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THE SOCIAL CONSTRUCTION OF NEWS AUTOMATION AND THE USER EXPERIENCE

LAURENCE DIERICKX
Université Libre de Bruxelles, Brussels – Belgium
ORCID: 0000-0001-5926-8720

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ABSTRACT – This paper examines the role of the social representations and cultural practices of journalists in shaping the uses (and non–uses) of news automation software as a tool to support journalism practices. It is approached through an empirical study conducted within two newsrooms in French–speaking Belgium, where we have followed the process of a socio–technical construction involving journalists in the design process. This first form of use led the journalists to reconfigure their professional practices, placing the accent on the necessity of shaping a tool that will reproduce their know-how. Still, automated news will only make sense through journalistic mediation.
Key words: News automation. Structuring of uses. Professional practices. Diffusion of innovation.

NEWS AUTOMATION COMO EXPERIÊNCIA DO USUÁRIO

RESUMO – Este artigo examina o papel das representações sociais e práticas culturais de jornalistas na modelagem dos usos (e não–usos) do *software* de automação de notícias quando considerado como uma ferramenta de apoio às práticas do jornalismo. É fundamentado em um estudo empírico realizado em duas redações na Bélgica francófona, onde seguimos o modelo de uma construção sociotécnica que envolveu jornalistas no processo de design. Essa primeira forma de uso levou os jornalistas a reconfigurar

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suas práticas profissionais, enfatizando a necessidade de moldar uma ferramenta que reproduza seu *know–how*. Ainda assim, as notícias automatizadas só farão sentido através da mediação jornalística.
Palavras-chave: Automatização das notícias. Estruturação dos usos. Práticas profissionais. Difusão da inovação.

NEWS AUTOMATION COMO EXPERIENCIA DE USUARIO

RESUMEN – Este artículo examina el papel de las representaciones sociales y las prácticas culturales de los periodistas en el modelado de los usos (y no usos) del *software* de automatización de noticias cuando se considera como una herramienta para apoyar las prácticas periodísticas. Se basa en un estudio empírico realizado en dos salas de redacción en Bélgica francófona, donde seguimos el modelo de una construcción socio–técnica que involucró a periodistas en el proceso de diseño. Esta primera forma de uso llevó a los periodistas a reconfigurar sus prácticas profesionales, enfatizando la necesidad de dar forma a una herramienta que reproduzca sus conocimientos. Aun así, las noticias automatizadas solo tendrán sentido a través de la mediación periodística.
Palabras clave: Automatización de noticias. Estructuración de usos. Prácticas profesionales Difusión de la innovación.

1 News automation in context

News automation consists of transforming structured data into texts in natural language or other form of visual representation. Three variables explain the development of this phenomenon: the constantly evolving information and communication technologies, which constitute the engine of innovations (Hammond, 2017); the availability of increasingly large volumes of data that participate in the "datafication" of society (Loosen, 2018); and the quantitative turn undertaken in the world of journalism (Coddington, 2015).

News automation technologies are unanimously recognized for their performance or potential (Graefe, 2016; Fanta, 2017; Leppänen et al., 2017), including high-speed processing, real–time coverage, large–scale content production, the possibility of generating different forms of visual representations from the same data set, multilingualism, or even extension of the media coverage to subjects barely covered due to limited human resources. However, these technologies are not without limits. The need for structured

data that meets technical and journalistic quality requirements (Dierickx, 2018) explains why the covered fields are currently limited to sports, the economy, election results, or the environment. The strong dependence on the expertise of an application domain further explains why these technologies are often unique and non-reproducible (Linden, 2017).

These information systems can be used for the dissemination of information that is not subject to journalistic reprocessing, whether via the web pages or social networks of a news media (*Le Monde* in France, *Yle* in Finland, *The Washington Post* in the United States) or flows delivered by press agencies (*Associated Press* in the United States, *NTB* in Norway). They can also be used either as tools for data-driven journalism (*Press Association* and *Urbs Media* in the United Kingdom) or to provide alerts for subjects with a potential interest in the fields (*MittMedia* in Sweden). One of the main arguments put forward to justify their introduction within newsrooms is the management of time–consuming tasks (Carlson, 2015). Nevertheless, can journalism only be considered through the lenses of a sum of tasks and skills, allowing their execution (Van Dalen, 2012)? Much more than an occupational activity, journalism also constitutes a professional culture and ideology that encompasses values, strategies, and formal codes commonly shared, despite the diversity of production contexts (Deuze, 2005). Therefore, it is not just the definition of the role of the journalist that is questioned: the professional identity and authority and the meaning of the job are just as important (Neveu, 2010). As workers, journalists have always deal with technological developments (Hardt, 1990). News automation technologies imply an overhaul of what journalism is: who does it and what does it do (Primo & Zago, 2015).

Often associated with the metaphor of the "robot journalist", news automation encourages dual representations that reflect its challenges – either a threat against employment and professional identity or an opportunity through an enchanted vision of the reinvention of journalism. In facing this phenomenon, journalists have expressed a series of antagonistic attitudes that testify to the long history of ambiguous relationships with such technologies. They could be deterministic or resilient, considering that technological developments are unavoidable and will help strengthen existing professional standards (Van Dalen, 2012); reactionary, believing that technological developments do not fit professional practices and values

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and represent a threat to employment (Graefe, 2016; Thurman et al., 2017); or positivist, viewing the phenomenon as a lever to reinvent journalism (Karlsen & Stavelin, 2014). These postures, which have characterized the discourses of the journalists about technological innovations for almost forty years (Powers, 2012), cannot be dissociated from the social and cultural representations of the technical object. If news automation can be considered a finished product delivered to audiences without journalistic mediation, this paper is interested in its aspect related to journalistic practices. In terms of complementarity, the system deals with raw facts or provides first drafts, while the journalist brings depth to the context and analysis (Thurman et al., 2017; Latar, 2018). More specifically, this research focuses on the role of the social representations and cultural practices in shaping the uses (and non–uses) of news automation software that support journalism practices. It is based on two case studies conducted in two Belgian newsrooms; in these, journalists, as the end–users of the software, were invited to participate in the design process of news automation artifacts. Did the tools meet their journalistic requirements? Did the ambivalence of the metaphor of the "robot journalist" between opportunity and threat influence their representations of the tool? To what extent has this influenced their uses?

2 Sociohistorical background

Journalists have often shown resistance to the introduction of technological innovations in newsrooms because they were seen as constituting a stressor that induced deterioration of working conditions, on the one hand (Mico et al., 2013) and because they were able to challenge the idea of what journalism is, both in terms of its practices and its professional ideals, on the other (Deuze, 2005). The phenomenon of resistance can be explained by a refusal to upset the values conveyed by the ideology of journalism (Deuze, 2005; Nygren, 2014). In the context of ICT, resistance has often arisen from representations influenced either by an ideal of the profession or by the myths conveyed by the technology. Digital innovations were often characterized by utopian and dystopian discourses on the advantages (or disadvantages) of adopting them (Domingo, 2008). The imaginaries of journalists have been shaped in an individual and collective way – individual because the mental representations of a

person are conditioned by his referents, whether social or cultural, and collective because professionals have shown common positions. In the wake of the development of convergence policies, digital technologies were seen as stressing journalists who had to develop new skills to produce more content in a multimedia logic (Saltzis & Dickinson, 2008). Scholars have also explained the resistances induced by the changes within the professional practices and a weakening of the dividing line between journalistic and technical teams (Cottle & Ashton, 1999), by organizational factors linked to the management of the news media (Ursell, 2001; Boczkowski, 2015) as well as by a lack of budget or time dedicated to training (Garrisson, 2001 as cited in Deuze, 2008).

Convergence policies have led journalists to reconfigure social and editorial processes, as they had to reconsider their skills and professional specificities. However, multiskilling or multitasking was not always viewed negatively. Young journalists appeared to be the most receptive, believing that these are new opportunities (Nygren, 2014). Moreover, a multi–support logic could be considered as a positive engine for a professional career (Singer, 2004). This illustrates the fact that the novelty was less connected to the way on how technologies have modified professional practices than to the way on how they have integrated them (Plesner, 2009). One of the main consequences of these policies was the development of new skills less focused on the traditional tasks of journalists. It is now recognized that journalists must meet the requirements of a multimedia logic; the essential characteristics of journalism, however, have remained the same (Singer, 2019). Journalism has become more technical, and journalists have seen a shift in their role, going from news producers to news gatherers or managers (Bakker, 2014). Digital technologies have contributed to changes in editorial processes and professional routines. Journalists have had to deal with the challenges of a digital environment while time became an adversary and new forms of work appeared: fast production of content requires skills that need time to learn and practice (Deuze & Bardoel, 2001; Powers, 2012). However, technology should not be seen as an independent factor but as expanding and amplifying previous ways of doing things (Deuze, 2008). If versatility occurs when the professional skills of journalists go beyond newsgathering activities, it is also a part of a technological and economic logic. It has often been accompanied by deskilling since it leaves less time to satisfy traditional practices (Kammer, 2013).

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News automation is growing in a particularly difficult context for the news industry, which is not without adverse effects on work conditions (Deuze & Witschge, 2018). That is why it is understandable that journalists might fear a technology that takes charge of some parts of their job (Linden, 2017). However, journalism cannot be solely seen as an occupational activity: reducing journalism to a sum of tasks obscure the fact that journalism is much more: a know-how, a professional culture, or an ideology (Deuze, 2005; Kammer, 2013). Until now, no news automation system can conduct interviews, build a relationship of trust with information sources, provide in-depth analysis, or deliver opinions (Graefe, 2016). Nevertheless, recent developments in artificial intelligence could be a game–changer in the coming years. When it is tackled as a tool to help journalists in their investigative or daily routines, news automation can be seen as a new avatar of data-driven journalism (Latar, 2018). In this case, journalists do not necessarily have to develop new skills but focus on their additional values; this is emphasized even more because of imaginary excellence in journalism grounds, a data-driven approach that carries the myth of information being more accurate, reliable, and objective (Anderson, 2018).

News automation is further nourished with the representations carried by the robot metaphor, which arouses professional, identity–related, or ideological anxieties because it questions the idea of what journalism is (Linden & Dierickx, 2019; Neveu, 2010). If the machine takes charge of the most annoying and repetitive tasks (Van Dalen, 2012), it also implies that journalists would have to find work that only they can do (Carlson, 2015).

3 How the machine works

Compared with a robot, news automation systems do not share anything with the former's appearance: they are computer programs that transform data into text or any other visual representation forms. The robotic metaphor induces misconceptions about how the machine works and leads to fantasized representations (Linden & Dierickx, 2019). News automation will neither destroy journalism nor create a brighter future for news media organizations. That is why these technologies are to be taken for what they are – software that can be used for a wide range of editorial purposes, depending

on the managerial strategies behind them. Furthermore, the imitation game proposed by a writing software seems still incomplete. When the American magazine *Wired* paid tribute to Marvin Minsky in 2016, the text model could not be fully automated due to the difficulty of extracting data and the inability to incorporate the "touching" dimension of a human-written obituary. The same year, American journalist Adrian Lafrance fed a machine learning system with 725,000 words corresponding to the whole of articles that she wrote for *The Atlantic*. However, it was not enough to create a "Robot Adrienne". The journalist concluded that the machines should probably stick to processing sports results or writing weather reports.

According to the first report about news automation software published by Gartner in June 2019, the logic of a template-based approach still dominates, signifying that the primary process to transform data into text in natural language has not changed much since the commercialization of the first systems in the early 1990s. Its main characteristic is a strong dependence on the knowledge of an application domain (Reiter & Dale, 2000). If structured data is another requirement, the steps that the machine will follow mostly rely on a rule-based process ("if... then... or..."). The theoretical pipeline architecture model describes this process in three stages: macro-planning, which is related to the structuration of the document, micro-planning, which corresponds to the aggregation, lexicalization, and generation of reference expressions; and linguistics realization, which provides the final content. These stages do not necessarily evolve linearly and distinctly as the processes often interact with each other. They can be summarized by two questions, which can be connected to any editorial activity: "What do we say?" and "How do we say it?" (Danlos, 1991).

News automation technologies have the particularity that only the entry points of the system are subject to human intervention (Ekbia & Nardi, 2014). Although they can quickly provide factual reports and deal with a vast amount of data, these technologies cannot replace the complexity of the human brain and human creativity since they are based on rational models according to which all uncertainty is rejected from the system (Latar, 2018). The mythology related to news automation can also be reinforced by the fact that data allow achieving objectives of truth, precision, or objectivity in journalism (Sandoval-Martín & La-Rosa, 2018). In the world of journalism, these concepts contribute to shaping an ideal

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of the profession and legitimizing the discourses of the journalists (Zamith, 2019). The posture of objectivity makes it possible to claim social authority by presenting their work as credible, balanced, and true (Lewis, 2012). However, news information cannot be detached from its production context any more than it cannot be separated from the socio-cultural and professional referents of the social agents who make the news (Carlson, 2019).

Considering that a computational process will also result from human decisions, the computer code cannot be tackled as a neutral agent. Coding is labor as well, a cultural practice that structures interactions in mediated environments, and it can be understood through the hidden values or issues it conveys (Gillespie, 2014; Geiger, 2014; MacKenzie, 2006; McCarthy & Wright, 2007). Like Russian dolls, the "black box" of news automation technology involves nesting a journalistic "black box", That is why computation and journalism activities are first and foremost cultural and social before being technical. That is also why the "rationality" of the machine can be opposed to the "subjectivity" of the journalist, based on the testification of two professional cultures that are built on the myth of "objectivity", either as a technological argument or as a journalistic ideology.

When confronted with the settings of a writing engine, journalists do not feel a particularly pleasant experience. In the United Kingdom, Thurman et al. (2017) showed that journalists perceived the limited nature of automation and reacted negatively. However, they saw news automation technologies as presenting facts as they are, without manipulation. In the United States, Van Dalen (2012) studied how journalists reacted to the phenomenon, and he demonstrated that they believe that news automation will change how they work. In consequence, they would have to reexamine their professional skills. While automation may raise fears of job loss in an economically fragile sector, it is also observed that the phenomenon brings new forms of work or professional profiles. This consists of ensuring the quality of the data that feeds the information systems, controlling the quality of the automated productions, or defining standardized text templates for their automation (Diakopoulos, 2019; Plattner & Orel, 2019).

4 The social construction of technology

In this paper, we examine how the journalists of two Belgian newsrooms have contributed to the design of news automation artifacts that aim to support them either for an investigative purpose or to support their daily routines. These artifacts can be considered as objects and tools of journalism, as far as they act as a way of mediation to produce journalism (De Maeyer & Le Cam, 2015); and that they constitute a new source of information to support journalists within their daily work. The two projects we are studying here consisted of the two first news automation experiences in French-speaking Belgium. They are about two newsrooms that have very little in common. In both cases, journalists were associated with the design process of each news automation artifact. This inclusive approach can be considered as the first form of use, where reciprocal adjustment mechanisms will occur between the object and its social environment (Akrich, 2006, 2010). However, this process will not guarantee end-uses, even when we can suppose that it will facilitate it. Six journalists were involved in both cases, but they did not all participate in the process due to a lack of interest or time to participate in meetings. Therefore, this research focused on the journalists who took an active part in these reunions.

In the first studied newsroom, *Alter Échos*, the journalists work in an associative structure. They do not feel very attracted by technological tools as well as on a more general data-driven approach. The newsroom is composed of five journalists and a pool of twentieth freelancers. These five journalists were concerned by the news automation project, as well as a freelance journalist specialized in the environment. The purpose of the news automation artifact, "Bxl'air bot", was to provide real-time news and statistics analysis about air quality in Brussels from public open data.

In the second one, the studied social group is that of the "Investing" service of L'Echo, a daily newspaper published by the Mediafin press group, which is composed of six journalists (while the media employ fifty journalists). The news automation system, named "Quotebot", aims to support them in their live coverage of stock markets by providing them a first draft that they can either publish as it is, or publish by enriching it with their expertise, or not publish it at all. In these two experiments,

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journalists were invited to define the functionalities of automation systems.

The method of collecting empirical data consisted of participant observations, which permitted the researcher to live the reality of the studied subjects and, by doing so, collect material that would be impossible to collect otherwise (Soulé, 2007; Becker & Geer, 1957). This method was completed with interviews (organized at the start, middle, and end of each experience) and anonymous online surveys to focus on how journalists felt about the experience (von Pape & Martin, 2010). The research approach was thus based on a changing angle of observation during the same investigative (Chart 1), that permits to vary the observer position and, by doing so, to broaden the perspectives for the analysis (Denis, 2009). On an epistemological level, the position of the researcher was placed under tension between commitment and distance, one of the main characteristics of an ethnographic study (Elias, 1993).

Chart 1 – Method of collecting empirical data.

Method	Alter Échos		L'Echo	
	Amount	**Total duration**	**Amount**	**Total duration**
Editorial/work meetings	3	03:07:05	6	07:09:31
Kick-off meetings	–		2	03:01:59
Semi-conducted interviews	12	04:56:51	5	03:54:32
E-mail interviews	–		1	–
Workflow observation	–		1	04:00:00
Online calls	–		5	02:46:04
Online surveys	3		2	
E-mail exchanges	139		129	
Working documents	–		62	
Duration of the experience	12 months		24 months	

4.1 A three-stage process

The Social Construction of Technology (SCOT) model frames the analysis of the design process of these two technological artifacts. It makes it possible to approach the development of the technological artifact as resulting from constructions and compromises where the particular interests of the social agents involved in this process will come into play (Bijker et al., 1987). Placing the level of analysis on humans further permits to tackle the problem of the use as a form of socio-technical mediation (Flichy, 2008).

This theoretical model, which consists of a three-stage process, advocates that technology is a social construction, shaped and interpreted by social agents influenced by their cultural and social context. As a result of social choices, a technological artifact will embed the norms and values of the involved social agents (Bijker et al., 1987; Valenduc, 2005). The SCOT model, which distinguishes the conception of the object of its exploitation, addresses the problem of use as a form of socio-technical mediation. The process ends when the diffusion of innovation is achieved (Vinck, 1995; Flichy, 2008; Vinck, 2012). The model is characterized by three variables: (1) the identification of relevant social groups, who will share the same interpretative grid (Valenduc, 2005, p.59); (2) the social agents belonging to a social group, who are considered as exerting "detectable influence" on others within a network; and (3) the technological framework, which consists of a shared cognitive frame that defines the social group and which is likely to encourage or discourage actions (Bijker et al., 1987). From a perspective of journalism studies, technological artifacts potentially replicate, embody, or modify professional standards (Domingo, 2008; Anderson, 2013). They also reflect the know–how of the media organization (Linden et al., 2019, p.39). Conceptually, this model can be put in parallel with the incremental software development process to follow the development of each artifact through each of their technical and social steps (Chart 2).

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Chart 2 – Parallel between the stages of the SCOT model and the incremental process of software development.

Source: from Bijker et al. (1987) and Ghezzi et al. (2002).

The SCOT model begins with the interpretative flexibility, which aims to define the functionalities of the automation system regarding the end-uses of the journalists. Technological innovation is seen as an open process whose results will depend on its social circumstances, according to the interpretative grid of the social group involved (Valenduc, 2005).

In the first case study, "Bxl'air bot", wherein two journalists were mainly involved within the design process, two difficulties were observed: the reconfiguration of a journalistic process, which traditionally consists of defining an angle before collecting information; and the exercise of projecting itself into end-uses since it is a long-term journalism project. A journalist said that the process of using a tool to find information is complicated and that a data journalism project is challenging for the newsroom as "no one is used to" it. Although the other journalist involved within the design process asked to implement statistical functionalities, it appeared that some of them were not useful at all while new demands have emerged so far as the project was going on: "I discover all the potential of the tool (...) It is the tool that creates the need", said a journalist. For the journalist involved in the design of the project, this experience was viewed as an opportunity to train in data journalism and to wonder about the future of the profession: "When I worked for a daily newspaper, where I was processing dispatches, I had the feeling of doing robot work (...) It is a profession that changes quickly, both for better and for worse: you can lose jobs on the one hand and, on the other, see new possibilities that open up. It is fascinating".

While the journalists discovered the perceived benefits of the news automation systems as the experience progressed, the contrary was observed in the case study "Quotebot". Since the first working session, journalists showed their enthusiasm: "We are

going to make it work", "That is an additional source of information that will facilitate our task", "If that can help us to automate specific tasks to focus on something else (..) It is great as a project, it is good". The daily coverage of stock markets means being always on the alert. Indeed, the variations of values are likely to happen at any time. According to a journalist, the estimated gain of time would be a half-hour per day and journalist. That is not negligible given a work organized in just-in-time flow, which leaves little respite for journalists who barely dare to take a break. From this point of view, the definition of their needs appeared relatively straightforward. From the opening to the closing bell, journalists identified three highlights that could be automated. To give the service provider in charge of the development, a French start-up specialized in the development of semantic technologies, journalists had to deconstruct their way of writing with defining text templates that would be automated. These were short texts (barely ten lines) designed according to a rule-based generation system, based on the potential variations in stock values and indices: "if ... then ... or..." They also defined a list of synonyms and a list of reference expressions, considering the particular vocabulary used in the field of stock market coverage.

The second stage of the SCOT model is called stabilization. It is related to the closure of debates around technological artifact (Doray, 2015). In the "Bxl'air bot" experience, this stage started four months after the launch of the project, and it took eight months. It consisted mainly of maintenance activities around the quality of the collected data, as human monitoring appeared as fundamental to ensure the reliability of the information system. Indeed, it was found that the data values were likely to evolve: the missing values could be added a few days later, and abnormal values could also be corrected. This human input was invisible to the journalists and not perceived, supposing the autonomy of the system. "It is a tool that frees me from pressure. The data retention is reliable, scientific, and much more accurate than what I can do manually", said one of the two journalists involved in the design process. "I imagine the robot sorts the results, calculates, and draws faster than me (and that is what it is for)", said the same journalist.

In the second case study, the stabilization stage corresponds to the correction process where the journalists were also involved. The service provider proposed several versions

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of the texts generated automatically, which had to integrate the requirements defined during the stage of interpretative flexibility. This process took longer than expected and contributed to delay the launching, which was initially planned for over one year. Journalists encountered two central problems: on the one hand, data quality problems appeared; the contract binding the press company to the supplier was not provided for real-time transmission for all the stock markets; and on the other, the proposed texts did not correspond to journalistic requirements. Data quality issues were managed by revising contract terms, which implied to redefine journalistic requirements according to data transmission possibilities.

On the other hand, the problems related to the quality of the texts were less obvious to solve. It was attributed to a lack of expertise of the service provider in stock markets, while the knowledge of the application domain constitutes a prerequisite to any natural language generation project (Reiter & Dale, 1997). Nevertheless, his technical expertise was recognized. "There were certain things that seemed obvious to us and that they did not understand, or that they were not wrong", said a journalist. "The complexity of carrying out this project seems to have been underestimated. As it stands, the articles (...) are therefore neither reliable nor usable, in my opinion, because they should be flawless (...) there is a risk of errors, wrong formulations, aberrations, etc. 'Quotebot' cannot (yet?) be used at this stage", said another journalist. Therefore, the controversies surrounding the technical subject have not been closed, as the problems relating to the quality of the texts have not been resolved. The stage of closure could not thus be observed.

This third and last stage refers to adopting the relevant social group and being subject to a consensus, whether rhetorically or practically (Valenduc, 2005). One year after the launching of "Bxl'air bot", the data collected and processed by the automation system were used by one journalist in a paper called "One year with a robot". She was the only journalist to integrate it within her journalistic production, playing with the robot metaphor to give a sympathetic tone to the experience: "It did not take much space and did not serve coffee. That is a simple application that has made its nest on our website", she wrote. Even if the appropriation of the artifact was observed all along with her paper, she kept her distance with it, as she was

not in demand: "He came within the newsroom without being invited". At the same time, she indirectly recognized that all the choices made within the design of the artifact were subjective, as they came from journalistic choices: "The robot assumes the part of subjectivity that any interpretation activity involves". From a rhetorical point of view, the principle of the news automation system was already accepted by the other journalist who contributed to the design process. She testified so of a form of symbolic adoption, related to the acceptance of the idea of the innovation (Klonglan & Coward, 1970). In an editorial, she used the robot metaphor to give a positive image of a news media that innovates. For the four other journalists from the newsroom, who had not participated in the design process, it was considered as a tool that took form and meaning through a journalistic appropriation: "It is a form of journalism if you take the data (...) and if you treat it in a journalistic way". For all of these reasons, we can consider that the closure was partially achieved there.

4.2. Multifactorial resistances

When considering the sociology of uses, the concept of resistance can be connected to non–use, which can refer to non–adoption and non–appropriation. Refusal or cultural resistance characterizes non-uses (Proulx, 2005; Boudokhane, 2006). A variety of factors can explain them: a lack of need, interest, and motivation, or meaning; technophobia, related to the apprehension of the technology; and ideological rejection, linked to a form of non–conformity or resistance to the consequences that technology could induce on traditional patterns of work (Kellner et al., 2010; Selwyn, 2003). All of those factors were encountered in the two projects examined in this paper.

At the "Bxl'air bot" level, it appeared that the project failed to meet the interest of four journalists, who did not invest themselves within the design process. First of all, most of these journalists did not feel comfortable with data; two of them emphasized that "numbers make me scared". This reluctance in facing mathematics has been observed for a long time in the profession, even among journalism students who say that they want to write and not calculate (Curtin & Maier, 2001;

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Schmitz-Weiss & Retis-Rivas, 2018). The four journalists have also described their approach of journalism as "traditional" or "old school" in a shared vision of practicing a "slow journalism". They do not reject digital technologies but feel less concerned, highlighting time-consuming aspects of learning or practicing them. "We stay in our comfort zone, which is written, and we are all formatted to that", said a journalist. In this perspective, the automation experience would have induced a change of habits. It is to be noted here that the average age of these journalists was less than 40. However, they explained that they understand the value of a data-driven approach. The role played by the metaphor of the "robot journalist" was also non-neglectable. If it is commonly admitted that technological imaginaries are not stable and evolve over time (Musso, 2009), it was not verified here. At the beginning of the experience, a journalist said that she was "Rather suspicious (robots that steal the job of journalists) but amused (robots are funny)". One year later, this point of view was not changed "The mega threat of the robot that will steal my job is still here".

On the contrary, no resistance was observed at the launching of the "Quotebot" project. Journalists immediately identified the benefits of using such a tool, which was connected to gaining time during intense working days. They always considered it as a "writing engine" that is not in competition with them. The service provider in charge of the development was seen, for a journalist, eventually as the challenger: "Are they the ones who will replace us? Are we helping them replace us?" As long as the project progressed to the stabilization stage, during which journalists discovered the generated texts based on their requirements, their enthusiasm went down. Journalists listed a high number of errors, either in substance or form. Their quality requirements were not met, and all journalists considered that "Quotebot" did not write like them. Only one journalist appeared more accommodating by highlighting that this process had to be considered as tests that aim to improve the writings. After receiving the fifth version of texts to correct, a journalist triggered an internal crisis. Although he was not satisfied with the generated contents, he directed his dissatisfaction against the management of the newsroom, considering that the workload induced by the corrections of the texts was too high. This crisis, which was qualified as "verbally

violent", also contributed to delaying the project by blocking it for several months.

5 Beyond a complex process

Following the socio-technical construction of a news automation artifact through the analysis framework proposed by the SCOT model made it possible to break down the process by highlighting the difficulties encountered at each of its stages. Although this model is not without limits, such as the difficulty to reach the closure or the reducing of technological choices to social choices (Williams & Edge, 1996; Valenduc, 2005), its strength is to focus on the controversies related to the use of technologies (Flichy, 2008). In the two experiences described in this paper, it appeared that the particularities of the two socio-professional contexts contribute to shaping the way journalists have projected themselves in their final uses.

Two main lessons were learned here. First, when journalists are associated with the design process of a news automation tool that aims to support investigative work, it might be difficult to define all the functionalities that they will need for their purpose. Within a newsroom where journalists are not familiar with a data-driven approach, it also supposes to reconfigure a traditional journalistic process because the data results will permit to define the journalistic angle. Second, when a news automation artifact is developed to support daily routines, it facilitates how the journalists will project themselves in their end-uses. Journalistic requirements took the form of pre-written text templates, implying that journalists were led to deconstruct their way of writing to produce standardized texts that fit a rule-based system. The correction process implied a work overload that was not expected, and it triggered an internal crisis.

In both cases, a socio-technical mediation was required to bridge the requirements defined by the journalists and how they will be technically translated. These developmental activities were not fully automated as they required human inputs, which were not always perceived by the journalists, either to maintain the data quality over time or to code a computational program that will fit the journalistic requirements. It also appeared that only the end-results

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counted. If the know-how and the requirements of the journalists are not met, the news automation system will not be used at all. Further, in both cases, the autonomy of the information system was not fully recognized: only a journalist will give the meaning to automated news.

On a representational level, the role played by the robot metaphor appeared as ambivalent: either a brake on the involvement within the design process, or a brake on internal communication purpose, or a way to promote the symbolic adoption of a "sympathetic" artifact. The duality of the metaphor – between threat or opportunity – did not appear as the determinant factor to shape the uses. The way a news automation system is used (or not) will depend on socio-cultural factors as well. When journalists are used with technologies and numbers, the weight of the robot metaphor will be absent from the discussions. On the contrary, when journalists do not feel comfortable with digital technologies and numbers, the metaphor is likely to discourage acts and to encourage dramatization discourses.

Resistances appeared all along the design process of the artifacts. They were characterized by resistance against the symbolism carried by the artifact, by ambiguous relationships with technologies and numbers, by a lack of interest in the purpose of the project, by a kind of refusal to question the traditional approach of journalism, as well by resistance against the management when the involvement within the design process induced additional workload. However, it was also observed in the first case study, the news automation artifact conducted the two journalists involved in the design process to reconsider their skills. They also showed a growing interest in data-driven journalism and their desire to learn it.

These findings correlate to previous research that focused on the diffusion of innovation within newsrooms, where technologies were seen as a stressing factor. These were less related to the use of the technology than to the consequences of the innovation on the workflow and the tensions observed from a managerial perspective. Although journalists were often kept away from organizational strategies, these two experiences showed that the involvement of the journalists will not necessarily lead to end-use and that the human factor, mainly as a socio-technical mediator, remains decisive. The acceptance of the idea of the innovation will depend on how the

phenomenon is tackled regarding the habits of practices within a given newsroom and how journalists perceive the benefits and risks of the innovation. However, these will not be the sole factors to be considered, as end-use also strongly depends on the quality of generated content.

Viewed through the lenses of the software studies, the social construction of a news automation system can be seen as a remixed form of an editorial process, especially since the automated process results from cultural transcoding fed by previous editorial experiences (Manovich, 2010, 2013). The process at work is less technical than social. It implies that journalists have to project themselves into their end-use while learning how to deconstruct their usual professional practices to define the expected results. This may open up prospects for further research focused on the evolution of professional practices.

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LAURENCE DIERICKX. PhD in Science of Information and Communication from Université Libre de Bruxelles (ULB, Brussels). Her research focused on the integration of news automation within professional practices. She is currently an assistant for the faculty of journalism at ULB, a scientific collaborator at the ReSIC research centre, and a member of the research laboratory LaPIJ. E-mail: Laurence.Dierickx@ulb.be

REVIEWS

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