

Spanish Science Culture and Innovation Units (UCC+i) in digital press: a case study¹

Estudio de caso sobre las Unidades de Cultura Científica (UCC+i) españolas en la prensa digital



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Abstract:

Science communication offices (SCOs) are common departments in research centers and their work has been favored by the increasing availability of online tools. This work study the impact reached in digital newspapers by the Spanish Science Culture and Innovation Units (UCC+i), a specific type of SCO focused on the dissemination of scientific culture to citizens. A mixed methodology –content analysis and qualitative observation– is applied on a sample of 3619 news items from 19 Spanish digital newspapers between January and September 2016. Results suggest that UCC+i become a key actor to assure public visibility of research centers in regional and local newspapers. Also that digital media with low resources depend informatively on them.

Keywords:

Science communication; digital press; science journalism; UCC+i; content analysis.

Resumen:

Las oficinas de comunicación de la ciencia (SCO) son departamentos habituales en los centros de investigación. El presente trabajo realiza un estudio de caso sobre unas SCO particulares por su fin social, las Unidades de Cultura Científica y de la Innovación (UCC+i) españolas, y su impacto en medios digitales. Se aplica una metodología mixta, el análisis de contenido cuantitativo y la observación cualitativa, sobre una muestra de 3619 textos procedentes de 19 periódicos digitales españoles entre enero y septiembre de 2016. El trabajo sugiere que estas unidades están favoreciendo la visibilidad de la ciencia española y que los medios digitales con escasos recursos dependen informativamente de ellas.

Palabras clave:

Comunicación científica; prensa digital; periodismo científico; UCC+i; análisis de contenido.

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1. Introduction

Internet has completely change the way in which science has been communicated to the lay public. Online media has broken the technical and economic barriers that separated science journalism in traditional media from their largely passive audiences (Peters *et al.*, 2014). The online environment allows a more immediate communication and, in turn, has the potential to make research more visible in the public sphere (Holliman, 2010).

It has also enriched the ways in which science is communicated (Trench, 2007). The interactive nature of tools such as blogs or social networks makes it possible to improve understanding of science so that communicators who have online storytelling skills today have the potential to communicate science much more effectively (Dunwoody, 2014). In addition, Internet allows finding a wide range of background in relation to a scientific issue (Koolstra *et al.*, 2006), which favors the presentation of complex and controversial scientific subjects in an attractive and innovative way (Hermida, 2010).

At the same time, corporate public relations in the field of science have become a widespread phenomenon in research centers in recent years (Trench, 2009). While during the 90s those departments were rare exceptions, today there is scarcely a single university or research institution without a science communication office –SCO– (Gerber, 2014).

Internet, and 2.0 tools are also responsible for this boom, so they enable these scientific communication offices to effectively communicate with their vast audiences trough two different channels: on the one hand, the media, so that

they collect their information and disseminate it to the general public; And on the other hand, directly with the public itself, without the mediation of journalists (Trench, 2009; Granado, 2011).

SCO use Internet as an easy, trusty cheap way to persuade general audiences about the goodness and quality of their research contributions (Trench, 2009). An effect called “mediatization” of science in Peters (2013) words. This process is characterized by the institutionalization of science press departments, as the communication of science is considered part of scientists work, the professionalization of the relations with the media and a strategic use of those relations for institutional purposes.

Science communication offices have adopted journalistic formats, styles and distribution channels to better reach general public. The sites of these research centers have sections of news or equivalents in which they present science news, anticipating to some extent the interpretation of professional science journalists (Trench, 2009). In addition, SCO practitioners have been trained to disseminate research results as success stories, contributing in some cases to the configuration of a distorted picture of scientific reality (Gerber, 2014).

At the same time, several studies suggest that science journalists increasingly depend on press releases sent to them by scientific journals, universities and research centres (Trench, 2009; Calloni *et al.*, 2009; Granado, 2011; Murcott and Williams, 2013) which raises various ethical and professional objections.

Given the importance of continuous updating and the high competition especially in digital media sector, (Dunwoody, 2014), also considering the decreasing number of journalists working in the news rooms (Hermida, 2010, Priest, 2013), is possible to better understand why media tends to publish information directly received from institutional sources, which may contribute to the dissemination of the biased interests of research institutions (Granado, 2011).

Thus, either directly or indirectly, for some authors SCOs have more influence than ever on what is published in the media and, consequently, on what the public thinks about the work done by scientist and research centres (Brumfiel, 2009).

However, more empirical studies are needed to confirm this situation, as well as to determine the real presence of the work of these SCOs in the media and the particular image of science and knowledge which finally reach the audience.

This paper presents a case study on particular type of SCO, the Spanish Scientific Culture Units (UCC + i). Its singularity is that they are promoted, financed and institutionalized at the state level despite being part either of public or private research departments. This governmental support guarantee that they fulfil a social function, as well as a promotional one. Beyond science publicity and public relations, their fundamental objective is the diffusion of science culture among lay public, so citizen have access to the necessary scientific knowledges and practices required to properly understand, form critical opinions or engage with the scientific system. A model that better match the Responsible Research and Innovation principles that EU is explicitly promoting in H2020 R&D programme.

To reach this goal, UCC + i carry out different kind of activities among which public engagement, science education or science communication actions are included. After a decade of experience, it seems to be the right time to study the impact of their actions. Specifically, this paper focus in the analysis of the impact that UCC+I science communication actions have reached in the Spanish digital press, considering the importance, as has been noted, of the online environment in

the current context of science communication. For that purpose, three specific objectives are also considered: quantify the number of science news items released by the UCC + i have been published in the media over a representative period of time; Describe the predominant journalistic frames in those news items and, as far as possible, detect empirical evidence of the digital media dependence from institutional sources regarding science news, that have been raised in the literature.

The present study poses the following objectives:

- Investigate the impact of the UCC+i in the Spanish digital press, considering the importance of the online environment in the current context of science communication.
- Quantify that presence over a representative period of time.
- Describe the journalistic and cyberjournalistic treatment carried out by digital media and the representations of science and knowledge that they reflect.
- Detect, as far as possible, indications of the informative dependence of organized sources raised in the literature.

1.1. Science Culture and Innovation Units (UCC + i) in Spain

Although some SCOs have been working in research centres in the United States and Europe for more than 50 years, they are relatively new in the Spanish-speaking world (Frías and Rueda, 2014). In Spain, the largest universities and research centres began to incorporate their communication offices in the 1980s (Onieva, 2016). Those new structures were mainly focused on institutional communication activities with an occasional involvement in science communication.

2007 was declared by Royal Decree the Year of Science in Spain. In that context, Spanish government promoted the figure of Science Culture and Innovation Units (UCC + I) through the Spanish Foundation for Science and Technology (FECYT). The aim of this measure was to create offices for the dissemination of science culture embedded either in private or public Spanish research departments as key element for improving social engagement in science and innovation processes. In order to achieve that goal, it was crucial, as it was stated in the Royal Decree, to mitigate the lack of interest in science detected by Social Perception of Science surveys among Spanish citizens.

With this objective in mind, UCC + i have worked in the organization of scientific outreach activities of diverse nature such as open days, exhibitions, training activities, guided visits to research centres or activities to encourage young people pursuing STEM careers.

Since their launch, the UCC + I units have also assumed science communication activities as a fundamental task to bring science to the general public and increase their scientific culture. According to the White Paper of the Science Culture and Innovation Units (AA.VV., 2012), one of the main recipients of science communication actions are the media themselves. Given the scarcity of science journalists in the newsrooms and considering the privileged access to scientific sources held by the UCC + i, “they must work to offer rigorous, updated scientific contents, access to research sources and any other additional material, such as images, graphics, videos, recorded statements or statistical data, that may be useful for the media to compose high quality science news items “ (2012:16).

This way, mediating between scientists and journalists, becoming a common source in the communication and dissemination of scientific results, managing the participation of researchers in the analysis of current issues, thus contributing to generating a critical opinion in society; promoting awareness about the contributions of science to society but also about social needs and concerns about science or contributing to increase the quality of science news, are some of the core tasks assigned to the UCC+I Units in its White Paper.

Nowadays, there are over 70 UCC + I spread throughout Spain integrated not only in research centres and universities, but also in private companies and non-profit organizations related to science (AA.VV., 2016).

Up to date, no other empirical study has been found that evaluates the overall impact of these units on science news published by the media. Some works have been located focused on the analysis of the actions that Spanish universities and other public and private research organizations carry out to communicate their work to society through the media, or how Institutional scientific information is collected in the press (López Pérez, 2015).

Works about the visibility and the institutional image of universities in Spanish press have also been found (Barroso Osuna, 2000, Legerén Álvarez, 2014). With a similar aim Repiso et al., (2016) study the existing similarities between Spanish Universities by analysing the news published about any kind of institutional activities in national and regional newspapers. Recently, another paper has developed an index that measure to what extent institutional scientific production of Spanish R&D entities matches their visibility in digital science news (Pérez-Rodríguez, 2016).

The present case study aims to answer the following research questions: How much information do Spanish digital newspapers publish about entities with an associated UCC + i? Have UCC + i contributed to increase the presence of science content in online media? What kind of media coverage provide the media and under what frame it is presented? Do they take advantage of the online environment to enrich this information? Are there any evidences of the dependence of the media on UCC+i sources in order to cover science news?

After literature review and the context presented below, the following hypotheses are proposed:

Hypothesis 1: digital media cover limited scientific and academic information. In this context, it is expected a predominance of sciences news from press agencies and communication offices which normally cite just one source. As it has been observed in previous studies there might be an overrepresentation of biomedical news.

Hypothesis 2: digital media do not take advantage of web environment functionalities, such as multimedia, hypertext, constant update and interactivity, to enrich scientific and academic information.

Hypothesis 3: The presentation of new research results and projects is the predominant framework in science news, as it is the more common issue in UCC+I press releases.

Hypothesis 4: The authorship, mainly agencies and newsroom items, and the sources cited in the texts reveal media dependence on institutional communication offices.

2. Method

A mixed, quantitative and qualitative methodology has been designed, based on content analysis and ethnography. In line with previous works (Legerén Álvarez, 2014, Mayoral Sánchez *et al.*, 2016), it has been carried out a systematized search of science news items published in digital editions of national, regional and local scope Spanish newspapers, relating to institutions to which 42 UCC + i are ascribed¹.

Specifically, the study analysed the digital editions of the two national newspapers with greater diffusion in Spain, El Mundo and El País². However, under the premise that smaller institutions may have little presence in these national media, and with the need to have a sufficiently representative sample, it was decided to broaden the searching to the digital editions of those newspapers with greater diffusion at a regional or local level in the territory where the 42 chosen UCC+i are located³: *Diario Córdoba, Diario Sur, ABC de Sevilla, Diario La Rioja, La Vanguardia, El Correo, Hoy, Las Provincias, El Periódico de Aragón, El Correo de Burgos, ABC, El Comercio, El Ideal, La Voz de Cádiz, Diario Jaén, Diario de Mallorca y La Voz de Galicia*.

In order to obtain the most up-to-date results possible, the search interval has been limited from January 1 to September 30, 2016. Searches have been carried out with keyword strings referring to the complete official names of the institutions

¹ The study includes data from the 42 UCC + i that gave their voluntary consent to be monitored within the project FCT-15-10271 entitled Impact of UCC + i on the public visibility of Spanish Science: digital press and Twitter. Those were the UCC+I from Cordoba University [UCO], Spanish Research Council [CSIC], Rovira i Virgili University [URV], Complutense University from Madrid [UCM], University of Málaga [UMA], University of Sevilla [US], International University from La Rioja [UNIR], National Research Centre for Human Evolution Studies [CENIEH], University of Girona [UdG], Technological Centre AZTI Tecnalia, University of Extremadura [UEX], University of Valencia [UV], University of de Zaragoza [UZ], University Carlos III from Madrid [UC3M], University of Burgos [UBU], Mathematics Science Institute [ICMAT], Polytechnic University from Madrid [UPM], University of Alcalá [UAH], Foundation for Applied Research and Technology Promotion in Asturias [FICYT], King Juan Carlos University [URJC], University of Granada [UGR], University of Oviedo [UO], Institute for Agricultural and Fisheries Research and Training [IFAPA], University of Cádiz [UCA], Discover Foundation, Mediterranean Institute for Advance Studies [IMEDEA], University of Jaén [UJA], Open University from Catalunya [UOC], University of Barcelona [UB], Autonomus University from Madrid [UAM], Technological Corporation from Andalucía [CTA], Excelency International Campus Euskampus, Catalan Association for Science Communication [ACCC], Particles, Astroparticles and Nuclear Physics National Centre [CPAN], National Centre for Acelerartors [CNA], Paleoethology Institute Miquel Crusafont [ICP], Pompeu Fabra University [UPF], Biomedical Research Park from Barcelona [PRBB], Astrophysical Institute from Andalucía [IAA-CSIC], CSIC Delegation in Valencia, CSIC Delegation in Galicia, Marine Research Institute [IIM-CSIC].

² According to data published by the Office for Diffusion Justification (OJD), available at: <http://www.introl.es/medios-controlados/> (last consultation 08/03/2018).

³ Although regional and local media with greater diffusion has been chosen as a general criterion according to the data published by the Office for Diffusion Justification (OJD), available at: <http://www.introl.es/medios-> (Last consultation 08/03/2018), the variability in the search systems of the digital media has prevented the inclusion of some newspapers, since it does not allow searches with the criteria described in the methodology, so they had to be replaced by the next newspaper with greater diffusion. In addition, in some cases as El Periódico, the few news items recovered suggest that some kind of malfunction in the retrieval information system.

under study, without acronyms, except in the case of the CSIC.⁴ In the case of institutions that officially have two denominations, one in Spanish and another one in a regional official language, the searches were carried out in both languages to avoid the loss of information.

The search and recovery of the news items included in the sample was carried out using the information retrieval systems provide by the digital archives of the chosen media between October 1st, and 10th, 2016. Once these items were located and downloaded, a content analysis tab was created with two types of variables: on the one hand purely journalistic features –medium, scope, author, genre, sources and thematic– handled in several studies (Fernández Muerza, 2005; Camacho Markina, 2008), on the other hand features related to the four characteristics of cyberjournalism referred to by Díaz Noci and Salaverría (2003) –multimediatization, hypertextually, update and interactivity–.

Regarding news framework (Koziner, 2013), the following possible frames were used to classify news items: a study or scientific project developed by the Institution which is presented as main source, an activity or event organized by an institution, a mention in an article where the entity is not presented as the main actor, experts of the institution performing valuations on a subject, an editorial piece from an institutional expert, and an undefined framework, for those news items that wouldn't match any of the others.

The coding work was developed by a team of four researchers. In order to test codebook and inter-coder reliability, a previous test was programmed between the 11th and 15th of October 2016, with a random sample of 50 test news items. A reliability coefficient of 93 % was obtained, satisfactory according to the estimates of Lombard *et al.* [2002]. However, after that test the codebook was revised, including new answers for some of the variables previously formulated.

Along with the analysis of quantitative content, a qualitative observation study was also carried out, due to the need to combine different research methodologies to achieve complementary findings - the so-called methodological triangulation (Arias Valencia, 2000; Rodríguez Ruiz, 2005).

Relevant information derived from indirect and unstructured observation was registered in a cloud field diary. The qualitative study was carried out between October 1st and November 30th, 2016, in parallel to the search tasks.

2.1. Materials

Some aspects of the qualitative study related to the methodology are presented as somehow they have been able to produce some bias in the results. The search and retrieval systems of digital newspapers are as numerous and varied as media themselves, which makes it difficult to guarantee that all the published information has been recovered and that the news items included in the sample are the original version of that particular item, since journalists can re-make and re-publish an information, at any time, without any trace left.

⁴ It was considered that Spanish National Research Council acronym –CSIC– may be widely recognize and therefore may be used by the media without citing its complete denomination. To verify this, a preliminary query was made in the digital archive of El País and El Mundo in which the search “CSIC” obtained 2,676 results, in the case of the first newspaper, and 2,763 results in the second, while the search “ Consejo + Superior + Investigación + Científica “returned 1,366 in the first case and 732 results in the second.

It is noteworthy that in many digital media the same news items have been located invariable on consecutive days, perhaps due to the fact that the information published in the printed version is systematically turned to the web in the following days, regardless that some of those pieces had already been published in the digital version. In those cases, only the oldest news item has been considered.

There have also been cases in which the same news item has been identified under a different URL and date or even in a different section. This may be due to the fact that news reaches the newspaper in different ways [agencies, communication offices, journalists from different sections, etc.] and the piece is published again without checking if it had already been issued. In these cases just the oldest news item has been included in the analysis, unless a significant modification from one version to another was noticed.

3. Results

3.1. Presence of the institutions with an UCC + i in the digital press

In total, 3619 news items fulfilled the criteria established in the methodological section and were finally included in the sample.

In the first place, it has been studied the temporal distribution of these news. All news items of the database were published between January 1st and September 30th, 2016. Along this period, May 18th was the day with the greater amount of science news items registered, with a total of 31 articles, while August 16th. was the less productive day with just one science article. The average of recovered information is 13 news items a day. No evident patterns emerge to explain such distribution.

The largest number of news items was located in the digital version of the two national newspapers, [a total of 721 in *El País*, 19.92 % of the database, and 448 in *El Mundo*, (12.38 %)]. The difference between these two media is significant, and although it may be due to differences in their editorial policies, the different functioning of retrieval systems should also be considered. Local and regional media pay close attention to the work carried out by universities and research centres in their immediate surroundings, in line with the journalistic criteria of proximity (see Table 1).

Table 1. Articles distribution by newspaper.

Periódico	Frequency	%
El País	721	19,92 %
El Mundo	448	12,38 %
El Periódico de Aragón	346	9,56 %
El Comercio	321	8,87 %
El Ideal	309	8,54 %
Las Provincias	286	7,90 %
Diario Jaén	195	5,39 %
ABC	189	5,22 %
Hoy	188	5,19 %
Sur	158	4,37 %
Diario Córdoba	136	3,76 %
Diario La Rioja	120	3,32 %
El Correo de Burgos	79	2,18 %
La Voz de Cádiz	43	1,19 %
La Voz de Galicia	41	1,13 %
La Vanguardia	30	0,83 %
Diario de Mallorca	5	0,14 %
El Correo	4	0,11 %
Total	3619	100,00 %

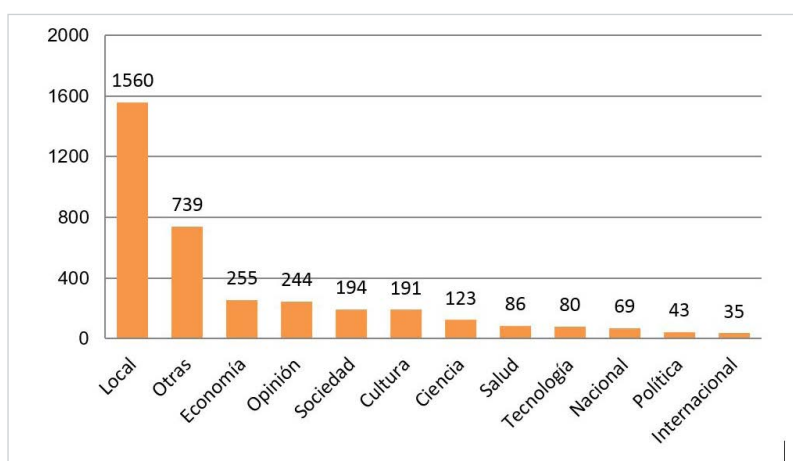
A total of 4625 references to entities with an UCC + i were identified among the 3619 analysed news, which means an average of 1.21 nominations per item and suggests the existence of a regular collaboration between those institutions.

The presence of these entities in the database is significantly unequal. It is noteworthy that the University of Valencia (UV) is the institution with the higher number of mentions, with 407 references (9.54 % of the total), eight more than those registered by the Spanish Research Council -CSIC (399; 9.36 %), despite being the largest research body in the country. On the other hand, no reference has been found to the Euskampus, International Campus of Excellence or to the National Centre for Particle, Astroparticle and Nuclear Physics (CPAN).

3.2. Coverage

The results show that the ‘Local’ section is significantly more frequent (43.11 %), reinforcing the premise that the work carried out by UCC + i has fundamentally a local scope.

Figure 1. Articles by section (total frequencies).



Far behind are sections such as ‘Economy’ (7.05 %), ‘Opinion’ (6.74 %) and ‘Society’ (5.36 %), the latter as hotchpotch, mainly in local and regional newspapers, which use it for those topics that do not have their own sections as science, health or technology.

This may explain why that sections which were expected to concentrate the greatest number of science news from the UCC + i, such as ‘Science’, ‘Health’ or ‘Technology’, do not obtain remarkable results.

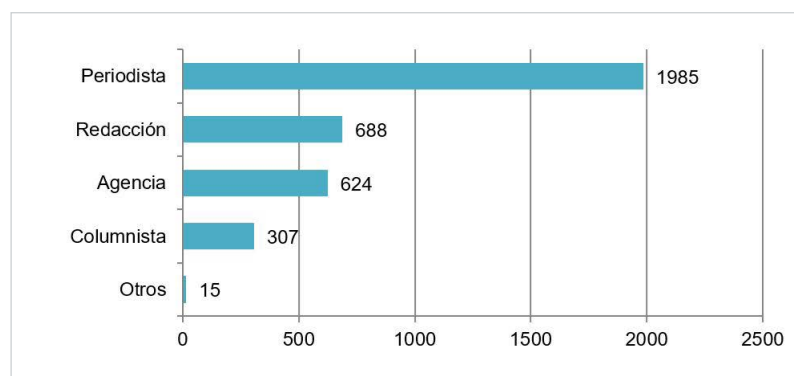
It is noteworthy also how the section “others” initially unrelated to science topics is in the second place, with 20.42 % of the total. Most of the news included in this category, as reflected in the qualitative study, are found in local and regional newspapers which maintain permanent or temporary sections closely related to the idiosyncrasy of each locality. For

example, news items have been registered in the section 'Fallas' in *Las Provincias* or '75 anniversary' in *Diario Jaén*, which again demonstrates the involvement of research centres in their local environment.

Journalists (54.85 %) are the main authors of the news in the database. Although it may seem logical, the staff cuts experienced in the newsrooms in recent years (Priest, 2013; Cullen, 2013) might suggest that the weight of press releases and agencies materials would be far greater than registered (17.24 %). However, authorship is not indicated in 19.01 % of the sample. So, it is probable that those non-signed news could also come from agencies although the source is not mentioned, so that the percentage corresponding to agencies could be higher than the one obtained.

Also, experts from the research centres are authors of 8.48 % of the sciences news, in congruence with 9.01 % of opinion articles recorded in the genre variable.

Figure 2. Articles authorship (total frequencies).



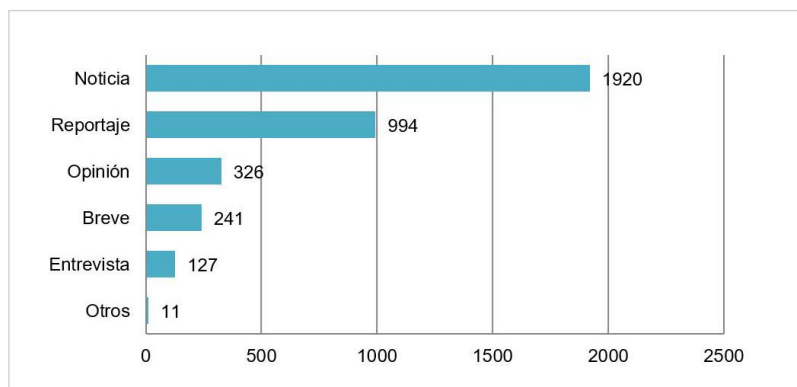
News articles are the predominant genre (53.05 %). Far behind is the reportage (27.47 %) despite being, by its nature - greater extension, an in-depth treatment of the issues, multiplicity of sources, greater dynamism and freedom in the writing, etc., the more appropriate genre to address science issues (Calvo Hernando, 1997).

For the stated reasons, the brief articles are indeed one of the less used genres in the database (6.66 %), along with interviews (3.51 %). According to the qualitative study, short stories are mainly found in local and regional newspapers.

Regarding the interviews (4 %), the data is also striking, taking into account that expert assessments is a common demand from the media when referring to research centres. But data reveal that they are mainly presented either as sciences news source or as author of an editorial piece.

Finally, experts working as columnists in the opinion sections are responsible for the 8.48 % of the news items. This percentage rises exponentially in the case of some entities whose experts work regularly for some media.

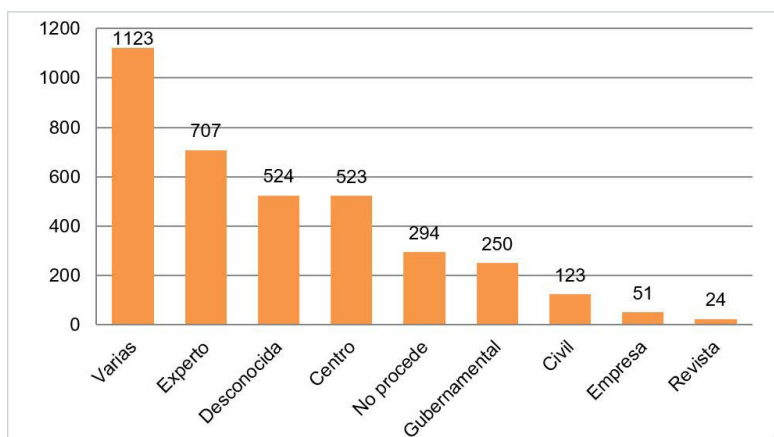
Figure 3. Articles by genre (total frequencies).



Most news just include a single source of information (46 %). Those in which several sources are used represent a 31.03 % of the database, while a 14.48 % do not have a recognizable source.⁵

Regarding sources nature, it has been noticed that expert are the most common source (19.54 %) in the news, followed by the institution which is being represented by the UCC + i with a 14.45 %. Further away, governmental departments are cited in 6.91 % of news items, non-profit organizations (NGOs) appear in 3 % of the database while companies and academic journals represents respectively 1 % of the identified sources.

Figure 4. Sources (total frequencies).



⁵ When the genre of a news item has been codified as an opinion article, the response to this variable has been “not applicable”, except in those cases of articles of an interpretative character, such as chronicles or analysis, in which it has been considered.

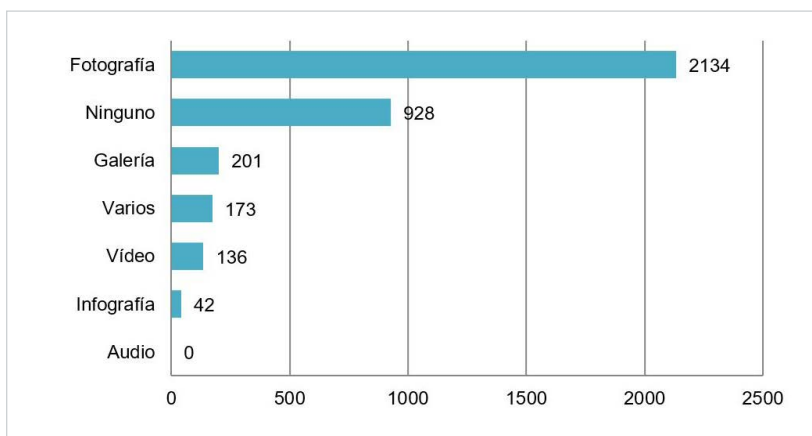
Topics are very varied in the data base and their frequency is significantly unequal. The Social Sciences are, in general, the most frequent topic (13.37 %), possibly due to the fact that they integrate issues related to politics, sociology, communication itself or human geography, in which expert’s opinions are often required.

The second more common topics are Art and History (12.24 %). Far behind can be found Plant Biology, Animal and Ecosystems (7.43 %), Economics (6.48 %), Clinical Medicine (6.27 %) and Biomedicine (6.16 %). Regarding topics, the qualitative study reflects, that some of them are more prevalent in some local media because they are related with the local idiosyncrasy.

3.3. *Cyber-journalistic features*

The use of several multimedia resources in the news is still very precarious and has only been recorded in 5 % of the database. Photos seem to be the only element complementing most of news items (59.08 %) as traditionally happen in printed editions. Although digital information can be enriched simply by adding more images as photo galleries, they are only included in 5.55 % of cases.

Figure 5. Multimedia resources in the articles.



Hypertext use is also an unexploited possibility. No hypertext is included in 72.23 % of the journalistic pieces. In 11.44 % hypertext is used to directly link the content with other articles previously printed in that same newspaper –the so-called micro-navigation (Díaz Noci and Salaverría, 2003), and just 6.85 % of news items link to non-newspaper websites– macro-navigation, according to the authors -. Only 9.45 % of the news in the database combine macro and micro-navigation. As observed in the qualitative study, in those cases the intra-links normally point to related news, previously printed by the media, while the external links guide the reader to some of the original sources, such as universities and research centres, scientific journals, research project web pages, non-profit entities, etc.–.

Most part of news items without hypertext have been identified in local and regional newspapers. Through the qualitative study, it has also been observed that some digital newspapers mention webs as a source throughout the text but they do not link them.

As for the content update, the results show that it is a frequent practice: 24.81 % of the texts have been published in the morning, 23.32 % in the afternoon and 30.95 % in the evening. However, it is striking that a high percentage of the news items (20.92 %), do not include the time they were published. In *Diario Jaén*, for example, the time is not specified in any case, according to the qualitative study.

The qualitative study also shows a trend of updating at specific times such as midnight -00: 00 hours- and dawn -04: 00, 05:00, etc.-. In these cases, it is likely that the information will be included in next day printed edition and has been scheduled for automatic publication in the web.

Finally, it has been quantified the use of comment sections by readers as an indicator of interaction. In total, 48513 comments have been posted to news items related to an institution with an UCC + i. On the other hand, there is 211 news in which there is no possibility of commenting or the option to do it has already been closed, as frequently happened in those articles published in the Opinion section from El País.

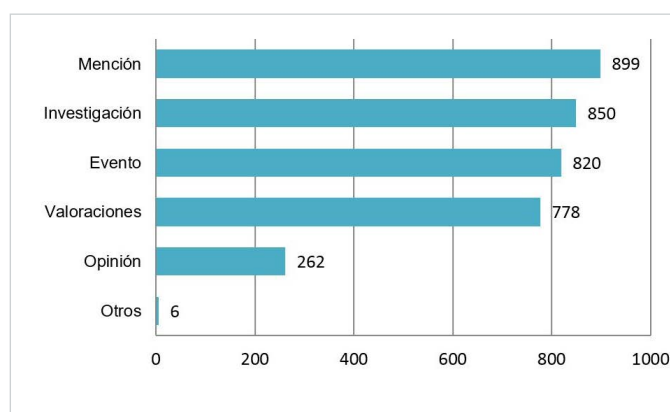
Thus, the institutions with an UCC + i whose information has received more comments are the University of Barcelona (UB), CSIC, and the University of Málaga (UMA). They are followed at a considerable distance by Pompeu Fabra University (UPF) and the University of Valencia (UV). In the case of CSIC, these data correlate with the overall impact that the centre has on the sample, where it also ranks second.

On the other hand, the fact that the news from the University of Barcelona receive a greater number of comments may be due to the type of presence that this university has in the sample: institutional expert evaluations (36.9 %) and opinion articles (23.21 %), which a priori seem to generate a greater debate.

3.4. Frames in UCC + i news

Results suggest that there is no standard frame in those news items referring institutions with an UCC + I (see Figure 6). A 24.84 % of the news are relate to studies in which the institution is directly involve and 23.57 % refers to research projects. A 22.66 % of news items cover events that has been organized by those institutions and, a 21.5 % of the data base contains expert evaluations on a current topic. Only the fifth type of framework envisaged, opinion articles written by experts, obtained clearly lower percentage (7.27 %).

Figure 6. Articles by frame.



When news were related to a research project carried out by an institution with an UCC + i, it also has been measured, whether the entity appears in the texts alone or in collaboration with others, so it may be establish the nature of some R&D networks.

In 59.95 % references to a collaboration between the institutions with an UCC + i and other universities or research centres have been found. In a 24.03 % those collaborations were established within a national scope. Collaboration with other countries outside the European Union stands at 15.9 %, while partnerships with other entities in the closest local or regional environment, were identified in a 11.66 % of the collaboration cases. It should be noted that references to alliances at a European level only amount to 8.36 %, a striking figure taking into account the Spanish participation in European research programs such as Horizon 2020, as reflected in the COTEC 2016 Report⁶.

It should also be stressed that in 40.05 % of the database some UCC+i institutions appear alone, which offers a somewhat atomized image of Spanish science system.

4. Conclusions and discussion

The present study has analysed, for the first time, the impact in the digital press of the science communication activities developed by a particular type of SCO, Spanish UCC+i. With that purpose media scope have been monitored as well as the coverage received by UCC+i sciences news in an online environment that is revolutionizing the way in which science is being communicate to the general public.

The amount of information located in just nine months seems to indicate that the communication activities carried out by the UCC + i effectively reaches the media and, through them, society, which is their ultimate goal. Considering the

⁶ COTEC 2016 Report: Innovation in Spain shows that this country collects 9.7 % of funding from the Horizon 2020 research program (retrieved from: <http://cotec.es/pdfs/COTEC-informe-2016.pdf>)

data obtained by Pérez-Rodríguez (2016), which measure at a 5 % the annual growth of sciences news in the same digital editions of the two national newspapers that has been monitored in this study, it is estimated that the 1168 news items assigned to the UCC + I in this work, would represent a 68.83 % of the total scientific information published by these headings along the analysed period.

The UCC + i are favouring media visibility of the science work developed by Spanish universities, research centres, companies and non- profit institutions, placing these issues in the public debate, contributing to improve the scientific culture of the population and promoting critical opinions on current issues with a scientific component, based on the knowledge provided by their experts.

On the other hand, it is remarkable the implication of Science Culture Units with its closest environment. In this regard, the study shows that the science and knowledge generated by institutions with an associated UCC + i is intimately related to the socioeconomic peculiarities of the area in which they are located, and that a high degree of research specialization has been achieved by those institutions in relation that topics with local interest.

In contrast, an image of the uncooperative science at national and international level has been detected, with scientists working within their laboratories in close contact with scientific and institutional local collaborators, but without much external networking.

Regarding coverage, certain tendencies can be outlined. Even a “type” of news item in which institutions with an UCC+I associated appear can be established: a news item with a local scope, with a single source of information, which has been produced by a journalist using data from a press release and that is usually accompanied by a single photograph and none hypertext. All this data considered, hypothesis 1 would be almost completely confirmed: digital media cover limited scientific and academic information.

They regularly use press releases from SCO or agencies, and the news they cover focus mainly in biomedical topics. The only aspect that don´t match the original hypothesis is the expected predominance of biomedical topics, since the subjects related to Social Sciences, Art and History are more common than biomedical subjects.

The results also suggest that are the experts, scientists, researchers and academics who favor a greater or lesser presence of a research institution in the digital press. Their assessment of current scientific, political, social and economic issues and the analysis of the implications of the research work carried out by other scientists are constantly required by the media, thus refuting hypothesis 3. The work of the UCC + i concerning managing the participation of researchers in the analysis of current issues, encouraging contact and acting as intermediaries between scientists and the media, seems to be being fulfilled in an effective way.

In contrast, regarding additional materials UCC+I are either not fulfilling their original tasks as science communication offices, as they are not providing additional materials, such as video, audio, or access to research original data in order to improve digital science news quality, either media are not using them.

Only 5 % of the analyzed news items include several multimedia resources and for example, only one audio has been identified, a surprising fact that suggests that, despite the potential of the web in the multimedia environment, there

is still much room for improvement not only for the media but also for the UCC + i themselves, constituting a future challenge within their work. Neither the use of hypertext nor the recorded interactivity have obtained significant results, so that the hypothesis 2 would be almost completely corroborated. Only the capacity for permanent updating is being exploited today by the online media.

In relation to hypothesis 4, we have found empirical evidence in this case study in relation to the information dependence of organized sources, such as communication offices and UCC + i. In the qualitative analysis, there were indications that this could be determined by the media scope. To verify this hypothesis, certain variables - the authorship, the sources and the predominant framework - were filtered according to the national, regional or local newspapers scope. The comparison showed that, indeed, the dependence of organized sources posed by Trench [2009], Calloni et al. [2009], Granado [2011] or Murcott and Williams [2013] could be directly related to the scope of the media.

Regional and local media coverage, with lower economic resources and staff, is more superficial and dependent on press releases and calls issued by institutional press offices. It is observed in the proportion of pieces signed by journalists (48 %), which is almost equal to the sum of texts signed by agencies or by the newsroom, (47 %) a generic term used when the media re-write the information using other media or news agencies as sources. Also in the predominance of the scientific institutions when a single source is cited (18 %) - a percentage that could be greater if you consider that in 21 % of texts the source is unknown and possibly institutional-. And finally, in the fact that more common frame of those news is that in which an event organized by a research institution is presented (31 %). This news are normally the result of a call coverage.

The analysis presented in this article is just a first step of a wider research line around the impact of SCO have in the media, especially in the current online scenario. It would be interesting to extend the work to other SCOs outside the Spanish UCC + i model including international digital media, in order to know if the data obtained in this case study replicates in other contexts. It will also be interesting to compare impact results obtain by UCC+I in the media with the impact of other kind of activities developed by UCC+I reached in educational context, among policy makers or companies.

Likewise, future research will be directed to deepen in media information dependence on this type of sources. As noted in the introductory section, UCC + i are a particular type of SCOs because they were born with a social purpose, such as the promotion of the scientific culture among citizens. However, it would be useful to study the extent to which they currently respond to this social goal and not just to the promotion of institutional interests. If it is possible to prove that they are effectively accomplishing that social task they may be a useful prototype to test some RRI implementation measures inside research institutions.

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