by the champions of media convergence at the beginning of the 1980s, who predicted the rise of a single technology that would include all media, our homes and pockets are full of physical objects that allow users to enjoy digital contents: portable and desktop computers, tablets, smart phones and watches, televisions, USB memory cards, to name a few examples. Through technological obsolescence, digital devices are assigned a predefined duration and replaced by new models in a consumerist recursive process. This does not mean that digital tools are built inaccurately or with substandard materials. Rather they "grow old" for fashion reasons or because of the erosion of their computing capabilities. A second aspect of digital obsolescence is, once again, the second life of objects: fallen into disuse, mobile phones or computers often travel from North America and Europe to poorer countries, where they find new users or are dismantled, recovered, and their materials recycled.

As mentioned, another crucial dimension of the study of digital circulation are technological infrastructures. In STS, the interest in the socio-technical building and maintenance of infrastructures has being developed since the mid-'90, especially through the work of Star and Bowker (1999; Star and Ruhleder 1996). This interest has evolved into a distinctive sub-field of "information infrastructures studies", aimed at understanding the dynamic processes sustaining and surrounding technical systems for information circulation in specific contexts such as public databases, scientific and professional communities, and so on (Bowker et al. 2010). Different formulations, such as "inverse infrastructures" (Egyedi et al. 2012), focus on the understanding of infrastructures for communication that are built "from below" by users and citizens.

However, it is quite surprising that this sensibility toward the role of infrastructures in information and communication technologies has not percolated consistently in media and communication studies until quite recently. One reason could be the lack of overlapping and cross-fertilization between historical and sociological studies of telecommunications and similar studies on mass media. This is even more startling if we consider that, since the mid '90s, Internet and network infrastructures have rapidly and overwhelmingly acquired a centrality in our everyday lives and within the media system. While internet infrastructures (from cables to the cloud, from search engines to social networks and collaborative platforms) turned into basic everyday tools, media scholars have only rarely adopted an infrastructural sensibility to unpack how our lives are embedded into their technical constraints.

And yet from a media and communication studies perspective, the view becomes richer. Communication studies have developed distinctive perspectives to address the relevance of technical systems of communication, which have been historically addressed as "telecommunication networks". This infrastructural heritage rooted in communication studies includes, for example, Armand Mattelart's (1991) or Patrice Flichy's (1991) histories of communication, which begin from the building of the "optical telegraphy" between Paris and Lille in France at the end of 18th and at the beginning of the 19th century under the pressure of war and nation state conflicts. However, scholars such as Flichy, Matterlart, but also Harold Innis, James Carey or Manuel Castells, did not focus enough on the way these networks had been technically and materially designed, implemented and maintained. The "technical" here seems to be a reflection of political, cultural and economic inputs, while its material and physical constraints and opportunities are left unexplored.

Only recently a more fluid circulation between different perspectives on media and communication infrastructures and networks has started to flow across different disciplines and fields. A recent and relevant take on the intersection between STS and media and cultural studies is the work of media scholar Jonathan Sterne (2012) on the history of the mp3 music format. In his book, Sterne unfolds some of the very technical bases of

the development of this sonic technology and at the same time articulates a political and culturalist interpretation. This allows him to coordinate in a distinct way the micro dimension of the technical ground with a macro, long-term, politically-oriented trajectory of the evolution of sound recording technologies.

A more recent contribution that brought the technical dimension of infrastructures on the foreground of media studies is a volume edited by Lisa Park and Nicole Starosielski, *Signal Traffic.* The book is explicitly aimed at building bridges between STS infrastructure studies and other approaches to the media, including environmental studies, urban studies and affect theory. Moving beyond contemporary hegemonic views, in these works media networks are not seen as decentralized, flexible and adaptive structures, but rather as the output of historically sedimented, technically resistant and politically crystallized processes, which remain largely invisible within today's liquid and cloud-based rhetoric about the role of the internet in our societies.

3. The Contributions in this Issue

The articles comprised in the first portion of this double publication offer distinct takes on the issue of digital circulation and on the objects, materialities and infrastructures involved in it. Each of them identifies specific empirical terrain, exploring and expanding the circulation of ideas between STS, media and communication studies and other neighboring fields.

Sergio Minniti's *Polaroid 2.0: Photo-Objects and Analogue Instant Photography in the Digital Age* describes an exemplary kind of digital circulation occurring between digital and analogue photographic media and specifically focuses on the reconfiguration of instant photography in the digital age. The article reveals the enduring presence of material objects in emerging photographic practices thus refuting any separation between 'old' analogue and 'new' digital photographic practices. Minniti explores the mutual influence between the digitization of photography and the resurgence of analogue objects and material artefacts within photographic communities. Moreover, by working on technology and social practice co-production, the article attempts to address the theoretical relationship between STS, media studies and photographic history.

In *Plants as Digital Things: The Global Circulation of Future Breeding Options and their Storage in Gene Banks*, Suzana Alpsancar presents the results of her research into two seed banks preserving both plant material and information. The author shows that, through processes of digitization and re-materialization, plants acquire value by becoming part of different chains of circulation. The bottom-up circulation of plant material from collectors to seed banks is coupled with the top-down diffusion of plant data from the seed bank in digitized genetic information form. Yet while

the digitization of plant data abstracts seeds from their material environment while allowing a broader circulation around the globe, this does not equate to full materialization.

In *Strategies of Circulation Restriction in Whistleblowing: the Pentagon Papers, WikiLeaks and Snowden*, Philip di Salvo deals with the content circulation restriction strategies used to block the dissemination of leaked material in three famous journalistic cases: the Pentagon Papers (1971), WikiLeaks (2006) and Edward Snowden (2013). His detailed description of these strategies aims to shed new light on the topics of information circulation on the one hand and (re)materialization on the other. Whistleblowers have always fought against forces, from government or from business, attempting to silence them and restrict their circulation networks, forbidding physical access to sources in the analogue era and restricting and limiting connections to sources in the digital era. What is surprising, according to di Salvo, is the fact that even in the digital era materiality matters and reappears: the physical destruction of the hard drives on which digital documents were stored is just one example of the ways in which Snowden was limited (with scant success).

In *A Different Kind of Story: Tracing the Histories and Cultural Signs of Pirate Copied Film,* Maria Eriksson focuses on piracy in the film industry and related social anxiety concerning the circulation of 'illegal material'. The author embraces a counter-intuitive narrative: pirate copies of films help standardize technologies of circulation for digital movies and contribute to innovating aesthetics and narratives. Standardization is another traditional STS topic dealing with infrastructures: networks, objects and ideas need to be standardized in order for them to circulate and thus acquire new meanings. Whilst pirated copies are still generally viewed negatively they are actually 'ambivalent objects' which often stimulate the diffusion, sharing and popularity of specific films.

The Scenario section provides an overview of recent work in the journalism studies field at the crossroads with digital circulation studies. Christoph Raetzsch and Henrik Bødker (*Journalism and the Circulation of Communicative Objects*) argue that circulation is becoming a critical concept with which to analyze online journalism and, specifically, that digital infrastructures are increasingly shifting attention from traditional players (such as newsrooms or corporations) to journalistic practices, user perspectives, newspapers, (im)materialities and social meanings. The key concept analyzed here is the 'communicative object'. Journalism should no longer focus on texts and styles (in a word: content), but rather on how circulation sustains and creates techno-social structures.

Finally, the issue ends with a new section called Crossing Borders dealing with convergences and differences between STS and media studies in communication technologies studies. This section, entitled *STS and Media Studies: Alternative Paths in Different Countries*, includes contributions on the dialogue between STS and media studies from three European countries: Germany (by Cornelius Schubert and Estrid Sørensen),

France (by Romain Badouard, Clément Mabi and Guillaume Sire) and Italy (by Alvise Mattozzi). This section explores the opportunities and difficulties involved in the specific intellectual and institutional contexts in which this dialogue takes place.

Together with the articles to be published in the second installment of this special double issue of Tecnoscienza planned for next December, the work presented here contributes to expanding the STS's continued navigation towards different empirical lands and new theoretical harbors.

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