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Public communication of science, scientific culture and sense of localness. The case of the city of Teruel, Spain

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Abstract

Introduction. This article analyses how the sense of localness mediates the articulations of the public communication and the social perception of science, as part of the configuration of scientific culture. **Method.** The analysis is based on the case study of the Spanish city of Teruel, which is examined by means of a semi-structured questionnaire and interviews. **Results.** The main consequences of the mediation exercised by the sense of localness in the public communication and the social perception of science occurred in such areas as the assessment of the communication of science in local media, the opinions on Teruel’s scientific institutions and their impact on local development, and people’s commitment to increase scientific culture in the city. **Discussion.** Taking into consideration the previous results, the article examines the main dimensions (communicative, emotional, individual/collective relationships) in which the local dimension mediates those articulations. **Conclusions.** The local dimension mediates the configuration of scientific culture in a complex way.

Keywords

Public communication of science; scientific culture; social perception of science; localness.

Contents

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Translated by **Lázaro M. Bacallao-Pino**, Ph.D. (National Autonomous University of Mexico).

1. Introduction

Science and technology have played an exponentially increasing role in Modernity, from its beginning to contemporary societies, which have witnessed the emergence of scientific fields such as biotechnology and genomics, and the wide social impact of certain technological areas such as information and communication technologies (ICT). The presence of scientific and technological activities in contemporary societies extends to almost all areas of everyday life: education, health, food, transportation, housing, leisure, economy and work. However, some research works have underlined the lack of interest, even among young people, on scientific issues (Gil *et al.*, 2005), and have even considered the scientific literacy of all citizens to be an impossible task to achieve (Gil and Vilches, 2004).

Faced with this scenario, some authors propose that, based on the important contributions of science to citizen culture, in such areas as participation in the decision-making processes related to technological developments, and its contribution to the formation of critical citizens, it is necessary to increase scientific culture among citizens –by means of such actions as the so-called public communication of science–, (Gil and Vilches, 2006). Interrelationships between science and society are not linear and simple because, as Magro Mazo (2008: 142) points out, “the idea that more knowledge will generate wealth and hence social welfare is no longer adequate. Relationships between science and society are more much complex than this simple approach”.

Scientific culture has been defined by Vaccarezza (2008: 110) “as the understanding of the social dynamics of science, which intertwines producers of scientific knowledge and other social groups, as participants in the development of culture, producing meanings whose origins and justifications come from different practices, interests, regulatory codes and power relations, understood as a continuous becoming”. The communicative dimension is central to this conceptualisation, since it is an inherently relational concept, associated with the meaning-production processes that take place around the scientific activity.

This relationship between communication and science has been traditionally characterised by a predominant trend linked to a certain pedagogical approach and dissemination, which reduces to three the number of actors involved in the communicative process: the scientific researchers and their institutions; the audience; and the educators or journalists, who become mediators with the

responsibility of interpreting and shaping the scientific messages in order to ensure the understanding by the second type of actors—, setting a one-way relationship between them, according to the Sender→ Message → Receiver model. As a consequence of this approach to the interrelationships between science and communication, researchers have considered divulgation as “an impossible mission and even as a bastard activity, suspected of transmitting anything but science” (Fayard, 2004: 14).

In view of this traditional understanding of the relationship between science and communication, Fayard highlights the need to shift from an informative paradigm to a mediation paradigm, based on a change in the approach to the relationships among the actors of the communication process and between them and knowledge and culture. The transition from a perspective of divulgation towards a view of public communication for science involves overcoming its reduction to a simple process of knowledge transfer, a tendency that, in fact, often produces effects that contradict the original purpose of getting closer, sharing and stimulating people with regard to science and technology.

This paradigm shift is in line with the increasing importance of the public perception of science, a process that goes hand in hand with the increasing impact of science and technology in every social dimension. Three other interrelated aspects are also linked to this. First, the interest of the scientific community in maintaining the necessary levels of public funding for the scientific activity; second, the emergence of social movements and organisations that are critical to some scientific developments; and, third, the design of public policies on the social understanding and awareness of science and technology (Polino *et al.*, 2003). As a proof of this is the growing number of studies on the public perception of science and scientific culture, which is a tendency that has spread among science and technology institutions from different countries since the mid-1970s.

The main objective of the studies on the public perception of science and scientific culture was to recover the social trust on science, which had been affected by the development of technologies such as nuclear weapons and pesticides, and by the emergence of certain phenomena, including the energy crisis and climate change (Polino *et al.*, 2003). However, as these authors note, such studies have gone through a process of three stages, each with its particular research objectives and needs. Besides that initial interest in recovering the social trust on science—which was the main goal until the mid-1980s—a second objective emerged from that date and until the end of the decade: the debate on the quantity and quality of people’s scientific literacy.

From the 1990s, these studies increasingly adopted a new strategic perspective as part of their project to increase the social participation in scientific and technological activities, by increasing the social control of science and technology, which would include, among other things, better information for citizens and the articulation of institutional channels to facilitate the communication of scientific knowledge (García Galindo and Moreno Castro, 1999).

In this regard, the indicators of the social perception of science are currently oriented towards “the assessment and observation of the relationships between three dimensions: the public perception of science, the scientific culture and citizen participation, i.e. the measurement of awareness, knowledge and participation” (Magro Mazo, 2008: 146). However, some critics have noted that the methodological perspectives of these studies are still based on an outdated scientific paradigm that

privileges the communicative elements and underestimates the democratic and participatory dimensions.

In this regard, the article aims to analyse how the local dimension -a central scenario for citizen participation (Font *et al*, 2002.)- mediates the interrelationships between the public communication of science and its social perception, as part of the configuration of scientific culture. The complexity and importance of context in the public communication of science and technology have been emphasised by previous studies (Alcíbar, 2009), but the mediation of the local dimension has not been specifically examined by any study.

Therefore, the inclusion of the local dimension as mediator in the analysis of the public communication of science and technology is a relevant analytical perspective, not only because of the importance of citizen participation at the local level, but also due to the particular increasing significance of the local dimension in current societies, as the common narrative of the globalisation processes (Hylland Erikse, 2014), including the such issues as local information and communication (Cantalapiedra, 1997).

From this approach, the article aims to show that, in certain contexts where the sense of place is particularly relevant to individuals, the local dimension –reflected in the sense of belonging and local identity, etc.– significantly mediates the appropriation of science and technology and, particularly, the interrelationships between the public communication of science and the public perception of science. The senses of proximity and belonging closely associated with local scenarios (Pellegrino, 2011) would facilitate the emergence of a vision on science and technology that goes beyond its social representation as an area exclusive for experts and far from individuals, instead of a practical and specific and demystified area than is open to ordinary people (Dominguez-Gutiérrez, 2006).

2. Method

Given the characteristics of the research problem and objectives, we have decided to use a mixed methodological perspective that combines quantitative and qualitative tools. As some authors have highlighted (Creswell and Plano Clark, 2011), in contrast to the traditional opposing methodological approaches, the mixed perspective allows us to articulates the use of statistics and the measurements of certain phenomena, which is characteristic of the quantitative paradigm, with an in-depth analysis of the variables under analysis and the understanding of the meanings attached to them, which is characteristic of the qualitative perspective.

2.1. Methodological strategies

The analysis is based on the case study of the Spanish city of Teruel, due to its participation in the European project Platform of Local Authorities and Communicators Engaged in Science (PLACES), which is part of the 7th European Framework Programme for Research. In addition, Teruel's context

is also relevant for the analysis.

Teruel is the less populated province capital city in Spain (INE, 2009), which makes it a peculiar urban environment for the study of the local dimension. Moreover, its status of province capital makes it possible for the scientific activity to have an impact on the city.

Teruel has important scientific areas, such as the cultural, scientific and entertainment park “Territorio Dinópolis”, which is part of the Paleontological Foundation of Teruel. “Dinópolis has received more than 2 million visitors since its opening in 2001, and in 2013 it received about 175,000 visitors [1], which is almost five times the population of Teruel. The combination of a singularly local urban environment, a significantly aging population and the presence of scientific institutions, makes Teruel a relevant case for the analysis we propose.

Given the novelty of the topic of research, we propose a descriptive study of the way the local dimension mediates the configuration of the scientific culture among the city’s population, and particularly the articulation between the public communication and the social perception of scientific and technological activities.

2.2. Population and sample

Teruel has a population of 35,961 inhabitants, of which 48.47% are men and 51.72% are women; 26.06% are under 24 years of age, 56.23% are 25 to 64 years old, and 17.71% are aged 65 years or older (INE, 2013). To analyse the scientific culture and the social perception of science among the inhabitants of the city we carry out a survey among 656 people living in Teruel and aged 16 and older, and applied in-depth interviews to individuals from Teruel who are directly associated to scientific and technological activities in the territory.

The selection of survey respondents was not based on criteria of statistical representativeness but on their membership to the different local institutions which enabled citizen participation. Thus, we identified the spaces for citizen participation in the city –foundations, associations, educational institutions (colleges and universities), non-governmental organisations, business associations, media companies and trade unions– and selected the survey respondents from them.

This theoretical selection criterion allowed us to avoid certain disadvantages of the survey as a research technique –in particular its atomism and therefore its lack of attention to the relationships and interactions among subjects and social groups (Alvira Martin, 2011:12–13)– and to make our study part of the trend –relevant since the 1990s in the studies of the social perception of science– that aims to increase the social dissemination, appropriation and democratisation of science and technology. Likewise, the questionnaire is fully consistent with this approach, since it aims to respond to the complexity of the analysis of how the local dimension mediates those processes.

2.3. Data collection tools

The semi-structured survey questionnaire is based on the models applied by previous studies on the social perception of science (López Cerezo *et al.*, 2009), but the questions have been adapted in form and content in order to meet the complex and integral approach of the research problem.

Thus, we have included three types of specific questions that aim to: 1) know how respondents rate the level of scientific culture in their city and the role of science in Teruel; 2) gather information on the public communication and social perception of science; and 3) explore the impacts of the local dimension on respondents, particularly in connection with the scientific activity (for instance, their level of identification with the local scientific activity; the scientific and technological objectives, strategic lines, actions and results that they believe the city should have, etc.). Consequently, the semi-structured questionnaire includes both closed and open-ended questions that explore the public communication and social perception of science as its mediation by the local dimension.

Interviews followed an open guide, which has also included questions about the three dimensions included in the questionnaire.

2.4. Procedure

The research design was based on the review of previous studies on the social perception and public communication of science. In addition, we identified the main spaces that enable civil participation in Teruel and the individuals involved in the city-based scientific and technological sector.

Once the research instruments were designed and the participatory spaces and individuals were identified, the survey and interviews were carried out. The survey questionnaire was applied in printed and online formats, while the interviews were conducted face-to-face. Once data were collected, we proceeded to analyse it. In the case of the structured questions included in the questionnaire, data processing was conducted using Excel, while data from the open-ended questions and interviews (texts) were subjected to qualitative content analysis, an appropriate research technique to identify meanings through a set of interpretive procedures (Piñuel Raigada, 2002).

The results of both processes were triangulated, a technique based on “contrasting the description, explanation, and evaluation of the content analysed in an investigation, with descriptions, explanations and evaluations from other independent research on the same subject, and also by contrasting –within the same research on the same object–, a combination of techniques, including content analysis as a means to provide external validity to the data” (Piñuel Raigada, 2002: 14).

3. Results

In general, respondents showed a high informative interest about issues of science and technology. The majority of them (67.38%) said that they frequently get information on topics related to science and technology: 32.62% do it often and 34.76% do it occasionally. On the contrary, only 13.72% of

the individuals surveyed showed a low interest in getting information about those topics (2.13% says that they never do it and 11.59% affirms that they almost never do it). In a middle position, one in five respondents (18.75%) stated that they only get techno-scientific information sometimes. [2]

This trend contradicts the idea that Teruel's population would have a low interest in science and technology news and information since Teruel is a province of the Autonomous Community of Aragon, one of the Spanish regions with the lowest interest level according to the Fourth Survey of the Social Perception of Science (FECYT, 2012).

However, in this case, those high levels of interest would be related to the education and occupation of the individuals included in the sample, since most of them have university education (51.52%) – followed, way behind, by respondents with high-school education (26.52 %) and vocational training (8.99%) - and are salaried workers (50.91%) –followed way behind by studying respondents (28.63 %).

The local communication system responds to this need of information mainly through *Diario de Teruel* (Teruel newspaper), which published from 2003 to 2014 a weekly supplement titled *Fundamentos paleontológicos* (“Paleontological Fundamentals”), which was coordinated by the Dinópolis Foundation. This peculiar initiative offered the collaborations of the scientists working at the Foundation, and reached a total of 500 editions.

It also included an international section with information on the geological and paleontological richness of European Geoparks, in what is considered as another unprecedented initiative in this field. Similarly, since 2012, every week this local paper publishes scientific articles produced by the local campus of the University of Zaragoza.

In the case of local radio stations, there is a monthly space called “Lógica paleontológica” (“Paleontological Logic”) in Radio 5, which belongs to the Spanish National Radio Station at Teruel. On regional television there are no specific spaces for scientific communication, and it only provides media coverage to activities related to science and technology. In fact, the local television –Aragón Televisión– decided not to create a section related to the PLACES project, because it considered that the sector of the audience interested in this topic was too small.

This local media trend, especially in the case of television, is similar to the general trend followed in the main Spanish online pay newspapers that, according to previous studies, show a low presence of scientific information and a lack of criteria to classify scientific news on a specific section (Aladro Vico *et al.*, 2014).

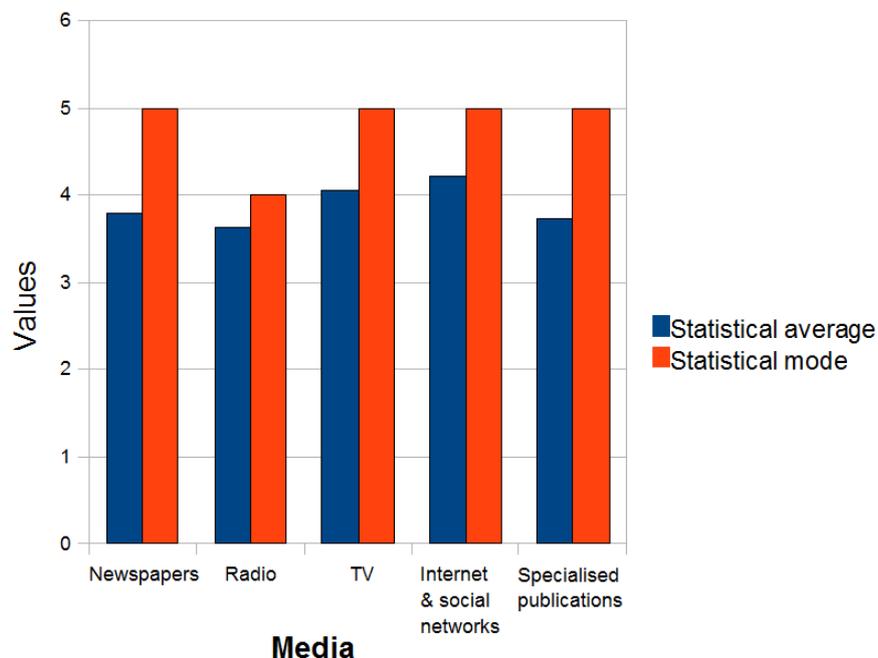
Coherently with the high informative interest shown by respondents and the presence of this type of news in the local media system, a high percentage of people (68.60%) consider that the local media devote little space to news on science and technology, while at the opposite side, just 0.76% of the respondents think there is too much space for that type of information in the local media. Those trends demonstrate that there is a need for science and technology news, which is not satisfied by local media.

In that regard, it is relevant to consider the media through which people would prefer to get more

information about science and technology. All the aforementioned media (newspaper, radio, television, the Internet and social networks, and specialised publications) have a level of preference that exceeds the statistical average of the proposed scale (from 1 to 5) and always rank above the option "I would not like it or dislike it". In all cases, except for radio –whose statistical mode corresponds to the option "I would like it" and precisely has the lowest average (3.63 points)–, the statistical mode corresponds to the option "I would like it very much".

Significantly, the two media with highest statistical averages of preference are the Internet and social media and television, which confirms the general trend among Spanish people, who prefer to get scientific information or news primarily through the Internet, and secondly by television, in addition to the significant hegemony of social media as a channel for scientific information among individuals under 25 years old (FECYT, 2012). Television, in particular, is considered a fundamental media for the scientific literacy of the population (Martínez Ruiz *et al*, 2005) to the extent of creating a different way of public communication of science given the particularities of the medium: the audiovisual scientific dissemination (Salcedo, 2009). These preferences regarding the different media would be associated, on the one hand, to the age composition of the sample –44.67% of respondents are young people (16-35 years old)–, as well as to the significant presence of high school and college graduates in the sample and, on the other hand, to the paradigm shift in the public communication of science, from a one-way information approach to a mediational and bidirectional approach (Fayard, 2004), which is facilitated in the case of the Internet by its multimedia nature and interactivity.

Figure 1. Respondents' preference to receive scientific information from different media



Source: Authors' own creation. Options: 1 = "I would dislike it very much"; 2 = "I would dislike it"; 3 = "I would not like it or dislike it"; 4 = "I would like it" to 5 = "I would like it very much"

This tendency to prefer the two-way public communication of science is confirmed by the respondents' suggestion of the creation of face-to-face communicative spaces for the public communication of science, such as open-doors lectures, conferences courses and exhibitions, as well as other specific local actions (free newspapers and advertising on the city's streets shops, educational institutions and scientific publications). In that regard, in addition to this preference for two-way communication, these recommendations also demonstrate a predilection for local and community communicative spaces.

However, the general interest on science and technology information does not correspond to the levels of face-to-face interaction between respondents and local scientific institutions. Most of them stated that they visit these institutions infrequently: 23.02% of them do it sometimes, 34.76% do it rarely and 12.80% never visit it. On the other hand, only 8.54% of the respondents visit these institutions frequently and 19.82% do it occasionally. [3]

In other words, more than half of the respondents (70.58%) do not visit these institutions frequently, while only one in three individuals (28.36%) do it regularly. This confirms, in the case analysed, one of the paradoxes identified by Fayard (2004: 17) in the studies on the social perception of science: the mismatch between people's acknowledgement of the importance of science and technology and people's low levels of attendance to centres of scientific culture.

The fundamental reasons for respondents' low frequency of attendance to local scientific institutions include their perception of which institutions are associated to science and technology. The fewer institutions are associated with this activity, the lower the chances individuals will visit them. Respondents also consider that the activities by local scientific institutions are mainly focused on tourism, and so they argue that, for instance, in the case of museums one visit is enough since its collections are not periodically updated. The local dimension then mediates both the representation of what is and what is not a scientific organisation, as well as the assessment of the activities performed by those institutions that are perceived to be associated to science.

In contrast, people who visit more often those institutions are usually people with university degrees and engaged in activities directly or indirectly related to science and research, and they do it primarily for personal reasons that are related to their employment or professional activity, so they do not need to receive any kind of information from the scientific institutions. In this case, people's frequency of the visits to the local science and technology institutions is more influenced by their personal than local dimension.

With respect to these trends, interviewees emphasised, firstly, the need for local scientific institutions to implement an adequate communication strategy towards the community and, secondly, the lack of access to institutions perceived as related to scientific or technological activities.

So there is physical proximity but also symbolic distance between people and the local organisations they perceived as associated with these activities, which results from the persistent social representation of science as a sphere exclusively for experts and not for ordinary people (Dominguez-Gutierrez, 2006).

In fact, only two types of institutions mentioned in the questionnaire were associated to scientific

activity by more than half of respondents: research centres, whose name makes explicit their relation, and educational institutions (schools, colleges, universities) and their research institutes, whose role in the development of scientific knowledge has been considered relevant (Martínez Ruiz *et al.*, 2005).

However, the institutions most closely linked to the daily and local action of individuals –such as businesses and associations– were considered as linked to science and technology only by 13% and 29% of the respondents, respectively. Everyday life, therefore, is not associated to scientific and technological activities, since those institutions that have a greater presence in the territory – businesses or associations– are not perceived as scientific by the majority of respondents. The more institutions are associated with this activity, the more likely individuals will consider visiting this kind of institutions frequently.

The local map of science drawn by respondents mainly includes the Palaeontology Foundation of Teruel-Dinópolis; Aragon’s Centre for Cosmos Physics Studies (*Centro de Estudios de Física del Cosmos de Aragón* - CEFCA); the local campus of the University of Zaragoza; the Institute of Teruel Studies (*Instituto de Estudios Turolenses*), Teruel’s Museum and secondary schools. Only two local businesses were included by respondents in their list of local organisations linked to science and technology –the Tervalis Group, dedicated to the production of fertilizers, and *Unión Vidriera Aragonesa*– in addition to the local Chamber of Commerce and the Regulatory Council of Teruel’s Ham.

Traditionally, studies on the social perception of science ask people to share their general and universal judgments on science and technology (López Cerezo *et al.*, 2009). In contrast, our study investigated people’s assessments of the scientific activity carried out in their local context. In this regard, the largest percentage of respondents (43.29%) considered that Teruel is a backward city in scientific research, while the smallest percentage (6.10%) considered the opposite: that it was a forward city in science and technology. Of the respondents, 35.98% chose an intermediate position when assessing the scientific local activity, while 14.18% do not have an opinion on it. [4]

Interviewees considered that, since there is a generalised opinion about Teruel as a “backward city in everything” (to such a degree that, for example, its inhabitants have mobilised to demand infrastructure and investments, as in the case of Citizen Coordination known as *Teruel existe* (“Teruel exists”)), then this opinion is also applies to the scientific and technological field. [5]

Consequently, Teruel is a “backward city” on this aspect too, especially since science is an activity that is inherently associated to development. Respondents, for their part, explain that this negative opinion about the local scientific and technological dimension is based on the lack of connection between science, businesses and local government. They also argue that another reason is the low scientific culture of the local population, which is an obstacle for the emergence of non-governmental scientific initiatives (from local people, businesses and associations).

An important factor in respondents’ social perception of science is their evaluation of Teruel’s scientific institutions. In this regard, they consider that the specific contribution of the local scientific institutions to the development of the city and the social usefulness of the knowledge generated by those institutions are positive. However, there is a tendency to consider the latter type of benefit

greater and critical than the former when assessing the local contribution of scientific institutions.

In the first case, most individuals did not “agree nor disagree” with the statement “the contributions are significant”. On the other hand, most respondents “agree” that “the knowledge generated by those institutions is useful to society in general”. This trend is confirmed since most respondents (87.04%) believed that, in the future, the contribution of local scientific centres to the development of the city should be higher than it has been so far, while only 2.13% of them think it should be the same, just 0.76% consider it should be less than it has been so far and 8.54% have no opinion about it. [6]

Similarly, citizen’s demands on the future contributions of Teruel scientific institutions to local development are in line with the emphasis on the local dimension and, consequently, are linked to the most significant current local issues.

According to respondents, the most important contribution of the local scientific activity would be associated, first, to the creation of jobs (74.24% of respondents). In a context of a deep economic crisis and high unemployment rates, one can understand that for most people job creation should be the most significant contribution of the scientific activity to the territory. By the end of 2013, Teruel had a 19.83% unemployment rate and in March 2014 there were 10,659 unemployed persons registered in the province, the second highest unemployment rate in the Community of Aragon. [7]

According to the results of the survey, the second most important demand to local scientific institutions is general: 54.27% of respondents consider that a relevant contribution of these organisations is to create important innovations for society. The other contributions considered important by respondents also underline the significance of the economic and socio-occupational dimension of the local community. While 49.85% of respondents included such aspects as increasing the city’s scientific culture, 41.46% of respondents consider as a priority a task directly related to the economic impact of science: to increase the application of scientific and technological knowledge to local businesses.

The sense of belonging and identification of individuals with a particular community is another important dimension of the local context (Morley and Robins, 2013). Consequently, we have analysed this aspect of the local dimension as part of the study of the social perception of science and the scientific culture in Teruel. In general, respondents showed a high level of identification with the project to increase Teruel’s scientific culture: 23.02% were “very identified” with this project; 43.6% were “identified”; 21.19% were “little identified”; 5.34% were “not identified”; and only 4.57% were indifferent [8].

Interviewees argued that this level of identification is consistent with the scientific potential identified in the city and also with the fact that this goal is seen as “a great opportunity for the whole province, both for its image, development and future projection as well as for its economy”. Similarly, respondents underlined the potential socio-economic benefits are associated with this goal, as well as the positive personal and professional consequences for the people whose jobs are related to the technological and scientific activity.

Respondents with little or no identification with this goal are not interested in getting involved in the

communicational and informational dimensions of the project at the local level. Therefore, they consider that there is a lack of information or knowledge in the people of the city to achieve this goal and that Teruel's people is not clearly identified with this kind of projects, so it would be difficult to motivate or mobilise them around it by creating a sense of belonging and involvement with this goal. The communicative and emotional dimensions, in relation to the local scenario, synthesise this negative position with regards to the goal of making Teruel a city of scientific culture.

However, the inherent complexity of the local dimension –given its multidimensionality and, in particular, its articulation of the emotional and rational dimensions– is confirmed by the fact that, despite some people are little identified with that goal, most respondents (85.52%) believe that Teruel should have a strong commitment with science and technology as sources of local development. This is consistent with the general tendency in Spain where, according to the VI Survey on the Social Perception of Science (FECYT, 2012), most of the population consider that science improves the quality of life in society (88.6%) and contributes to the economic development (87.1%).

At the same time, the tension between individuals and the community becomes a significant aspect of the mediation of the local context in the communicative processes that configure the scientific culture. There is a difference of almost 20 percentage points between the share of respondents that considered that Teruel should be commitment with science and technology as sources of local development (85.52%) and those who declared themselves as “very identified” or “identified” with the goal of making Teruel a city of scientific culture (66.62%). This difference confirms that, for certain individuals, this goal is not seen as an issue that involves them directly and individually. This difference between the socio-institutional and personal dimensions is similar to the national trend in which most people consider that public institutions should invest more resources in science, but only 40% of them would be willing to donate money for science (FECYT, 2012).

In this regard, there are significant differences between the things that people think they should do individually and collectively to improving the scientific activity in the city. From the individual point of view, respondents again underline their ignorance about the network of local scientific institutions and their general level of education. Interviewees also highlight the influence of the image of expertise associated to science, so those people with no professional links to this field believe that they are not able to contribute to science. People perceive a personal distance from the scientific activities and, consequently, although they identify themselves with the local project that includes this dimension they feel that their participation or contribution is limited.

People do recognise the need for a major personal commitment with science, for instance through higher levels of participation in scientific activities. In fact, respondents frequently mentioned two possible personal contributions to the goal of increasing the local scientific culture that precisely do not require any level of expertise or professional link with scientific activity. The first contribution is communicative, i.e. to disseminate through their own social networks (friends, families) information on the local scientific and technological activities and results. The second contribution is associated to the emotional dimension, and involves spreading awareness among the rest of the population of Teruel on this idea, by encouraging people in their nearest environment to participate in scientific activities and also by playing a role in bringing about a collective construction of an emotional

dimension associated to this project, which is considered by respondents as a central aspect for moving forward a major local commitment with science.

Both the individual and collective commitment and contribution to this goal have important emotional and identity dimensions, which are also relevant for the sense of localness. In this sense, interviewees underlined that it is important for “the city to believe that it has the potential for it” and for “its inhabitants to trust in the possibilities of science and technology”. They also highlight the importance of bringing science closer to the population since “in general, people have an unrealistic idea far of what science and scientists are”. Thus, they recommend “to implement actions that increase the involvement of citizens, and to increase the transfer of knowledge from scientific institutions to businesses”.

The fact that there is “some degree of citizen participation in Teruel” is also considered an opportunity by the interviewees, since this would facilitate the involvement of its inhabitants on the project of making Teruel a city of scientific culture. In conclusion, experts state that, in this process, “firstly, one must become aware of what it [science] means. We have to start from the beginning in aspects such as the information to citizens and, above all, make them to feel that all the improvements we can achieve belong to them. (...) It is as simple as giving citizens all the information on the little contributions we achieve in the scientific area, so we make Teruel’s inhabitants take pride in their city”.

People identified with the project of increasing scientific culture in Teruel have are motivated by their love for the territory, and their desires to develop the city and its positive aspects –such as the knowledge produced by its local scientific institutions–, and their commitment with all types of actions that tries “to make my loved Teruel a better place”. In many cases, the interviewed experts believe that we need more scientific dissemination outside the city and to advertise its local scientific activity to improve its image.

However, as mentioned, respondents consider that this process must be collective and led by public institutions, private businesses and local scientific centres, which reinforce the idea that the individual contributions are understood as collaboration with these institutional agents. As part of that collective “duty”, the economic dimension is particularly underlined, since individuals demand more funding, both public and private, for R&D projects. This confirms, in the case analysed, the predominant national trend to consider that the government needs to increase or maintains the level of funding in science and technology (FECYT, 2012).

4. Discussion and conclusions

The theoretical potential of the communicative mediation theory of Jesús Martín-Barbero has been underlined by many authors (Gámez, 2007), particularly as part of the analyses of the processes of meaning construction (Alonso, 2010), precisely because mediation is defined as “the place where meaning is given to communication” (Martín-Barbero, 1986: 145). Consequently, the mediation of the sense of localness in the articulation of the public communication and social perception of science –as part of the configuration of scientific culture– becomes a relevant topic to be analysed.

In the case of the city of Teruel, the data analysis shows that, indeed, the local dimension mediates, in a fundamental manner, the public communication and the social perception of science. Opinions on the local scientific activity –its social impact, local institutions associated to this activity, its main contributions to local development and the objectives to be reached on this area– demonstrate that, contrary to the traditional perspective on science that presents it as an exclusive area for experts and the scenario of the scientific knowledge, the scientific culture of individuals is based, significantly, on the information and perceptions they get from the local (and thus close) institutions that they perceived as associated to science. In this regard, people assess the capacity of impact of the local scientific institutions on the territory to be more relevant than the general social importance of the knowledge produced by them.

People show a high level of interest in getting information on scientific activities, and prefer to satisfy this need in spaces that enable two-way communication through technological means –such as the Internet and online social networks– and face to face sessions which are facilitated in local environments. This opens up a new possible line of research: the so-called proximity press which, according to some authors (Pardo Baldeón, 2013), has had an outstanding role in the articulation of the local communities where it is practiced, giving those communitarian their own narratives.

This tendency takes place in the context of a paradigm shift in the public communication of science, which confirms that individuals are not only passive audiences –as is the case of the diffusionist model– and actually demand participatory communicative actions and, on the other hand, that people can also become communicational actors on this regard. This change is confirmed by the preference for certain communicative spaces such as the Internet and social networks, with their inherent interactivity and multimedia nature.

Since there is a greater geographic and symbolic proximity to local scientific and technological institutions, the social perception of science and the scientific culture of people are directly influenced by the work of those organisations. At the same time, there is a greater demand for the public communication of science from the local media and a demand for resources for scientific development from the local public and private entities.

Simultaneously, the local conditions mediate the contribution that individuals are willing to make to the configuration of a collective scientific culture. This personal contribution is precisely linked to two central dimensions in the sense of localness: the communicative dimension –through the personal local social and communicational networks– and the emotional dimension –which impacts feelings and identities–.

This mediation of the sense of localness, however, involves a number of contradictions. First, the physical proximity of the local scientific institutions fails to break the social representation of science as an activity of experts that is far from and inaccessible to most ordinary people. This explains the mismatch between people's high level of interest on science and their low level of attendance to science and technology centres.

The local dimension also mediates the interrelationships between individuality and collectiveness in the social perception of science, as part of the processes of configuration of scientific culture. Although individuals recognise the social and economic importance of the science and technology,

they demand a greater contribution from these areas to the future development of their local environment and also show a high commitment with the project of making their city a place of scientific culture, but at the same time do not commit themselves to making a substantial individual contribution to it.

This identification with the goal of increasing scientific culture in their city is not considered an issue that directly and individually involves them, since individuals largely see it as a collective responsibility of basically the governmental and private institutions.

In fact, one of the reasons given by respondents for their pessimistic positioning towards the feasibility of the making Teruel a city of science is the lack of interest and the difficulty for getting the people from Teruel involved in this project. At the same time, individuals consider that one of the main priorities regarding that goal is to motivate people, which is something closely related to the communicative dimension. In other words, the emotional dimension is recognised as central in the configuration of a scientific culture, and it is associated to the sense of belonging and commitment with –and even love to– the territory.

The local dimension also provides important support for the further critical component of the local scientific and technological activities, which as mentioned is among the causes of the emergence of a field study on the social perception and public communication of science. If, as proposed by Gil and Vilches (2006), one of the main contributions of science to civic culture is its input to the development of the critical dimension of individuals, then one can consider that, in this case, the local dimension reinforces that contribution, since the local sense of belonging increases criticism – both negative and constructivist– towards the scientific and technological dimension of the city's immediate everyday reality. In this regard, criticism is qualified precisely by this immediacy and, instead of being centred on ethical issues or universal narratives, it is focused on issues such as the financing of the scientific activity, its presence in the local public opinion, or the targeting of local institutions to an external audience (visitors), demanding more attention towards the inhabitants of the city.

People's tendency to place responsibility on institutions instead of assuming an individual responsibility shows some sort of deformation of the local and the collective dimensions associated to the scientific activity, limiting it to the public space and the local government. This tendency reflects a scenario in which this reading of the local dimension becomes a central mediation between citizen participation and scientific culture. The sense of localness contributes both to the identification of subjects with the scientific activity and the local development it produces and to the perception of the local public and private institutions as responsible for the development of the scientific activity. If scientific culture is not an individual but actually a group responsibility (Domínguez-Gutierrez, 2006), then this explains the centrality of the mediation of the local dimension on its configuration, as well as in the processes of public communication and social perception that are articulated in its configuration, especially in the context we have analysed, where the local dimension has a special importance and density.

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Dates:

- Start of research: January, 2013
- Completion of research: May, 2013

5. Notes

[1]. Dinópolis received 174,777 visitors in 2013, according to the Managerial Team of the Paleontological Complex of Teruel. See: *Dinópolis cierra la temporada con las mejores cifras de los últimos 9 años, con cerca de 175.000 visitantes* (“Dinópolis closes the season with the best statistics of the last 9 years with about 175,000 visitors”), December 12, 2013. Available at <http://www.aragonradio2.com/noticias/hemeroteca/dinopolis-cierra-la-temporada-con-las-mejores-cifras-de-los-ultimos-9-anos-con-cerca-de-175000-visitantes/> [Accessed on 1 April 2014].

[2] 0.15% of respondents did not answer this question.

[3] 1.07% of respondents did not answer this question.

[4] 0.46% of respondents did not answer this question.

[5] A social movement emerged in 1999 from the convergence of different citizen platforms (e.g. *En defensa del Ferrocarril* [In defence of the Railroad], *Pro Salud Mental* [Pro Mental Health], *Pro Helicóptero y Transporte Sanitario* [Pro Health Helicopter and Transport]) that demanded the investment and infrastructure needed by Teruel to reach the same level of development of the rest of Spanish provinces. This citizen movement brought together all the city civil society, leading several strikes and even a general strike across the province.

[6] 1.37% of respondents did not answer this question.

[7] Those statistics have been published by the Government of Aragon, based on the data of the Spanish Public Service for State Employment. Available at: <https://www.aragon.es%2Festaticos%2FGobiernoAragon%2FOrganismos%2FInstitutoAragonesEstadistica%2FDocumentos%2Fdocs%2FAreas%2FEconomia%2FInfCoy%2Fparoreg.xls&ei=SWZFU7rIq38yAH2woDIDg&usg=AFQjCNFcf05QdUznV4kr3ZOgFURGfPlyKw&bvm=bv.64507335,d.aWc> [Accessed on 1 April 2014].

[8] 2.29% of respondents did not answer this question.

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