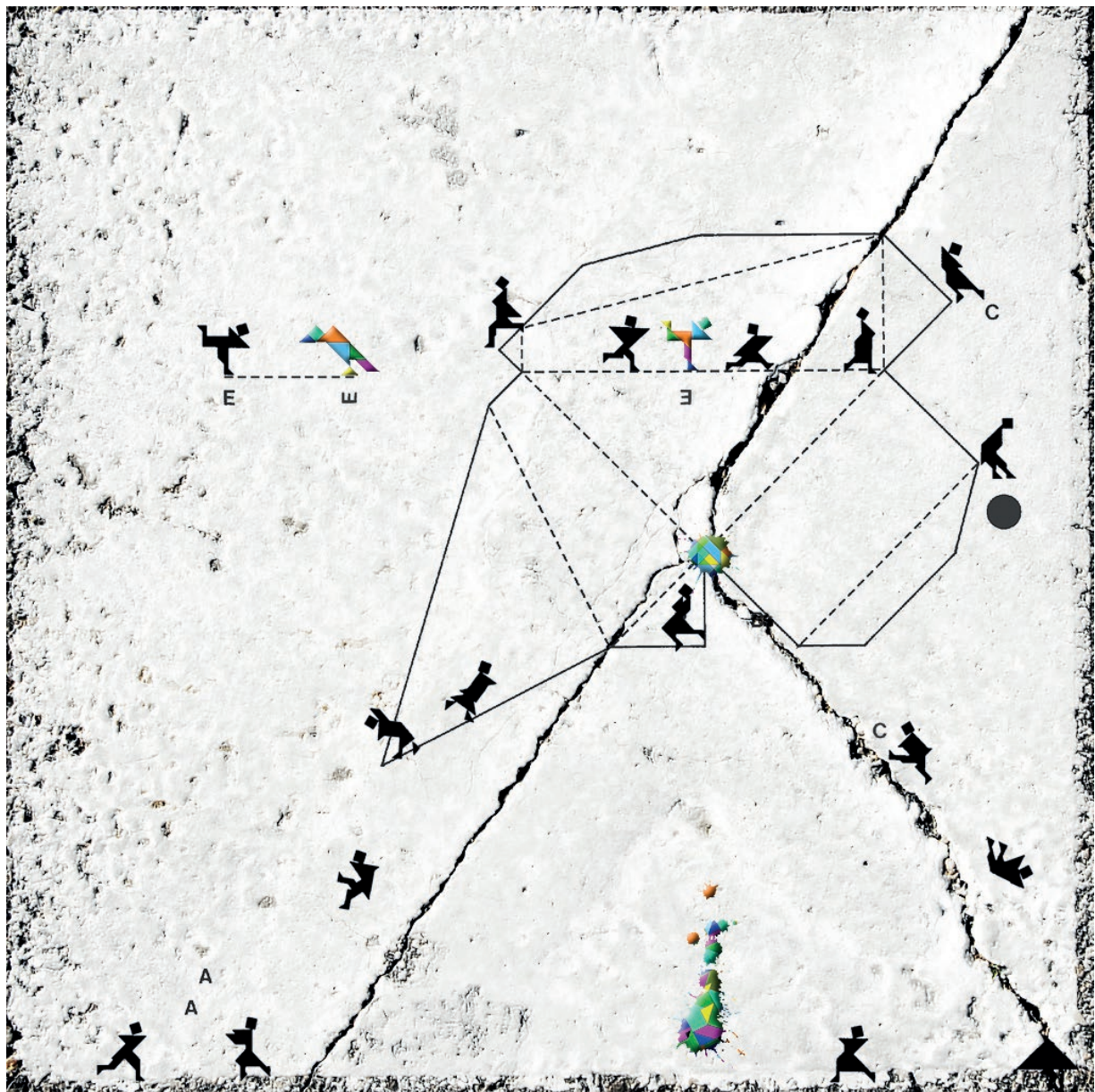


# EASST *Review*

European Association for the Study of Science and Technology



# STS MULTIPLE

# Pa.S.T.I.S.

## PADOVA SCIENCE, TECHNOLOGY & INNOVATION STUDIES

*Questa sezione presenta la storia e i principali ambiti di ricerca dell'unità di ricerca PaSTIS (Padova Science Technology & Innovation Studies), istituita nel 2008 per unificare la ricerca di alcuni professori, ricercatori post-doc e dottorandi nell'area degli studi sociali della scienza, della tecnologia e dei media all'interno del Dipartimento di Sociologia presso l'Università di Padova. La storia di PaSTIS è interessante non solo perché racconta l'attività di una specifica unità di ricerca STS, ma anche perché permette di leggere l'evoluzione dell'approccio STS in Italia, un paese che è stato fino a poco tempo alla periferia della geografia europea degli Science & Technologies Studies. Nei testi vengono inoltre presentati alcuni dei principali progetti di PaSTIS. Uno è il progetto TIPS, che si basa sull'idea di utilizzare i quotidiani on-line come fonte per analizzare il modo in cui la scienza e la tecnologia sono rappresentate nella sfera pubblica, al fine di studiare il ruolo della tecnoscienza nella società, la sua rilevanza e l'evoluzione. La piattaforma TIPS sta monitorando gli otto più importanti quotidiani italiani e, in un arco temporale che va dal 2010 ad oggi, sono stati raccolti circa 1,2 milioni di articoli. Altri progetti di PaSTIS riguardano invece lo studio dei processi di 'infrasrutturazione'. Uno dei principali progetti dedicati a questo tema ha riguardato lo sviluppo delle reti wireless comunitarie (WCN), ovvero l'attività di costruzione di reti di comunicazione locali realizzate da gruppi di attivisti, hackers e cittadini. Un altro progetto di ricerca di PaSTIS è stato dedicato all'analisi delle pratiche di progettazione e sviluppo in campo informatico e, in particolare, l'analisi della realizzazione di due specifici dispositivi tecnici informatici di una delle più importanti compagnie informatiche italiane. Gli articoli presentati mettono in luce, oltre alle attività di PaSTIS, anche le circostanze che hanno contribuito a sviluppare e sostenere l'unità di ricerca e, in particolare, lo sviluppo di un più ampio movimento di STS in Italia.*

# THE PADOVA UNIVERSITY PASTIS UNIT AND THE INFRASTRUCTURING OF STS RESEARCH IN ITALY

Paolo Magaudda, Federico Neresini

**THE EMERGENCE OF PASTIS WAS A BOTTOM-UP PROCESS, A SORT OF ALCHEMIC BLEND, THE CONTINGENT PRODUCT OF A WORK OF 'HETEROGENEOUS ENGINEERING' WHICH WAS THE RESPONSE TO A SITUATION: THE ITALIAN UNIVERSITY SYSTEM. ONE OF THE POSITIVE CIRCUMSTANCES THAT HELPED TO DEVELOP AND SUSTAIN PASTIS HAS BEEN THE GROWING OF A WIDER STS MOVEMENT IN ITALY, MAKING OUR LOCAL UNIT AN INTERSECTION IN A WIDER PROCESS OF 'CO-EVOLUTION' INVOLVING AN ENTIRE NATIONAL ACADEMIC COMMUNITY.**

The PaSTIS (Padova Science Technology & Innovation Studies) research unit was set up in 2008 as an attempt to unify and catalyze the research of a number of professors, post-doctoral researchers and PhD students in the social studies fields of science, technology and communication within the Department of Sociology at Padova University (<http://www.pastis-research.eu>). PaSTIS's emergence is interesting not only in that it tells the story of a specific STS-focused research unit but also because it offers a glimpse into the path taken by the STS perspective in a country like Italy which was until recently at the periphery of the main European STS geography.

It is not far from the truth to say that PaSTIS is today the most important research center expressly devoted to STS research in Italy, although there are also other universities in the country with a STS milieu such as the University of Trento, where the last 6th STS Italia conference was held in late November 2016. Although not exclusively Science & Technology Studies focused – but also interested in other approaches to the study of culture and communication – PaSTIS today encompasses around 15 scholars mostly with a sociology background including full and associate professors, several post-doctoral researchers and a turnover of PhD students and research assistants. During its almost ten years of existence, the research unit has also hosted around ten foreign visiting scholars from Europe, the US and South America. This highlights the fact that PaSTIS is also a place where STS scholars from other countries can spend a period of research finding a collective and stimulating environment: we would be happy to receive further visiting proposals in the near future.

The chief topics addressed over the years by PaSTIS with its research and initiatives include a number of areas: the study of public communication in science and technology and analysis of media and public discourses relating to science, technology and the innovation (on this subject see the section on the TIPS project by Giardullo and Lorenzet here); analysis of information infrastructures and media technologies and devices (see the section by Crabu and Mongili); the study of scientific practices and laboratory work, especially in relation to the biomedical domain and the field of nanotechnology; research on media practices, with specific focus on the process of digitalization, the use of social networks, the emergence of new forms of sexuality over the Internet and the processes of consumption of cultural content. A pivotal point bringing together the work of PaSTIS's members is essentially the idea that social and cultural processes today can be understood by looking at the way scientific processes, technological artefacts and infrastructures innervate contemporary social experience and are thus the core of the re-configuration of the whole current set of practices, routines, values, meanings, emotions and the overall texture of everyday social organization.



Fig. 1: The PaSTIS people (almost all the members, with some guests)

However, more interesting than a plain description of PaSTIS's activities is an examination of the distinctive conditions of the research unit's development which has not been a top-down process sustained by ministerial or university inputs. Rather, the emergence of PaSTIS was actually a bottom-up process, a sort of alchemic blend, the contingent product of a work of 'heterogeneous engineering' which was the response to a situation, the Italian university system, in which research units are not official entities and – especially in the social sciences and humanities fields – still quite few and far between. Many university departments across the country have no research units whatsoever and still prioritise the idea of self-sufficient independent scholars working on their own specific academic interests. At the same time, the experience has been that the setting up of research units has been seen by many as an institutional innovation stirring up traditional power assets and localist logics. This is a distinctive feature of the Italian academic system as compared to other countries and it speaks volumes about the fact that doing STS today (and by extension, social studies as a whole) requires diverse efforts, tools and strategies in diverse countries in order to produce a fruitful alignment of research, theory and local institutional frameworks. The institutional rigidities and weaknesses of the Italian academic system (one which has, over the last decade, also experienced a shortage of new tenure-track positions, a lack of internal mobility, a massive diaspora of Italian scholars and, therefore, has one of the highest average age of professors – in 2013 the average age of assistant professors was 46!) was for us the stimulus to adapt, re-invent and localize the idea of 'research unit' seeing it as a crucial strategy in the search to develop new opportunities to deal with the troubles typical of our national academic system.

One of the positive circumstances that helped to develop and sustain PaSTIS has been the growing of a wider STS movement in Italy, making our local unit an intersection in a wider process of 'co-evolution' involving an entire national academic community. On one hand, our research unit has clearly been sustained by the broader Italy-wide STS movement which was given institutional form as a national STS society, STS Italia, in 2005 and also sponsored the creation of the 'Tecnoscienza: Italian Journal of Science & Technology Studies' journal in 2010.

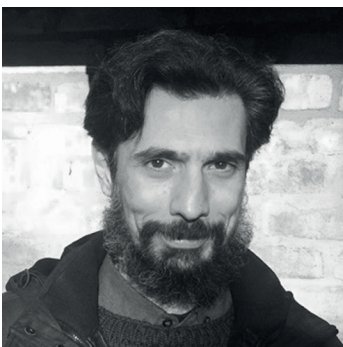
Whilst even before the mid-2000s in Italy there were at least a few scholars linked to STS these were just individuals with no chance of giving a collective dimension to their work and thus having a stronger impact on the study of science and technology in the country. There are many accounts of the way PaSTIS co-evolved within the broader national STS community and, at the same time, also became one of the drivers of STS development in Italy: for example, in 2012, PaSTIS co-organized the 4th STS Italia Conference in Rovigo on ‘Emerging technologies’ and in 2015 the 3th STS Italia Summer School on ‘Biomedical research’. Several STS Italia workshops have been hosted in Padua: focusing on creativity in 2009, on interdisciplinarity in 2013 and on biomedicine in 2014. A number of PaSTIS scholars played a crucial role in establishing and editing the *Tecnoscienza* journal and energised efforts to build up the main STS Italia initiatives organized elsewhere in Italy.

Hence, if PaSTIS has been an instrumental device in the process of STS community infrastructuring in Italy, our research unit is, at the same time, an emerging outcome of the broader establishment of a STS community in Italy, thus confirming once again that science, like culture and art, is a truly collective activity which involves not only, in our case, PaSTIS’s current members, but also a wider group of people as well as artefacts and infrastructures. PaSTIS, STS Italia and *Tecnoscienza* can thus all be understood as a creative - and to some degree ‘resisting’ - reaction to the limits, rigidities and constraints of our national academic system whose scholars need to open up their work to an increasingly integrated, competitive and fast-developing global scientific community.



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# TECHNO-SCIENTIFIC ISSUES IN THE PUBLIC SPHERE (TIPS)

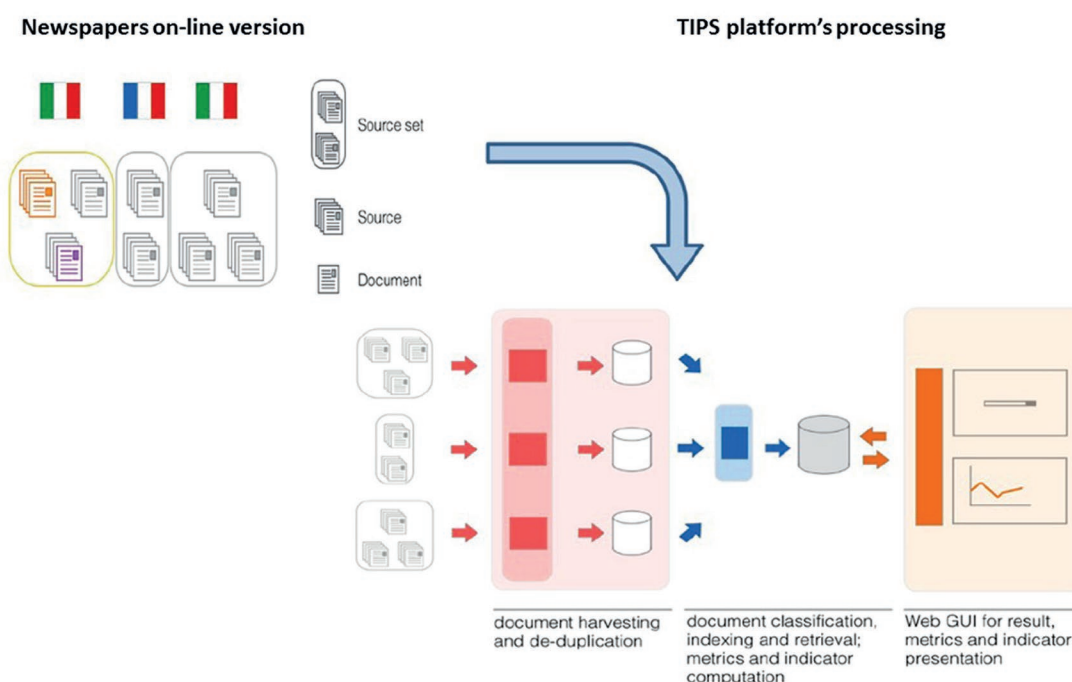
Paolo Giardullo, Andrea Lorenzet

**THE TIPS PROJECT IS BASED ON MASS MEDIA AND ONLINE NEWSPAPERS AS A SOURCE FOR ANALYSING THE REPRESENTATIONS OF SCIENCE AND TECHNOLOGY IN THE PUBLIC SPHERE MAPPING ITS RELEVANCE AND EVOLUTION. IT MONITORS THE EIGHT MOST IMPORTANT ITALIAN NEWSPAPERS, IN A TIME SPAN RANGING FROM 2010 TO YESTERDAY. IN 2014 THE TIPS PLATFORM ALSO BEGAN COLLECTING TWO UK, TWO US, ONE INDIAN AND SEVEN FRENCH NEWSPAPERS. TIPS CALCULATES AD-HOC 'TECHNO-SCIENCE INDICATORS' BASED ON MORE THAN 2.6 MILLIONS OF DOCUMENTS: IT COMPUTES 'SALIENCE', 'PROMINENCE' AND 'PRESENCE' OF TECHNO-SCIENCE. TIPS ALSO PROVIDES A 'RISK INDICATOR', OPERATIONALISING RISK AS AN ONTOLOGICAL ANALYTICAL DIMENSION OF PUBLIC TECHNO-SCIENCE DISCOURSE.**

The TIPS project is based on the idea of using mass media and online newspapers, in particular, as a source for analysing the way science and technology is represented in the public sphere in order to study the role of techno-science in society, its relevance and evolution. To fulfil these aims, TIPS is grounded on a purpose built ICT infrastructure. Its design includes a dedicated platform capable of collecting, sorting and automatically analysing the text of newspaper articles in their digital format. These texts are then indexed and stored in a database for research analysis<sup>1</sup>.

<sup>1</sup> For an overview of the platform, see the PaSTIS web site (currently at the bottom of the home page).

Fig. 1: TIPS platform's processing workflow: from newspapers to data and indicators



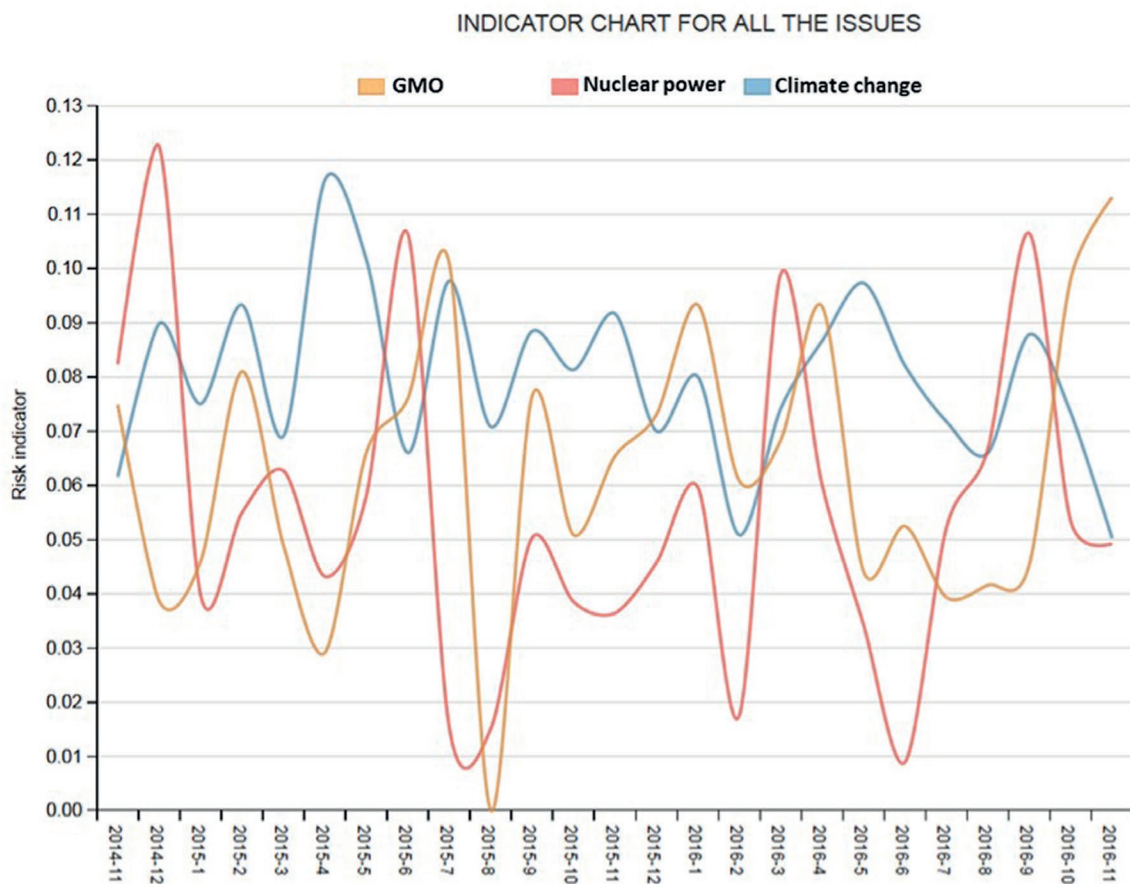


Fig. 2: TIPS risk indicator trends for three specific issues in the last 24 months

The TIPS platform is currently monitoring the eight most important Italian newspapers and, in a time span ranging from 2010 to yesterday, approximately 1.2 million articles have been collected. In 2014 the TIPS platform also began collecting two UK, two US, one Indian and seven French newspapers thus adding a further 1.4 million articles to its database. By means of 'classifiers' specifically developed by the TIPS research group, the platform determines whether the content of each article pertains to the science and technology domain. Then each article stored in the database is 'tagged' so that it is available for further analysis with an even greater focus on specific research questions.

The TIPS platform also calculates *ad-hoc* techno-science presence indicators and metrics within the main Italian daily newspapers: its 'saliency' (i.e. the relative weight of techno-science in all the published articles in a given time span), 'prominence' (i.e. its presence on the home page) and its 'presence' outside newspaper sections specifically devoted to science and technology. The platform also provides a 'risk indicator', a measure expressly developed to operationalise risk as an ontological analytical dimension of public techno-science related discourse (figure 2).

So far, the research on techno-science in the media has generated a great deal of work on quite a wide range of issues including, of the most significant, climate change, genetically modified organisms, cloning, stem-cells, digital innovation and health risks. A majority of these analyses has focused largely on a limited portion of news, i.e. those specifically regarding a given issue, even if, alternatively, there have been also studies based on samples designed to map the presence of techno-science as a whole and thus to study its representation as well as to outline the perspectives of the social actors involved.



By contrast, TIPS was designed to take a non-specific topic-oriented approach. Rather than focusing on a restricted set of research topics, the objective is to follow techno-science coverage as a whole over time, enabling researchers to examine specific topics of interest. Accordingly, one of the most important methodological novelties generated by the TIPS project regards its infrastructure. The latter was designed to collect and analyse newspaper articles on a daily basis allowing researchers to analyse whole sets of online newspaper articles and texts.

The TIPS project roots its epistemological assumptions in recovering STS key-concepts. As techno-science resumes all the elements interwoven in processes of science and technology production and circulation (Latour 1987, pp. 174-175), TIPS assumes it as main concept to orient its monitoring activities. Indeed, from an empirical point of view, considering techno-science as an epistemic category enables researchers to avoid the need for univocal definitions (Shapin 2008, p. 3), keep their minds open to those processes and be flexible enough to intercept emerging trends about what are not yet 'scientific facts'. The approach chosen by TIPS – i.e. considering the news as a whole using automated content analysis, comparing the features of specific issues against those of other issues or against media coverage as a whole – offers a perspective which embodies these key STS assumptions. However, this 'operational openness' has to be balanced with robust classification criteria. Indeed, in so far as TIPS aims to monitor techno-scientific issues, it first needs to establish clear criteria with which to identify techno-scientific content in a newspaper article. STS concepts, such as science as situated activity, the agency of non-human actors (artefacts, research tools, infrastructure etc.) definitely contributed to setting up useful demarcation elements as a reference for building up the classifiers, the indicators and the metrics used by TIPS.

Early outcomes of the project have been presented in international venues such as workshops in Stellenbosch (South Africa), Salvador de Bahia (Brazil) and Istanbul (Turkey), besides STS Italia and International Sociological Association conferences. In these, indicators and indexes as well as research outcomes were discussed showing techno-science salience trends and selected issue coverage. The relationship between media coverage and public opinion has been also explored, as in the case of recently published work on the nuclear power controversy which compares TIPS risk indicators from newspapers with public opinion perceived risk data (Neresini and Lorenzet 2016).

The operationalization of STS concepts into a media monitoring project is a first step in the hybridization between different, even related, scientific debates. The entire research group, however is a hybrid. Within TIPS this partnership has moved it in the direction of genuine interdisciplinary project organization involving scholars with sociology, linguistics, social psychology, statistics and ICT backgrounds. As Evans and Aceves (2016) have recently argued "machine learning is enabling the translation of text into social data" and this is the perspective TIPS is exploring further. This interdisciplinary cooperation is taking technical aspects about how properly to clean and interrogate data, for instance, further by making machine learning features such as 'topic modelling' (Blei 2012), 'Named Entity Recognition (NER)', and 'part of speech (POS) tagging' available for analysis. This interdisciplinary environment has proved to be ideal for tailoring and validating classification tools in the custom development of TIPS infrastructure. Machine Learning tools such as the Support Vector Machine (Cristianini and Shawe-Taylor 2000), for instance, have been crucial to positively testing the trustworthiness of the TIPS thesaurus-based classification scoring system. Interdisciplinary cooperation has further web-data automated monitoring development potential.

Indeed, the research team is presently working on a variety of topics related to technical aspects of content analysis by means of text mining. A further future development is investigating the potential for including the 'corpus linguistics' approach (Biber et al. 1998) as a possible feature for cross-linguistic and longitudinal analysis.

The TIPS team is therefore actively dedicated to exploring how the so-called 'data science' epistemological discontinuity (Kitchin 2014) may bring a better understanding of techno-science in the public sphere. Future developments generated

by this epistemic potential will relate to both cross-country and source comparison. For the former, automated text classifiers for English and French are already in the pipeline. The latter, which will enlarge the analytical spectrum to social networks and blogs, is at an advanced level as TIPS is presently collecting approximately a thousand blog posts per day.

The ever increasing volume of data available for the purposes of virtually analysing any topic whatsoever, not only those linked to techno-science, is a stimulating challenge that still requires multiple skills and in-depth cross-fertilization between concepts, theoretical models and approaches ranging across various disciplines.

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# MATERIALITY, POLITICS AND INFRASTRUCTURING WORK

Stefano Crabu and Alessandro Mongili

**THE STUDY OF INFRASTRUCTURES IN TERMS OF “INFRASTRUCTURING” AND “INFRASTRUCTURING WORK” REPRESENT A STARTING POINT FOR AN IN-DEPTH DISENTANGLEMENT OF THE MULTIDIMENSIONAL PROCESS OF TECHNOLOGICAL INNOVATION AND SOCIETAL CHANGE. THE PROJECT ON WIRELESS COMMUNITY NETWORK LED US TO CONCEPTUALIZE BOTTOM-UP INFRASTRUCTURES AS THE EMERGING OUTCOME BY A HETEROGENEOUS PROCESS IN WHICH THE MUTUAL ENGAGEMENT OF MEDIA ACTIVISTS, HACKERS AND SCIENTISTS TURNS A POLITICAL PROJECT INTO AN INNOVATIVE DIGITAL INFRASTRUCTURE MODEL. IN PERFORMING OUR INVESTIGATION ON DESIGN AND DEVELOPMENT IN COMPUTING, WE ARGUED THAT INFRASTRUCTURING IS A FIELD OF HETEROGENEOUS ACTIVITIES AND CHALLENGES EXTANT RELATIONS, WORK POSITIONS, SKILLS AND HIERARCHIES.**

Nowadays, social scientists frequently consider infrastructure analysis as a starting point for an in-depth disentanglement of the multidimensional process of technoscientific innovation and societal change with a particular focus on the social and material ecologies in which human behavior is embedded (Gillespie *et al.* 2014). Since the mid '90, interest in infrastructure has profoundly permeated social theory attracting growing attention from sociologists, anthropologists and ethnographers working in the multidisciplinary STS field. Conceptually speaking, infrastructure can be considered sophisticated *socio-material entities* emerging by means of the management of a “series of tensions (between local and global, today's requirements and tomorrow's users, research and development; between project and originating practices, implementation and maintenance/repair, individual and community; but also identities and practices, planned and emergent course of action)” for the purposes of ordering everyday life (Mongili and Pellegrino, 2014, p. xvii).

Connecting to this broad field of inquiry, over recent years PaSTIS has developed a solid interest in the study of *infrastructuring*, a dimension through which infrastructures are generated and performed in practice. More precisely, PaSTIS has carried out a constellation of research, academic events and editorial projects aimed at capturing and exploring design and shaping, use, maintenance and repair activities related to infrastructure and infrastructuring work (Denis *et al.* 2015; Balbi *et al.* 2016). In so doing, we have cultivated an analytical perspective oriented to scrutinizing infrastructure as ongoing and open-ended processes grounded around an ecology of cognitive, material, and symbolic resources enacted by means of situated practices (Crabu 2014).

## THE REBELLIOUS SIDE OF INFRASTRUCTURING WORK

One of the main research projects dedicated to the issue of *infrastructuring work* has related to *Wireless Community Networks* (WCNs) construction and consolidation processes. Conducted in partnership with the University of Trento, this project focused on these grassroots and joint working infrastructures, generally built-up at local level by media-activists, hackers and 'nerds' on the basis of explicit political as well as civic beliefs oriented to opposing the neoliberal and hierarchical

Fig. 1: The work of setting-up a WCN's antenna on a roof.

Courtesy of [Ninux.org](http://Ninux.org).



governance of the commercial Internet. In this sense, WCNs imply heterogeneous work in which technical practices require constantly alignment with symbolic, political and organizational activities. From this point of view, WCNs constitute an exemplary environment with which to investigate processes of heterogeneous 'infrastructuring' (Star and Bowker 2002) at the local level in the field of digital media technologies (Parks and Starosielski 2015).

Technically, WCN is a decentralized infrastructure consisting of interconnecting antennas usually set up on the roofs of participants' homes or on those of informal groups or volunteer organizations. These decentralized networks are fully independent from the Internet, although in a few countries they were popularized as a less expensive alternative to commercial ISP connections. WCNs are mostly self-built as volunteers adapt existing software, hack hardware, set up coordination rules, and materially install antennas. In this sense WCNs are rooted in a radical critique of contemporary governance of the Internet raising awareness on a relevant issue pertaining to the reconfigurations of power relationships between citizens and governments and also regarding distribution asymmetries relating to the growing pervasiveness of digitally-mediated communication (Crabu *et al.* 2015). In other words, WCNs represent alternative approaches counteracting the pervasive practices associated with the centralized control of digital communications and therefore shaping more autonomous and self-governed digital interaction spaces.

This research was based on a qualitative case study on the Ninux.org project, the main Italian WCN. The empirical data was gathered via in-depth interviews, documentary analysis and ethnographic observation of online and offline interaction aiming to investigate how Ninux.org members' identities and motivations, as well as material artifacts, play a role in shaping and sustaining infrastructuring work in unconventional innovation contexts such as "squatted community centers" or do-it-yourself environments.

This research work will focus in particular on the cultural, political, and technological issues rooted in the Ninux.org project highlighting the way these different aspects are strictly interwoven and can hardly be understood as separate



Fig. 2: A meeting of Ninux's coders Courtesy of [Ninux.org](http://Ninux.org).

dimensions. We thus unraveled the intricacies of the mutual relationship between the various actors involved in the project emphasizing that the WCN is an emerging outcome from the cooperation of members involved in a process of mutual-learning and sharing of academic expertise and political outlooks. Indeed, contemporary innovation in infrastructures is increasingly characterized by a close relationship between experts and lay people. Taking into account this crucial aspect, we have shown that the shaping of grassroots infrastructures implies a processual and in-the-making work of creation and maintenance developed outside predictable and conventional innovation settings (Crabu *et al.* 2016).

Overall, on the basis of this research project we have been able to argue that bottom-up infrastructures, or more specifically 'inverse infrastructures' (Egyedi and Mehos 2012), are the result of an heterogeneous innovation process in which technical, political, material and cultural aspects interact recursively with each other and in which the mutual engagement of media activists and scientists is crucial in turning a political project into an innovative digital infrastructure model.

#### INFRASTRUCTURING IN COMPUTING DESIGN AND DEVELOPMENT

Another research project related to infrastructures carried out by PaSTIS has regarded design and development practices in computing. Drawing on seminal work by Gregory Bateson, Leigh Star (2010, 610) used to say that users and designers, especially in computing, are bound together by a "double bind". In the digital environment, it is extremely hard to distinguish design from development in practice. Although the design-mode in computing is a strategic re-ordering, designers limit themselves in practice to assembling elements that already exist, only rarely introducing new ones. Many developers verify or produce interoperability among the elements which are driven to converge in a new device. Their job thus consists of prolonged use of tools, libraries, databases and materials at hand. This use is often inextricably intertwined with their main activity. Sometimes developers act as designers, changing the original project or writing pieces of software for the purposes of integrating the heterogeneous elements better (Mongili 2014).

In order to explore this designer-developer tangle in depth we carried out ethnographic research into an Italian company working in telecommunications, Internet connections and other digital services. We studied their design and development practices in computing and more specifically monitored the development of an application for video surveillance connected with a social network owned by the same company. In particular, we observed testing activities which were articulated in two main information specific tools, two defect tracking systems (DTS), softphones, a protocol suite (SIP), a camera and so on.

Testing practices move forward as contingencies emerge. The ability of specific actors to exploit unanticipated gaps in previewed practices can be crucial to progress following and accompanying testing, development and design aiming at interoperability (at least at demo level) between a camera, a social network architecture and SIP protocol. To achieve this, developers looked for a camera and developed patches on extant codes, achieving OS level. They also intervened within the DTS which we have considered information infrastructure here, playing around with their different versions, obliging them to include the SIP Protocol as a part of their routine monitoring, interpreting their reports and learning the classifications they operate with. Not infrequently they interpreted and tried to change the threshold proposed by the DTS.

In accordance with Leigh Star and many other scholars, we can consider any information artifact, which relates a human activity and forms a whole with it, as an information infrastructure thus emphasizing the relational aspect of this definition. Every information artifact can converge toward a specific activity, becoming an information infrastructure but not every artifact is necessarily an infrastructure. This convergence is relatively unstable and obliges humans to take care of the infrastructure nesting their activity as a normal routine. Therefore, the 'infrastructuring' process challenges the invisibility of these infrastructures, their taken-for-grantedness. And a multiplicity of actors intervenes continually to alter elements and fix them.

By focusing on designing and developing, any new device can be conceptualized as the emerging outcome of hybrid practices, aimed to manage adverse contingencies and any sort of tensions. Infrastructures intersect any activities but are also extremely fragile. Infrastructures contain relations, especially through the data culture that they express, which is based on forms of classification containing forms of hegemony. This is another crucial issue: infrastructuring is a field of heterogeneous activity at the very center of technological cooperative circulation and at the crossroads of contemporary innovation processes.

On the basis of this theoretical and empirical reflection, issues related to infrastructures and their design and development now represent a consolidated pillar around which PaSTIS's research work is organized.

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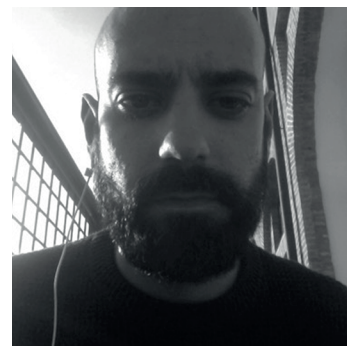
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