

Frontiers in Sociology and Social Research 7
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Francesca Comunello
Fabrizio Martire
Lorenzo Sabetta *Editors*

What People Leave Behind

Marks, Traces, Footprints and their
Relevance to Knowledge Society

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Chapter 18

Traces and Algorithms as Socio-digital Objects



Enrica Amaturo and Ciro Clemente De Falco

Introduction

Traces and algorithms have become privileged objects of study to understand many dynamics of contemporary digital culture. Their constant presence in everyday processes makes them a pillar of the digital society.

Actor-network theory (ANT) (Latour & Woolgar, 1979; Callon, 1984; Law, 1992) is a promising approach for studying these objects¹ because it considers the social, material, technological, and scientific domains are intertwined and the role of nonhuman actors, the actants, within the social processes. For ANT, actors are not those who act intentionally but those that modify status quo by making a difference (Latour, 2007).

From an ANT perspective, digital traces and algorithms are a product or an effect of a heterogeneous entanglement of constantly shifting relations between human and nonhuman actants (Latour, 2007; Halford et al., 2010). Lupton (2016) talks about digital data-human assemblages to underline how humans only represent a node of an extensive network composed of nonhuman actors, defined as socio-digital devices. We speak of socio-digital objects to underline the strong intertwining between the social world, made up of norms, economics, politics, and the digital world, formed by material and technological objects. The social and digital worlds influence each other in a dynamic in which they are inextricable.

Digital traces and algorithms may be understood as socio-digital objects because the way they are collected, catalogued, and used is not neutral but results from social,

¹Waldherr et al. (2019) highlighted that this approach has been handy in fields such as education (Fenwick & Edwards, 2010; Fenwick & Landri, 2012), journalism (Primo & Zago, 2015), marketing (Shim & Shin, 2016), and linguistics (Kelly & Maddalena, 2016).

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economic, and political interests. Moreover, in socio-digital assemblages, actions and interactions of individuals produce digital traces and are shaped by these.

There is a continuous and deep intertwining between human actors and socio-digital devices. For example, wearable devices such as self-tracking and self-monitoring devices (rings, watches, glasses, etc.) illustrate how these traces can modify people's behaviors and actions. It is possible to use this large amount of digital data generated by these objects for multiple purposes: users can track their health, marketing companies can make a profit, they serve as navigational tools, and they are helpful for location-based services (Murero, 2020).

Algorithms play then a central role in these transformations as they collect, classify, and analyze these traces, thus creating dynamics that impact on the behavior of individuals.

This article aims to identify the features that allow us to frame traces and algorithms as socio-digital objects. We rest on concepts borrowed from the ANT, such as opacity, authority, and autonomy. The following section describes how these objects exercise authority and have consequences over individuals. We will also depict the logic of their functioning and how they are gaining autonomy from human actors in the socio-digital assemblage. In the final section, geographical traces are used as an example to discuss the features of socio-digital objects.

Emerging Features of Socio-digital Objects

There are three main features of algorithms and digital traces as socio-digital objects. The first one is the ability to influence individual and collective action, the second refers to the opacity of their operating logic, and the third is the ability to establish relationships autonomously.

Latour identifies two kinds of figures in the assemblages: the intermediary and the mediator, i.e., those who can convey a meaning or a force and can be both human and nonhuman elements. The difference between intermediary and mediator is in the capacity of transformation. The former is a mere carrier of a social meaning created elsewhere, whereas the latter is an actual social meaning-maker (Latour, 1993; Latour, 2007). So, in the intermediary's case, the output will be predictable when the input is known. In mediator's cases, the output will be unpredictable.

Algorithms presented as neutral intermediaries are instead mediators. We cannot consider algorithms as "neutral entities" (Airoldi & Gambetta, 2018) because critical algorithm studies have highlighted that the algorithms incorporate their creators' social, political, and economic interests (Seaver, 2017). Furthermore, algorithms implement "creative, performative, generative and provocative" processes (Muniesa, 2011), which makes them mediators that actively participate in the process of construction of information (Neresini, 2015).

The new relevance of algorithms arises as a response to the rapid development of the datafication process (Amaturò & Aragona, 2019). Prosumerism and neoliberalism accelerated the transformation of social and individual life into digital traces,

which generates new needs for data extraction, identification, and classification. The processing and the ordering of these large numbers of digital traces are algorithms' tasks. For this reason, they acquire an essential role in the new data-human assemblages. This importance also emerges in how algorithms impact the processes of individual and collective action in the digital world.

Rogers (2013) wrote about the "algorithmic authority" for describing how the search engines are authentic epistemological machines that exercise power over sources considered necessary. Cheney-Lippold (2011), on the other hand, speaks of the "soft power" of algorithms to refer to their influence on the existential possibilities of individuals. Many empirical pieces of research highlight the authority of algorithms in the fields in which they are applied (Haimson et al., 2021; Graham & Rodriguez, 2021; Gorwa et al., 2020; Campbell-Verduyn et al., 2017). Among these, we can mention Ma and Kou (2021) research in which emerges that the algorithm underlying the moderation of YouTube's content can orient not only the individual and collective action of YouTubers but also their feelings of insecurity and precariousness. In their work, the two authors pointed out that the interviewees perceive a strong feeling of precariousness because they do not know how the demonetized system works. The inability to understand how the moderation algorithm works causes this feeling.

This inability to access the algorithm's code described by the authors is not an isolated case but rather a constitutive feature of algorithms. To describe this feature, we usually use the concept of opacity. Opacity means that algorithms are sometimes actual black boxes whose functioning is almost impossible to decode (Pasquale, 2015). Cybersecurity positively considers opacity because it allows the defense of information flows from hacker attacks. However, it can have adverse effects on individuals and the community. Burrell (2016) identifies three kinds of opacity:

1. intentional corporate or institutional self-protection and concealment and the possibility for knowing deception;
2. the result of specialistic and technical skills;
3. the mismatch between mathematical optimization in a high-dimensionality characteristic of machine learning and the demands of human-scale reasoning and styles of semantic interpretation (pag. 4).

The last type of opacity would characterize algorithms as socio-digital tools. Machine learning algorithms are an example. According to Burrell (2016), "When a computer learns and consequently builds its representation of a classification decision, it does so without regard for human comprehension. Workings of machine learning algorithms can escape full understanding and interpretation by humans, even for those with specialized training, even for computer scientists" (pag. 10).

This unprecedented type of opacity that characterizes algorithms operating in the digital world with large amounts of data makes complex to control any bias embedded in the process. Socio-digital devices, in fact, by creating their own rules of classification, also tend to create a space of autonomy within the logic embedded in the code. Autonomy is the salient aspect of digital devices' third feature, and sociological studies still little explore this field.

Socio-digital objects are starting to implement the possibility of establishing relationships autonomously. This feature is salient because it allows nonhuman actors to attain their sense autonomously. In ANT, the sense of a nonhuman actor was instead realized only in the relationship with a human actor. So, the socio-digital objects are progressively learning to establish relationships and communicate autonomously with each other. The result is an ecosystem that allows people and smart objects to interact within a social structure of relationships (Baskiyar & Meghanathan, 2005). This new feature of socio-digital objects is the main interest of the Social Internet of Things (SIOT), a new concept merging the Internet of Things and the social capabilities of the modern Internet.

The SIOT works on protocols for digital devices to make them act independently in the network, allowing them to choose which devices to connect to and which kind of data they can request or exchange. We can find examples of interconnected socio-digital devices in individual or community service. Digital devices communicate to identify and manage problems in real time in personal care services or smart cities. It is interesting to point out that a sociological concept such as trust plays a crucial role in SIOT. Firstly, it affects how devices decide to connect, and, furthermore, it configures the overall assemblage and the outcomes. Thus, the algorithms that will attribute trust to the other actors' network play a key role.

Digital Geographic Traces as Socio-digital Objects

Geographical traces are a very good example of digital traces. These traces are crucial for many geolocation services, and public bodies and private companies' investments in these services are increasing.

With the spread of Web 2.0 and GPS technologies, two primary sources of digital geographic traces arose. Goodchild (2006) define the first as "volunteered geographic information" (VGI) to describe the use of the web to generate, process, and disseminate geographic information provided by individuals voluntarily. Campagna et al. (2015) define the second as "Social Media Geographic Information" (SMGI). The difference between the two sources is the voluntariness in providing geographic information. In the SMGI the spread of geographic information is not the final purpose of production (Stefanidis et al., 2013). Locative media (Wilken & Goggin, 2015) feed both sources, enabling the process of geomediatization (Fast, 2018). We can extract digital geographic traces from both sources through geocoding, geoparsing, and geotagging.

As Middleton et al. (2018) noted "geocoding is the act of transforming a well-formed textual representation of an address into a valid spatial representation, such as a spatial coordinate or specific map reference. Geotagging assigns spatial coordinates to media content items, typically by building statistical models that, given a piece of text, can provide an estimate of the most likely location (spatial coordinate) to which the text refers. Geoparsing does the same for unstructured free text and

involves location extraction and location disambiguation before the final geocoding” (pag. 2).

In the digital society, geographic information allows the citizen to use a variety of services, such as the possibility of obtaining road information, traffic information, information on the closest activities and services, and the evaluation provided by other users. This information is also used in businesses (Pick, 2008), by researchers (De Falco et al., 2022), as well as by governments for multiple purposes, including organizing rescue during environmental disasters (Joseph et al., 2018) or spatial planning (Poser & Dransch, 2010).

Geographic traces acquire social science researchers’ attention as socio-digital objects because their creation, collection, and processing are far from neutral processes. Locative media and these traces result from social, cultural, technological, and commercial rationality (Fast et al., 2019). For Thielmann (2010), the adoption of “locative media” was mainly born to respond to the cultural, social, and political crisis introduced by global warming. Furthermore, the production of traces by users derives from social logic, such as identity formation and demarcation between social classes (Lindell et al., 2021).

Regarding the “collection”, users do not intentionally produce all traces, and the possibility to use these large amounts of geographical data is allowed by privacy rules. Public and private companies take much information on the users’ location without their explicit consent (Obermeyer, 2007). In addition, the algorithms that govern geoparsing operations are blackboxed. Dewandaru et al. (2020) said: “the geoparser does not know anything about the event structure or semantics; the event coding system simply attaches the coordinate of the detected, resolved toponym to the event’s location” (pag. 3).

Specific criteria guide user information processing in each place. For instance, “a calculative spatiality that prioritizes economic interactions” (Luque-Ayala & Neves Maia, 2019) characterizes the maps produced by Google Maps. Hence, the algorithms that underlie the mapping app processes possess high authority in defining how users perceive the space and their mobility (Wagner et al., 2021). We are used to imagining the world as represented by maps, but those maps represent only a Cartesian space, while other spaces such as social or cultural space exist (Ferretti, 2007). According to Ferretti (2007), this consideration nourished a debate within the world of GIS (Geographic Information System). The GIS is the adopted standard for map creation and works primarily on a Cartesian concept of space (Goodchild, 2006). For this reason, the algorithm defines the space and the way the user perceives it and how he can move within it.

The consequences of the algorithms influence on how users experience urban spaces are manifold and related to phenomena that have extreme sociological relevance, such as for example gentrification (Jansson, 2019). In a different way, the geomediatization process is shaping the digital economy (McQuire, 2019).

Finally, the increasingly widespread use of geo-data in SIOT is another example of how geographical traces and the algorithms that analyze them have effects on users’ behaviors. They are used for developing disaster detection algorithms based on social media data such as Twitter (Bhuvaneswari & Valliyammai, 2019). These

systems can identify geographical events and enrich them with photos through the interaction between platforms and data. Other applications concern using geographical and temporal information to model the users' emotional states with cluster analysis (Hu et al., 2019).

As socio-digital objects, geographic traces may represent a fascinating and promising field of investigation for unfolding the dynamics of digital society. Approaching traces and algorithms as socio-digital objects can help us to understand the role they have in influencing individual behavior, human not-human interaction, and information processes. However, much remains to be done, and more empirical studies are needed. To this end, from our point of view, it is crucial, first of all, to work on the operationalization of socio-digital objects' characteristics and then on the creation of research protocols to analyze their production and use.

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