The data journalist network.

Profiles, skills, routines and tools of professionals in Spain and Latin America

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Abstract

In the data journalism field, professionals are one of the key nodes within a complex human and technological network. This study, based on the Actor-Network Theory (ANT), seeks to determine the relationships between the actants involved in a specialized field defined by hybridization and complexity from two dimensions: cognitive and normative. It delves into the education, specialization, teamwork, working conditions and tools that apply to data journalism. The field work was carried out through a survey (n=208) using an open database with a web directory format (n=296). The resulting profile is that of a Journalism graduate who is not specialized in data, with a predilection for analysis and research, accustomed to working in a team, with limited experience, low job stability, and expertise in digital resources for processing and viewing data. The research confirms that data journalism operates at the heart of an overlapping network featuring various types of interconnected professionals as well as social, cultural and technological structures.

Keywords: Data journalism, computational journalism, journalism profession, Spain, Latin America, survey.

Introduction

Several years have passed since data journalism ceased to be "a very niche activity, conducted in just a handful of newsrooms" (Bell, 2012, p. 48). At major media outlets, multidisciplinary teams led by data journalism professionals have made it necessary to overcome tensions between their structures and subcultures (Stalph, 2020, p. 1). Additionally, their expansion and evolution have made it possible for smaller newsrooms (Arias-Robles & López López, 2020, p. 14) and projects at the periphery of journalism to create content by processing vast amounts of data (Cheruiyot et al., 2019, p. 1).

Professionals are the smallest component of data journalism and they continue to play a fundamental role. However, these roles or actants appear in multiple forms and with an array of profiles in a complex network where technology and open, multidisciplinary teams work together as their own entities. Professionals continue to drive this specialized field, with more self-motivation than support from their company or

environment (Zamith, 2019, p. 1), but on the other hand, they are surrounded by a framework of partnerships and digital resources resulting from their involvement in that network.

Appelgren & Lindén (2020, p. 64) highlighted the need to thoroughly analyze this type of professional as a pioneer in the innovation of main journalism processes: "Even though data journalism is carried out in teams, there is little research on individual data journalists as pioneers. Pioneering journalists have been found to perceive themselves as forerunners who can act as intermediaries and bring together various competencies." However, assuming that data journalists have played (and continue to maintain) a significant role in this specialized field, the nature of this phenomenon, just as that of journalism as a whole, cannot be understood without the influence of several other factors (human and technological) that are continuously being negotiated (Weiss & Domingo, 2010, p. 1159).

The rise of data journalism was accompanied by a growing interest on behalf of academia at the start of the last decade (Heravi et al., 2018, p. 118). Research on profiles, routines and interconnections between industry professionals has not been an exception (Borges Rey et al., 2018; Heravi et al., 2018). However, data journalism is still being developed, just as it continues to be a rather unstudied field in journalism research that remains "largely unexplored" aside from national case studies and epistemological insights (Stalph, 2018, p. 1).

These shortages are emphasized beyond the Anglo-Saxon sphere. Although data journalism is practiced globally, its research has traditionally focused on a limited set of countries, primarily within the liberal and democratic corporatist media systems (Appelgren et al., 2019, p. 1191). It now seems obvious that data journalism has become a global phenomenon that cannot be fully grasped merely within national contexts (Cheruiyot et al., 2019, p. 1). Therefore, it is important to examine the development of data journalism beyond the Western paradigm because every region—and country, in some cases—seems to be adopting "a specific culture orientation that best describes its position when it comes to data journalism" (Mutsvairo, 2019, p. 1289). Wright et al. (2019, p. 1295), in addition to lamenting the Western world's excessive focus on data journalism research, have promoted comparative studies, international collaboration and methodological diversity.

Among these opportunities to advance research in data journalism, Ibero-America is a region that remains relatively unexplored (Borges Rey et al., 2018, p. 2). This is the geographic context in which this research aims to analyze the education, routines, working conditions and technological tools used by those involved. It also seeks to highlight the interconnection of all these elements to comprise a complex and hybrid network (Stalph, 2019).

Based on these premises, this study considers the following research questions:

> RQ1: What is the level of education of the professionals who comprise the data journalism network in Spain and Latin America?

> RQ2: What do these professionals specialize in and how do they coordinate their skills with teamwork?

> RQ3: What is the employment and socio-economic situation of these actants (years of experience, type of employment with regard to the specialization, connection), and how do they rate their situation?

RQ4: What is the role of the most common and innovative technological tools in this specialization?

Literature review

Data journalism professionals

The most common data journalism tasks have led to specialized fields that professionals fall within. The source of these categories can most likely be traced back to what is known as the "inverted pyramid" by Bradshaw (2011). The author defined five levels: compile, clean, context, combine and communicate. The essence of this proposal remains intact in the subsequent modifications made by other authors. Antón Bravo (2013, p. 112) spoke of analyzing, cleaning and selecting data; Tarlá Lorenzi Reno (2016, p. 176), of searching, extracting, cleaning, analyzing and viewing; Ferreras-Rodríguez (2016, p. 270), of searching, selecting, processing, analyzing, comparing and publishing; La Rosa & Sandoval-Martín (2016, p. 1212), of extracting, systematizing, processing and publishing; and López López, 2019 (p. 111) of accessing, extracting, cleaning and viewing. This study has combined and simplified these contributions into three: compiling, processing and publishing, to which a fourth task has been added that departs from the most direct information processing and covers aspects such as project management and academic research.

These concepts are elaborated on in research about data journalist profiles. The most ambitious was probably the one led by Rogers (2017), involving 56 detailed in-person interviews with journalists in the U.S., U.K., Germany and France, along with an online survey of more than 900 journalists (not only specialized in data). The main findings include the expansion of this specialization in the work done by professionals and their newsrooms, as well as the educational shortcomings and limited time and resources to properly carry out these efforts.

Also worth noting is the work of Heravi et al. (2018), in which they surveyed 206 journalists from 43 countries to reveal the importance of including data-related courses and modules in higher education journalism and communication programs. Most of the journalists surveyed show low and varying degrees of formal training in technical and data-oriented aspects such data analysis, statistics, coding, data science, machine learning and data visualization. Another key study was led by Appelgren & Salaverría (2018), in which 96 Spanish and 84 Swedish data journalists were interviewed to compare the transparency of institutions in the two countries. Finally, beyond the Western sphere, another noteworthy initiative was the survey Fahmy & Attia (2020, p. 9) of 60 data journalists from eight Arab countries.

Most of the findings of this research and other more qualitative work with smaller sample sizes have focused on the new skills needed for data journalism. Although the majority agree that these professionals must preserve the fundamental principles of journalism—reporting, editing, and networking skills (Örnebring & Mellado, 2016, p. 1), in addition to ethical matters (McBride, 2020, p. 10)—the nature of this specialization requires delving into two key aspects: technology and data management.

In terms of technology, Appelgren & Lindén (2020, p. 61) highlight two aspects: programming and design skills. López-García, Toural-Bran, & Rodríguez-Vázquez (2016, p. 292) go one step further and point out the need to master IT tools, specifically those for database management, information visualization and

multimedia narratives. Broussard & Boss (2018, p. 1213) underscored the importance of comprehending frameworks and programming languages, such as Javascript, to create projects. Technical skills come into play at the end of the process (such as data visualization and interface design) but also in the beginning (such as automated database collection) (Boyles & Meyer, 2017, p. 435).

Along these lines, Engebretsen, Kennedy, & Weber (2019, p. 3) highlighted the connection between the development of phenomena such as data visualization and the rise of technological innovation. Loosen et al (2017) concluded that the question now is if and to what extent data journalism is actually a new reporting style, and that the skills of "technical journalists," such as programming and data journalism, are currently upgrading journalism. Finally, Diakopoulos (2020, p. 2) stressed the benefits of what he calls computational news discovery, the use of algorithms to orient editorial attention to potentially newsworthy events or information prior to publication, such as monitoring scope, filtering output and defining newsworthiness.

Other types of innovative skills, including social media management, web development, content and audience analytics, and programming languages such us Python, are also frequently demanded of these specialists (Guo & Volz, 2019, p. 1311). This emphasis on technology is also linked to the emergence of native media outlets and, above all, news projects at the periphery of journalism (Appelgren & Lindén, 2020, p. 61).

With regard to the other key aspect, data management, Davies (2018, p. 110) stresses the importance of eliminating the obsession with math and leveraging these resources for day-to-day journalism. Appelgren & Lindén (2020, p. 61) expand this view by pointing out the need to be familiar with investigative journalism methods, statistics, data management and statistical reporting. In this sense, multi-skilled journalists are being valued more. Along these lines, Weiss & Retis-Rivas (2018, p. 3) defend the need to eliminate "the notion that math and statistics are 'not in the journalist's wheelhouse.'" This is particularly true now because simplified tools eliminate certain technological barriers, so editors are placing greater importance on the ability to find topics from vast amounts of data (Arias-Robles & López López, 2020, p. 10).

In this sense, data journalism students must become comfortable with handling data and also nurture their critical capacity to understand the limitations of data: "Working with statistics is a good way to introduce students to the complexities of data and demonstrate that it is not value-free" (Burns & Matthews, 2018, p. 94). Research such as that carried out by Faria Brandão (2019, p. 929) shows a lack of fluency in journalists' numerical language as well as a shortage of time for verifying the data obtained. "Journalists need to be data literate, but seldom have they acquired training and developed the necessary numeracy skills which would allow them to use data efficiently."

Training is essential for handling data and technological resources. Heravi et al. (2018, p. 112) have discovered that the data journalism community tends to be highly educated, and its roots lie primarily in journalism and communication degrees as opposed to data science or computer-related fields. While technical, data analytics and statistical skills do not appear to be strengths that the participating journalists list as part of their journalism experience, it seems that many newsrooms already have a dedicated data team and/or produce data-driven stories on a regular basis. Burns & Matthews (2018, p. 94) defend that these new concepts should be taught to journalism students from the beginning of their undergraduate studies, just like what is done with primary and secondary sources. Integrating these profiles in newsrooms requires implementing complex processes (Stalph, 2020, p. 11) that are oftentimes experimental due to

their newness, in addition to updated methods for supervision and leadership (Boyles & Meyer, 2017, p. 435).

Above all, the expansion of this specialized field is also driving hyper-specialization within data journalism. While data units had a greater technical specialization, these groups had less subject-matter expertise in the beats that have historically structured the newsroom (Boyles & Meyer, 2017, p. 435). Loosen, Reimer, & De Silva-Schmidt (2017) found that data journalism is frequently done by cross-disciplinary teams that have divided the work into data analysis, visualization and writing.

There is also general consensus that data journalists must combine their individual efforts with teamwork. Data journalism production, which is a highly complex and collaborative effort, often requires more teamwork across the organization than traditional models do (Boyles & Meyer, 2017, p. 435). Programmers, infographic designers, documentalists (Guallar & Peiró, 2013, p. 28) and statisticians (Palomo & Palau-Sampio, 2016, p. 192) are, since the emergence of this specialized field, some of the most common profiles that work together with journalists.

Training is also essential for this, which is why journalists must be aware of their limitations and learn how to communicate with professionals who have more technical profiles, such as data scientists and information designers (Burns & Matthews, 2018, p. 94). Data unit members are more likely to rely on non-specialist colleagues for cultivating human sources within institutions or attending public meetings where data is readily available. As task uncertainty increases within data-driven newsrooms, data practitioners often trade beat knowledge for computational knowledge (Boyles & Meyer, 2017, p. 435). Scholars denote external actors with these types of knowledge as interlopers or actors at the periphery of journalism (Appelgren & Lindén, 2020, p. 61).

The evolution of data journalism in Latin America and Spain

With a few exceptions, data journalism in Spanish-speaking countries has lagged behind English-speaking and northern European nations (Appelgren & Salaverría, 2018, p. 9). In Spain, this delay is due to three reasons: barriers to accessing public information, with no specific law until 2013 (the last in the European Union in a country with more than one million residents (Tejedor Fuentes, 2014, p. 620)); technical limitations on aspects such as reusable formats; and the lack of tradition and training in this specialized field, both in newsrooms (particularly senior management) and beyond (Ferreras Rodríguez, 2013, p. 130). As in the implementation of any innovation, the journalistic culture, the media markets and the political situation were deciding factors for its development (Appelgren et al., 2019, p. 1195).

The data journalist profile first appeared in Spain and Latin America at the start of the last decade. Between 2010 and 2012, Hacks and Hackers opened offices in Madrid and in many large American cities (Ferreras Rodríguez, 2013, p. 129). The first major case in Latin America was that of La Nación de Argentina, created in 2010. Its specialized team, LN Data, continues to be an industry benchmark, with innovations such as audience participation in large-scale projects (Palomo et al., 2019, p. 1270). The specialization also expanded in Colombia, Peru and Venezuela, once again with user participation as one of the main drivers, even for tasks such as computer programming and correcting information (Appelgren et al., 2019, p. 1194).

On the other hand, in regions such as Ecuador, data journalism advanced at a slower pace and public institutions were frequently the sole data transmitters (Costales, 2018, p. 223). In many of these countries, more attention was paid to developing narratives and structures to leverage the impact of social media (Goyanes et al., 2020; Harlow, 2020, p. 1) or audiovisual formats such as podcasts (Rojas-Torrijos et al., 2020). The scarce development of university education in this specialization in countries such as Argentina (Manozzo et al., 2019, p. 21) most likely slowed down the expansion of this phenomenon, despite having one of the top international news outlets.

In turn, this region stands out for the rise of the fact-checking variant, with major technological advances (Vizoso & Vázqez-Herrero, 2019, p. 127) and activism for transparency and data on behalf of journalists as well as the professionals linked to social causes (Palomo et al., 2019, p. 1284).

In 2011, Spain founded Medialab Prado, which is probably the initiative with the greatest impact on the emergence of this specialization (Antón Bravo, 2013, p. 113). Data journalism in Spain completed its consolidation in 2013 with the creation of a section in La Sexta's El Objetivo, an influential evening TV program, and with the first specialized conferences held in Madrid and Barcelona (Guallar & Peiró, 2013, p. 25).

That year, the publishing house El Mundo launched the first master's program specialized in data and research (Ferreras Rodríguez, 2013, p. 128). That same year also marked the creation of the first data journalism teams at three stand-alone online newspapers: El Confidencial, eldiario.es and La Información (Chaparro Domínguez, 2014, p. 46). Between late 2014 and early 2015, Vocento, the top group for regional newspapers, El Mundo and La Sexta launched similar initiatives (La Rosa & Sandoval-Martín, 2016, p. 1210). The following year, a research project by Ferreras-Rodríguez (2016, p. 270) identified 14 Spanish media outlets that regularly or sporadically published information classified as data journalism.

One of the latest data journalism initiatives in Spain can be found in the nation's top newspaper, El País, which at the start of 2019 hired the head of El Confidencial's data department to build its own specialized team. This media outlet had already launched innovative endeavors such as the development of a predictive algorithm for 2018 World Cup results. Although it received widespread approval from industry professionals, there was a lack of reader comprehension due to a shortage of similar initiatives (Rojas-Torrijos & García-Cepero, 2020, p. 1).

The ANT applied to innovation and data journalism

Research on data journalism has reached a sufficient level of maturity to be backed by a number of methodological theories. Field and ecology approaches have been shown to be useful for explaining social spaces such as innovation in this journalism specialization, characterized by "spaces with internal logics, internal diversity of agents, and complexity" (Lowrey et al., 2019, p. 2132). The combination of methods from other fields to study new production and consumption formats in journalism, oftentimes in collaboration with data analysts, as noted by Lecheler et al. (2020, p. 857), becomes increasingly important in this journalism specialization.

Research in computational journalism, one of the multiple ways (such as algorithms, automated or robot) of referring to innovation in journalism with data and technology (Díaz-Campo & Chaparro-Domínguez, 2020, p. 14), has also been based on the concept of structure. According to this vision, defining computational journalism in terms of its data structures, rather than algorithms or as a toolkit, can clarify the roles of data,

abstraction and editorial oversight within an increasingly data-driven media environment (Caswell, 2019, pp. 16–17).

In this sense, the so-called computational methods have been considered to be useful for digital journalism researchers with the opportunity to study established research questions from novel analytical angles (Buhl et al., 2019, p. 912). Going a little further, the potential of creativity for research has been emphasized to develop new approaches, with three implications: "A concept that informs what we are looking for when studying journalism, a guide for the range of available research methods, and an inspiration for the stories we tell about our research" (Witschge et al., 2019, p. 972).

But even more appropriate for these endeavors is the Actor-Network Theory (ANT), whose vocabulary offers meaningful sensibilities for exploring data-driven newswork, "particularly constructive to examine the relations between data, computation, and journalism practice, epistemology, reflexivity, and journalistic artifacts" (Stalph, 2019, p. 1)

ANT was conceived as a conceptual framework to understand processes of technological innovation assuming a mutual shaping of technology and society. Actants, who take their form and acquire their attributes as a result of their relations with others, can be human or non-human (a technological tool or an organization). The relations among actants are simultaneously material (between things) and semiotic (between concepts), making journalism a complex network of actants, all negotiating with and for and against one another (L.-P. Spyridou et al., 2013, p. 79). The network, the other key concept in this theory, is understood as a "string of actions" that gives meaning to its actants. In fact, a network can be defined by its actants just like an actant can be defined by its networks, which means that each actant, human or non-human, is a network within other networks (Primo & Zago, 2015, p. 45).

These premises make ANT the most suitable conceptual framework for studying the vast network woven by data journalism professionals. Aside from considering the technological variables (Turner, 2005, p. 321), it makes it possible to analyze journalism networks, with a special emphasis on aspects such as multidisciplinary work (Weiss & Domingo, 2010, p. 1166) or data management (Primo & Zago, 2015, p. 48). It is no surprise that the actor-network theory is emerging as the dominant paradigm for understanding data journalism, but sometimes in largely uncritical ways (Hammond, 2017, p. 1). The applicability of the actor-network theory to media studies has been covered in the literature, but it has seldom been thoroughly used for empirical research of innovations in journalism. As Weiss & Domingo (2010, p. 1166) have argued, an actor-network approach can be particularly beneficial for tracing the power relationships between the actors involved in developing an innovation in a newsroom, the conflicts around defining a technology, and the process of reaching closure, including technical artifacts as another actor in the equation, which has frequently been blurred to highlight the role of human actors (Stalph, 2019, p. 11).

Methodology

The database

Based on this theoretical focus, the research uses several methodological tools, the first of which is an open database in the form of a web directory. Since it has also been created to distribute the survey to registered participants, this methodological tool also serves as a network. This is true, above all, because it obtains

from ANT a view of the profession in which profile hybridization (Primo & Zago, 2015, p. 45) is blurring the boundaries between professional profiles as well as between the human and the non-human (Turner, 2005, pp. 321–322). This is the reason why the directory, which remains active and is continuously being updated, interrelates editors with designers, developers, project entrepreneurs and scholars of a specialized field that can only be understood through multidisciplinarity (Figl, 2017, p. 43). It also includes links to the professionals' social media accounts, where they frequently display their work and the application of their technological resources.

The initial database entries were submitted through several professional and mainstream social media platforms. Bradshaw (2018, p. 8) already pointed out the importance of resources such as email distribution lists and specialized applications like Slack or Meetup, in addition to hack days and conferences, in order to reach data journalists. Aside from these resources, professional social media platforms (LinkedIn), specialized channels in Telegram and specialized publications (blogs) were used for this study.

However, the main source of data was Twitter, which is a fairly common work tool in this ecosystem. Felle (2016, p. 5), for example, tracked users in this platform who describe themselves as data reporters or data journalists on social media, and those who were verified as professionals were contacted and asked to participate in a study. According to the author, Twitter allows quick and easy access to a large pool of people, some of whom may be potential respondents. The drawback is that respondents are largely limited to those who are engaged on social media. However, it is reasonable to expect that, given the nature of their work, almost all data journalists must be active on social media, mainly Twitter. This is particularly the case in Spain and some Latin American countries, where Twitter has a huge insight among journalists, especially the most tech-savvy and those specialized in data (Zhang, 2018, p. 737).

To classify data professionals, first a list of users was created from six existing lists that included accounts linked to data journalism. There were two main selection criteria: the account had to be for a person as opposed to a media outlet or a project; and the profile description or the 20 latest posts had to show a connection to data journalism. As a result, and following the same steps as Wright & Doyle (2018, p. 5), those who described themselves as data journalists or as having an interest in data journalism were included. In addition to journalists in the strictest sense, professionals involved in creating informative content, such as programmers, designers and analysts, were also included.

The list was fed with results from the Twitter search engine using the essential terms (Zhang, 2018, p. 7): "periodismo de datos", "data journalism" and "ddj" (with/without a #, and with/without a space). The *Following* and *Followers* of the top data journalism and innovation profiles in Spain and Latin America were also analyzed, and the same was done for accounts specialized in data, infographics and graphics from the top 40 media outlets in the Spanish-speaking world.

Once a Twitter list containing all the data professionals identified had been created, a Webscraper spider was designed to collect the data available on the platform in an automated manner (name, photo, profile, location and website). Aside from the 287 records, 19 professionals found on LinkedIn, Meetup, Telegram and Slack were added.

In July 2018, this database with 306 entries was used to launch a static website containing the complete list and a pop-up window with a profile for each record. In addition to an explanation about the initiative, there was also a form for anyone to submit additional professionals or to correct existing data. It was shared on social media (primarily Twitter and LinkedIn) and in specialized publications. The main distribution effort

was made possible thanks to the collaboration of users included in the database, who were contacted via email or direct message on Twitter and Facebook. Once filtered, the voluntary contributions pushed the total number of directory members to 354 by July 2019. This was followed by a more thorough review of all the members to exclude any professionals with little or no connection to data journalism, or anyone who had changed their specialization, and the final total was 296. Details about the composition of this sample are included in the results of this research.

Questionnaire design

It was decided that a survey was the perfect tool for collecting additional information about the sample. Although it tends to be underused in studies about the journalism profession (Segado Boj, 2020), it has been successfully implemented for other data journalism research (Heravi, 2018, p. 108). Scholars and professionals helped create the survey: the questionnaire structure was defined by four expert scholars specialized in data journalism, and the draft was reviewed by six professionals (included in the sample).

The final survey consisted of 32 questions divided into 3 sections. Some of the responses were for expanding and updating the web directory, others for collecting contact information to be used in future projects, and the rest for describing the characteristics of these professionals in greater detail. There were 2 open-ended questions for long answers, 13 open-ended questions for short answers, 7 close-ended questions with a single answer, and 10 close-ended questions with multiple responses (although participants were asked to select up to 3).

The questions for this research focused on two of the three dimensions identified in the journalistic culture: the cognitive and the normative. The first primarily refers to the knowledge, techniques and training required to produce journalism. The second takes into account the rulebook that defines the way journalists work, such as reporting methods, news values and work routines (Singer, 2003, p. 139; L. P. Spyridou et al., 2013, p. 80).

The survey was released in July 2019 and remained open until January 2020 on Google Forms. In addition to being made public on social media and in specialized publications, just like in similar studies (Fahmy & Attia, 2020, p. 9), it followed the example set by Appelgren & Salaverría (2018, p. 4) in the sense that directory members were invited to participate in the online survey via a personal message sent to them via Twitter containing a link. In the event that Twitter messages were disabled, an email or a LinkedIn message was sent to them. In 14 cases, it was necessary to contact them through their colleagues, and 6 could not be reached in any way. In the end, 206 professionals (70.6% of the total sample) participated in the survey. The database resulting from the survey was processed with Open Refine to unify the fields and the names of the tools used. Finally, the data was filtered using dynamic tables to obtain the definitive results for each of the variables analyzed. The number of responses (N) for some of the multiple-choice questions is greater than the 206 survey participants. In these cases, the percentages for the number of survey participants and the number of responses have been differentiated.

Results/ Results discussion

The data obtained through the survey have made it possible elaborate on the specifics of the education, specialization, professional routines, employment status and tools used by data journalism professionals to study the configuration of this complex network in Spain and Latin America.

Table 1: Bachelor's degree

Bachelor's degree	N	% (surveyed)	% (responses)
Journalism	118	57.3	55.9
Communication	37	18.0	17.5
Engineering	22	10.7	10.4
Statistics, Mathematics and Physics	7	3.4	3.3
Design and Fine Arts	8	3.9	3.8
Geography, History, Philosophy and Philology	8	3.9	3.8
Other	11	5.3	5.2
Total	211	102.4	100

Souce: Authors

Most data professionals in Spain and Latin America hold a bachelor's degree in Journalism or Communication (75.3%). However, a significant number of survey participants have completed a technical or science degree (14.1%), particularly Engineering (10.7%). University degrees in Design, Art and Humanities are less common (7.8%). All of the survey respondents have a university degree.

Table 2. Master's/postgraduate degree

Master's/postgraduate degree	N	% (surveyed)	% (responses)	% (with degree)
Journalism	75	36.4	35.9	54
Data Journalism and/or Research	9	4.4	4.3	6.5
Communication	16	7.8	7.7	11.5
Economics and Business	6	2.9	2.9	4.3

Engineering	6	2.9	2.9	4.3
Design	5	2.4	2.4	3.6
Visualization	4	1.9	1.9	2.9
Statistics and Data Science	3	1.5	1.4	2.2
Other	15	7.3	7.2	10.8
NA	73	35.4	34.9	
Total	209	101.5	100	100

Souce: Authors

Most survey respondents have completed a postgraduate degree (65.1%). Of these professionals, the majority (72%) hold master's and postgraduate degrees linked to Communication. However, only a small percentage of these degrees (6.5%) are specialized in data and/or research. Of the programs unrelated to Communication, those linked to Engineering (4.3%) and Economics and Business (4.3%) stand out. Other specializations that in theory have closer ties to data journalism, such as Visualization (3.9%) or Statistics and Data Science (2.2%) represent an even smaller share.

Table 3. PhD and other education levels

	PhD		Courses and other	
	N	**%**	**N**	**%**
No	183	88.8	128	61.8
Yes	23	11.2	79	38.2
Total	206	100	206	100

Souce: Authors

The results on PhD degrees show that only 11.2% of survey participants hold this highest level of academic degree. On the other hand, the findings show that most data journalism professionals in Spain and Latin America (61.8%) have not completed any training programs beyond a bachelor's or postgraduate degree.

Table 4. Specialization category that professionals fall into

Specialization	N	% (surveyed)	% (responses)
Data Analysis	127	61.7	20.6
Research	113	54.9	18.3

Visualization	108	52.4	17.5
Projects	79	38.3	12.8
Transparency	55	26.7	8.9
Academia	47	22.8	7.6
Verification	43	20.9	7
Programming	33	16	5.3
Other	13	6.3	2.1
Total	618	300	100

Souce: Authors

The survey shows that 61.7% of the professionals consider themselves to be experts in data analysis, within information processing, and 54.9% in research, viewed as one of the collection methods. Visualization, the most important aspect of the publication phase, also has a high result (52.4%). On the other hand, only 16% of the professionals view themselves as programming experts.

Table 5. Teamwork (internal)

Collaboration	N	% (surveyed)	% (responses)
With journalists	149	72.3	30.8
With programmers	106	51.5	21.9
With designers	84	40.8	17.4
With analysts or mathematicians	60	29.1	12.4
With other comm. prof.	50	24.3	10.3
None. Work alone	30	14.6	6.2
Other	1	0.5	0.2
NA	4	1.9	0.8
Total	484	235	100

Souce: Authors

The data journalists surveyed in Spain and Latin America work primarily in teams. Very few work alone (14.6%) and many partner with more than one type of professional. Most collaborate with other journalists (72.3%), but also with programmers (51.5%) and designers (40.8%). It is much less common to work alongside analysts or mathematicians (29.1%), or other communication professionals (24.3%).

Table 6. Teamwork (external)

Collaboration	N	% (surveyed)	% (responses)
With other media outlets	68	33	23.1
With other departments	65	31.6	22.1
With professional networks	54	26.2	18.4
With projects unrelated to journalism	47	22.8	16
No	56	27.2	19
NA	4	1.9	1.4
Total	294	142.7	100

Souce: Authors

Data journalism also has external collaborations in Spanish-speaking regions. Almost one third (33%) of survey respondents have worked with professionals from other media outlets. The results are similar when considering the relationship with other departments (31.6%), professional networks (26.2%) and projects unrelated to journalism (22.8%). At least one third (27.2%) state to have never gone beyond their close contacts.

Table 7. Professional experience in data journalism

Years	N	%
1	36	17.5
2	30	14.6
3	23	11.2
4	31	15
5	35	17
6	13	6.3
7	8	3.9
8	10	4.9
9	5	2.4
More than 9	11	5.3
NA	4	1.9
Total	206	100

Souce: Authors

The results for the years of experience of survey respondents reflect the newness of this specialization. The average number of years working in data journalism is 4.5 and the median is 4. Of those surveyed, 75.3% have less than 5 years of experience, and nearly one third (32.1%) have 1 or 2 years of experience. In turn, only 5.3% of the professionals have worked more than 9 years in this specialization.

Table 8. Type of data journalism employment

Employment	N	%
Full time	77	37.4
Part time	70	34
Occasional	56	27.2
NA	3	1.5
Total	206	100

Souce: Authors

The survey reflects a fairly uniform distribution among the top degrees working in data journalism in Spain and Latin America. However, most (37.4%) work full time in this field and 27.2% work occasionally in this area.

Table 9. Employment status

Relationship	N	%
Employed	109	52.9
Freelance	54	26.2
Entrepreneur (self-employed)	33	16
Other	6	2.9
None	4	1.9
Total	206	100

Souce: Authors

The employment relationship analysis shows clearer results. More than half of those surveyed (52.7%) have an employment contract with a company. More data journalists work as freelancers (26.2%) than those who have started their own company (16%).

Table 10. Self-assessment of employment status

Score	N	%
1	16	7.8
2	5	2.4
3	6	2.9
4	7	3.4
5	25	12.1
6	29	14.1
7	50	24.3
8	37	18
9	31	15
10	0	0
Total	206	100

Souce: Authors

Most data journalists approve of their employment status. A small number give their employment status a score below 5 (16.5%) and more than half of those surveyed (57.3%) rate it with a 7 or higher. The average score is 6.3 and the median is 7.

Table 11. Tools used for data journalism

Tool	Standard			New		
	N	% (surveyed)	% (resp.)	N	% (surveyed)	% (resp.)
Excel	66	32	19.6	2	1	1.6
Tableau	31	15	9.2	4	1.9	3.1
R	27	13.1	8	14	6.8	11.0
Flourish	25	12.1	7.4	26	12.6	20.5
Google Sheets	20	9.7	6	0	0	0
Python	18	8.7	5.4	12	5.8	9.4
D3	15	7.3	4.5	4	1.9	3.1

Datawrapper	15	7.3	4.5	0	0	0
Open Refine	14	6.8	4.2	0	0	0
A. Illustrator	6	2.9	1.8	0	0	0
Carto	6	2.9	1.8	0	0	0
Infogram	6	2.9	1.8	0	0	0
JavaScript	6	2.9	1.8	2	1	1.6
Tabula	6	2.9	1.8	0	0	0
Illustrator	5	2.4	1.5	0	0	0
QGIS	5	2.4	1.5	0	0	0
Mapbox	0	0	0	5	2.4	3.9
G. Data Studio	0	0	0	4	1.9	3.1
Workbench	0	0	0	4	1.9	3.1
Graphext	0	0	0	3	1.5	2.4
Raw	0	0	0	3	1.5	2.4
Other	65	31.6	19.3	44	21.4	34.6
Total	336	163.1	100	127	61.7	100

Souce: Authors

The analysis of the tools used shows significant diversity, as well as consolidated and new tools. Microsoft Excel is one of the applications most used by nearly one third of survey respondents (32%), to which we should add those who use the Google equivalent (9.7%). Other popular applications include Tableau (15%), Flourish (12.1%), Datawrapper (7.3%) and Open Refine (6.8%), as well as the programming languages R (13.1%) and Python (8.7%). Of the new tools being used, the programming languages R (6.8%) and Python (5.8%) stand out, with Flourish (12.6%) at the top.

Conclusion

This study follows the line of research on data journalism to elaborate on the characteristics of this essential role in how the specialization is configured in Spain and Latin America. The results paint the picture of a professional whose education is primarily academic and journalistic, whose duties cover mainly analysis and research, who is accustomed to working in a team and has limited work experience and job stability, but has an array of solid technological resources for data processing in spreadsheets and for visualization.

This article also brings to light the usefulness of the Actor-Network Theory (ANT) for data journalism research. These theoretical postulates make it possible to differentiate between multiple actants, creating a complex network of collaboration and technological innovation. Conventional journalists are interconnected and hybridized (Primo & Zago, 2015, p. 42) with other profiles that combine the skills of analysts, graphic designers, developers, computer programmers, entrepreneurs and academic researchers. Social constructions such as multidisciplinary teams (stable or one-time), social media, training programs and the professional cultures of this specialization also operate as actants. Finally, the importance of technological

actants is irrefutable (Turner, 2005, pp. 321–322). These elements are materialized primarily in digital tools and programming languages that make it possible to work in the three major areas of data journalism: collection, analysis and publication.

The level of education (RQ1) of data journalism professionals in Spanish-speaking countries is high compared with that of other counterparts in their profession. All of the survey respondents hold a university degree, as opposed to 92% of the profession as a whole in Spain (APM, 2019, p. 24). This is probably due to the young age of this new specialization and of the majority of the people who comprise it. Most hold a degree in Journalism or Communication, in line with the findings published by Heravi et al. (2018), but there is also a higher than usual number of individuals with technical or science degrees in the sector.

Nearly two thirds of the group has completed a master's or postgraduate degree, a number that is 41% greater than that of the sector in Spain (APM, 2019, p. 24). However, only a small percentage of these degrees are specialized in data or research, which could reflect a lack of educational alternatives, socio-economic limitations (such as the cost of certain programs) or that they are geographically concentrated (Flores-Vivar & López-López, 2020, p. 91). Although the percentage of PhD holders among survey respondents is small, it is nearly double that of existing research on the profession in Spain (Tomás Frutos, 2008, p. 97). Despite this high level of formal university education, only a third of survey respondents have completed courses or other specialized programs, thereby confirming the significant room for improvement to consolidate and diversify specialized training in this field (Heravi, 2019).

The specialization facets (RQ2) in which the professionals are classified show a greater presence in the intermediate phase of data journalism processing (analysis), but also in the initial compilation (research) and the final publication (visualization). Aspects that are tangential to the practical process of data journalism (project management and academic research) remain secondary. Programming as a specialization is even less common.

This explains, at least in part, why teamwork is so widespread among data journalists in Spain and Latin America. Professionals who work alone are in the minority, bringing to light the existence of an underlying professional network beyond individual actants. Working with other journalists is the most common situation, but many of those surveyed collaborate with more than one type of professional, primarily developers and designers. Although working with analysts and mathematicians occurs less frequently, it probably represents one of the future horizons for this specialization.

This multidisciplinary work also applies to professionals beyond their close contacts, and it includes collaborations with other media outlets as well as with other departments or professional networks, thereby opening and hybridizing this network. The ability to successfully interact with profiles that overflow conventional newsrooms and in more open ecosystems, an emerging phenomenon in the sector as a whole (Örnebring & Mellado, 2016), is emphasized in more technical specializations, such as those that work with data (Porlezza & Splendore, 2019).

This study reflects the image of a professional with few years of experience in the specialization, largely due to its recent implementation in Spanish-speaking settings, and with an employment status that is less stable than that for the profession overall (RQ3). The data journalist profile can be divided into three groups according to years of experience: 1) new arrivals, with one or two years of experience, are the most

common; 2) those who have some experience (approximately five years); and 3) veterans, with seven or more years of experience, less common and perhaps linked to other areas beyond journalism, but also present and essential for sharing knowledge with the next generations (Borges Rey et al., 2018; Heravi et al., 2018).

The research shows that a significant percentage of these professionals work full time on data journalism, but nearly two thirds share their time with other fields. This proves that data journalism must continue to make progress in Spanish-speaking newsrooms in order to consolidate, recognize and promote the specialization (Palomo et al., 2019), but it also reflects the initiative's importance as well as the extra volunteer work it entails.

This coincides with the special employment status of these professionals. Although more than half of those surveyed are employed by a company, the percentage of data journalists who are freelancers (26.2%) is higher than that of the profession as a whole in Spain (7%) (APM, 2019, p. 14). This circumstance can probably be explained by the young age of most of most of the interviewees and the sector's progressive precariousness (Hermida & Young, 2017), but also by the ability of these professionals to perform specific tasks for multiple media outlets. Another important aspect is the high number of professionals who are self-employed, primarily through the creation of entrepreneurial projects, thereby confirming the connection between data journalism and innovation at the industry's periphery (Appelgren et al., 2019; García-Avilés et al., 2016).

Despite all of this, the majority of data journalists view their situation as positive. In fact, the average self-evaluation score is 7 or more. This has three non-mutually exclusive interpretations: 1) that professionals have adjusted to the industry's continuous changes (Harlow, 2020) and many do not view the lack of a stable connection with a company as negative; 2) that this profile is highly regarded and well paid in the sector, resulting in a certain degree of financial stability, even if they must coordinate several jobs or render their services to multiple entities; 3) that data journalism is a vocational specialization with a considerable gregarious component (Broussard, 2019, p. 94).

Finally, the list of technological resources used for their work reveals the existence of a wide array of possibilities along with standards for using software and programming languages. Spreadsheets are at the top, followed by the environment focused on statistical analysis, R and Python, which stand out for the legibility of their code, although JavaScript and D3 are also prominent alternatives due to their excellent library for data visualization (Guo & Volz, 2019, p. 10). The survey also shows the emergence of other tools that work together with or replace existing ones. Examples include online services for data visualization as well as the aforementioned programming languages. The diversity and importance of these tools in the eyes of survey respondents show the role of technology as an actant in the Spanish-speaking data journalism network.

Some of the limitations affecting this study are biases in the sample's geographic composition in the sense that there are more Spanish professionals than their Latin American counterparts. A potential explanation lies in the fact that Twitter, the main source used to obtain database entries, is less important for data journalists in Latin American countries than it is for those in Spain. It is also worth noting that only a portion of the results obtained through the survey have been used in this study in order to elaborate sufficiently on

the educational and occupational characteristics of the professionals. Finally, this analysis does not make it possible to expand upon key matters such as the overall integration of data journalists in newsrooms. It is possible that, as more journalists acquire data production skills, data journalism will cease to be a specialized subfield. Findings from Boyles & Meyer (2017, p. 436) suggest that data skills will inevitably be subsumed into the everyday routines of all reporters. As newsrooms continue to experiment with data journalism, organizational structures will concurrently shift to accommodate the talents of these new specialized practitioners. However, data practitioners are currently viewed as technical experts within the newsroom, and as individuals whose work requirements are uniquely managed.

In any case, the findings of this study elaborate on the idea that behind the narrative innovations based on graphics, the research initiatives with automated mechanisms and the local stories obtained from databases, there are professionals with an array of profiles, challenges, skills and resources. It appears that data journalism comprises a complex ecosystem in which human actants from multiple specializations are interconnected, along with social, cultural and technological factors. However, additional research is needed to closely examine the professionals within this mature specialization that is integrated within the industry but has specific traits and a long road ahead.

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