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SCIENTIFIC PUBLIC INTELLECTUALS AS A
MEANS OF ACHIEVING GREATER SCIENTIFIC
CULTURE IN SPAIN

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1. Introduction

The 20th century legacy in terms of economic policies set the fundamentals of the current age of neoliberalism in western societies. Thus, the 21st century is defined “by the increasing predominance of free-market forces and the growing privatization of the public good” (Gilbert, 2013, p. 33). The over-valuing of private profit and the eagerness with which we, as a society, seek development, has become, however, deeply worrisome. It seems that everything revolves around individual interests, a human tendency already described by Jean-Jacques Rousseau in 1775. Rousseau expressed the inclination towards individualism as a human necessity of distinction, of being favourably compared to other people, and he depicted it on his essay *Concerning the Origin of Inequality among men* as the outset of corruption in human society: “Finally, consuming ambition, the zeal to increase one’s wealth –less out of a genuine need than in order to set oneself above others– create in all men the dark inclination to injure one another” (as cited in Noelle-Neumann, 1993, p. 85).

The existence of countless social problems requiring an almost immediate solution if we want to avoid, or at least reduce, the consequences that derive from them and that in many cases we are already suffering, presses upon us to appeal our more intimate social conscience. But, how can we, as individuals, generate a significant, positive change in our communities if we are deeply rooted in individualism and, thus, reluctant to do things in alternative ways? Who is to show us the way? What is the lever for change?

1.1. Why public intellectualism?

There is a model for measuring advertising effectiveness, the so-called hierarchy of effects model (Figure 1), which classifies the steps that a customer goes through before making a final purchase decision into three behavioural dimensions: cognitive, affective and conative (Lavidge & Steiner, 1961, p. 61; Martín-Santana, Reinares-Lara E. & Reinares-Lara P., 2015, p. 87). Pursuing to commercialise and to sell a new product, companies follow different advertising strategies. At first, they inform, they make us become aware of the existence of the new product so that we know what does it have to offer. Thereafter, they try to make us adopt a certain attitude towards the advertised object, they want us to like it and they put the efforts into making us develop a preference for it. At last, they try to convince us and to provoke a purchase behaviour. The gist of this model can be extrapolated to any other type of communication since every message that reaches an audience, either if it is designed to do so or not, will influence the audience’s behaviour at one of the mentioned dimensions. Therefore, deciding whether to

take action or not on a specific crusade can be explained by the same underlying reasons that explain why do we decide to start buying a new washing powder or just continue using the one we are used to.

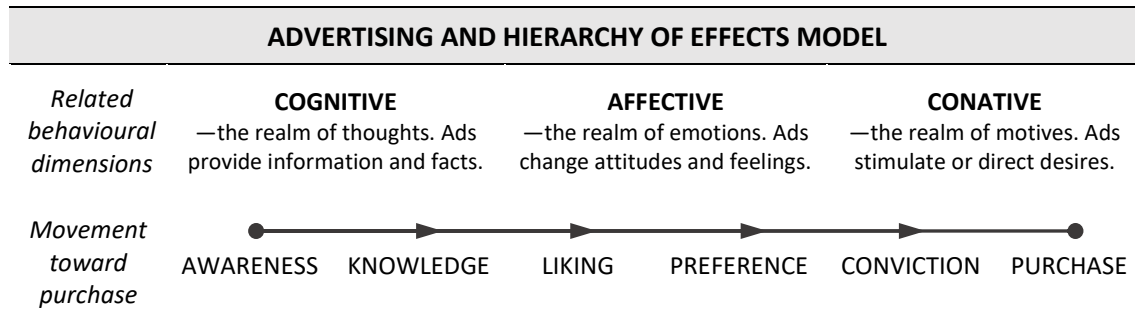


Figure 1. Hierarchy of effects model. Adapted from Lavidge & Steiner (1961, p. 61).

For a social initiative to succeed there is a need of citizens who are committed to the cause, who believe that their individual efforts have a positive impact, and who see the value of what they are trying to achieve. Social changes are, therefore, the result of a collective endeavour. Thus, to achieve a social impact requires a critical mass of people to go through all six steps and to finally ‘buy’. This means that people have to be aware of the issue, develop a predisposition towards action and, finally, they need to decide to act either on a personal level or getting involved on a certain initiative with the aim of changing things for better. However, the process is far more complicated than making people buy a new washing powder. There are some serious pitfalls to consider. First and foremost, there is a need for information in the public sphere. Debates allowing public discussions on topics of social concern are scarce. One of the reasons is that social issues are controversial topics. It is not easy to speak about them without generating conflicts and being detrimental to some private enterprise. Therefore, these topics are mostly avoided and the voices that differ from the establishment point of view, the dissident voices, are suppressed by the media (Chomsky & Herman, 1988, p. 23). Beliefs are shaped based on the information we are exposed to. Attitudes, though, are assumed as a result of a compromise between personal convictions and the existing social consensus, also known as public opinion, a swampy terrain which is hard to fight against: “Today it can be proved that even when people see plainly that something is wrong, they will keep quiet if public opinion [...] and, hence, the consensus as to what constitutes good taste and the morally correct opinion speaks against them” (Noelle-Neumann, 1993, p. x).

The opinion of the majority concerning a specific topic is in many cases grounded in unfounded arguments. But, if we are to make decisions that affect us all, it is reasonable to say that those decisions should be made based on solid arguments supported by demonstrable evidences.

“A high level of consensus, which is a source of happiness, a place of refuge and safety for the vast majority of mankind, fills the avant-garde, those who prepare the way into the future –the artists, scholars, and reformers– with horror” (Noelle-Neumann, 1993, p. 139). Committed to the future are also public intellectuals, whose main concern is “to make people think, to challenge, and ultimately, to make things better” (Lamberts, 2017, p. 7). Their role is of immense societal value since they challenge the status quo and provide citizens with knowledge and tools so they can actively participate in the decision-making process regarding issues that affect society as a whole (Walker, 2017, p. 1). Hence, public intellectualism presents itself as a tool to toss our inner thoughts and to stimulate the awakening of a widespread social conscience.

1.2. The need for scientific culture

Public intellectuals can belong to any branch of knowledge. Most professions, though, “don’t separate themselves as clearly from society as scientists seem to want to do” (Johnston, 2017, p. 3). There is a shortage of scientific public intellectuals and, thus, a need for scientists to be encouraged to speak in the public sphere. A reason for it is that “we need to influence ongoing debates by seeking to push them towards rational and the evidence-based arguments and towards points of scientific consensus. To shift out the deliberately distracting stories and to counter fake news” (p. 2). The public intellectual as a strong opinion leader could help to achieve this transition. And, by replacing those public opinions grounded in unfounded arguments, we would be empowering people to participate in substantial debates using solid statements to support their claims. However, a society with scientific culture is needed for that to happen. What it takes to achieve such a society will be further discussed onwards, but briefly, and oversimplifying it, it refers to the idea that citizens need to understand the science behind the evidence, as well as the value that such evidences have compared to opinion-based arguments. It could be argued that scientific evidences share no connection with lay concerns. Hecht (2015), though, retorts this is not the case:

[Lay concerns] are issues of political, cultural, or individual importance that have no necessary connection to science. [...] [However,] calling them matters of lay concerns does not deny the importance of science to them. [...] Many of the most important

crucibles in which public attitudes on science are formed consist of discussions that are not fundamentally about science at all. (p. 8).

Science is so intertwined with every other social component that it is not unreasonable to think of scientific evidence as valuable to any debate.

A society with a strong scientific culture, where public opinion will potentially answer to evidence-based arguments, will allow to generate enough consensus so to promote solutions to social issues. The literature points public intellectuals to be individuals who have the skills and the attitude that is needed to make front to this complex situation. Thus, this work sets out to analyse (i) if public intellectuals can help boost the development of a society with greater scientific culture and (ii) if the current Spanish context is prone to favour the democratisation of this public figure. The democratisation process alludes to the idea of incorporating this public figure as one more constituent of the social infrastructure seeking to allow, and facilitate, those individuals to act as agents of social change assuming responsibilities to improve society.

1.3. Hypothesis and research objectives

This study is intended as a first approach to the potential benefits of scientific public intellectualism on promoting scientific culture, as well as, to explore the pitfalls such a public figure should have to overcome to successfully act, within social institutions, as an agent of social change in today's Spanish society. The study is divided into two phases: a first literary research phase, and a second phase with a focus on quantitative and qualitative data collection and analysis. Briefly, the idea is to first critically assess relevant literature on the fields of science communication, scientific culture, and public intellectualism to understand how those three interact. Because Spanish scientific research about popular science has been shown to be scarce (González-Alcaide, Valderrama-Zurian & Aleixandre-Benavent, 2009, p. 863) and, as pointed out by López-Pérez & Olvera-Lobo (2017), "the history of public communication of science in Spain is yet to be written" (p. 1), this work combines the available Spanish literature with the canonical view of the relations between science and the public. It also adds to the discussion international literature on public intellectualism and, since there has been a sudden increase on the number of studies about scientific culture promoted by the Spanish Foundation of Science and Technology (p. 9), this work considers the last Spanish theories and measurement approaches on scientific culture. By combining the analysis of public intellectualism and scientific culture in Spain, we are most likely entering new research territories.

This research draws on the following hypotheses:

H1. Public intellectuals can help boost the development of a society with scientific culture.

To prove this first hypothesis, I set out to establish an association between the role of scientific public intellectuals and the likelihood of their actions having a positive effect promoting a society with greater scientific culture.

Research objectives:

RO[a]. To determine how can public intellectuals help to develop a society with scientific culture.

RO[b]. To identify potential Spanish scientific public intellectuals.

H2. The current Spanish context does not favour the democratisation of public intellectuals.

To prove this second hypothesis, I set out to identify social factors that can limit the democratisation process. Two different scopes have been analysed in search of limiting factors: the guild that works to promote scientific culture and the scientific community.

Research objectives:

SCOPE 1 – Scientific Culture and Innovation Unit (UCC+i) network

RO[c]. To determine the suitability of the system that currently promotes scientific culture in Spain to support public intellectuals.

SCOPE 2 – Academic community

RO[d]. To determine the willingness of scientists to become public intellectuals.

2. Contextualisation

‘Integrity’, understood as “a way of being and acting regardless of particular interests and that is immune to outside pressures to influence behaviour according to the interest of certain sectors” (Casado, Neves, De Leucona, Carvalho & Araújo, 2016, p. 65), is a deontological requirement in scientific research, as it is for any other professional activity. The *Declaration on Research Integrity in Responsible Research and Innovation* sets “the imperatives of truth, rigour and objectivity, independence, impartiality and neutrality, cooperation and honesty, transparency and fairness, commitment and social responsibility” as the basic principles that define science (p. 67). However, science has not always been the specialised and autonomous sector that nowadays is. The production of properly scientific knowledge can only be explained by looking at the historical relations between science and the public. This historical view provides insights to understand what scientific culture is and how is being promoted in the 21st century in Spain. A quite extensive contextualisation becomes necessary to show the reader the complexity of the subject and the many factors that need to be considered in this work.

2.1. Historical relations between science and the public

Briefly, the canonical account supports that back in the 17th century there was no clear demarcation between science and other cultural, and social, structures (Shapin, 1990, p. 991). Lay concerns could potentially influence the content of scientific knowledge compromising its reliability and objectivity. The differentiation and specialisation of science began in the 1880s when the Scientific Naturalist movement broke down the existing link between theology and science (p. 1000). Since then, the public’s role “consists solely in acceding to scientific judgements and in rendering support for activities that scientists have deemed desirable or essential” (p. 992). The opinion of the public on scientific matters was left aside, specialised terminology made scientific knowledge inaccessible to most social sectors and, thus, the matter-of-course place that science used to have in general culture was lost. As a result, public interest toward science was altered, which created an explicit need for scientific knowledge to be popularised. Science communication, although performed through different channels since the 17th century, became a crucial tool to convey that sort of knowledge to the public in accessible ways (Shapin, 1990, p. 1001). A more detailed discussion on the role of science communication is provided further on in this work (section 2.3).

The economic support for science until the end of the 18th century came from patronage. In fact, this was one of the reasons why lay concerns could, through the patron’s interests,

influence scientific work. The patron, as described by Shapin (1990), is who “offered support, subvention and encouragement, protected the men of science from enemies, and suggested topics of inquiry and trajectories of research” (p. 1003). However, from the 19th century until now, “it is the state that speaks for (or claims the right legitimately to speak for) the public and to voice public interests in the conduct of science” (p. 1004). Now, in the 21st century, when the state is failing to give the support science needs, is when the relations between science and the public are being redefined again. Efforts at different levels, and driven by a diversity of institutions, are being directed toward building again a bridge that allows fluent communication with the public, but, of course, without compromising the objectivity and autonomy of the scientific field. López-Pérez & Olvera-Lobo (2017) perfectly summarise how this situation applies to the Spanish context, which will be further described in section 3.1:

The economic crisis and the cuts experienced by Spanish research in recent years are seriously affecting resources directed at R&D+i [Research & Development + Innovation]. Only the public can reverse this situation with its voice and decisions, but in order to do so it must be informed and feel part of the scientific process. Is the second decade of the 21st century the moment to demystify science for it to once again take up a place in society? (p. 9)

To understand why it is important for society to speak back and how are science communication efforts being directed, it is necessary to briefly describe how has science been understood within political agendas during the 20th and 21st centuries.

2.2. Historical relations between science, the state and the public

During the first part of the 20th century, science and technology were understood within political agendas as one more component contributing to a country’s economy on the basis of research and development (R&D) (González de la Fe, 2009, p. 739). The occurrence of the Second World War made necessary for all countries involved to promote collaborations between their government and universities in search of innovations that could help win the dispute. After the war, innovation turned to be the element providing companies with a competitive advantage and, near the end of the century, scientific and technological research became the new basis for the creation of wealth and economic development in most industrialised countries (p. 741). Innovation started to be considered within political agendas when speaking about science and technology, and R&D became R&D+i. This new concept of economic policies was named ‘knowledge-based economy’ by the Organization for Economic Co-operation and Development (OECD) in 1996 (as cited in González de la Fe, 2009, p. 741).

A few years later, in 2000, the European Union (EU) devised the Lisbon Strategy, an economic development plan aiming to achieve “the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion”, by 2010 (European Council, 2000, p. 1). Thus, in the 21st century, innovation has become the major force to generate wealth, and although most of the goals from the Lisbon Strategy were not achieved, the new strategy proposed by the European Commission, Europe 2020, builds upon them (European Commission, n.d.).

The concept of a knowledge-based economy required the readjustment of the theory behind the economic models that were in use until 1996. The Triple Helix (TH), a model developed based on a sociological approach as a mean to justify and legitimize political decisions with respect to innovation became the economic model of reference for most industrialised countries (González de la Fe, 2009, p. 740). As described by this author, the TH model underlies the policies regarding industry, higher education and scientific and technological research that were implemented by the OECD and the EU at the beginning of the 21st century (p. 742). This model for knowledge-based economies, which builds upon the concept of neoliberalism as defined at the beginning of this work, examines the interaction between three different societal sectors (universities, industry and the government) with the important consideration that innovation results from the interaction between those three areas of society (p. 743). The TH model does, therefore, constitute an alternative to the mode 1 of knowledge production, which, until the end of the 19th century, was merely intended to provide new findings as a mean to understand the world (Valdeleón & Manoslava, 2013, p. 68). Thereafter, knowledge began to be seen as capital and “the increasing privatisation and appropriation of ideas, creativity and innovation for corporate purposes” (Gilbert, 2013, p. 35) became the new mode of knowledge production (mode 2). The almost universally accepted knowledge-based economy presents, though, some drawbacks since it “obscure[s] science’s cultural and social value, and science communication’s possible contribution to broad social access, balanced dialogue and cultural completeness” (Trench, 2008, p. 127).

A society marked by the capitalization of knowledge leaves aside all social agents since social responsibility is not considered of significant importance on a system that revolves around capital. When speaking about science and technology, citizens and, thus, society, are the beneficiaries of the research and innovation process. Therefore, the way in which knowledge is produced should follow a human-centred rather than a capital-centred system, where capitalised knowledge would be that intended to help meet the needs of society. In 2014, responsible research and innovation (RRI) was defined on the Rome Declaration as “the on-going

process of aligning research and innovation to the values, needs and expectations of society” (European Commission, 2014, para. 1), which requires that “all stakeholders *including civil society* [emphasis added] are responsive to each other and take shared responsibility for the processes and outcomes of research and innovation” (para. 3).

The concept behind the Rome Declaration overcomes the TH model. Citizens are being located as central actors of the RRI processes and, now, in the second decade of the 21st century it is possible to start talking about a mode 3 of knowledge production and a quadruple helix (Valdeleón & Manoslava, 2013, p. 78), which are more democratic models due to the effective inclusion of social agents. As described by these two authors, the mode 3 has the commonality with the mode 2 of considering knowledge production based on market demands, although this time those demands coming from the fourth helix, social agents, are prioritised upon those coming from private agents (p. 78). Furthermore, in this new mode, knowledge production is oriented to solve social problems and to empower communities. It is believed that the conditions are now right to achieve the goal of successfully implementing such a system, and that is why resulting from the Rome Declaration, there is a call for action “to create experimental spaces to engage civil society actors in the research process as sources of knowledge and partners in innovation” (European Commission, 2014, p. 2). However, to fulfil the ideal where civil society would actively participate of the research and innovation process it is necessary to create a critical mass of citizens with an interest in science, educated and with scientific knowledge (FECYT, 2016, p. 7). This is not an easy task. A lot of work needs to be done to facilitate the interrelation of civil society and the scientific community. It is important to understand the popular attitudes toward science to successfully build a bridge between these two sectors, which “has become a hot topic [of study], prompted in part by voluble and influential dissent on matters of scientific consensus [...] [and] by parallel concerns about contemporary politics” (Hecht, 2015, p. 7). As the French philosopher, Bernadette Bensaude-Vincent has put it: “the history of science should no longer be isolated from the history of the public’s attitude toward science. The public is not a passive spectator of scientific advances, it is *volens nolens* the partner of scientific enterprise” (as cited in Hecht, 2015, p. 7).

2.3. Public communication of science

The fact that scientists have separated themselves from society more than any other profession has been the result of the boundaries established back in the 19th century, which allowed science to specialise and to acquire greater autonomy at the expense of restricting the role of the public. From that moment, as mentioned in section 2.1, different communication strategies

started to be used as a tool to popularise science. The role of the public had been reduced to merely get informed about new scientific discoveries and to support science activities. However, citizens could not properly perform either one of those since the state took the supportive role and scientific knowledge became inaccessible due to specialised terminology. The public's attitude toward science was, therefore, dramatically altered. Now, citizens are expected to actively support knowledge production with "its voice and decisions" (López-Pérez & Olvera-Lobo, 2017, p. 9) and public communication of science presents itself as a crucial tool to promote public engagement.

Science communication has been understood nearly since the late 18th century (Shapin, 1990, p. 1001) as a 'top-down' process of information transfer where knowledge is "transmitted by experts to audiences" (Trench, 2008, p. 131) perceived to be "ignorant and uninformed" (Irwin, 2008, p. 201) for science. As pointed out by Irwin (2008), this conceptualisation, known as the 'deficit model', presents the issue that it does not "draw on public engagement in any meaningful way" (p. 201). Furthermore, it "misses the many ways in which nonscientific actors influence scientific research: funding decisions, regulations, policy initiatives, media discourse, and cultural attitudes" (Hecht, 2015, p. 7).

The importance that communication between diverse groups has concerning the implications of scientific knowledge is well exemplified by Trench (2008):

In dealing with such topics as embryonic stem-cell research, energy, climate change and pandemic risks, science comes into contact with ethics, economics, public service provision and business. In those contexts, knowledge derived from scientific research is just one ingredient of public policymaking and public debate, and scientists are called on to open 'science-in-the-making' for public scrutiny. (p. 126)

As it derives from the above argumentation, "more active, open and democratic relations between science and citizens are both desirable and necessary" (Irwin, 2008, p. 200). There are two other dominant communication models, both with the desire to democratise science making it "easier for the public to talk back": the 'dialogue' and the 'participation model' (Trench, 2008, p. 120; Figure 2). The former considers communication to flow "between scientists and their representatives and other groups" with a focus on discussing applications of science (p. 131). On the other hand, the latter considers communication to take place "between diverse groups on the basis that all can contribute, and that all have a stake in the outcome of the deliberations and discussions" (Trench, 2008, p. 132). It focuses more on the implications of science.

Base Communication Models	Ideological and Philosophical Associations	Dominant Models in PCST*	Variants on Dominant PCST Models	Science's Orientation to Public
Dissemination	Scientism	Deficit	Defence	They are hostile
	Technocracy		Marketing	They are ignorant They can be persuaded
Dialogue	Pragmatism	Dialogue	Context	We see their diverse needs
	Constructivism		Consultation	We find out their views
			Engagement	They talk back They take on the issue
Conversation	Participatory democracy	Participation	Deliberation	They and we shape the issue
	Relativism		Critique	They and we set the agenda They and we negotiate meanings

*Public Communication of Science and Technology

Figure 2. Analytical framework of science communication models. Figure taken from Trench (2008, p. 131). Remarks have been added in grey.

Science communication initiatives, to the extent of my knowledge, are far from implementing the participation model. However, as supported by Trench (2008) and Irwin (2008), there has been already a major shift from the deficit to the dialogue model. It is important that this transition is applied to institutions of scientific governance to better address “complex issues of socio-scientific decision-making” (Irwin, 2008, p. 209). Implementation of the dialogue model on such institutions would help to establish more transparent governance, which would be responsive to public opinion on the basis of a broad societal consensus on matters of sociotechnical concern (p. 208) (Figure 3). The models are not mutually exclusive and, thus, “all three will continue to have their uses in particular circumstances” (Trench, 2008, p. 132).

The second decade of the 21st century is marked by “a change in the culture of science communication and decision-making” (Irwin, 2008, p. 200) facilitating new relations between science and the public. The full range of actors that influence these relations (scientific governance, public communication of science, cultural attitudes, and their interrelations, among others) conform, altogether, the “character of [what is known as] *scientific culture* [emphasis added]” (p. 209). Thus, countries that can be considered to have great scientific culture would be those capable of aligning all societal actors using in each case the communication strategy that better suits a specific situation.

	Deficit model	Dialogue model	Toward a participation model
Main focus	Public ignorance and technical education	Dialogue, engagement, transparency, building trust	Direction, quality and need for sociotechnical change
Key issues	Communicating science, informing debate, getting the facts straight	Re-establishing public confidence, building consensus, encouraging debate, addressing uncertainty	Setting science and technology in wider cultural context, enhancing reflexivity and critical analysis
Communication style	One-way, top-down	Two-way, bottom-up	Multiple stakeholders, multiple frameworks
<u>Model of scientific governance</u>	Science-led, 'science' and 'politics' kept apart	Transparent, responsive to public opinion, accountable	Open to contested problem definitions, beyond government alone, addressing societal concerns and priorities
<u>Sociotechnical challenge</u>	Maintaining rationality, encouraging scientific progress and expert independence	Establishing broad societal consensus Public intellectuals	Viewing heterogeneity, conditionality and disagreement as a societal resource
Overall perspective	Focusing on science	Focusing on communication and engagement	Focusing on scientific/political cultures

Figure 3. Comparison between the three dominant models in public communication of science and technology with respect to scientific governance and sociotechnical concerns. Adapted from Irwin (2008, p. 208).

2.4. Public communication of science in Spain

The culture of change that is currently being promoted in Europe, as exemplified by the Rome Declaration, will not be effective simultaneously in all countries. Each one of them will implement new strategies regarding science communication and decision-making according to their needs and how do they prioritise those needs. In fact, Spain has been isolated from the rest of Europe in different occasions, the last one being the period of the Dictatorship established after the Civil War (López-Pérez & Olvera-Lobo, 2017, p. 4). In terms of the public communication of science, this isolation meant that the field blossomed with delay respect the other European countries. This has certainly had a negative impact in Spanish society since, the OECD establishes that Spain is currently “one of the European countries with the least scientific culture” (as cited in López-Pérez & Olvera-Lobo, 2017, p. 9). Thus, efforts in the public communication of science in Spain are being directed to reverse this situation.

Historically, museums and science centres have taken the educational role of disseminating general scientific concepts to the lay public aiming to increase the literacy levels of Spanish society. However, the major agent acting to bring together science and the public has been journalism (González-Alcaide et al., 2009, p. 866). Since science became of interest to be disseminated, journalists have relied on the means of mass communication to present scientific results to society. Nowadays, scientific journalism is becoming more and more professionalised due to its inclusion as an area of study into the curriculum of universities together with other courses addressing public communication of science (López-Pérez & Olvera-Lobo, 2017, p. 8). Until the government created the Spanish Foundation of Science and Technology (also known by the Spanish acronym 'FECYT') in 2001 (p. 8), efforts to promote scientific culture were scattered. The FECYT is now the main institution committed to reinforcing the relations between science and society for which, among many other initiatives, the Scientific Culture and Innovation Units (also known by the Spanish initialism 'UCC+i') were created in 2007 (FECYT, 2016, p. 10). Now, in 2018, the UCC+i network is one of the most dynamic agents working to spread science widely among Spanish citizens aiming to improve literacy levels and to generate a positive attitude toward science and technology (FECYT, 2016, p. 9). The network is a very diverse setup where each UCC+i can choose to specialise in two out of four possible lines of action: communication of R&D+i results, dissemination of general scientific knowledge, training researchers to acquire communication skills, and/or perform theoretical research about public perception of science and technology (FECYT, 2012, p. 9). César López who is the responsible person of the network at the FECYT informs that, at present, there are 81 recognised units distributed all over the Spanish geography (personal communication, June 20, 2018). The distribution, though, is quite diverse. Andalusia, Catalonia and Madrid are the autonomous communities with the highest number of units (FECYT, 2016, p. 13). Many other communities count with a single UCC+i and the Balearic Islands do not even have one yet (FECYT, 2017b). It is important to note that most of the network has chosen to specialise and to carry out science communication and dissemination activities, the target audiences for which have been mainly the general public, youngsters and children (FECYT, 2016, p. 15). As described in sections 2.2 and 2.3, there are other audiences such as policymakers, activists or the business community, which would also be important to target since they also influence scientific research. The scientific culture and innovation units' network (UCC+i network), though, does not have them as priority audiences. As indicated on the publication *UCC+i: origen y evolución* (FECYT, 2016), it is important to note that despite their diversity, all units work toward common goals:

Todas las UCC+i, con independencia de su enfoque, trabajan por y para que la sociedad se sienta cada vez más atraída por la ciencia, estimulando su curiosidad, contribuyendo a sensibilizar a la opinión pública sobre los avances de la investigación hasta superar su posición espectadora y facilitar su incorporación a la agenda científica. (p. 10)

The UCC+i network represents a setup with high potential to help Spain reach a greater level of scientific culture in a relatively short period of time. It is for this reason that the network has been chosen to be analysed in this study to determine its suitability to support public intellectuals (section 1.3).

But, what are public intellectuals? And, how can they play a part within the current system of scientific culture? To understand, where do public intellectuals fit, and before introducing them to the reader, it is necessary to take a look to the theories studying scientific culture and to what are the limitations that public intellectualism could potentially help to overcome.

3. Theoretical Framework

After a thorough contextualisation to provide the reader with a sense of what scientific culture means and how a society with great scientific culture should look like, it can be extrapolated that it is a complex issue to address at a theoretical level. This section sets out to describe the research theories that are currently being used to approach the concept and measurement of scientific culture. Thereafter, the public intellectual will be, at last, introduced.

3.1. Framing scientific culture

3.1.1. *Scientific culture models*

In line with the argumentation followed until now with respect to the relations between science and society, “una sociedad con cultura científica sería aquella que permite y fomenta la participación democrática de sus ciudadanos en las decisiones sobre ciencia y tecnología” (Revuelta & Corchero, 2011, p. 184). Thus, it is important to consider public engagement or, in other words, the “disposition of an individual to the action” (Cerezo & Cámara, 2007, p. 71), when addressing scientific culture from a theoretical perspective since it is a component that has been traditionally left out. Spanish scientific research in this area is scarce, though, lately, the publication rate has increased (González-Alcaide et al., 2009, p. 863; López-Pérez & Olvera-Lobo, 2017, p. 9). There are, to the extent of my knowledge, two models worth to consider on this work. Both models have been built based on data retrieved from an opinion survey on public perception of science and technology (also known by the acronym EPSCYT) that the FECYT conducts every two years, the sample of which can be said to be representative of the Spanish population.

The first model is a two-dimensional approach that considers scientific literacy and public perception of science. The model defines four types of scientific culture (designated by the letters U, B, M and H) allowing the study of how public engagement relates in broad terms to each one of them (Requejo, Escobar & Quintanilla, 2017, p. 287). As described by Requejo et al., (2016) and depicted in Figure 4, a small segment of Spanish society is associated with the U model of scientific culture, which is characterised by a low level of scientific literacy coupled with a negative attitude toward science. On the other extreme of the chart, a much wider segment of population presents opposite characteristics, that is a positive attitude toward science and a quite advanced level of scientific knowledge. This segment represents 46% of the Spanish population and constitutes the so-called, B model. The other major segment (36%), grouped as the M model, shows good understanding of scientific concepts together with a

neutral attitude toward the scientific field. And, lastly, the H model groups together those individuals that, despite not really understanding science, present a positive attitude towards it. All in all, it is important to note that Spanish citizens mostly present a positive attitude toward science and technology.

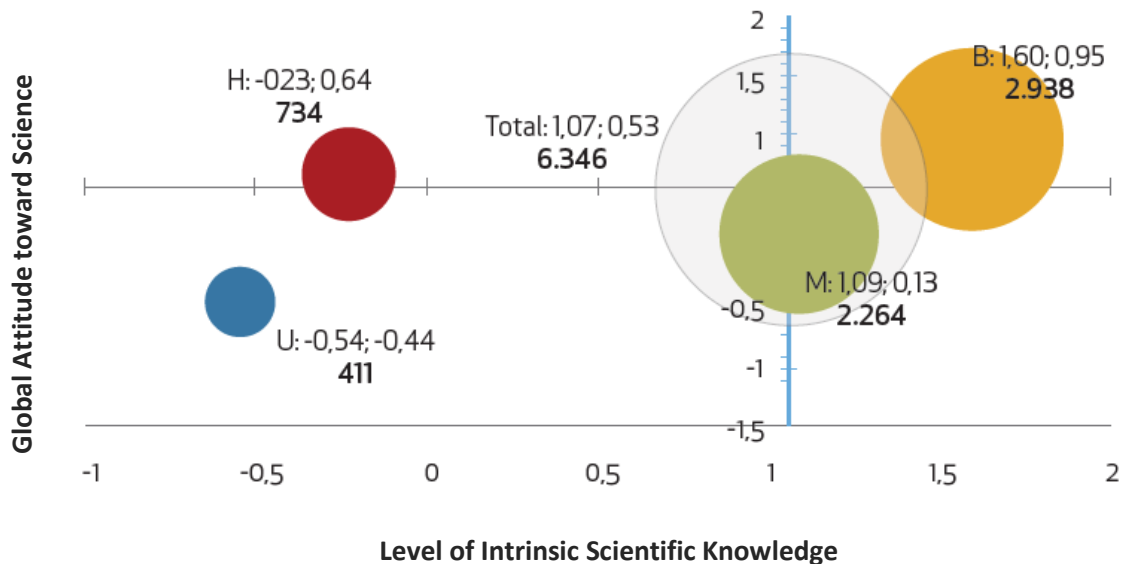


Figure 4. Two-dimensional models of scientific culture: the Unamuno model (U), the Hilarion model (H), the Marcuse model (M), and the Bacon model (B). Each model makes reference to the level of scientific literacy and to the attitude toward science that display a particular segment of the Spanish population. Taken from Requejo, Escobar & Quintanilla (2017, p. 287).

The second model is a multidimensional approach that goes in depth in the study of how an individual acquires such a disposition to the action. The approach is based on the concept of ‘social appropriation of science’, which has been defined as “the incidence of scientific and technological knowledge on the beliefs and daily life decisions of individuals” (Hurtado, Laspra & Cerezo, 2017, p. 72). These three authors describe that to achieve scientific culture is necessary to influence citizens to develop positive opinions and attitudes toward science:

[Achieving scientific culture] is being able to use scientific knowledge when making a decision to purchase in the supermarket or when considering the exposition to a medical technology, as a customer, as a parent, as an entrepreneur or as a worker. [...] [And] it requires assimilation of diverse types of information in the enrichment of one’s own life, not only generating *opinions* but also *attitudes* and *disposition to the action* [emphasis added] in different spheres of daily life. (p. 71)

The information about science made available to the public through different channels may influence individuals at three different levels, which relate to the behavioural dimensions

considered by the hierarchy of effects model used by advertising researchers (Figure 1). Beliefs and opinions fall into the cognitive dimension, attitudes into the affective dimension, and disposition to the action into the conative dimension. Effective appropriation of science implies the change of certain beliefs and behaviours of an individual (Cerezo & Cámara, 2007, p. 80). This behavioural change can be explained by the hierarchy of effects model as a linear effect. Scientific information presented to citizens through different communication channels might influence beliefs and opinions of individuals predisposing them to a certain attitude change, which if it becomes effective, will at the same time predispose the individual to the action, to change a certain behaviour. To have an interest in science, to trust scientific information, and to be able to discern its practical implications, are preconditions to initiate these set of events (Hurtado et al., 2017, p. 37). Data supporting the appropriation model, though, indicates that higher levels of appropriation are related to a higher interest toward science (p. 37). This fact, without disproving the linear effects of the hierarchic model, points that the relation between the three dimensions is not necessarily always linear. In fact, in this case, an attitude change would have a bidirectional effect upon the cognitive and the conative dimensions. Hurtado et al., (2016) summarise their findings by saying that “cuanto más aprecias el valor práctico de la ciencia, más te interesa y mejor la conoces, y también hace que estés más inclinado a formarte y manifestar una opinión sobre sus aspectos positivos y negativos” (p. 47).

3.1.2. Public engagement as an indicator of scientific culture

Public engagement is a broad concept. Thus, it is measured in relation to the disposition of an individual, or group of individuals, to support a specific aspect of the R&D+i system. The two-dimensional model has been used to provide a measurement of public engagement based on the disposition of individuals to support scientific research through crowdfunding. This approach shows that those individuals who perceive science to be positive for the society (B and H models; Figure 4), which implies having a great interest on it, are more likely to engage in crowdfunding activities than those whose attitude is negative or neutral (M and U models) (Requejo et al., 2016, p. 290).

On the other hand, the model of the appropriation of science has been constructed upon a different approach. In this case, the criterion used to measure the disposition to the action was the tendency of an individual to make informed decisions (Hurtado et al., 2017, p. 26). What would you do if you become aware that a product you consume has an ingredient that raises controversy? Would you replace directly the product with a similar one or would you search for information to help you decide what to do? It is important to note that to make this sort of

decisions requires a basic understanding of science and a positive attitude towards it (Hurtado et al., 2017, p. 26). Although to have an interest in science seems to be a prerequisite to achieving effective appropriation levels, in this model, to appreciate the practical implications of science is a more important factor. The measurements performed by Hurtado et al., (2016) do not relate to public engagement understood as the likelihood of citizens to participate of the R&D+i process but more to an idea of engagement at a personal level. Thus, the appropriation model aims to study how to achieve citizens with greater scientific culture as a mean to achieve a society with greater scientific culture.

The crowdfunding approach to measure public engagement in the R&D+i system has provided, so far, the only data that can be considered to explain the relation that exists between developing a positive attitude toward science and how does that predispose individuals to engage in the research and innovation process. Therefore, this relation needs to be further studied. However, despite the unknowns, within the development of a positive attitude toward science, interest and appreciation of the practical implications of science seem to be two important factors contributing to the individuals' disposition to the action. The last EPSCYT survey shows citizens' interest in science to be stalled and that a downward trend can start to be noticed (FECYT, 2017c, p. 51). Although this trend is not yet statistically significant, there has been an increase, from a 25.9% in 2014 to a 29.6% in 2016, in the number of citizens who indicate that have no interest in science (FECYT, 2017c, p. 398). Could this mean that the public's interest in science is in decline?

3.1.3. The importance of appreciating the practical implications of science

Appreciating the practical implications of science goes much further than having an interest in it. It implies certain sensitisation to the role that science can play in solving issues of social concern. Citizens should "become aware of the concerns and [to] understand the issues" (Neville, 2008, para. 3). Thus, as it will be further discussed in this work, to communicate the implications of science helps "changing public attitudes and policy directions" (para. 4). It is not unreasonable to think that the appropriation model can be as useful to explain social public engagement as it is to explain engagement understood as the personal appropriation of science. Whether this shows to be true or not, it is important to analyse if there is any institution committed to spread widely the implications of science and the new technological advances.

Museums and other science-related activities for the public such as science fairs have shown to maintain the public's participation rate as compared to previous years (FECYT, 2017c, p. 36). The purpose of these activities, though, is to educate and, therefore, they are mostly based on the

deficit model. These initiatives are unlikely to help people develop a disposition to the action, which requires more reflective communication strategies. If museums have an educational role and the mass media communicates scientific results considered to be newsworthy, as it has been mentioned in section 2.4, is there anyone communicating the practical implications of science? Some entities within the UCC+i network such as the *Euskampus Fundazioa* have, in fact, started to consider to be of importance to disseminate not only the applications of scientific knowledge but also its implications in our society (Euskampus Fundazioa, n.d.). However, there is no evidence of the impact that their actions might have had, if any so far, on the targeted audiences. It is, of course, a first step on the right path, although to appreciate the practical implications of science should be the main and only object of new communication strategies, which according to the appropriation model would promote a higher tendency among the Spanish population to comment on matters of sociotechnical concern.

All in all, there is a need to keep working to facilitate the connection between science and civil society by increasing the level of scientific culture of the country. This can be achieved among other things by using science communication strategies to promote a positive public attitude toward science and technology. A society where citizens appreciate and see positively the practical implications of science will, most likely, have higher chances of reaching a critical mass of science literate individuals. Those individuals would have well-founded opinions based on scientific concepts on many different topics and, thus, would be in disposition to participate actively in R&D+i decision-making. This, in fact, would have, at the same time, a positive impact on solving social issues since a well-founded opinion considering scientific concepts would bring public opinion closer to a consensus to pressure the state to take action.

Public intellectuals are a group of individuals with the skills and the attitude that are needed to make front to this complex situation. They are “adept at communicating not just about the science itself, but also about its real-world consequences, implications or opportunities. They communicate with passion and purpose” (Walker, 2017, p. 3) and the role is of immense societal value since they challenge the status quo and provide citizens with knowledge and tools so they can actively participate in the decision-making process regarding global issues (Lamberts, 2017, p. 5). The figure of the public intellectual is the *raison d’être* of this work, as it sets out to analyse (i) if this public figure can help boost the development of a society with greater scientific culture and (ii) if the current Spanish context is prone to favour its democratisation (section 1.3). As Marshall & Atherton (2015) point out, “it is difficult to characterise the public intellectual. Definitions are either too broad [...] or, [...] they are far too narrow” (p. 70). For this reason, next section aims to provide the reader with a detailed description of how public intellectuals are to

be understood in this work. Furthermore, the many available scholarly definitions and interpretations have been used to construct a sort of hierarchy of categories on how scientists can become public intellectuals (Figure 5).

3.2. Framing scientists as public intellectuals

3.2.1. *Hierarchy of levels toward scientific public intellectualism*

Edward Said, a Palestinian-American literary theorist, directed the reflection on the role and meaning of an intellectual toward the concept of public intellectualism. His notion of an intellectual is constructed upon Antonio Gramsci and Julien Benda's descriptions of this figure. Although influenced by the same social context, descriptions of intellectuals given by these two 20th century contemporaries are technically opposed. On the basis of a society where the private sector started to gain importance, Gramsci defined as 'organic intellectuals' those whose activity consisted in pursuing practical aims to support enterprises, in Edward Said's words, "to organise interests, gain more power, get more control" (Reith Lectures, 1993, p. 1). Nowadays, Gramsci's organic intellectual counterpart would be the so-called 'private intellectual', who is "valued to the extent their scholarly work can be commodified and sold on the free market" (Gilbert, 2013, p. 38). The neoliberal trend that established the corporatisation of universities characteristic of today's knowledge-based economies has made corporate purposes a priority calling "into serious question the long-term prognosis for intellectual work in service of the public good" (p. 38). Benda perceived the dangers of pursuing practical aims as it could make intellectuals compromise their principles. Proof of that has been provided by Noam Chomsky and Edward Herman's work (1988) on the performance of the mass media of the United States:

[Corporations co-opt experts by] putting them on the payroll as consultants, funding their research, and organising think tanks that will hire them directly and help disseminate their messages. In this way, bias may be structured, and the supply of experts may be skewed in the direction desired by the government and the market.
(p. 23)

Benda considered that a 'real intellectual' should refuse to pursue practical aims. They should be moved, in Said's words, "by metaphysical passion and disinterested principles of justice and truth" instead (Reith Lectures, 1993, p. 2). On the basis of these universal principles, the intellectual in Said's sense of the word is committed to be critical of society's misconducts "not just passively unwilling, but actively willing to say so 'to, as well as for, a public' in public" (Reith Lectures, 1993, p. 8). Said, though, seems to consider all intellectuals to have a public role in society. This work differs in regards to this aspect. The definition that Said made extensive to all

intellectuals is considered to be, in fact, only applicable to a specific type of intellectuals, the public intellectuals. The upcoming discussion considers it as expressed in the first lecture of a series called *Representations of the Intellectual* (Reith Lectures, 1993):

[A public intellectual is] someone whose place it is publicly to raise embarrassing questions, to confront orthodoxy and dogma (rather than to produce them), to be someone who cannot easily be co-opted by governments or corporations, and whose *raison d'être* is to represent all those people and issues who are covered under the rug. (p. 4)

In modern times, most intellectuals are faculty members of a university and, thus, they are “trained in a particular discipline, such as linguistics, biology, history [or] economics” (Lightman, 1999, para. 11). They are experts in their fields. Lightman understands that such a person becomes a public intellectual when he or she decides to address a large audience on the basis of their expertise (para. 11). Public communication was for a long time disapproved within the sciences (Walker, 2017, p. 2), yet, the success in the public sphere of some individuals with high scientific stature, such as Rachel Carson, “had the effect of legitimizing public discourse as a worthwhile activity for scientists” (Lightman, 1999, para. 23). Yet, not every science communicator can be considered a public intellectual. A scientist, a science communication academic, and a scientific public intellectual differ from one another on how they approach public communication of science.

Lightman (1999) proposes three levels of public intellectual. However, his hierarchical model presents some limitations from the perspective of this work. Lightman’s level 1 involves “speaking and writing for the public exclusively about your discipline”, while level 2, requires relating the explanations of an area of expertise to “the social, cultural, and political world around it” (para. 13). Finally, the level 3 public intellectual is asked to “speak about a large range of public issues, not necessarily directly connected to their original field of expertise at all” (para. 14). However, in Said’s terms described above, the two first levels do not meet the requirements to be considered real public intellectuals. In fact, Lamberts (2017) has already incorporated Said’s perspective into Lightman’s model pointing out that “the arena for a public intellectual would start at a place between Lightman’s levels 2 and 3” (p. 3). Lightman (1999) considers the third level as a stage where “the intellectual has become elevated to a symbol, a person that stands for something far larger than the discipline from which he or she originated” (para. 14). Thus, it is likely that Lamberts does not situate Said’s intellectual directly at Lightman’s level 3 because most public intellectuals are not likely to achieve a

recognition of such magnitude. Thus, level 1 and 2 are prior to becoming a public intellectual and level 3 is too sumptuous to be generalised. This work considers that Lightman’s classification should be understood as a hierarchy of levels toward achieving public intellectualism more than as a “hierarchy of levels of public intellectual”, as he considers it (Lightman, 1999, para. 11). Consequently, it is here proposed a new approach aiming to accommodate scientists, science communicators and scientific public intellectuals within the same model. Two levels have been added and the new approach has been constructed integrating many available scholarly definitions and interpretations in order to provide a detailed description on how science, technology, engineering, and mathematics (STEM) academics can become public intellectuals (Figure 5).

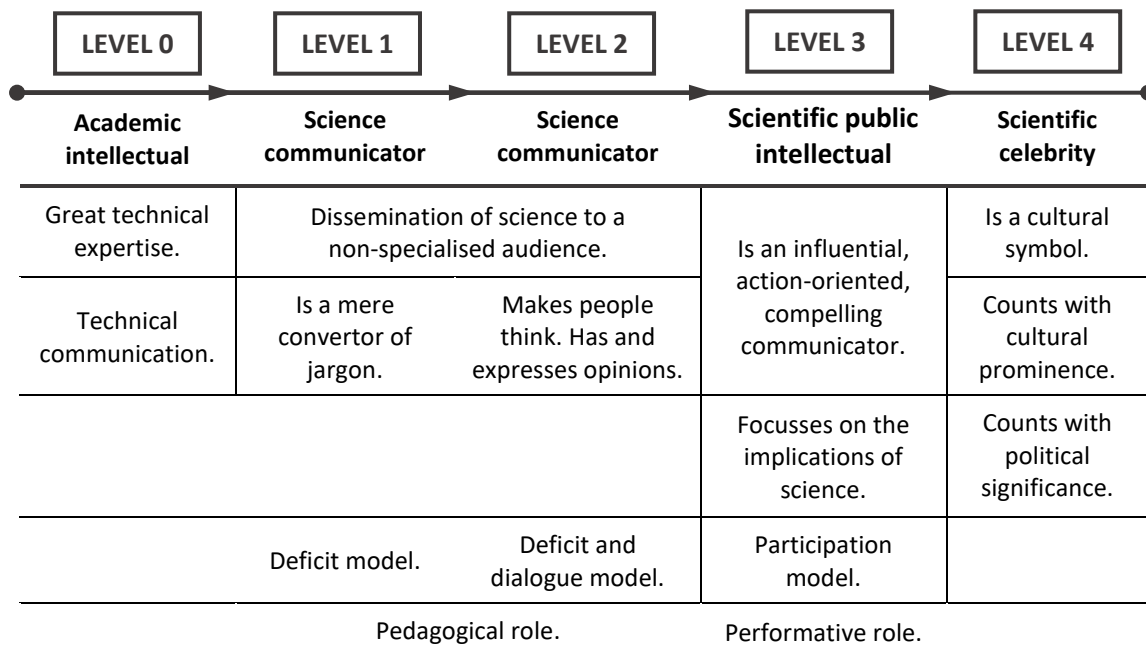


Figure 5. Hierarchy toward public intellectualism. A five-level model that considers that a scientist (level 0) should become a science communicator (level 1 and 2) before it can be recognised as a public intellectual (level 3) or, even more, as a scientific celebrity (level 4). The figure shows the main characteristics of each level.

The proposed hierarchy toward scientific public intellectualism is a five-level model. Level 0 corresponds to ‘academic intellectuals’ such as STEM academics. These are individuals with great technical expertise committed to “push back the frontiers of knowledge” (Walker, 2017, p. 1). Science communication at this level is understood as a tool to present the results of a research to the scientific community using technical terminology (publish in scientific journals, attend conferences, etc.). When such a person decides to address a non-specialised audience, he or she becomes a ‘science communication academic’. Nowadays, with scientific journalism

becoming more and more professionalised (López-Pérez & Olvera-Lobo, 2017, p. 8), there is an increasing number of individuals with a background in journalism who specialise in science communication. This model groups together both profiles and refers to them as ‘science communicators’. Level 1 and level 2 remain as defined by Lightman (1999) and reviewed above. However, as opposed to Lightman's considerations, in this model individuals associated with these two levels are not considered public intellectuals but science communicators. In terms of the information they communicate, level 1 individuals are considered mere convertors of jargon into language that can be easily understood by a non-specialised audience. Level 2, though, is much more demanding, it requires “to make people think”, which cannot be accomplished only by translating science into plain language (Lamberts, 2017, p. 7). It also involves “having, and expressing, *opinions* [emphasis added]” (p. 7). It is important to note that the “science communicator’s task is primarily pedagogical” (Stokes, 2017, p. 2) since it implies “translating the contents of specialist literature(s) for the general public in order to contextualise issues” (p. 2). Taking a look back into the science communication models described in section 2.3, the nature of the pedagogy used by level 1 science communicators is likely to follow the deficit model. Furthermore, it is not unreasonable to think, that level 2 communicators’ pedagogy will combine the deficit and the dialogue models since expressing opinions requires more reflective communication strategies. As pointed out by Stokes (2017), if science communicators are to be public intellectuals they should implement a “more performative than pedagogic[al] approach” (p. 3). Lamberts (2017) can be seen to agree with Stokes since he indicates that two defining elements of public intellectuals are “a drive to challenge the status quo, and an orientation towards action” (p. 5). Lightman’s level 3 has been divided in two. Now, level 3 accommodates perfectly Said’s definition of public intellectuals, while the new level 4 groups those scientific public intellectuals that, as Lightman (1999) expressed, are recognised as “a symbol” by society (p. 2). These are, following the American tradition, the so-called ‘scientific celebrities’ (Hecht, 2015, p. 2).

Scientific public intellectuals are individuals “who by trying to use what they know and how they think about the world expose themselves to ridicule, and even attack” (Lamberts, 2017, p. 7). They address public affairs, matters “of or inflected by a political or ideological concern” (Posner as cited in Marshall & Atherton, 2015, p. 70) attempting to “direct or influence public opinion” (Turner, 2015, p. 696). The purposes of a public intellectual may range “from influencing legislation or policy to influencing administrative decisions, *to influencing personal behaviour* [emphasis added], to providing intellectual orientation relevant to political issues” (p. 695). Therefore, they “are agents of social change, of political engagement” (Lamberts, 2017, p. 3). As

Stokes (2017) points out, public intellectuals should not be seen “as a sort of oracular figure” but “as a product of training and ongoing hard work, and someone open to engagement with and learning from the public as an interlocutor” (p. 6). This type of engagement requires to allow citizens to have a say in the outcome of public discussions, which seems to fit quite well with the participation model exposed in section 2.3 on this work. As previously described, this communication model has a desire to democratise science making it “easier for the public to talk back” (Trench, 2008, p. 120). Furthermore, it focusses on the implications of science which as seen in section 3.1.3, have a great potential to promote a positive public attitude toward science and technology, which would help to increase the level of scientific culture of the country ultimately facilitating the connection between science and civil society.

The idea of the model is that anyone can move upward through these various levels and evolve from being an academic intellectual to a scientific public intellectual. Moreover, public intellectuals may reach a *celebrity* status and enter level 4 due to their public exposition. However, most of them will not reach this last level since they will not achieve the required “cultural prominence and political significance” (Hecht, 2015, p. 2). Nonetheless, scientific public intellectuals can still be considered at a lesser extent to be a cultural symbol. Rachel Carson, Carl Sagan, Albert Einstein, Robert Oppenheimer, or more recent personalities such as Jane Goodall or Jeremy Jackson, are examples of scientific public intellectuals. Most of them have indeed achieved a scientific celebrity status.

As a closing remark to this section, it is important to reflect on the responsibilities of these individuals and the following fragment from Lightman’s (1999) is perfect for it:

The public intellectual is often speaking about things beyond his or her area of expertise. Some people will refuse such an invitation, others will accept the responsibility that has been given to them. [...] Such a person must be careful, he must be aware of the limitations of his knowledge, he must acknowledge his personal prejudices because he is being asked to speak for a whole realm of thought, he must be aware of the huge possible consequences of what he says and writes and does. He has become, in a sense, public property because he represents something large to the public. He has become an idea himself, a human striving. *He has enormous power to influence and change, and he must wield that power with respect* [emphasis added]. (p. 3)

3.2.2. *Why should scientists be public intellectuals?*

“The enlightenment is under threat. So is reason. So is truth. So is science, [...]. I am one of those scientists who feels that it is no longer enough just to get on and do science. We have to devote a significant proportion of our time and resources to defending it from deliberate attack from organized ignorance. We even have to go out on the attack ourselves, for the sake of reason and sanity”.

(Richard Dawkins Foundation for Reason and Science 2007 as cited in Trench, 2008, p. 122)

Research can be influenced by many nonscientific actors (section 2.3), but it is not a one-way conduit. Influence goes both ways. Science has the potential to influence regulations, policy initiatives, cultural attitudes, and even media discourse. The problem is that for a long time the prevailing attitude has been “that scientists were meant to be detached, objective observers of nature —driven only by data, willing to document the end of nature without ever raising an eyebrow” (Olson, 2017, p. 5). This meant for scientists to avoid highly politicised domains such as climate change or conservation biology. But, “why go to great lengths proving that adding huge amounts of airborne carbon into the atmosphere messes with climatic stability if humanity continues to trip merrily down the carbon-pumping lane in blissful ignorance?” (Walker, 2017, p. 3). Scientists should take a stand to make the voice of science to be heard. After all, the aim of scientific research is not only to push back the frontiers of knowledge, but to do so with an intent to improve “the way in which we live on our planet” (p. 3), which cannot be achieved, though, if the voice of science is silent.

Nowadays, the public domain is swamped with tweeters, bloggers, youtubers, and public figures such as politicians, who are “willing to attack and undermine evidence-based arguments that stand in their way for their own ideological and/or profit-making purposes” (Johnston, 2017, p. 2). This is the situation to which Richard Dawkins refers to when he says that science needs to be defended “from deliberate attack from organized ignorance”, on the opening-quote of this section. Truth is being threatened by the increasing supply of unsubstantiated opinions to the public realm. Scientific public intellectuals, though, are not to be presented as bearers of the truth, but as “critical thinkers and sceptical observers” (Johnston, 2017, p. 2), who by providing citizens with rational arguments seek to influence ongoing debates trying to counteract all those decisions that are being made mostly on the basis of economic interests. They seek to toss our inner thoughts and to stimulate the awakening of a widespread social conscience. They are necessary to effect a global change, to address countless social problems requiring an almost immediate solution.

3.2.3. *Activism and three other defining elements of a public intellectual*

“Somehow, along with the science, we need the activism. They are inseparable”.

(International AIDS Society Conference on Pathogenesis, Treatment and Prevention. Lewis, 2009, p. 82)

Public intellectuals are equipped with a wide range of attributes that make them qualify as a quite special group of individuals who can make front to the complex situation described throughout this work. They are influential, action-oriented, compelling communicators capable of achieving public engagement at a level that allows making their audience aware of and responsive to any given situation they may try to tackle. Out of these four defining elements (Figure 6), orientation toward action is the most controversial since it entails combining science and activism.

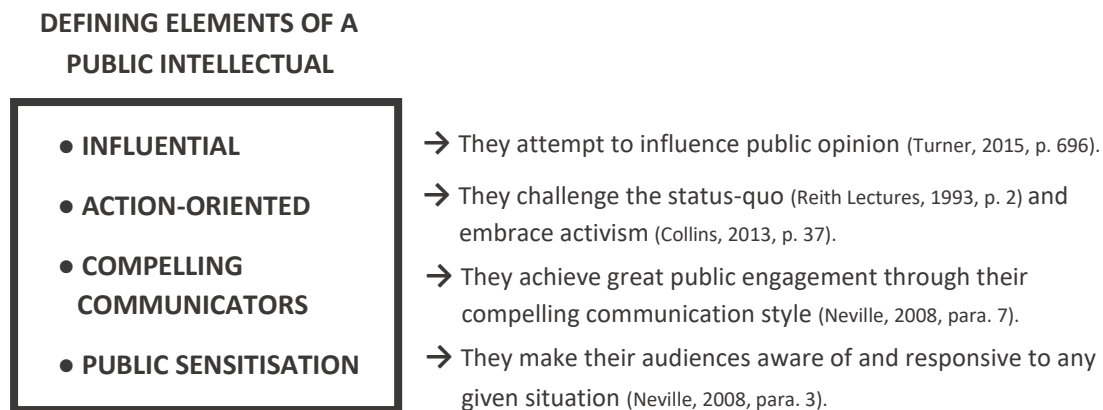


Figure 6. The four defining elements of public intellectuals: to be influential, action-oriented, compelling communicators and capable of sensitising their audience.

The popular perception is that “socially and often politically laden activism, striving to bring about social change, seems to be in stark contrast to the neutrality of scientific research” (Bandelli, 2015, p. 1). However, “science [also] involves values” (Ottinger, 2015, p. 1). Thus, it is necessary for science communicators to become public intellectuals that they transcend the value-free ideal (p. 3). It is necessary they understand that “the borders between socially motivated, value-driven activism and the pursuit of scientific knowledge are in fact osmotic membranes” (Bandelli, 2015, p. 3). Activism can be understood in many different ways. Typically, a distinction is made between social, political and environmental activism, but there is also intellectual activism and even entrepreneurship could be understood as a form of it. It is up to public intellectuals to decide how to direct their actions. For instance, Jane Goodall, a British scientific public intellectual, among many other contributions, has founded her own

Institute allowing her work and visions to inspire others to conserve the natural world. On the other hand, Jeremy Jackson, an American scientific public intellectual, has taken an advocacy role at the World Wildlife Fund, which is the leading organization in wildlife conservation. Intellectual activism, though, is essential to public intellectualism and it is performed by every public intellectual with no exceptions. It consists in “speaking truth” either to power or to the people (Collins, 2013, p. 37). Truth, though, should be understood not as a universal concept, but as facts and ideas that differ from what the establishment claims to be true (p. 37).

Stephen Lewis concluded his speech at the opening of the International AIDS Society Conference on Pathogenesis, Treatment and Prevention saying that to effect a global change “requires the collective will of people who speak with unimpeachable scientific authority, and [who] if they so wished, and brought advocacy to bear, could move the mountains of resistance and inertia” (Lewis, 2009, p. 84). In this regard, “we must support our public intellectuals —question their conclusions, but champion their causes, critique their claims, but provide them with alternative information” (Neville, 2008, para. 17). In the end, as Lamberts (2017) points out, “it [probably does not] matter if we call this public intellectualism, advocacy, activism or science communication” (p. 7), what matters is making a positive impact in the world.

4. Methodology

This study is intended as a first approach to the potential benefits of scientific public intellectualism on promoting scientific culture, as well as, to explore the pitfalls such a public figure should have to overcome to successfully act, within social institutions, as an agent of social change in today's Spanish society. The study is divided into two phases: a first literary research phase, and a second phase with a focus on quantitative and qualitative data collection and analysis. From the above critical assessment of selected relevant literature, it has been possible to establish what seems to be a strong theoretical association between the role of public intellectuals and the likelihood of their actions having a positive effect promoting a society with greater scientific culture, which partially supports H1 and RO[a]. As a brief recap:

H1_ Public intellectuals can help boost the development of a society with scientific culture.

RO[a]_ To determine how can public intellectuals help to develop a society with scientific culture.

RO[b]_ To identify potential Spanish scientific public intellectuals.

Additionally, literary research has allowed to propose a five-level model on how scientists can become public intellectuals (section 3.2; Figure 5). Particularly, the 'hierarchy toward scientific public intellectualism' has been constructed combining Lightman's (1999) hierarchy of levels of public intellectual together with Said's famous definition of an intellectual (Reith Lectures, 1993), Lamberts' (2017) point of view on having and expressing opinions, Stokes' (2017) pedagogical and performative approach, and, at last, Hecht's (2015) annotations about scientific celebrities. The new model will be used when addressing H2_ SCOPE 2_ RO[d]. As a brief recap:

H2_ The current Spanish context does not favour the democratisation of public intellectuals.

SCOPE 1 – UCC+i network

RO[c]_ To determine the suitability of the system that currently promotes scientific culture in Spain to support public intellectuals.

SCOPE 2_ Academic community

RO[d]_ To determine the willingness of scientists to become public intellectuals.

The second phase consisted in designing an online survey that would allow to compile data to address both hypotheses, although, H2 in a larger extent. In line with the theoretical argumentation and the defined research objectives, two different samples were considered to undertake the survey. On the one hand, people working as part of the UCC+i network, since it represents a setup with high potential to help Spain reach a greater level of scientific culture in a relatively short period of time (SCOPE 1). And, on the other hand, the academic community of the faculties of science of the University of Barcelona since academic intellectuals are the first

level in the proposed model toward scientific public intellectualism (SCOPE 2). Social factors that can limit the democratisation of public intellectuals are, thus, to be identified as related to one of the analysed samples or to other social aspects, groups or institutions.

The questionnaire was designed following Lissette's Fernández personal advice, as well as, her published considerations on how to elaborate a survey (Fernández Núñez, 2007). It was structured in 5 sections: three common sections plus one specific for each sample. The full survey can be found in Appendix 1. Google Forms was chosen as the platform to host the survey and its distribution was done by emailing. It is worth noting that the delivery to the different units of the UCC+i network was done in collaboration with César López, who is the responsible person of the network at the FECYT. The survey was made available from June 18 to June 29 and it was performed in Spanish so that respondents could easily provide their answers.

The survey combines three types of closed-ended and two types of open-ended questions. The former could be answered either by a simple 'yes' or 'no', by a four-point Likert scale, or by a five-point Likert scale. The four-point scale was intended for those questions where respondents were expected to have a formed opinion on that specific matter. They were asked to state their level of agreement with a given statement (disagree, slightly agree, mostly agree or completely agree), but they were deprived of the possibility to choose a neutral 'neither agree nor disagree' option. On the other hand, the five-point scale included the neutral option and was intended for those questions where it was not sure that respondents would have a formed opinion on the topic. In this case, they were asked to state their level of agreement or disagreement with a given statement (strongly disagree, disagree, neither agree nor disagree, agree or strongly agree). In specific cases, respondents were asked to further elaborate their answers by a follow up open-ended question asking 'why?'. And, lastly, the last open-ended question on the survey asked respondents to provide what they thought to be factors that could limit the democratisation of public intellectuals in Spain.

Descriptive statistics was performed using the Statgraphics Centurion XVIII software on those questions that required quantitative data analysis (closed-ended questions). Open-ended questions, though, required to be analysed qualitatively. It is important to note that qualitative research is highly time-consuming, in fact, it is estimated that data analysis requires two to five times more time than data collection (Miles & Huberman as cited in Fernández Núñez, 2006, p. 1). 'Why?'-questions have been merely used to provide illustrative examples to the argumentation. The analysis of question P39, though, has been performed taking into consideration the procedures reviewed by Fernández Núñez (2006) on how to analyse 'free text'

through codes. This process requires the formation of categories grouping together ideas or concepts that are similar (p. 4). The aim of the codification process is to reduce the amount of data (p. 6) and it is important to bear in mind that it requires the researcher to make value judgements about the meaning of the text subject to analysis (p. 4). The aim of the analysis is not to search if perceptions differ among the surveyed samples, but to acquire an overview of which aspects might prevent democratisation. Therefore, data from both samples, the UCC+i network and the academic intellectuals, have been processed together.

The codification process can follow an inductive or a deductive methodology. However, since the ultimate goal of the analysis is to connect the observations with a theory or set of constructs (Fernández Núñez, 2006, p. 9), it is possible to combine both methods in a mixed approach. The approach considers that “[el] esquema de códigos general no tiene un contenido específico, pero apunta a aspectos generales donde los códigos pueden desarrollarse inductivamente” (p. 10). Therefore, codes have been obtained directly from the data, but the formation of the different categories has been influenced by the topics drawn from the literature and already discussed throughout this work.

A total of 96 responses have been retrieved from question P39 and each response has been tagged with a 'name' or descriptive code that allows to express in a few words the concept to which it refers. Since a code might be common to more than one response, after completion of the analysis, 38 codes have been designated and grouped together under 9 categories. Those responses that neither form their own category nor fit any of the others have been grouped under a 10th category named 'related to other aspects'. Results have been depicted on a chart that shows the frequency of occurrence of each code and the percentage that each category represents (section 5.4). For the full list of responses see Appendix 9.

5. Description and analysis of the results

As informed by Lissette Fernández, online surveys generally receive a 20% response rate on average (personal communication, June 14, 2018). Therefore, it is important to frame the universe of the sample and to evaluate the actual survey's response rate.

The UCC+i network consists of 81 working units. The intrinsic diversity of the sample is, though, difficult to manage. However, each unit is known to integrate, at least, two technicians and the representative of the institution. It is, therefore, estimated that the minimum universe of the sample is about 243 people. The survey was distributed by the FECYT to 99 contacts, who were asked to forward it to the rest of technicians and to the representative of each of their units. The number of people who did, in fact, receive the survey is unknown, and therefore, the response rate that can be calculated is only an estimation. Considering that 34 replies to the questionnaire were obtained, and that the minimum universe of the sample is about 243 people, the response rate is estimated to be 14%. This rate is below the average for online surveys, which although not unexpected, it was thought that being distributed directly by a recognised institution such as the FECYT the response rate would have been much higher. By looking at the survey respondents' demographic traits (Table 1), it can be observed that the final sample mainly consists of technicians (82.4%) and that 9 out of 19 autonomous communities did not reply at all to the questionnaire. It is important to note that Andalusia, Catalonia and Madrid are the autonomous communities with the highest number of units and that many other communities count with a single UCC+i (FECYT, 2016, p. 13). The obtained data show to be consistent with this since Catalonia and Madrid present a higher response percentage, 35.3% and 14.7% respectively, compared to the other communities. Valencia (14.7%) instead of Andalusia (8.8%) is, though, the third community with more responses. Due to the obvious limitations of the sample, results are to be taken with an exploratory purpose. Conclusions cannot be generalised to apply to the whole UCC+i network and the overall outcome should be understood as part of an ongoing work to elucidate how can public intellectuals fit in the current Spanish society.

Academic intellectuals, characterised by being experts in a particular field of knowledge, constitute the first level of the proposed hierarchy toward scientific public intellectualism. Although, as pointed out by Lamberts (2017), "not all academics [are] necessarily intellectuals" (p. 4), all those academics with a PhD in science from the different faculties of the University of Barcelona were included as part of the academic community sample. The survey was sent to a total of 2.187 academics, of which 172 replied to the questionnaire reaching a 7.86% response rate (Table 2). The rate is quite below the average for online surveys, however, although all

academics were targeted, those who take part in science dissemination activities are of much more interest to this work since they are closer to becoming public intellectuals (level 1 and 2 of the hierarchy model; Figure 5). In fact, 125 out of the 172 respondents indicated that they conduct, in a greater or lesser extent, dissemination activities as part of their work (see question P19 in section 5.4). Thus, despite the low response rate, the sample quality is high with 72.7% of it representing science communication academics. It is worth noting at this point that questions P20 to P25 only consider the answers provided by this 72.7% of the sample (n=125). Overall, by looking at the survey respondents' demographic traits (Table 2), the sample is neither homogeneous nor can be said to be representative of the whole academic community. Therefore, results are to be taken with an exploratory purpose as for the UCC+i network sample. Conclusions cannot be generalised and, as stated above, the overall outcome should be understood as part of a broader picture trying to elucidate how can public intellectuals fit in the current Spanish society.

Table 1. Demographic Factors.

UCC+i network		
UCC+i RANK	Nº of responses*	TOTAL
UCC+i technician	28	82,4%
UCC+i representative	6	17,7%

AUTONOMOUS COMMUNITY	Nº of responses	TOTAL
Andalusia	3	8,8%
Aragon	2	5,9%
Asturias	1	2,9%
Balearic Islands	0	0,0%
Basque Country	1	2,9%
Canary Islands	0	0,0%
Cantabria	1	2,9%
Castilla-La Mancha	0	0,0%
Castile and León	2	5,9%
Catalonia	12	35,3%
Ceuta	0	0,0%
Extremadura	0	0,0%
Galicia	0	0,0%
La Rioja	0	0,0%
Madrid	5	14,7%
Melilla	0	0,0%
Murcia	1	2,9%
Navarre	1	2,9%
Valencia	5	14,7%

*Total sample survey respondents (n=34).

Table 2. Demographic Factors.

Academic community		
GENDER	Nº of responses*	TOTAL
Man	99	57,6%
Woman	73	42,4%

ACADEMIC RANK#	Nº of responses	TOTAL
<i>Investigador postdoctoral</i>	19	11,1%
<i>Personal externo</i>	7	4,1%
<i>Profesor/a agregado/a</i>	38	22,1%
<i>Profesor/a asociado/a</i>	25	14,5%
<i>Profesor/a catedrático/a</i>	29	16,9%
<i>Profesor/a emérito/a</i>	7	4,1%
<i>Profesor/a lector/a</i>	2	1,2%
<i>Profesor/a titular</i>	45	26,2%

UNIVERSITY FACULTY	Nº of responses	TOTAL
Biology	56	32,6%
Earth Sciences	9	5,2%
Pharmacy and Food Sciences	24	14,0%
Physics	22	12,8%
Mathematics and Informatics	5	2,9%
Medicine and Health Science	22	12,8%
Psychology	8	4,7%
Chemistry	26	15,1%

*Total sample survey respondents (n=172).

#Academic ranks are indicated in Spanish since not all of them have an English-equivalent translation.

The survey contains a total of 39 questions (P1 to P39) carefully designed to address the different hypotheses and research objectives of this work. Therefore, those questions that relate to the same research objective have been grouped together to facilitate the description and analysis of the results. Each section first introduces the questions indicating which sample answered it (either the UCC+i network, the group of academic intellectuals, or both) and the results that were obtained. Thereafter, the findings that can be deduced from the data are brought into discussion. All follow up questions that provide valuable insights to the discussion of the results have been included on the appendices. Furthermore, questions P31 to P38, have been excluded from the analysis. Apparently, the survey respondents do not have a formed opinion about the matters covered on the questions, which results on a high percentage of neutral answers invalidating the possibility of drawing any conclusion (Appendix 8).

5.1. Hypothesis 1. Research objective [a] and [b]

5.1.1. Data sheet

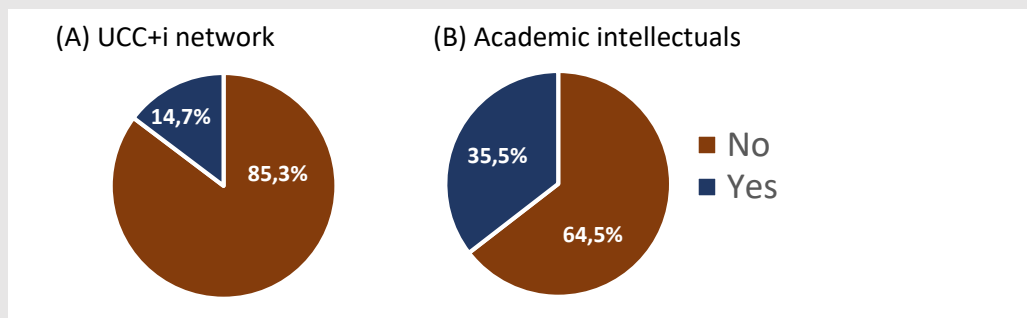
H1_ Public intellectuals can help boost the development of a society with scientific culture.

RO[a]_ To determine how can public intellectuals help to develop a society with scientific culture.

RO[b]_ To identify potential Spanish scientific public intellectuals.

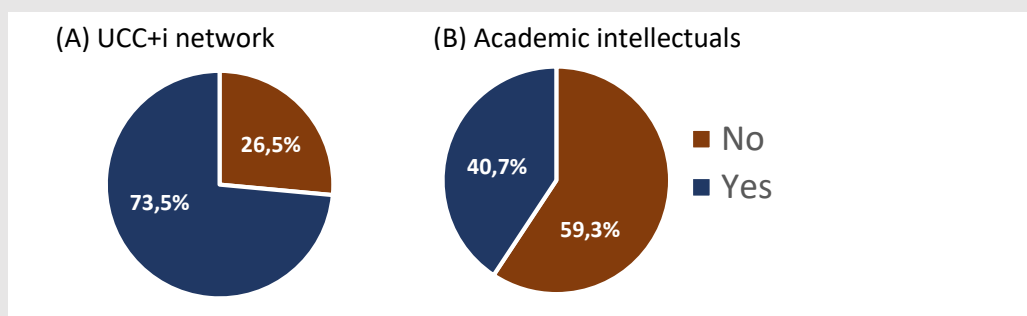
SURVEY QUESTIONS & RESULTS

P1_ Have you ever heard before of the public intellectual?



Base: Total sample survey respondents. (A) UCC+i network (n=34). (B) Academic intellectuals (n=172).

P2_ Would you say that the public intellectual currently exists in Spain?



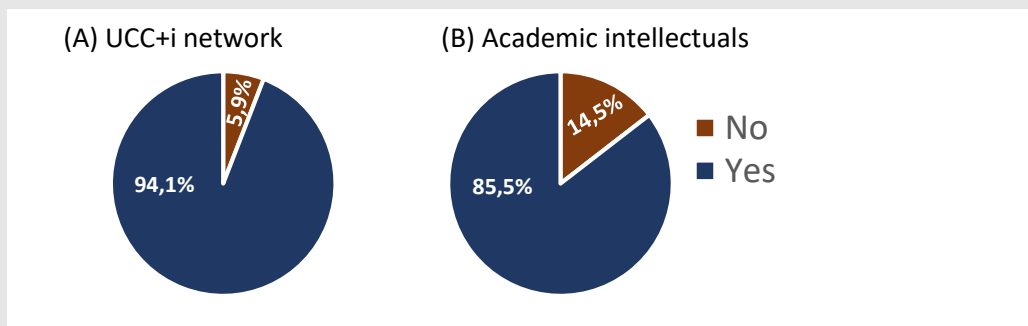
Base: Total sample survey respondents. (A) UCC+i network (n=34). (B) Academic intellectuals (n=172).

P3_ Could you indicate the name of anyone who you consider could currently be, or could have been, a public intellectual in Spain?

Abel Mariné Font	Gemma Marfany	Manel Esteller
Adolfo Quirós Gracián	Javier Peláez	Margarita Salas
Adonina Tardón García	Javier Sampedro	María Blasco
América Valenzuela	Javier Santaolalla	Mariano Marzo
Antoni Trilla Garcia	Joan Grimalt	Martí Boada
Antonio Martínez Ron	Joan Massagué	Miguel de Guzmán
Big Van Theory	Joan Oró	Miguel Delibes de Castro
Carlos Duarte	Joaquín Araújo	Narcís Prat
Clara Grima	Jorge Wagensberg	Pedro Alonso
Claudi Mans i Teixidó	José Antonio López	Pedro Arrojo
Cristina Junyent	José Baselga	Pedro Duque
Dani Jiménez	José Manuel López Nicolás	Pere Estupinyà
David Bueno i Torrens	José Manuel Sánchez Ron	Pere Puigdomènech
David Galadí	José Miguel Mulet	Ramón Folch
Eduard Masana	Josep Corbella	Rolf Tarrach
Eduardo Punset	Josep Peñuelas	Salvador Ribas
Enric Sala	Juan Carlos Izpisúa	Santiago Grisolia
Eudald Carbonell	Juan Ignacio Cirac	Santiago Ramón y Cajal
Federico Mayor Zaragoza	Juan Luis Arsuaga	Tomàs Molina
Félix Rodríguez de la Fuente	Juan Revenga	Valentín Fuster
Fèlix Serratosa	Juantxo López de Uralde	Valentín Rull del Castillo
Fernando Broncano	Laura Morrón	Xavier Barcons
Francis Villatoro	Lluís Montoliu	Xavier Querol

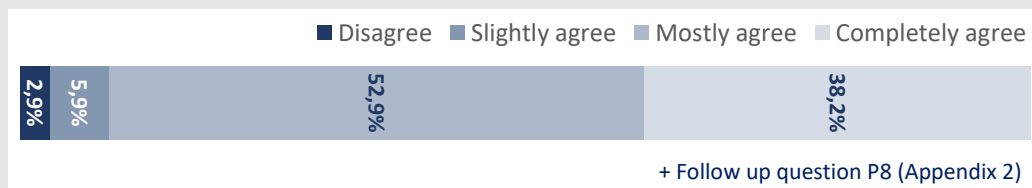
Base: UCC+i network and academic intellectuals responses combined.

P4_ Do you think that public intellectuals are necessary in today's society?



Base: Total sample survey respondents. (A) UCC+i network (n=34). (B) Academic intellectuals (n=172).

P7_ To democratise the public intellectual would help achieve a society with scientific culture.



Base: Total sample survey respondents. UCC+i network (n=34).

5.1.2. Findings

This work sets out to investigate if public intellectuals can help increase the level of scientific culture of Spanish society and, if so, how would they do it. From a thorough literary research, it has been possible to establish what seems to be a strong theoretical association between the role of public intellectuals and the likelihood of their actions having a positive effect promoting a society with greater scientific culture (section 3). Therefore, it was thought to be of value to know the opinion of the UCC+i network on this matter since, if they also were to perceive a positive association between scientific culture and this public figure that would further support the hypothesis. The survey was designed to first introduce the figure of the public intellectual and to provide respondents with some examples (Appendix 1). Thereafter, with respect to the objectives mentioned above, respondents were to indicate (i) if they have ever heard before about public intellectuals, (ii) if they think that such a public figure currently exists in Spain, (iii) if they think of them as necessary in today's society, and (iv) if they agree that democratising them would help to achieve a society with scientific culture. Results show that while the concept of public intellectualism is unknown for most of the sample (85.3%; P1(A)), nearly the same proportion, a 73.5%, considers that public intellectuals are currently a reality in Spain (P2(A)). Interestingly, whether or not they know about the term and/or they think that there are already people performing this public role, they almost unanimously perceive public intellectuals to be necessary in today's Spanish society (P4(A)). But, do they agree that incorporating this public figure as one more constituent of the social infrastructure would help achieve a society with scientific culture? In fact, 91.1% of the UCC+i network sample show a high degree of agreement supporting the potential benefits of democratising public intellectuals (P7). The reasons are quite diverse, but mainly refer to five concepts that can be summarised by quoting some of the respondents' answers (Appendix 2 for a list with all the answers):

- "La sociedad necesita *referentes*, no sólo *información* sobre temas científicos [emphasis added]."
- "Si se facilita la imagen del 'public intellectual' a la sociedad, esta gana poder y llega a más gente. Se les ha de dar *visibilidad* [emphasis added]."
- "Por su *influencia* [emphasis added]."
- "Para llegar a un *público* mucho *más amplio* [emphasis added]."

Based on these answers, it could be said that democratising public intellectuals would help achieve a society with scientific culture because it would allow scientific information to reach a broader public through individuals who are seen as referents and, as such, they are influential. However, there is a subtle proportion of the sample, 8.8%, who disagree (P7). Their opinion, though, should not be unnoticed (Appendix 2):

- “Nadie, por muy cualificado que sea o se considere, tiene derecho a ser ‘democratizado’. Esto huele a *tecnocracia* [emphasis added].”
- “Creo que si se institucionaliza la figura formaría parte de esa rueda burocrática y de intereses en la que suele abocar todo lo que se institucionaliza y *adquiere un cariz político* [emphasis added].”
- “La *educación en ciencia* [emphasis added] desde las etapas más tempranas es lo que ayudaría a alcanzar una sociedad con cultura científica.”

Some of the criticism relates to the idea that there are other ways to achieve a society with scientific culture. In this case, the alternative has been pointed to be the promotion of an education in science early in schools. A different concern relies on the fact that if public intellectuals are institutionalised as part of the democratisation process, they will also be inevitably politicised. This is a legitimate concern since there is proof that it occurs. In fact, when institutionalisation falls into politicisation is when private intellectuals are co-opted by corporations and governments to support claims that these power groups want to disseminate (section 3.2; Chomsky & Herman, 1988, p. 23). However, at this point, it is worth to remind the reader that private intellectuals are not considered real public intellectuals (section 3.2). Furthermore, in this work, institutionalisation does not refer to the idea of public intellectuals supporting specific institutions, but more to them having the support of those institutions. This is, of course, not optimal. But, considering that nowadays institutions have adapted to fit in the age of neoliberalism, the only option left for a public intellectual to support an institution would be if that institution had been founded with the aim of going against the current system. In other words, if ‘institution’ and ‘public intellectual’ have a common goal of challenging the status-quo. Those institutions, in my opinion, would be social enterprises since the goal of this type of enterprise is to solve a social issue, to generate a positive social impact.

The last, and probably, the most extreme critique concerning the idea of democratising public intellectuals is to relate ‘democratisation’ with ‘technocracy’. However, it is reasonable to think of this association. As it can be observed in Figure 2 (section 2.3), the three main models of public communication of science and technology have different ideological and philosophical concepts associated with them. In fact, technocracy is associated with the deficit model. However, public intellectuals, as already described in section 3.2.1, do not follow a deficit approach, instead, they fit better with the participation model, and thus, with the idea of a participatory democracy.

The perception of the academic community with respect to the worthiness of public intellectuals is also of great value since, as it will be discussed in a subsequent section, STEM academics are

a source of scientific public intellectuals. Therefore, the same first three questions described above for the UCC+i network sample were also asked to the group of academic intellectuals. It is interesting to see that over one-third of the respondents are aware of the term 'public intellectual' (P1(B)) and consider that there are already people performing this public role in Spain (P2(B)). Two-thirds of the sample, though, neither have ever heard before of this term nor they think it is something that exists nowadays. If STEM academics are to be encouraged to take a public role, it is important to ensure that more of them are aware of the term and some of the current referents. This seems even more important when considering the fact that most of the sample, 85.5% of it, perceive public intellectuals to be necessary in today's society (P4(B)). If they are willing to take the role themselves will be considered in the next section.

In accordance with the above argumentation, a first step in the democratisation process could be to identify scientific public intellectuals and to increase the visibility of those individuals on the public sphere so that society starts to recognise them as referents. Both samples were asked to provide the name of people who they consider could currently be, or could have been, public intellectuals in Spain. A total of 98 names were retrieved, of which 69 have been shown to be people with a relation with science and, thus, with the potentiality of being scientific public intellectuals (P3). However, they cannot be referred to as such, before a thorough research proves that they count with the defining elements of this public figure, which have been stated in section 3.2.3. Future studies should consider a case study methodology to approach this new line of research.

5.2. Hypothesis 2. SCOPE 1. Research objective [c]

5.2.1. Data sheet

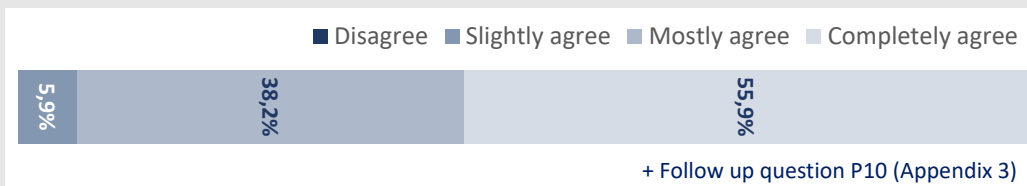
H2_ The current Spanish context does not favour the democratisation of public intellectuals.

SCOPE 1 – UCC+i network.

RO[c]_ To determine the suitability of the system that currently promotes scientific culture in Spain to support public intellectuals.

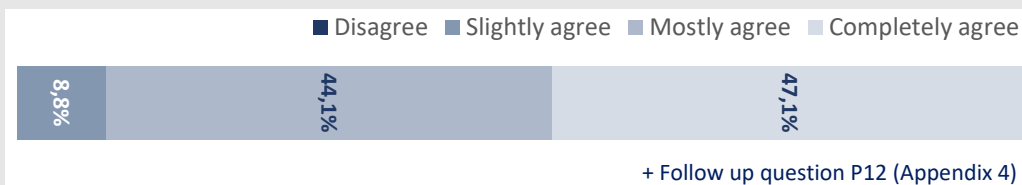
SURVEY QUESTIONS & RESULTS

P9_ The UCC+i network fulfils its aim of sensitising public opinion.



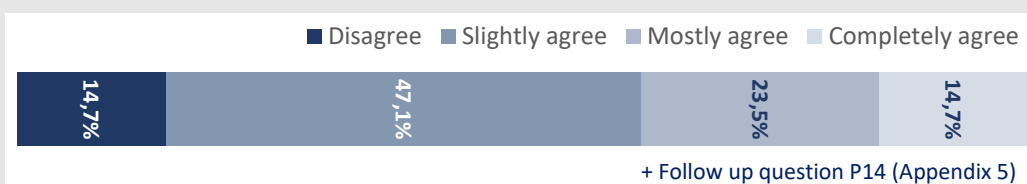
Base: Total sample survey respondents. UCC+i network (n=34).

P11_ The UCC+i network fulfils its aim of promoting scientists as opinion leaders.



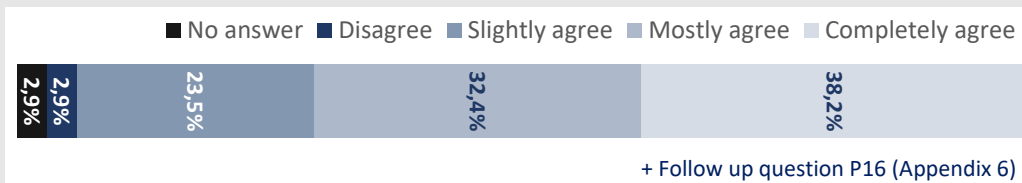
Base: Total sample survey respondents. UCC+i network (n=34).

P13_ The UCC+i network promotes activities to increase the participation of experts in the legislative activity of our country.



Base: Total sample survey respondents. UCC+i network (n=34).

P15_ The UCC+i network should give support to public intellectuals.



Base: Total sample survey respondents. UCC+i network (n=34).

5.2.2. Findings

Public intellectuals are committed to being critical about society's misdeeds actively willing to say so in public. The issues they tackle are controversial and it is not easy to speak about them without generating conflicts and being detrimental to some private enterprise. A society driven by profit-making purposes seems unlikely to be prone to favour the democratisation of a public figure who is willing to undermine those interests. To successfully act within an institution as agents of social change, public intellectuals need to overcome the many adversities that entails going against the system. But, what would happen if institutions start supporting this public figure? The UCC+i network brings together 81 different institutions working with determination to increase citizens' interest in science, as well as, their level of scientific culture. To promote scientific culture is not the main concern of scientific public intellectuals. However, they do so unconsciously as part of their *modus operandi* while they communicate the implications of science and technology, and while they engage with the public in compelling ways (section 3.2). If institutions within the UCC+i network were to give support to this public figure, it would make possible to measure the level of public engagement that they achieve with their actions. Data on public engagement could then be used as an indicator to qualitatively assess the impact that scientific public intellectuals have promoting scientific culture (section 3.1.2). The support of the UCC+i network would also corroborate the legitimacy of their causes and it would be a first step toward democratising public intellectuals. Most of the units of the network are, though, a small department within a bigger public institution such as a university or a research centre (FECYT, 2016, p. 12). Public institutions have always been highly dependent on government subsidies to perform their activities, but, nowadays, they also rely on a great extent on private funding. In fact, as already mentioned in section 2.2, the current knowledge-based economies are marked by the corporatisation of universities and, thus, this type of public institutions are now influenced by corporate purposes. It is unknown if the majority of the UCC+i network would be in disposition of supporting scientific public intellectuals since that might go in detriment of some of the corporate influences in which their institutions depend on.

To determine the suitability of the UCC+i network to support public intellectuals, they were asked to evaluate to which extent do they think they fulfil some of their objectives (P9, P11 and P13). The answers were analysed in order to identify limiting factors and it was assessed if public intellectuals could help overcome those limitations. Subsequently, they were asked if they think the network should give support to this public figure (P15).

The objectives of the UCC+i network take into account some of the tasks that are also to be performed by public intellectuals. If those tasks are proved to be fulfilled by the different units of the network, it would indicate that some of the critical aspects necessary to increase the level of scientific culture in Spain are already being successfully implemented without the need of scientific public intellectuals.

As stated in the publication *UCC+i: origen y evolución* (FECYT, 2016), one objective considers the importance of influencing public opinion:

“Todas las UCC+i, con independencia de su enfoque, trabajan por y para que la sociedad se sienta cada vez más atraída por la ciencia, [...], *contribuyendo a sensibilizar a la opinión pública* [emphasis added] sobre los avances de la investigación hasta superar su posición espectadora y facilitar su incorporación a la agenda científica”. (p. 10)

Results show that there is a high degree of agreement (94.1%) among the UCC+i sample with respect to the perception that the network fulfils in a great extent its aim of sensitising public opinion. However, a few respondents have a more critical opinion (P9; Appendix 3):

- “Hacen el trabajo de transferir resultados, pero no tanto de mostrar el impacto real.”
- “Las UCC+i hacen una tarea importante pero limitada. Llegan a poca gente y, a menudo, gente ya interesada en ciencia. Uno de los retos pendientes es llegar a la población que no le interesa la ciencia o que no sabe que le interesa la ciencia.”
- “Cumplen en la parte que aplica al desempeño; tengo dudas de que cumplan con el objetivo, es decir, no tengo claro que consigan el efecto deseado (por motivos extrínsecos).”

As stated in the same publication mentioned above, a second objective considers the role of scientists as opinion leaders:

“La *participación de los científicos como generadores de opinión* [emphasis added] en los temas de su competencia es una de las incorporaciones necesarias para consolidar una actitud informada y crítica de la sociedad, encaminada hacia su mayor implicación en la generación de ciencia”. (p. 9)

Results regarding the perception that the network fulfils its aim of promoting scientists as opinion leaders are very similar as compared to the first objective. Only an 8.8% of the sample point out the network to have problems to achieve this goal (P11). Some of the reasons why they think it is difficult to successfully achieve this goal are as follows (Appendix 4):

- “Tenemos poca capacidad de influencia sobre los científicos y su participación en divulgación.”
- “Creo que lo intentan, aunque en este caso depende del compromiso de los investigadores e investigadoras de sus instituciones.”
- “Porque no existe todavía una cultura del científico público como en el mundo anglosajón. En general, el debate de la opinión pública es muy bajo, deficiente y poco preparado para atender debates de este nivel.”
- “A veces no es fácil contar con la participación de los científicos por el miedo extendido de muchos de ellos de bajar al nivel de divulgación para todos los públicos.”

As stated in the publication *Libro blanco de las UCC+i* (FECYT, 2012), the third and last objective to be here analysed considers experts and policymaking:

“Las UCC+i pueden promover actividades que pongan en contacto a sus investigadores y los responsables de políticas públicas relacionadas con el conocimiento científico con el objetivo de *incrementar la participación de expertos en la actividad legislativa de nuestro país* [emphasis added]”. (p. 19)

Results show a quite different perception with respect to the objective of the UCC+i network of promoting activities to increase the participation of experts in the legislative activity of the country. In this case, results show that 61.8% of the respondents think that the network does not fulfil this goal or does it in a short extent. A 23.5% think the aim is achieved to a large extent and a 14.7% that the aim is successfully fulfilled by the network (P13). Thus, as opposed to the previous objectives, in this case, there is a higher proportion of people who think they generally fail to achieve this particular goal. The reasons are diverse, but can be summarised with the following examples (Appendix 5):

- “No creo que la función de las UCC+i incluya el poner en contacto investigadores con agentes políticos.”
- “No cuentan aún con el respaldo institucional suficiente.”
- “Creo que aún no está lo suficientemente activado este punto.”
- “Lo intentamos, pero no tenemos tanto poder. Nos enfocamos más hacia abajo, hacia la sociedad.”

Scientific public intellectuals attempt to influence public opinion, are considered strong opinion leaders and, among other things, they address not only the general public but also those who are in charge of legislation, policies and administrative decisions. From the above analysis, it could be said that the current system promoting scientific culture in Spain does perform quite successfully two of the main functions of a public intellectual. Thus, it could be argued if it is suitable or not for these institutions to actually support such a public figure when they manage

to perform a similar role. However, to satisfactorily fulfil the aforementioned roles does not allow for underrating public intellectuals, which can be justified by the thorough reflection done in previous sections on the social value of these individuals. The UCC+i network could still benefit from supporting public intellectuals in order to establish a connection between experts and policymakers since, so far, it seems to have problems to do so. It is important to establish this interrelation since it makes no sense to develop a disposition of citizens to participate actively on the R&D+i decision-making process if, in the end, those who are to take the final decisions are not ready to listen.

To provide further insights into the suitability of the UCC+i network to support public intellectuals, they were asked to indicate if they think they should support this public figure. Results show that almost all respondents are supportive in a greater or lesser extent (P15). A 23.5% slightly agree, a 32.4% mostly agree and, at last, a 38.2% completely agree with the aforementioned idea. It is worth taking a detailed look at the reasons that backup their opinions. Among those who are more willing to be supportive, public intellectuals are perceived as allies with whom to create synergies. As it decreases the level of agreement it increases the number of opinions that are more critical. There is who believes that to give them support would be beneficial for both parties, there is who considers that support should be given if it favours the objectives of the network, and, there is who thinks that it is not a priority to support this public figure since the network already performs too many things (Appendix 6):

- “Todos los agentes dedicados a promover la cultura científica en la sociedad deben de aunar esfuerzos para que el impacto de las acciones sea mayor.”
- “Sería provechoso tanto para el *public intellectual* que se beneficiaría de los contactos y del buen trabajo de las UCC+i como para la propia UCC+i ya que ayudaría a llevar su mensaje y misión de fomento del interés por la ciencia a otros públicos.”
- “Deben apoyar esta figura en la medida en la que favorece a sus objetivos, aunque es complejo valorizarla artificialmente.”
- “Nos dedicamos a tantas cosas, que añadir más deberes me parece excesivo. Si tuviéramos estructuras de personal más amplias, quizás alguna de las personas se podría dedicar a esta tarea. De momento no creo que sea ni un deber ni un objetivo prioritario.”

On the other hand, those who would not give support, or just in a lesser extent, to scientific public intellectuals is because they think of them as individuals who can make an impact without the support of the network, because supporting them could be controversial, and because their cause should be personal and private (Appendix 6):

- “Pueden dar apoyo, pero no sé si ‘deben’. Habitualmente se trata de perfiles que ya se desenvuelven adecuadamente en los distintos medios de comunicación y no requieren el soporte de una UCC+i.”
- “Apoyar a una ‘figura concreta’ es complicado, puede ser controvertido y no creo que sea la función de las UCC+i.”
- “Porque debe ser una misión de ellos, personal, privada.”

It seems that drawing a conclusion based on the available data would be neither appropriate nor representative of the reality. Although all respondents agree in some extent that the UCC+i network should support scientific public intellectuals, they provided a wide range of arguments that should be considered in more detail in further studies. However, it could be argued that whether they give their support or not, the different units and institutions within the network would benefit from studying the *modus operandi* of these public figures. The strategies they use could be applied to improve the communication and dissemination activities promoted by the UCC+i network.

5.3. Hypothesis 2. SCOPE 2. Research objective [d]

5.3.1. Data sheet

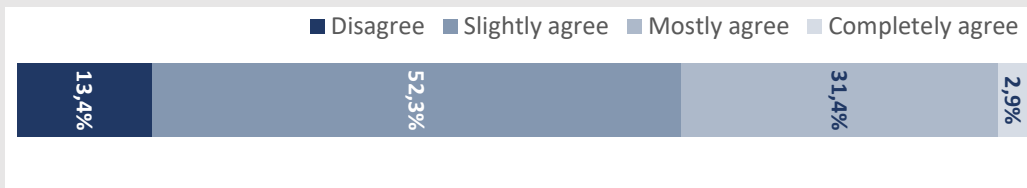
H2_ The current Spanish context does not favour the democratisation of public intellectuals.

SCOPE 2 – Academic community.

RO[d]_ To determine the willingness of scientists to become public intellectuals.

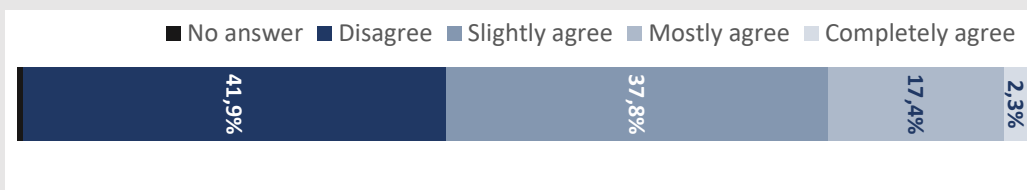
SURVEY QUESTIONS & RESULTS

P17_ Nowadays, scientific evidences have the impact that it corresponds in society.



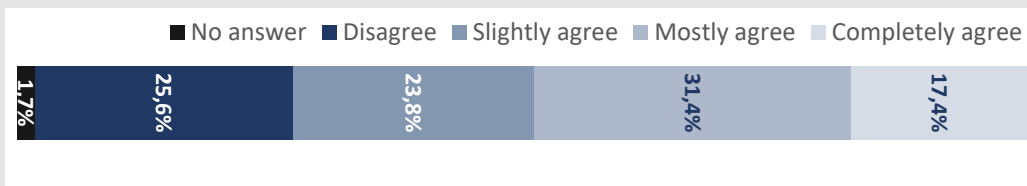
Base: Total sample survey respondents. Academic intellectuals (n=172).

P18_ Those who disseminate their work suffer the disapproval of the academic sector.



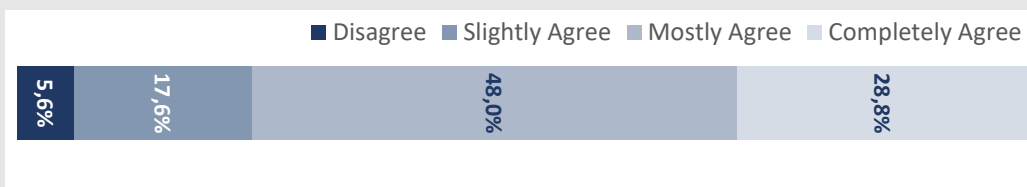
Base: Total sample survey respondents. Academic intellectuals (n=172).

P19_ I perform dissemination activities for non-specialised audiences as part of my job.



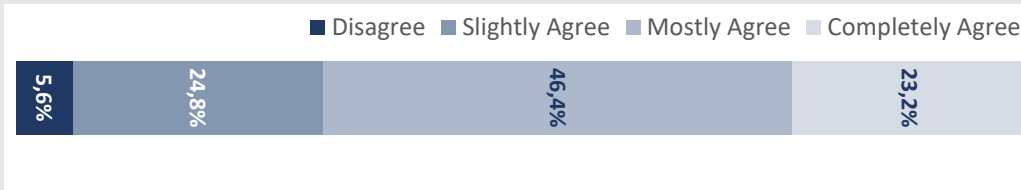
Base: Total sample survey respondents. Academic intellectuals (n=172).

P20_ When I disseminate science, I situate matters of scientific relevance into broader social, political and/or cultural contexts.



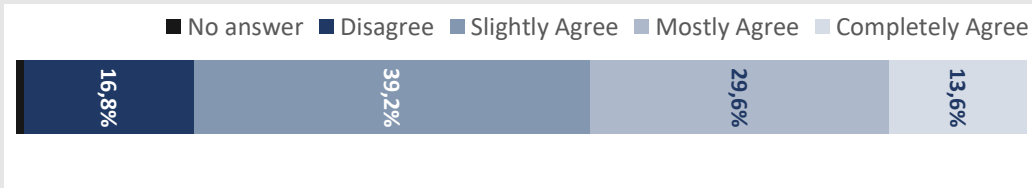
Base: Total sample survey respondents. Science communication academics (n=125).

P21_ I think it is important to express my opinion when I disseminate science.



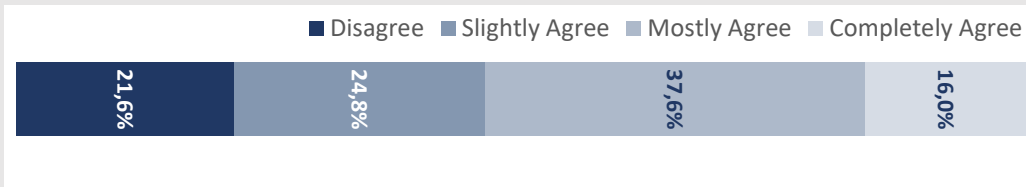
Base: Total sample survey respondents. Science communication academics (n=125).

P23_ Public scrutiny makes me refrain from commenting on controversial social issues.



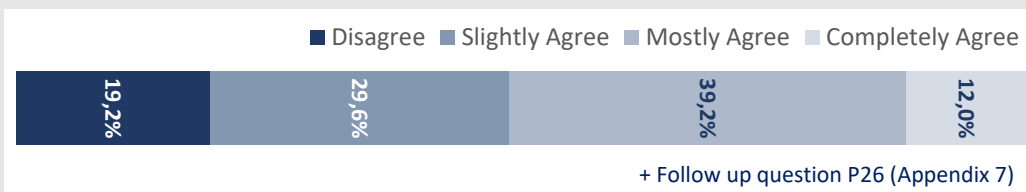
Base: Total sample survey respondents. Science communication academics (n=125).

P24_ I am willing to assume a role in the public sphere.



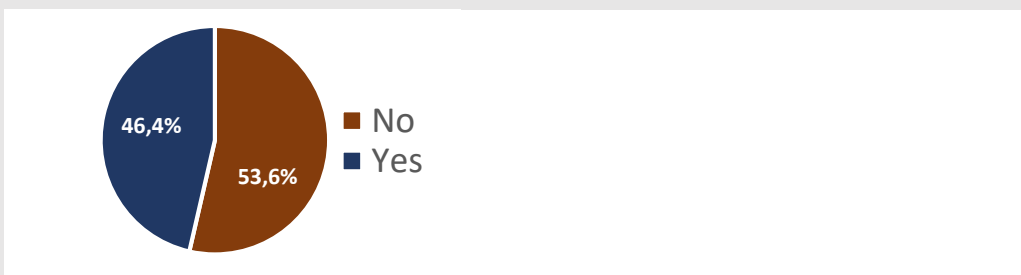
Base: Total sample survey respondents. Science communication academics (n=125).

P25_ I think it is important to conduct activism-related activities as part of my professional career.



Base: Total sample survey respondents. Science communication academics (n=125).

P6_ Do you think that to become a public intellectual is among your responsibilities as an academic?



Base: Total sample survey respondents. Science communication academics (n=125).

5.3.2. Findings

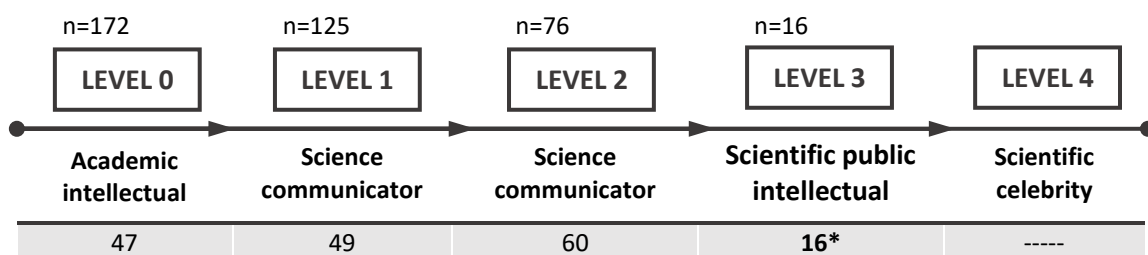
A society driven by profit-making purposes seems unlikely to be prone to favour the democratisation of a public figure who actively goes against the system encouraging others to do the same. Public intellectuals provide citizens with facts and ideas that differ from those provided by the establishment mostly through mass media. They try to make the world a better place and by doing so they expose themselves to be criticised and attacked, both at a professional and personal level, by those whose interests are being undermined. Science is intertwined with every other social aspect and it represents a critical and sceptical way of thinking that can help address global issues. However, examples of people trained in science who have become public intellectuals are scarce. Therefore, there is a need for scientists to take a stand to make the voice of science to be heard. But, are they willing to do so? Are scientists willing to take greater responsibilities?

To determine the willingness of scientists to become public intellectuals, a group of 172 academics with a PhD in science were asked to evaluate in which extent do they agree to perform, or to be willing to perform, actions that characterise this public figure. The five-level model toward scientific public intellectualism proposed in this work is here used as a tool to classify the sample discerning between academic intellectuals, science communicators, and scientific public intellectuals. Individuals can move upward through these levels as they incorporate into their way of being attributes that are characteristic of public intellectuals. To be outlined nearly as a scientific public intellectual, academics should state that they conduct science dissemination activities (P19) situating matters of scientific relevance into broader social, political and/or cultural contexts (P20) and expressing their opinions on those matters (P21 and P23). They also need to be willing to assume a role on the public sphere (P24) and to adopt activism as part of their career (P25). And, of course, they need to consider that it is a responsibility of theirs to become public intellectuals (P6).

It seems that, nowadays, not enough weight is being given to the evidence coming from science when decisions concerning society are to be made. Indeed, results show that almost two-thirds of the academics share this perception (P17). Even within the remaining one third, there is only a 2.9% of people who completely agree that science has the impact that it corresponds in society. The fact that scientists are aware of this situation might entail more of them developing an urge to do something to revert it. Favourably, “the historic cultural disapproval within the sciences of those who communicated their work publicly is breaking down” (Walker, 2017, p. 2). In fact, although there is a 20% who point out that disapproval still exists in a large extent, a

37.8% of the respondents perceive that it does not occur that much anymore, and a 41.9% disagree with the idea that it yet exists (P18). The majoritarian perception that disseminating science is no longer seen negatively is a step forward to promote scientists to more and more address a non-specialised public.

The hierarchy toward scientific public intellectualism considers that if academics do only see science communication as a tool to present the results of their research to the scientific community, they should be categorised as level 0 academic intellectuals. It is when they decide to address a non-specialised audience that they are to be considered level 1, or level 2, science communication academics (Figure 5). Results show that 72.7% of those who answered the survey conduct, in a greater or lesser extent, dissemination activities as part of their job, while the remaining 27.3% do not (P19). Thus, out of 172 respondents, 47 of them are to be categorised as academic intellectuals (Figure 7). The other 125 move upward to the next level of the hierarchy. The upcoming questions (P20 to P25 and P6) only consider the answers provided by those individuals. The next step is to elucidate if they are level 1, or level 2, science communicators. As described in section 3.2.1, level 1 is for those who merely act as convertors of jargon into language that can be easily understood by the public. Level 2, though, requires situating matters of scientific relevance into broader social, political and/or cultural contexts (P20) and, also having and expressing an opinion with respect to those matters (P21). When considering each requirement separately, most of those who engage in science dissemination activities do fulfil them. In fact, there is only less than a third of the sample failing to fulfil them (23.2% and 30.4% respectively). However, individuals need to comply with both to a large extent to be categorised into level 2 and only 76 out of the 125 science communicators indicate to do so (data not shown). As a result, 49 respondents fall into level 1 and 76 into level 2 (Figure 7).



*Individuals who are potentially to become scientific public intellectuals.

Figure 7. The hierarchy toward scientific public intellectualism as a tool to assess the willingness of academics to become public intellectuals.

Public intellectuals are a very special group of individuals and, thus, to be outlined nearly as such, academics need to be much more than science communicators. They need, among many other things, to comment on controversial topics (P23), to be willing to assume a role in the public sphere (P24) and to adopt activism as part of their career (P25). When it is individually analysed which proportion of the sample agrees to perform, or to be willing to perform, any of these three requirements, it is observed that more than a half of the science communication academics respond positively. A 56% state that public scrutiny does not make them refrain from commenting on controversial social issues (P23). A 53.6% show to be willing to actively participate in the public sphere (P24). And, a 51.2% believe they should conduct activism-related activities as part of their professional careers (P25). As previously mentioned in section 3.2.3, science and activism are generally perceived to be opposed, as two areas that should not be mixed together. In fact, this is one of the reasons stated by those academics who think activism is not part of their commitments, among others (Appendix 7):

- “Forma parte de dos esferas diferentes”.
- “Entiendo ‘activismo’ desde una perspectiva negativa”.
- “El activismo, tanto político como social, nunca puede ser, ni ha de ser, justificado científicamente”.
- “Una cosa es divulgar el conocimiento siendo crítico y otra es la ideología”.
- “El activismo debe formar parte de la vida personal, no de la laboral de un docente”.
- “Es una decisión personal”.

Activism and science, though, are brought together by scientific public intellectuals to generate a positive impact in society. The observed percentage in favour of participating in activism-related activities is quite promising since it represents that prevailing negative perceptions might be drifting toward being more positive. As provided by respondents (Appendix 7), some of these perceptions are:

- “Es una manera de poder llegar a cambiar cosas en la sociedad.”
- “Todos tenemos que participar de la transformación social que hay activa.”
- “Alguien ha de denunciar situaciones que muchos, por conocimiento o situación personal, no pueden realizar. Estar en la universidad es un compromiso social, hemos de actuar según nuestro deber para con la sociedad que nos paga por ello.”
- “Para que la visión desde el punto de vista científico también esté presente en el momento de desarrollar proyectos en un ámbito más social.”

It is reassuring to see that scholars, especially science communication academics, operate, or are willing to do so, similarly to a public intellectual. However, not everyone would consider that

it is their responsibility to fully take such a public role. In fact, although, more than half of the sample align with some of the characteristics of these particular individuals, only a 46.4% consider to be a responsibility of theirs to become a scientific public intellectual (P6). Thus, to complete the categorisation of the sample into the different levels of the hierarchy, it has been assessed whom of the 76 individuals previously classified as level 2 science communicators fulfil the last three requirements (P23, P24 and P25) and see themselves accepting such responsibility (P6). The outcome of the assessment indicates that only 16 individuals are well suited to be considered 'level 3' public intellectuals (data not shown; Figure 7). But, to actually consider them as scientific public intellectuals it would be necessary to perform a thorough evaluation of their performance based on a case study as also pointed out for the list of potential public intellectuals retrieved from question P3 (section 5.1).

It can be concluded that there are scientists willing to move upward in the hierarchy toward public intellectualism. Almost 10% of the analysed sample could potentially become scientific public intellectuals. Further studies should try to design a sample that can be considered representative of a larger group and that allows to define those willing to become more public based on demographic traits. That would allow to study if there is any relation between gender, tenure or other traits, and the willingness to become a scientific public intellectual.

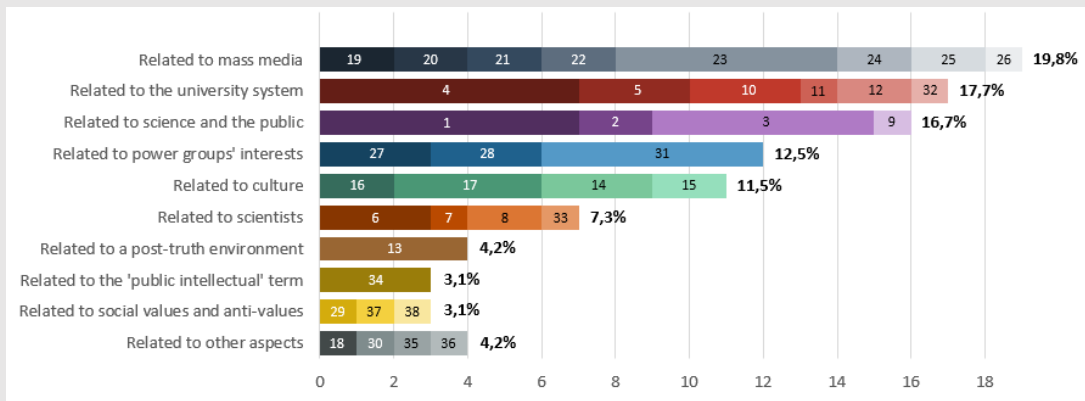
5.4. Hypothesis 2. Qualitative analysis of question P39

5.4.1. Data sheet

H2_ The current Spanish context does not favour the democratisation of public intellectuals.

SURVEY QUESTIONS & RESULTS

P39_ Indicate additional factors that you think could PREVENT public intellectuals from being democratised in Spain.



- | | | | |
|----|--|----|--|
| 1 | Lack of scientific culture. | 20 | Freedom of the media is compromised. |
| 2 | Science is underrepresented in schools. | 21 | Mass media interests. |
| 3 | Low public interest in science. | 22 | Lack of specialised science programmes in the media. |
| 4 | Lack of academic recognition. | 23 | The questionable priorities of mass media. |
| 5 | Lack of institutional support. | 24 | Questionable journalistic practices. |
| 6 | Scientists' lack of time. | 25 | Media dependence on political and economic powers. |
| 7 | Scientists' lack of motivation. | 26 | Media leaders' questionable competencies. |
| 8 | Scientists' objections. | 27 | Economic interests. |
| 9 | Science's technical language. | 28 | Economic pressures. |
| 10 | Scarcity of subsidies for scientific research. | 29 | The current social values. |
| 11 | A closed academic culture. | 30 | Lack of social acceptance. |
| 12 | Lack of resources. | 31 | The influence of power groups. |
| 13 | Post-truth environment. | 32 | Limited visibility of scientific societies. |
| 14 | Lack of critical thinking. | 33 | Lack of scientists in governance institutions. |
| 15 | Low literacy level of Spanish society. | 34 | English designation of the term 'public intellectual'. |
| 16 | Unfavourable public attitude toward culture. | 35 | Lack of habit. |
| 17 | Low cultural level of Spanish society. | 36 | Religion. |
| 18 | The influence of lobbies. | 37 | Intolerance. |
| 19 | Media lack of interest. | 38 | Dogmatism. |

Base: Total number of answers including both the UCC+i network and the academic intellectuals (n=96). The chart shows the frequency of occurrence of each code and the percentage that each category represents. See Appendix 9 for a chart with all the responses.

5.4.2. Findings

This work draws on the hypothesis that the current Spanish context does not favour the democratisation of public intellectuals. This public figure provides citizens with facts and ideas that differ from those provided by the establishment. They are committed to being critical of society's misconducts and, thus, the issues they tackle are controversial. This means that it is not easy to speak about them without generating conflicts and being detrimental to some private enterprise. It is for these reasons that a society driven by profit-making purposes seems unlikely to be prone to favour the democratisation of a public figure who is willing to undermine those interests. The last question of the survey (P39) asked respondents to provide factors that they think could prevent public intellectuals from being democratised. Question P39 has been analysed taking into consideration the procedures reviewed by Fernández Núñez (2006) on how to analyse 'free text' through codes. Although the final step of this type of analysis consists of constructing a conceptual model to depict how do the identified elements relate to each other (Fernández Núñez, 2006, p. 6), such a model has not been able to be described due to time constraints and, thus, it remains to be addressed in future studies. In this section, though, the different categories are connected to the theoretical foundations of the research, which are mainly related to how to achieve scientific culture, to the role of public intellectuals, to the potential benefits of supporting this public figure, and to the importance of scientists as a source of public intellectuals. Further comments upon some of the identified categories are provided when thought to add value to the discussion.

The category 'related to science and the public' provides elements, closely connected to the concept of scientific culture, that are thought to prevent public intellectuals from being democratised (P39). This category refers to a general lack of scientific culture and to the low public interest in science, which has been partially attributed to the fact that science is underrepresented in schools. Lastly, it also points as a limitation the technical nature of scientific information, which makes it difficult for the public to understand. As it has been described in section 3 and section 5.1.2, a strong theoretical association can be established between the role of public intellectuals and the likelihood of their actions having a positive effect promoting a society with greater scientific culture. Thus, it could be argued that these reasons do not prevent these individuals from acting, but rather they are one of the driving forces directing their actions.

The category 'related to the university system' includes as a limiting factor the lack of institutional support. In this work, institutional support has been addressed from the point of

view of the UCC+i network, which implies the support of universities since they are part of those institutions (section 5.2.2). Particularly, the two mentioned factors are (Appendix 9):

- “No hay ayuda desde nuestras universidades para ser formado en esta esfera”.
- “La falta en las universidades de tradición en promover debates sociales y preparar a los alumnos de ciencias en temas como las relaciones ciencia/sociedad”.

In this regard, to prepare university students to understand the relations between science and the public would be out of the scope of the UCC+i network. However, to promote social debates and to train researchers to acquire communication skills are roles that these units already perform (FECYT, 2012, p. 24; FECYT, 2006, p. 11). Thus, the support of the network does seem to be important to help democratise public intellectuals. Other elements of the university system that seem to be an obstacle to promote the activity of this public figure are the lack of academic recognition and the scarcity of resources, mostly economic (Appendix 9):

- “La competitividad y valoración de méritos de la carrera académica actualmente no da la importancia necesaria a nivel curricular de las acciones enmarcadas en *public intellectual*, lo que provoca que pocos académicos inviertan esfuerzos en esta línea dado que ello supone tiempo no dedicado a ‘publicar artículos científicos en revistas de impacto’, que es lo que se valora a nivel curricular”.
- “La divulgación científica muchas veces es una práctica voluntaria, no remunerada”.

It is reasonable to think that performing science dissemination activities should have proper academic recognition. However, it could be argued that these factors do not pose a negative influence with respect to the role of public intellectuals since “the intellectual’s representations, his or her articulations of a cause or idea to society, are not meant primarily to fortify ego or celebrate status” (Reith Lectures, 1993, p. 7). An intellectual “does all of these things not out of obligation to his society, but out of obligation to himself” (Lightman, 1999, para. 7). The recognition their activity might entail is not the incentive of their actions. Therefore, it is likely that all those scientists who would only consider acting as public intellectuals if their actions were to be recognised are not well-suited for the role.

Furthermore, economic recognition of such a role would entail conflict of interest. As it has been mentioned on two occasions in this work (section 3.2.1 and 5.1.2), when there is an economic interest, intellectuals risk compromising their principles. This happens when corporations and governments co-opt experts to support their claims (Chomsky & Herman, 1988, p. 23). In fact, categorised as ‘related to power groups’ interests’, the influence of power groups, economic pressures and interests are perceived as obstacles to the public intellectual (Appendix 9):

- “Hay que tener cuidado con el conflicto de intereses que se pueden dar entre empresas o fundaciones privadas que sustenten económicamente al *public intellectual*”.
- “Muchos investigadores/-as no se posicionan por miedo a represalias o a perder subvenciones o apoyos. Faltaría que fueran más independientes económicamente para que pudieran expresarse sin miedos”.
- “Interés de ciertas esferas para perpetuar el ‘analfabetismo científico’ como forma de control social”.

The last big category is ‘related to mass media’. The means of mass communication play a role of utmost importance in society. Chomsky & Herman (1988) describe this role on the first paragraph of their book *Manufacturing Consent*:

The mass media serve as a system for communicating messages and symbols to the general populace. It is their function to amuse, entertain, and inform, and to inculcate individuals with the values, beliefs, and codes of behaviour that will integrate them into the institutional structures of a larger society. (p. 1)

Membership to the level 3 of the hierarchy toward scientific public intellectualism (Figure 5), is “by invitation only” (Lightman, 1999, para. 14). An individual reaches a public intellectual status when the public recognises him or her as a referent, as “a symbol” (para. 14). It is through mass media that this public figure can gain visibility and social recognition. In fact, “there is a process of celebrification that has always imbued the presence of our thought leaders when they are present and are presented in the media that transforms them into very particular personas” (Marshall & Atherton, 2015, p. 69). For instance, although Robert Oppenheimer, also known as “the father of the atomic bomb” (Hecht, 2015, p. 1), was a talented physicist and a charismatic person, he became a public intellectual and a scientific celebrity not due to his contributions to science, but because of the many “actors who appropriated [his] story for political or cultural commentary” (p. 2). Thus, mass media are to play a crucial role if public intellectuals are to be democratised. However, it seems unlikely that they will support public intellectuals. Several aspects of the journalistic realm are perceived to be likely to prevent the democratisation of this public figure (Appendix 9):

- “Ausencia de libertad en la prensa para temas que puedan afectar intereses económicos o políticos influyentes”.
- “Los medios de comunicación están demasiado dependientes del poder económico y político”.
- “Se da más prioridad a otros temas de ‘supuesto’ interés. La ciencia no es todavía todo lo protagonista que debiera en la agenda de los medios”.

- “La falta de espacios especializados en televisión, que sigue siendo un gran medio de comunicación de masas”.
- “La falta de interés; no figura como una misión en muchos medios de comunicación, solo para vender más cuando hay dramas”.

Overall, although many other factors have been identified (P39; Appendix 9), it can be said that the Spanish context presents quite a lot of challenges that need to be overcome to successfully democratise public intellectuals. These individuals can face some of the factors themselves as it is part of their role as agents of social change, but there are many others that relate to an established social order influenced by a neoliberal trend. Those are more intricate problems.

6. Conclusions

As one of the European countries with the least scientific culture, Spain is looking to redefine the relations between science and the public putting an effort to promote public communication of science. This study is intended as a first approach to the potential benefits of scientific public intellectualism on promoting scientific culture, as well as, to explore the pitfalls such a public figure should have to overcome to successfully act, within social institutions, as an agent of social change in today's Spanish society. Conclusions neither can be generalised nor can be said to be quite significant due to sample limitations, thus, the overall outcome of this research should be taken as part of an ongoing work to elucidate how can public intellectuals fit in the current Spanish society.

From a thorough literary research, it has been possible to establish what seems to be a strong theoretical association between the role of public intellectuals and the likelihood of their actions having a positive effect promoting a society with greater scientific culture. This association is, preliminarily, further supported by a segment of the UCC+i network, which shows a positive perception about the potential benefits that democratising public intellectuals would have with respect to promoting scientific culture. All in all, it can be said there is enough evidence to consider the first hypothesis of this work to be confirmed. In fact, the fulfilment of the first research objective (RO[a]) has allowed to determine, based on the answers provided by a segment of the UCC+i network, that democratising public intellectuals would help achieve a society with scientific culture because it would allow scientific information to reach a broader public through individuals who are seen as referents and, as such, who are influential. Currently, efforts are being directed to democratise science, so citizens can actively participate in the R&D+i decision-making process. Public engagement is dependent on people having an interest and appreciating the practical implications of science and, although it cannot be proved if public intellectuals have a positive impact based on the scientific culture model of the appropriation of science until we start seeing them in the public sphere and evaluating the impact of their actions, they will certainly have a positive effect in society as can be justified by the thorough reflection provided in this work. Thus, future studies should evaluate the putative relation between the actions performed by scientific public intellectuals and the social appropriation of science. If such association can be established, it would prove that this public figure indeed promotes scientific culture. To perform such a study, it is necessary to first identify individuals who meet the requirements to be currently considered scientific public intellectuals in Spain, for which this work provides a list of 69 potential candidates (RO[b]).

If institutions within the UCC+i network were to give support to this public figure, it would make possible to measure the level of public engagement that they achieve with their actions. Then, retrieved data could be used as an indicator to quantitatively assess the impact that scientific public intellectuals have promoting scientific culture. The aim of the third research objective of this work (RO[c]) is to determine the suitability of this guild to support public intellectuals. Based on the analysed segment of the UCC+i network, it seems that some of the units could indeed be suitable to provide this support. They quite successfully achieve to influence public opinion and to promote scientists as opinion leaders, however, they could still benefit from supporting public intellectuals in order to establish a connection between experts and policymakers since, so far, it seems they have problems to do so. Furthermore, although the analysed segment of the network agrees in some extent that they should support scientific public intellectuals, they provided a wide range of arguments that should be considered in more detail before drawing any conclusion. Therefore, it remains inconclusive if although being suitable to give support they would provide it. It is, though, quite likely that their support denial would pose a negative influence on the process of democratisation of public intellectuals.

Public intellectuals provide citizens with facts and ideas that differ from those that the establishment claims to be true. Nowadays, the public domain is swamped with people undermining evidence-based arguments and, thus, scientists should take a stand to make the voice of science to be heard. From the sample of the study, it is reassuring to see that scholars, especially science communication academics, operate, or are willing to do so, similarly to a public intellectual in a greater or lesser extent. In fact, almost half of the science communicators consider to be a responsibility of theirs to become a scientific public intellectual. It can be concluded from the fourth research objective of this work (RO[d]) that there are scientists willing to move upward in the hierarchy toward public intellectualism. It is worth noting that this hierarchy is a conceptual approach developed in this work based on many existing definitions and interpretations of an intellectual. It is, therefore, considered an important contribution to facilitate future studies in this field.

Spain, as any other western society influenced by neoliberal trends, seems unlikely to be prone to favour the democratisation of a public figure who is willing to undermine the profit-making purposes of private enterprises if they consider there is a misconduct that should be denounced. Overall, many factors that could pose a negative influence on the process of democratisation of public intellectuals have been identified, among them: the general lack of scientific culture and the low public interest in science, the lack of institutional support, the lack of academic recognition and the scarcity of resources, and several factors related to mass media. According

to the second hypothesis of this work, it can be said that the Spanish context presents quite a lot of challenges that need to be overcome to successfully democratise this public figure. These individuals can face some of the factors themselves as it is part of their role as agents of social change, but there are many others that relate to an established social order, and those are more intricate problems. Particularly, the means of mass communication are to play a crucial role if public intellectuals are to be democratised since they allow this public figure to gain visibility and social recognition. Therefore, future studies should further investigate limiting factors within the journalistic realm, so they can be tackled in order to facilitate that the media can give support to scientific public intellectuals. Overall, results are consistent with the hypothesis, but further work should be done to confirm that the current Spanish context does not favour the democratisation of public intellectuals, so far, this serves just as a first approach to show that there are several factors that have a negative influence on such process.

All in all, there is a need to keep working to facilitate the connection between science and civil society by increasing the level of scientific culture of the country. This can be achieved among other things by using science communication strategies to promote a positive public attitude toward science and technology. A society where citizens appreciate and see positively the practical implications of science will, most likely, have higher chances of reaching a critical mass of science literate individuals. Those individuals would have well-founded opinions based on scientific concepts on many different topics and, thus, would be in disposition to participate actively in R&D+i decision-making. This, in fact, would have, at the same time, a positive impact on solving social issues since a well-founded opinion considering scientific concepts would bring public opinion closer to a consensus to pressure the state to take action.

The existence of countless social problems requiring an almost immediate solution if we want to avoid, or at least reduce, the consequences that derive from them and that in many cases we are already suffering, presses upon us to appeal our more intimate social conscience and to bring social issues to public debate. Merton (as cited in Noelle-Neumann, 1993) reflects on why most times public debate fails to deliver a decision:

The manifest function of public debate—bringing about a decision by presenting arguments in public—is conscious, intended, and approved of. Often, however, the population is not convinced on an *emotional level* [emphasis added] —not electrified—and the decision function thus lacks the strength required to create and defend the social consensus needed. (p. 233)

This brings us back to the three behavioural dimensions: cognitive, affective and conative. Plain scientific information will not accomplish to sensitise citizens making them aware and responsive to social issues. To change people's attitudes, we need to appeal to their emotions, and public intellectuals know how to do that. Rachel Carson, for instance, knew how "to portray problems in personally affective ways" (Neville, 2008, para. 5) and "her work is considered a key catalyst of the second wave of environmentalism in the United States" (para. 1). Therefore, it can be said that public intellectuals count with the skills and the attitude that are needed to make front to this complex situation, and, even more, that they can show us the way out of individualism so that we, as individuals, can generate a significant, positive change in our communities. They can be said to be the lever for change to a better future.

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Appendix 1. Full survey (in Spanish)

INTRODUCTION

Solicitamos amablemente su colaboración con el fin de recabar información para el proceso de elaboración de un proyecto final de máster en Comunicación Especializada por la Universidad de Barcelona. Dicho proyecto tiene por objeto analizar si el contexto español actual es proclive a favorecer la democratización de la figura del *public intellectual*. El cuestionario es anónimo y responderlo le llevará aproximadamente 10-12 minutos. Las preguntas abiertas no son obligatorias, pero resultan de gran valor para la elaboración del proyecto, por lo que esperamos tenga a bien responderlas en la medida de lo posible.

P.0a. Colectivo.

Intelectuales académicos	0
Red UCC+i	1

P.0b. Perfil del encuestado.

Investigador/a postdoctoral	1
Personal externo	2
Profesor/a agregado/a	3
Profesor/a asociado/a	4
Profesor/a catedrático/a	5
Profesor/a emérito/a	6
Profesor/a lector/a	7
Profesor/a titular	8
Técnico/a de una UCC+i	9
Responsable político/a de una UCC+i	10

P.0c. Sexo.**PREGUNTA EXCLUSIVA COLECTIVO 0**

Hombre	0
Mujer	1

P.0d. Facultad Universidad de Barcelona.**PREGUNTA EXCLUSIVA COLECTIVO 0**

Biología	1
Ciencias de la Tierra	2
Farmacia y Ciencias de la Alimentación	3
Física	4
Matemáticas e Informática	5
Medicina y Ciencias de la Salud	6
Psicología	7
Química	8

P.0e. Comunidad Autónoma.**PREGUNTA EXCLUSIVA COLECTIVO 1**

Andalucía	1
Aragón	2
Asturias	3
Cantabria	4
Castilla la Mancha	5
Castilla y León	6
Cataluña	7
Ceuta	8
Extremadura	9
Galicia	10
Islas Baleares	11
Islas Canarias	12
La Rioja	13
Madrid	14
Melilla	15
Murcia	16
Navarra	17
País Vasco	18
Valencia	19

SECCIÓN 1. Figura del *public intellectual***SECCIÓN COMÚN A AMBOS COLECTIVOS**

Un *public intellectual* es aquella persona que posee conocimientos especializados y que habla y opina con el objetivo de influenciar a la opinión pública acerca de asuntos sociales controvertidos que van más allá del campo en el que es experta. Estos individuos son agentes de cambio social, desafían el statu quo y actúan asumiendo responsabilidades para mejorar la sociedad. No solo llevan a cabo una función pedagógica de divulgación, sino que su actuación también es performativa, ya que dota a la ciudadanía de los conocimientos y las herramientas necesarios para que pueda participar en la toma de decisiones importantes respecto a temas que afectan a la sociedad en su conjunto. Algunos ejemplos de *public intellectuals* serían los siguientes:

- Jane Goodall (británica): etóloga, primatóloga y antropóloga. Activista en asuntos de conservación y bienestar animal.
- Rachel Carson (estadounidense): bióloga marina. Activista en asuntos de conservación.
- Robert Oppenheimer (estadounidense): físico. Activista contra el armamentismo nuclear.

P.1. ¿Ha oído hablar en alguna ocasión de la figura comunicativa del <i>public intellectual</i>?	
Sí	1
No	0

P.2. ¿Diría que actualmente existe en España la figura del <i>public intellectual</i>?	
Sí	1
No	0

P.3. ¿Podría indicar algún ejemplo de personas que considere que son o que fueron <i>public intellectuals</i> y que desarrollan o desarrollaron su actividad como tales en el territorio español?	
Respuesta abierta.	

P.4. ¿Cree que la figura del <i>public intellectual</i> es necesaria en la sociedad actual?	
Sí	1
No	0

P.5. ¿Por qué?	
Respuesta abierta.	

P.6. ¿Cree que entre sus responsabilidades como académico/a está la de asumir el papel de <i>public intellectual</i>?	
PREGUNTA EXCLUSIVA DEL COLECTIVO 0	
Sí	1
No	0

SECCIÓN 2. Las UCC+i	
SECCIÓN EXCLUSIVA COLECTIVO 1	
Entendiendo CULTURA CIENTÍFICA desde la perspectiva que alude al concepto de participación ciudadana, «una sociedad con cultura científica sería aquella que permite y fomenta la participación democrática de sus ciudadanos en las decisiones sobre ciencia y tecnología» (EPSCYT 2010:184).	
Por otro lado, el concepto de DEMOCRATIZACIÓN hace referencia al proceso de incorporar la figura del <i>public intellectual</i> a la infraestructura social como un constituyente más. Dicho proceso busca permitir y facilitar que estos individuos puedan actuar como agentes de cambio social asumiendo responsabilidades para mejorar la sociedad.	
Indique, en una escala del 1 al 4, su grado de acuerdo respecto a los siguientes enunciados.	
(1) = Nada de acuerdo	
(2) = Poco de acuerdo	
(3) = Bastante de acuerdo	

(4) = Totalmente de acuerdo

P.7. La democratización de la figura del <i>public intellectual</i> ayudaría a alcanzar una sociedad con cultura científica.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.8. ¿Por qué?	
Respuesta abierta.	

P.9. Las UCC+i cumplen con su finalidad de sensibilizar a la opinión pública.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.10. ¿Por qué?	
Respuesta abierta.	

P.11. Las UCC+i cumplen con su función de promover activamente la participación de los científicos como generadores de opinión.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.12. ¿Por qué?	
Respuesta abierta.	

P.13. La Red de UCC+i promueve actividades que ponen en contacto a sus investigadores y los responsables de políticas públicas relacionadas con el conocimiento científico, incrementando así la participación de expertos en la actividad legislativa de nuestro país.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.14. ¿Por qué?	
Respuesta abierta.	

P.15. Las UCC+i deben dar apoyo al perfil comunicativo del <i>public intellectual</i>.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.16. ¿Por qué?
Respuesta abierta.

SECCIÓN 3. Los intelectuales académicos

SECCIÓN EXCLUSIVA COLECTIVO 0

Indique, en una escala del 1 al 4, su grado de acuerdo respecto a los siguientes enunciados.

- (1) = Nada de acuerdo
 (2) = Poco de acuerdo
 (3) = Bastante de acuerdo
 (4) = Totalmente de acuerdo

P.17. En la actualidad, las evidencias que aporta la ciencia tienen la repercusión social que les corresponde.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.18. Aquellas personas que divulgan su trabajo sufren la desaprobación del sector académico.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.19. Realizo actividades de divulgación para públicos no especializados como parte de mi trabajo.	
Si su respuesta es que no está 'nada de acuerdo', deje el resto de las preguntas sin responder y continúe en la sección 4.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.20. Al divulgar temas de ciencia voy más allá del aspecto científico refiriendo mis comunicados a un contexto social, político y/o cultural determinado.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.21. Creo que es importante expresar mi opinión cuando realizo actividades de divulgación.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3

Totalmente de acuerdo	4
-----------------------	---

P.22. ¿Por qué?
Respuesta abierta.

P.23. El escrutinio público hace que me reserve mi opinión respecto a temas socialmente controvertidos.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.24. Estoy dispuesto a asumir un papel en la esfera pública.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.25. Creo que es importante incluir el activismo como parte de mi carrera profesional.	
Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.26. ¿Por qué?
Respuesta abierta.

SECCIÓN 4. Los medios de comunicación

SECCIÓN COMÚN A AMBOS COLECTIVOS

El concepto de DEMOCRATIZACIÓN hace referencia al proceso de incorporar la figura del *public intellectual* a la infraestructura social como un constituyente más. Dicho proceso busca permitir y facilitar que estos individuos puedan actuar como agentes de cambio social asumiendo responsabilidades para mejorar la sociedad.

Indique, en una escala del 1 al 4, su grado de acuerdo respecto a los siguientes enunciados.

- (1) = Nada de acuerdo
 (2) = Poco de acuerdo
 (3) = Bastante de acuerdo
 (4) = Totalmente de acuerdo

P.27. Las UCC+i, en su mayoría, mantienen una estrecha relación con los medios de comunicación.	
PREGUNTA EXCLUSIVA DEL COLECTIVO 1	
Nada de acuerdo	1

Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.28. La cobertura que los medios de comunicación hacen de temas científicos es extensa.

PREGUNTA EXCLUSIVA DEL COLECTIVO 0

Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.29. Los medios de comunicación de masas deberían facilitar la democratización de la figura del *public intellectual*.

Nada de acuerdo	1
Poco de acuerdo	2
Bastante de acuerdo	3
Totalmente de acuerdo	4

P.30. Los medios de comunicación de masas permiten a la figura del *public intellectual* adquirir visibilidad en la esfera pública; sin embargo, no todos los medios facilitan de la misma manera la democratización de esta figura comunicativa.

Indique, en una escala del 1 al 4, su grado de acuerdo respecto a si considera que los siguientes medios pueden promover la democratización de la figura del *public intellectual*.

- (1) = Nada de acuerdo
- (2) = Poco de acuerdo
- (3) = Bastante de acuerdo
- (4) = Totalmente de acuerdo

Televisión	1	2	3	4
Radio	1	2	3	4
Prensa escrita	1	2	3	4
Revista divulgación científica o técnica	1	2	3	4
Youtube	1	2	3	4
Prensa digital	1	2	3	4
Redes sociales y otras webs	1	2	3	4

SECCIÓN 5. Democratización del *public intellectual* – Factores

SECCIÓN COMÚN A AMBOS COLECTIVOS

Ya para finalizar, indique en una escala del 1 al 5 su grado de acuerdo o desacuerdo con cada uno de los siguientes enunciados respecto a factores que pueden limitar o promover la democratización de la figura del *public intellectual* en España.

- (1) = Totalmente en desacuerdo
- (2) = Bastante en desacuerdo
- (3) = Ni de acuerdo ni en desacuerdo
- (4) = Bastante de acuerdo
- (5) = Totalmente de acuerdo

P.31. La sociedad actual se rige por valores individualistas más que por valores sociales.

Totalmente en desacuerdo	1
Bastante en desacuerdo	2
Ni de acuerdo ni en desacuerdo	3
Bastante de acuerdo	4
Totalmente de acuerdo	5

P.32. Todavía no se ha democratizado la figura del *public intellectual* dado que el campo de la comunicación científica se inició en España tres décadas más tarde que en otros países europeos y, por tanto, vamos con retraso.

Totalmente en desacuerdo	1
Bastante en desacuerdo	2
Ni de acuerdo ni en desacuerdo	3
Bastante de acuerdo	4
Totalmente de acuerdo	5

P.33. La presión económica que deriva de la capitalización del conocimiento científico y que hace depender de fondos privados a los investigadores limita la libertad de estos para hablar de temas que poseen una dimensión política e ideológica con componentes de crítica social.

Totalmente en desacuerdo	1
Bastante en desacuerdo	2
Ni de acuerdo ni en desacuerdo	3
Bastante de acuerdo	4
Totalmente de acuerdo	5

P.34. Aquellos intelectuales que hablan públicamente acerca de temas controvertidos desafiando el *statu quo* sufren el rechazo de la comunidad científica (academia).

Totalmente en desacuerdo	1
Bastante en desacuerdo	2
Ni de acuerdo ni en desacuerdo	3

Bastante de acuerdo	4
Totalmente de acuerdo	5

P.35. Los intelectuales tienden a no hablar públicamente acerca de temas controvertidos por miedo a quedar aislados socialmente.

Totalmente en desacuerdo	1
Bastante en desacuerdo	2
Ni de acuerdo ni en desacuerdo	3
Bastante de acuerdo	4
Totalmente de acuerdo	5

P.36. Los intelectuales no suelen participar de acciones con la intención de generar un impacto social por miedo a la desaprobación.

Totalmente en desacuerdo	1
Bastante en desacuerdo	2
Ni de acuerdo ni en desacuerdo	3
Bastante de acuerdo	4
Totalmente de acuerdo	5

P.37. El sistema periodístico actual ha generado un pseudoentorno en el que la ciencia tiene difícil cabida, más aún si contiene elementos de controversia y crítica social.

Totalmente en desacuerdo	1
Bastante en desacuerdo	2
Ni de acuerdo ni en desacuerdo	3
Bastante de acuerdo	4
Totalmente de acuerdo	5

P.38. Estamos tan acostumbrados socialmente a percibir la ciencia como un ámbito separado de la sociedad, que nos conformamos con que sea así sin darnos cuenta.

Totalmente en desacuerdo	1
Bastante en desacuerdo	2
Ni de acuerdo ni en desacuerdo	3
Bastante de acuerdo	4
Totalmente de acuerdo	5

P.39. Indique otros factores que crea puedan LIMITAR la democratización de la figura del *public intellectual* en España.

Respuesta abierta.

Appendix 2. Follow up question P8. UCC+i network.

P7_ To democratise the public intellectual would help achieve a society with scientific culture.

P8_ Why?

	(1) Disagree	(2) Slightly agree	(3) Mostly agree	(4) Completely agree
1	"La única democratización posible parte de la equiparación soberana de todos los sujetos constituyentes. Nadie, por muy cualificado que sea o se considere, tiene derecho a ser 'democratizado'. Esto huele a tecnocracia. No olvidemos que todos escondemos un interés detrás de nuestras acciones."			
2	"Creo que si se institucionaliza la figura formaría parte de esa rueda burocrática y de intereses en la que suele abocar todo lo que se institucionaliza y adquiere un cariz político."			
2	"La educación en ciencia desde las etapas más tempranas es lo que ayudaría a alcanzar una sociedad con cultura científica."			
3	"Porque daría respuesta a preguntas sociales."			
3	"Porqué la sociedad necesita referentes, no sólo información sobre temas científicos."			
3	"Aunque resulta plausible que la introducción de esta figura en la vida pública ayude en la promoción de la cultura científica, creo que el hecho de que una sociedad valore las aportaciones de científicos e intelectuales es más un indicador del nivel de imbricación social que la ciencia ha alcanzado en dicha sociedad. Es por tanto más un resultado que un incentivo, desde mi punto de vista."			
3	"Para que la sociedad adquiera cierta cultura de temas científicos es necesario que cuente con referentes conocidos, con <i>public intellectuals</i> que aparezcan en los medios, sean referentes en redes sociales, etc. para llegar al público."			
3	"Si se facilita la imagen del <i>public intellectual</i> a la sociedad, está gana poder y llega a más gente. Como pasa en tele5 con otro tipo de personajes o jugadores de fútbol. Se les ha de dar visibilidad."			
3	"Creo que podría facilitar que se entendieran determinados asuntos que usualmente no se conocen por la mayoría de los ciudadanos de a pie."			
3	"Siempre que el <i>public intellectual</i> actuara de la forma más objetiva posible y ofreciendo todos los puntos de vista sobre un tema, la sociedad contaría con mayor información para la toma de decisiones que es la base de la democracia participativa."			
3	"Esta persona haría que la sociedad tuviera un conocimiento más amplio de temas científicos y por tanto pueda hacerse su propia idea de los hechos."			
3	"Ayudaría, aunque no lo veo esencial."			
4	"Porque se trata de una figura cuyo mensaje se basa en evidencias científicas."			
4	"Simplemente por el hecho de poder hablar de un tema de forma crítica, argumentada y con conocimiento de causa porque uno se ha informado demuestra que no hace falta ser un 'experto en X' para poder tener una opinión sólida sobre un tema determinado. ¿No lo hacemos con política, o con fútbol o con muchos otros temas? Ya llega la hora en la que la sociedad tenga la oportunidad de hablar y decidir sobre políticas científicas."			
4	"Cuantos más <i>public intellectuals</i> hubiera se lograría mayor impacto en la sociedad y una mayor formación en cultura científica."			
4	"Por su influencia."			
4	"Porque actúan como <i>influencers</i> y por lo tanto son escuchados y fomentan el posicionamiento."			
4	"Porque pondría el conocimiento al alcance de la ciudadanía."			
4	"Ayudaría a conseguir reconocimiento social a una labor que actualmente no está muy reconocida de manera oficial."			
4	"Al formar a la sociedad, ésta se vuelve más democrática y elige mejor a sus representantes."			
4	"Su comunicación sobre ciencia sería efectiva en los términos antes descritos."			
4	"Para llegar a un público mucho más amplio."			

Appendix 3. Follow up question P10. UCC+i network.

P9_ The UCC+i network fulfils its aim of sensitising public opinion.

P10_ Why?

	(1) Disagree	(2) Slightly agree	(3) Mostly agree	(4) Completely agree
2				"A veces acaban siendo entidades de comunicadores científicos para comunicadores científicos."
2				"Deberían tener más impacto. La gente no sabe que significa UCC+i."
3				"Hacen el trabajo de transferir resultados, pero no tanto de mostrar el impacto real."
3				"Somos intermediarios entre los actores de la Ciencia y la Tecnología y los ciudadanos desde el ámbito educativo al lúdico y cultural por lo que contribuimos a formar e informar sobre temas importantes que nos afectan a todos."
3				"Las UCC+i hacen una tarea importante pero limitada. Llegan a poca gente y, a menudo, gente ya interesada en ciencia. Uno de los retos pendientes es llegar a la población que no le interesa la ciencia o que no sabe que le interesa la ciencia."
3				"No todas, depende de las acciones que lleven a cabo."
3				"Cumplen en la parte que aplica al desempeño; tengo dudas de que cumplan con el objetivo, es decir, no tengo claro que consigan el efecto deseado (por motivos extrínsecos)."
3				"No sé si lo cumplen, pero lo intentan. Nosotros tratamos de organizar actividades que respondan a las inquietudes de la sociedad, que les hagan conscientes de determinados problemas y qué pueden aportar ellos para contribuir en su solución."
3				"Sí, pero solo llegan a un cierto número de personas relativamente reducido."
3				"Considero que las UCC+i que realizan actividades de divulgación buscan no solo la difusión del conocimiento, sino la concienciación sobre temas por ejemplo como el cambio climático, la vacunación, los transgénicos, etc."
3				"Porque trasladan el conocimiento especializado a un público que, de otro modo, no tendría acceso a él."
4				"Porque precisamente ésta es una de sus principales misiones."
4				"Porque hacen de nexo entre el investigador y la sociedad, siempre con el mensaje científico como base de dicho nexo."
4				"La labor de las UCC+i es el fomento de la cultura científica, aunque se limitaran a una comunicación tradicional de NdP o estática ya estarían contribuyendo. Pero ahora, cada vez más, se están proponiendo actividades de participación ciudadana en ciencia en las que el público tiene un papel cada vez más activo y se huye de la comunicación unidireccional en la que es un mero receptor de información. Eso ayuda a sensibilizar a la opinión pública."
4				"El trabajo de las UCC+i es básico para sensibilizar a la opinión pública en temas científicos. Hacen un gran trabajo de comunicación y divulgación de la ciencia."
4				"Son un agente de interfaz que ayuda a canalizar las inquietudes de unos y otros."
4				"Porque conectan con el ámbito local."
4				"Los contenidos que generan aportan cultura científica a la sociedad."
4				"Porque su objetivo es mejorar la cultura científica de la sociedad."
4				"Crean continuamente contenidos y mensajes positivos sobre la trascendencia de la ciencia en nuestras vidas."
4				"Porque ofrecen información rigurosa y contrastada con fuentes expertas sobre las disciplinas que divulga."
4				"Realizan actividades para divulgar la ciencia y la tecnología a la sociedad."
4				"Sirve de puente entre ciencia y sociedad y son capaces de transmitir los conceptos de la mejor manera para que lleguen a la sociedad."
4				"Las UCC+i acercan la ciencia a la sociedad y hacen que ésta conozca aspectos diferentes y los haga cotidianos."
4				"Porque somos estructuras profesionalizadas, con una trayectoria considerable y que intenta incidir de diversos modos en toda la sociedad."

Appendix 4. Follow up question P12. UCC+i network.

P11_ The UCC+i network fulfils its aim of promoting scientists as opinion leaders.

P12_ Why?

	(1) Disagree	(2) Slightly agree	(3) Mostly agree	(4) Completely agree
2	"Tenemos poca capacidad de influencia sobre los científicos y su participación en divulgación."			
2	"Creo que lo intentan, aunque en este caso depende del compromiso de los investigadores e investigadoras de sus instituciones."			
3	"Facilitamos canales de comunicación para que los científicos puedan acceder y acercarse a los ciudadanos y viceversa."			
3	"Facilitan el acceso a los medios de comunicación, promueven eventos divulgativos..."			
3	"Una de las tareas de las UCC+i es conseguir que los científicos salgan de los laboratorios y participen en actividades de divulgación, vayan a medios de comunicación..."			
3	"Porque si se trabaja con científicos directamente y se les hace posicionar frente a temas controvertidos, pueden influir generando opinión."			
3	"Porque no existe todavía una cultura del científico público como en el mundo anglosajón. En general, el debate de la opinión pública es muy bajo, deficiente y poco preparado para atender debates de este nivel."			
3	"A veces no es fácil contar con la participación de los científicos por el miedo extendido de muchos de ellos de bajar al nivel de divulgación para todos los públicos."			
3	"Porque implican a los investigadores de sus diferentes instituciones para que hablen como expertos de un tema a la sociedad, generando así una opinión experta en los mismos. De este modo promueve la participación de los investigadores, que sienten que su ciencia va más allá de sus instituciones."			
4	"Porque pueden gestionar su participación en los medios de comunicación, eventos de divulgación, etc."			
4	"La labor de las UCC+i es el fomento de la cultura científica, aunque se limitaran a una comunicación tradicional de NdP o estática ya estarían contribuyendo. Pero ahora, cada vez más, se están proponiendo actividades de participación ciudadana en ciencia en las que el público tiene un papel cada vez más activo y se huye de la comunicación unidireccional en la que es un mero receptor de información. Eso ayuda a sensibilizar a la opinión pública."			
4	"Fomentan la participación del personal investigador en los diferentes foros, jornadas, etc."			
4	"Buenas dinámicas dentro de la universidad."			
4	"Porque sirven de intermediarias con los medios de comunicación."			
4	"Estimulan la participación de los investigadores tanto a través de noticias como de actividades de divulgación científica."			
4	"Porque pedimos a científicos expertos que opinen desde el rigor científico sobre temas de actualidad social."			
4	"Parte de su función es formar, asesorar a los investigadores a salir al encuentro de las personas para comunicar, divulgar, contar, opinar como expertos ante multitud de cuestiones."			
4	"Porque es en ellos en quién se apoya para realizar su trabajo."			
4	"Las UCC+i constantemente movilizan investigadores para participar en las múltiples actividades que organizan."			
4	"Son las que están en contacto con sus investigaciones, viendo cómo son de relevantes para la ciudadanía y siendo las que promueven su participación más cercana con el público, no tan alejados."			

Appendix 5. Follow up question P14. UCC+i network.

P13_ The UCC+i network promotes activities to increase the participation of experts in the legislative activity of our country.

P14_ Why?

	(1) Disagree	(2) Slightly agree	(3) Mostly agree	(4) Completely agree
1	"Porque tenemos poco contacto con estos dos colectivos."			
1	"Creo que la mayoría de UCC+i realizan actividades para llegar a la sociedad, no a los políticos."			
1	"Se reúnen, pero no se les hace caso, la prueba certera, la ausencia de legislación."			
1	"No es habitual que en las actividades de las UCC+i participen quienes tienen responsabilidad en políticas públicas sobre conocimiento científico."			
1	"No tenemos esa capacidad de influencia ni el acceso."			
2	"No creo que la función de las UCC+i incluya el poner en contacto investigadores con agentes políticos."			
2	"Las UCC+i deberían trabajar más en este sentido, intentado que uno de los públicos que participaran en las actividades de las UCC+i fueran responsables de políticas públicas relacionadas con la ciencia o el conocimiento científico."			
2	"Creo que en este aspecto no se ha hecho nada, aunque no estoy segura."			
2	"No cuentan aún con el respaldo institucional suficiente."			
2	"No conozco casos, creo que es una tarea que aún queda pendiente de ir incorporando."			
2	"No es una competencia habitual de las UCC+i."			
2	"Creo que es una quizás una de las carencias de nuestro sistema político: una mayor presencia de técnicos e intelectuales en la toma de decisiones políticas."			
2	"Como UCC no se promueve."			
2	"Hasta el momento este no era su cometido."			
2	"Las UCC+i que desarrollan proyectos de investigación y divulgación promueven la participación del personal investigador en iniciativas que pueden influir en cambios o adaptaciones legislativas."			
2	"Creo que aún no está lo suficientemente activado este punto."			
3	"Lo intentamos, pero no tenemos tanto poder. Nos enfocamos más hacia abajo, hacia la sociedad."			
3	"Sí, aunque no tanto como se debería, porque a veces los políticos quedan al margen de las aportaciones de los investigadores. Bien porque no se llegue a ellos como se debería o porque a los políticos no les interesa tener en cuenta los resultados que estos investigadores les brindan sobre determinados temas controvertidos."			

Appendix 6. Follow up question P16. UCC+i network.

P15_ The UCC+i network should give support to public intellectuals.

P16_ Why?

	(1) Disagree	(2) Slightly agree	(3) Mostly agree	(4) Completely agree
1	"Porque debe ser una misión de ellos, personal, privada."			
2	"Creo que no se trata de una figura institucional, sino más bien particular. Podrá dar apoyo siempre que la institución se apoye en él para trasladar un mensaje, pero no convertirlo en parte de su política comunicativa."			
2	"Pueden dar apoyo, pero no sé si 'deben'. Habitualmente se trata de perfiles que ya se desenvuelven adecuadamente en los distintos medios de comunicación y no requieren el soporte de una UCC+i."			
2	"El <i>public intellectual</i> no necesita de las UCC+i tanto como éstas de él."			
2	"Siempre que dispongan de personal, pueden servir de apoyo en las actividades que realice el <i>public intellectual</i> . Su experiencia en divulgación es un buen punto de partida."			
2	"Apoyar a una "figura concreta" es complicado, puede ser controvertido y no creo que sea la función de las UCC+i."			
3	"Porque esta figura puede ser un gran aliado para el trabajo de las UCC+i."			
3	"Sería provechoso tanto para el <i>public intellectual</i> que se beneficiaría de los contactos y del buen trabajo de las UCC+i como para la propia UCC+i ya que ayudaría a llevar su mensaje y misión de fomento del interés por la ciencia a otros públicos."			
3	"Deben apoyar esta figura en la medida en la que favorece a sus objetivos, aunque es complejo valorizarla artificialmente."			
3	"Estoy de acuerdo, pero antes faltaría por dar a conocer esta figura y designar el término apropiado en castellano."			
3	"Nos dedicamos a tantas cosas, que añadir más deberes me parece excesivo. Si tuviéramos estructuras de personal más amplias, quizás alguna de las personas se podría dedicar a esta tarea. De momento no creo que sea ni un deber ni un objetivo prioritario."			
3	"Siempre y cuando sea un experto en la materia de la que habla o justifique sus declaraciones."			
4	"Para sumar esfuerzos."			
4	"Porque son servicios técnicos de asesoramiento al personal investigador."			
4	"Apoyándole, se refuerza la visibilidad de la institución que representa y, por tanto, redundan en una imagen positiva de marca."			
4	"Porque podrían juntos ser más potentes y crear sinergias."			
4	"Todos los agentes dedicados a promover la cultura científica en la sociedad deben de aunar esfuerzos para que el impacto de las acciones sea mayor."			
4	"Sería un canal más para llegar a más gente."			
4	"Porque los <i>public intellectual</i> son una de las mejores vías para hacer llegar la ciencia y la tecnología a la sociedad."			

Appendix 7. Follow up question P26. Academic intellectuals.

P25_ I think it is important to conduct activism-related activities as part of my professional career.

P26_ Why?

	(1) Disagree	(2) Slightly agree	(3) Mostly agree	(4) Completely agree
1	"Hay mucha tensión. Mas allá de lo puramente científico."			
1	"Entiendo "activismo" desde una perspectiva negativa."			
1	"Considero importante la divulgación, pero no es mi punto fuerte."			
1	"Al César, lo que es del César y a Dios, lo que es de Dios."			
1	"La carrera profesional no tiene nada que ver con el activismo político."			
1	"Problemas complejos requieren soluciones largas y muy complejas, y esto no es normalmente aceptado."			
1	"Forma parte de dos esferas diferentes."			
1	"No sé quin concepte d'activisme es refereix la pregunta. "			
1	"Porque me gusta la parte científica de descubrimiento básico, objetivo y minucioso, y considero que el activismo puede ser muy partidista y muy manipulado/manipulable."			
1	"No tengo vocación."			
1	"Defiendo mi visión de la veracidad, pero mi oficio no es 'activista'."			
1	"El activismo, tanto político como social, nunca puede ser, ni ha de ser, justificado científicamente."			
1	"Una cosa es divulgar el conocimiento siendo crítico y otra es la ideología."			
1	"Quizás por el carácter de mi disciplina."			
1	"La sociedad no está preparada para escuchar verdades. Solo se creen a Ana Rosa Quintana y Susana Griso. No hay nada que hacer..."			
1	"Mi investigación no tiene nada que ver con activismos. A nadie le importa lo que opine de ciertas cosas."			
1	"El activismo debe formar parte de la vida personal, no de la laboral de un docente."			
2	"Diferentes esferas."			
2	"El científic pot ser o no activista, però no em sembla apropiat. Es una opció personal."			
2	"Porque no me gustan las actitudes autistas."			
2	"Desde mi punto de vista el científico debe centrarse en lo que sabe hacer: ciencia y no implicarse (más allá de la implicación de cualquier ciudadano) en temas políticos relacionados con la ciencia. Creo que está bien asesorar a políticos y divulgar las ideas dando la opinión, pero no necesariamente tomar parte activa."			
2	"Algo debemos aportar a la sociedad."			
2	"Depende de qué tipo de activismo."			
2	"Es una decisión personal."			
2	"Distingo entre 'activismo' y divulgación. Activismo para mi indica voluntad de impulsar una determinada visión. La divulgación es (o puede ser) más neutra, aunque se puede ser 'activista de la divulgación'."			
2	"Posicionarse y opinar me parece bien, ser activista es una decisión personal, que no siempre tiene por qué acompañar a la profesional."			
2	"No creo que sea imprescindible incluir este tipo de comunicación en la carrera docente del profesor universitario."			
2	"El enfrentamiento y la polémica que muchas veces conlleva defender de forma activa determinadas posiciones no va con mi personalidad. Tengo tendencia a empatizar con múltiples posicionamientos."			
2	"Porque no me parece apropiado, creo que hay que optar por una cuestión de tiempo de dedicación."			

Appendix 7. Continuation. Follow up question P26. Academic intellectuals.

2	"Mi profesión no daría tiempo."
2	"És una opció absolutament personal. Ha de dependre del desig de fer-ho, no de l'obligació."
2	"Contesto 2 porque depende del espacio que me dejen las responsabilidades exigidas en mi carga de trabajo."
3	"Aprovechar el medio para llegar a la gente."
3	"Por lo dicho anteriormente, siempre que esto no comprometa mi carrera científica."
3	"Los científicos debemos informar acerca de temas sociales y dar la perspectiva científica."
3	"Es una manera de poder llegar a cambiar cosas en la sociedad."
3	"Para visibilizar nuestro trabajo."
3	"Es importante ser crítico también en ciencia o desde la ciencia. Es un buen ejemplo para el público. Desde la ciencia se quiere incidir en todos los ámbitos sociales."
3	"Todos tenemos que participar de la transformación social que hay activa."
3	"Para realmente compartir el conocimiento y lograr un impacto."
3	"Al elegir lo que deseas estudiar estas ayudando a que esta se desarrolle, por ejemplo, la mejora de los procesos químicos actuales conlleva beneficios ambientales y sociales al proponer soluciones que consumen menos, menos contaminantes, más seguros, con compuestos menos tóxicos y respetuosos con el medio, etc."
3	"La evidencia debe guiar nuestras decisiones, no la palabrería."
3	"Porque formo parte de una sociedad concreta."
3	"Es importante hacer llegar la ciencia a todos los ámbitos posibles."
3	"La societat ha d'estar informada de les diferents possibilitats que contempla la ciència dels nostres problemes."
3	"Porqué sino algunas cosas se hacen de forma incorrecta."
3	"Alguien ha de denunciar situaciones que muchos, por conocimiento o situación personal, no pueden realizar. Estar en la universidad es un compromiso social, hemos de actuar según nuestro deber para con la sociedad que nos paga por ello."
3	"Para que la visión desde el punto de vista científico también esté presente en el momento de desarrollar proyectos en un ámbito más social."
3	"El activismo, entendido como trabajar por las cosas que crees benefician a la sociedad, son positivas en cualquier aspecto de la vida."
3	"No hay que esperar a que lo haga 'otro'."
3	"Es importante divulgar tu investigación para que la gente sea consciente de la necesidad y aplicabilidad de los investigadores."
3	"La ciencia y la docencia no se limitan a las paredes de la universidad."
3	"Porque mi ámbito de trabajo lo necesita."
3	"Para defender la ciencia y la investigación en base a evidencia probada."
3	"Es otra manera de llegar al gran público y promover el conocimiento."
3	"El activismo científico de los profesionales ha de servir para compensar el predominio informativo y el prestigio que están adquiriendo las pseudociencias en los medios de comunicación."
3	"Por coherencia."
3	"Los académicos también tenemos opinión."
3	"Porque mi carrera está muy relacionada con nuestro bienestar, supervivencia y sostenibilidad de nuestro planeta."
3	"Si el conocimiento científico y la importancia de la ciencia no llega a la sociedad (y además, a una velocidad adecuada), la ciencia y la sociedad pierden capacidad de mejora."
3	"Porque creo que tenemos más información que la media."
3	"La divulgación y reflexión sobre la ciencia ya es una manera de hacer ciencia."

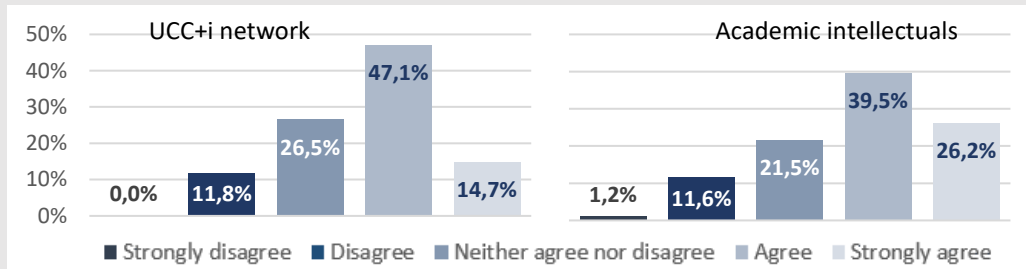
Appendix 7. Continuation. Follow up question P26. Academic intellectuals.

4	"Porque todos debemos ser miembros activos de la sociedad."
4	"La divulgació de la ciència, el <i>public understanding of science</i> , és un deure que té una responsabilitat social similar a l'ensenyament i la recerca: no només ens paguen per aquestes ocupacions, sinó per ensenyar allò que sabem a un públic més extens."
4	"Porque en la sociedad poco crítica en la que vivimos es importante que se hable de todo lo que cada uno considera susceptible de crítica."
4	"Cobro de la societat i li haig de ser útil."
4	"La sociedad ha hecho mucho por mí, me ha dado la oportunidad de aprender y desarrollar mi carrera, es de menester que yo devuelva parte de lo que me han dado."
4	"Los científicos tienen un compromiso con la sociedad."
4	"Porque pese a la cantidad de información de que disponemos las pseudociencias son cada vez más populares. Si fuesen únicamente opiniones personales no serían un problema, sin embargo, tienen tanto peso y tanta gente tiene fe en ellas que pueden costarnos dinero y salud como sociedad."
4	"Mis conocimientos, así como los de otros compañeros de trabajo, pueden aportar mucho a distintas causas."
4	"Responsabilidad y ética."
4	"Implicación social."

Appendix 8. Questions P31 to P38. Excluded from the analysis. Questions are kept in Spanish.

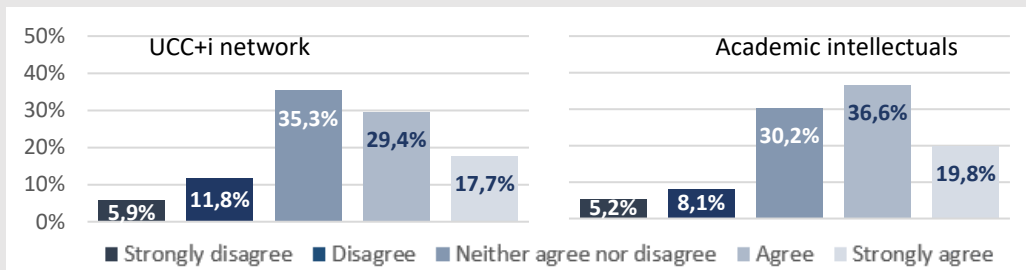
SURVEY QUESTIONS & RESULTS

P31_ 'La sociedad actual se rige por valores individualistas más que por valores sociales'.



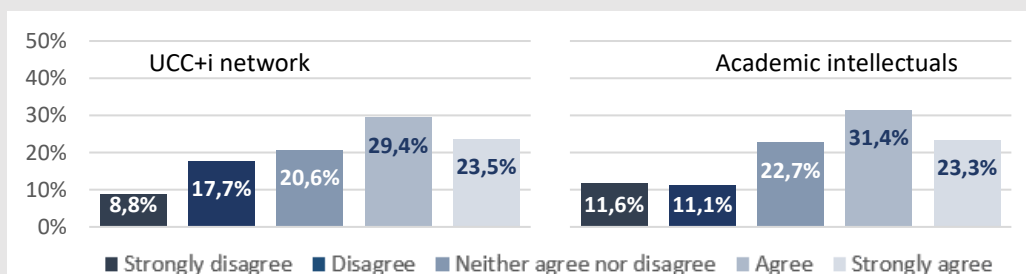
Base: Total sample survey respondents. UCC+i network (n=34). Academic intellectuals (n=172).

P32_ 'Todavía no se ha democratizado la figura del 'public intellectual' dado que el campo de la comunicación científica se inició en España tres décadas más tarde que en otros países europeos y, por tanto, vamos con retraso'.



Base: Total sample survey respondents. UCC+i network (n=34). Academic intellectuals (n=172).

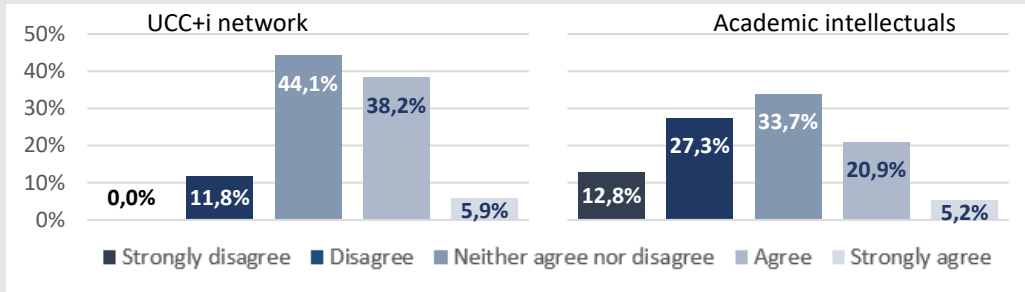
P33_ 'La presión económica que deriva de la capitalización del conocimiento científico y que hace depender de fondos privados a los investigadores limita la libertad de estos para hablar de temas que poseen una dimensión política e ideológica con componentes de crítica social'.



Base: Total sample survey respondents. UCC+i network (n=34). Academic intellectuals (n=172).

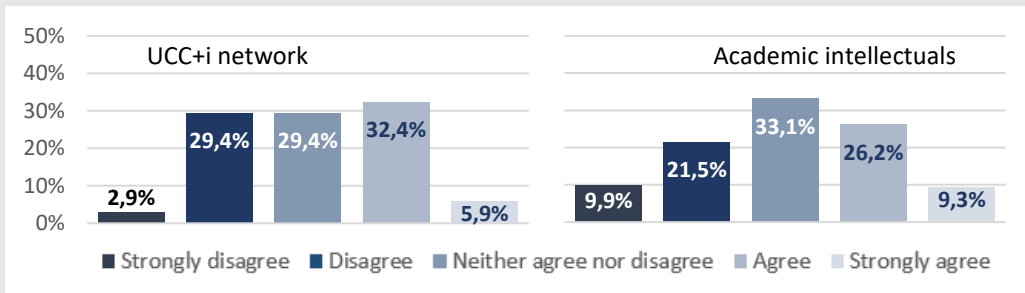
Appendix 8. Continuation. Questions P31 to P38. Excluded from the analysis. Questions are kept in Spanish.

P34_ ‘Aquellas intelectuales que hablan públicamente acerca de temas controvertidos desafiando el statu quo sufren el rechazo de la comunidad científica (academia)’.



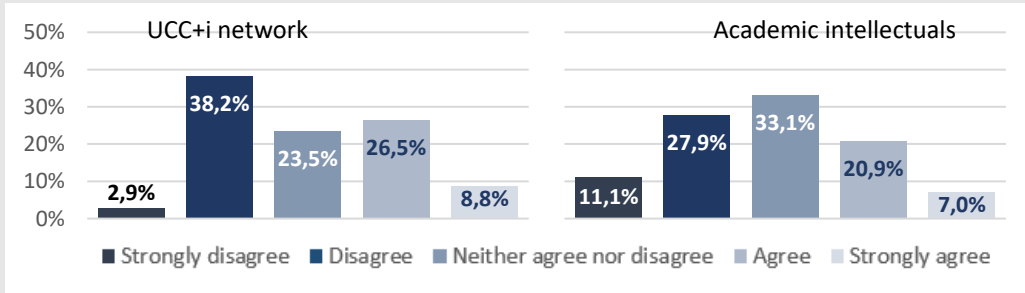
Base: Total sample survey respondents. UCC+i network (n=34). Academic intellectuals (n=172).

P35_ ‘Los intelectuales tienden a no hablar públicamente acerca de temas controvertidos por miedo a quedar aislados socialmente’.



Base: Total sample survey respondents. UCC+i network (n=34). Academic intellectuals (n=172).

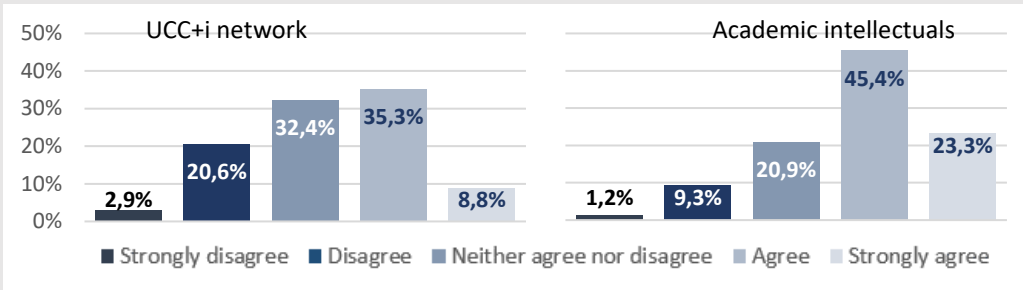
P36_ ‘Los intelectuales no suelen participar de acciones con la intención de generar un impacto social por miedo a la desaprobación’.



Base: Total sample survey respondents. UCC+i network (n=34). Academic intellectuals (n=172).

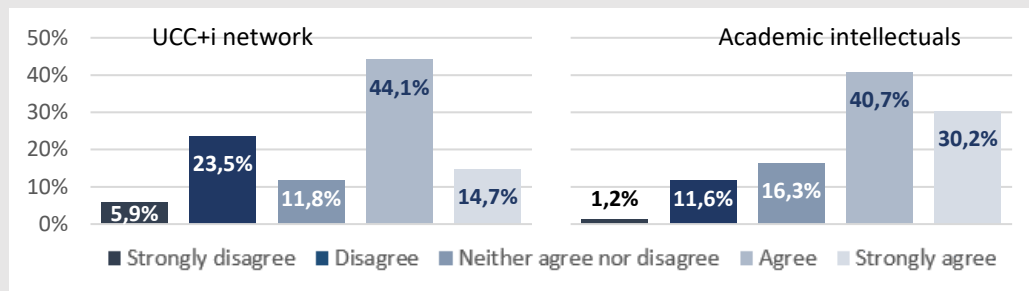
Appendix 8. Continuation. Questions P31 to P38. Excluded from the analysis. Questions are kept in Spanish.

P37_ 'El sistema periodístico actual ha generado un pseudoentorno en el que la ciencia tiene difícil cabida, más aún si contiene elementos de controversia y crítica social'.



Base: Total sample survey respondents. UCC+i network (n=34). Academic intellectuals (n=172).

P38_ 'Estamos tan acostumbrados socialmente a percibir la ciencia como un ámbito separado de la sociedad, que nos conformamos con que sea así sin darnos cuenta'.



Base: Total sample survey respondents. UCC+i network (n=34). Academic intellectuals (n=172).

Appendix 9. Qualitative analysis of question P39.

	CODE	DESCRIPTIVE CODE
Academic intellectuals (0) _ UCC+i network (1)		
(0) “La falta de cultura científica en la sociedad.”	1	Lack of scientific culture.
(0) “La falta de cultura científica .”	1	Lack of scientific culture.
(0) “La falta de cultura científica en el ámbito político.”	1	Lack of scientific culture.
(0) “ Falta de cultura científica de los ciudadanos.”	1	Lack of scientific culture.
(0) “La falta de cultura científica en los directores de contenidos.”	1	Lack of scientific culture.
(0) “La falta de una cultura científica e intelectual en el país junto a la envidia.”	1	Lack of scientific culture.
(0) “La falta de cultura científica .”	1	Lack of scientific culture.
(0) “La falta de interés de la sociedad en ciencia, debido a la falta de presencia de la ciencia en el ámbito educativo de tramos obligatorios.”	2	Science is underrepresented in schools (low public interest in science).
(0) “Una educación obligatoria excesivamente humanística que destierra el interés por la ciencia en la mayor parte de la población.”	2	Science is underrepresented in schools (low public interest in science).
(0) “La falta de interés en el tema de los investigadores/científicos.”	3	Low public interest in science.
(0) “A la gente no le interesa la ciencia.”	3	Low public interest in science.
(0) “ No hay interés por el conocimiento científico, únicamente por los resultados tecnológicos derivados.”	3	Low public interest in science.
(0) “El poco interés social en la ciencia.”	3	Low public interest in science.
(0) “ Falta de interés por parte de la ciudadanía.”	3	Low interest of society.
(1) “La falta de interés social.”	3	Low interest of society.
(0) “El poco reconocimiento en la carrera profesional.”	4	Lack of academic recognition.
(0) “Poco reconocimiento en las trayectorias académicas.”	4	Lack of academic recognition.

Appendix 9. Continuation. Qualitative analysis of question P39.

(0) “El reconocimiento a las figuras científicas existentes en este país.”	4	Lack of academic recognition.
(0) “La competitividad y valoración de méritos de la carrera académica actualmente no da la importancia necesaria a nivel curricular de las acciones enmarcadas en <i>public intellectual</i> , lo que provoca que pocos académicos inviertan esfuerzos en esta línea dado que ello supone tiempo no dedicado a ‘publicar artículos científicos en revistas de impacto’, que es lo que se valora a nivel curricular”.	4	Lack of academic recognition.
(1) “Culturales, falta de reconocimiento académico y científico de las tareas de divulgación.”	4	Lack of academic recognition.
(1) “El sistema de acreditación actual, que no favorece la dedicación a la comunicación social de la ciencia.”	4	Lack of academic recognition.
(1) “La divulgación científica muchas veces es una práctica voluntaria, no remunerada. ”	4	Lack of economic recognition.
(0) “ Falta de apoyo institucional. ”	5	Lack of institutional support.
(0) “ No hay ayuda desde nuestras universidades para ser formado en esta esfera.”	5	Lack of institutional support.
(0) “La falta en las universidades de tradición en promover debates sociales y preparar a los alumnos de ciencias en temas como las relaciones ciencia/sociedad.”	5	Lack of institutional support.
(0) “La disponibilidad de tiempo por parte de los científicos.”	6	Scientists’ lack of time.
(0) “ Falta de tiempo del académico/investigador.”	6	Scientists’ lack of time.
(0) “Resulta difícil de compatibilizar con las numerosas obligaciones y burocracias que tenemos asociadas a nuestra labor científica.”	6	Scientists’ lack of time.
(0) “La falta de una motivación clara por la cual el científico o intelectual debe dedicar parte de su tiempo a preocuparse del mundo que le rodea más allá de las paredes de su aula, despacho o laboratorio.”	7	Scientists’ lack of motivation.
(1) “Los mismos investigadores.”	8	Scientists’ objections.
(0) “La negativa de algunos académicos a ‘bajar a la tierra’ su conocimiento si eso supone hacer algunas concesiones para ‘simplificar’ sus ideas, o utilizar medios ‘poco serios’ en su opinión, como las redes sociales.”	8	Scientists’ objections (to disseminate science).
(0) “El lenguaje utilizado a veces puede ser muy técnico y con conceptos difíciles de entender por el público en general.”	9	Science’s technical language.

Appendix 9. Continuation. Qualitative analysis of question P39.

(0) “La precarización de la investigación. ”	10	Scarcity of subsidies for scientific research.
(0) “Los presupuestos públicos y privados dedicados a la investigación.”	10	Scarcity of subsidies for scientific research.
(1) “La precariedad de investigadores y centros de investigación.”	10	Scarcity of subsidies for scientific research.
(0) “Una cultura más abierta en el mundo universitario e investigador.”	11	A closed academic culture.
(0) “ Recursos dirigidos a esta función [la del <i>public intellectual</i>].”	12	Lack of resources.
(0) “Factores económicos.”	12	Lack of resources.
(0) “La llamada posverdad. ”	13	Post-truth environment.
(0) “El marketing, los gurús y pseudociencias, creando confusión.”	13	Post-truth environment.
(0) “ <i>Fake news.</i> ”	13	Post-truth environment.
(0) “Hay que ir con cuidado de no promocionar a los pseudocientíficos.”	13	Post-truth environment.
(0) “Los políticos. No interesa que la gente piense y sea crítica. ”	14	Lack of critical thinking.
(0) “La falta de una crítica rigurosa.”	14	Lack of critical thinking.
(1) “En la sociedad actual se busca la inmediatez, titulares y debates frívolos, demagogos. Hay poco espacio para el análisis y la reflexión. ”	14	Lack of critical thinking.
(0) “La falta de preparación intelectual del público, en general”	15	Low literacy level of Spanish society.
(0) “ Bajo nivel académico de la sociedad española.”	15	Low literacy level of Spanish society.
(0) “La falta de aprecio a todos los niveles de la ‘ CULTURA ’.”	16	Unfavourable public attitude toward culture.

Appendix 9. Continuation. Qualitative analysis of question P39.

(0) “El poco respeto de algunas instituciones a la cultura .”	16	Unfavourable public attitude toward culture.
(0) “El nivel cultural , hay que trabajarlo paralelamente y hacer ver que ciencia es cultura también.”	17	Low cultural level of Spanish society.
(0) “El bajo nivel cultural de la sociedad española.”	17	Low cultural level of Spanish society.
(0) “Los prejuicios e ignorancia de la sociedad española que es inculta y arrogante de su ignorancia.”	17	Low cultural level of Spanish society.
(1) “La falta de cultura y debate democrático en la opinión pública española.”	17	Low cultural level of Spanish society.
(0) “ Lobbies de comunicadores que no permiten la entrada de nuevos comunicadores.”	18	The influence of lobbies.
(0) “ Desinterés de los medios de comunicación.”	19	Media lack of interest.
(0) “La falta de interés ; no figura como una misión en muchos medios de comunicación, solo para vender más cuando hay dramas.”	19	Media lack of interest.
(0) “La prensa escrita está al servicio del poder mayoritariamente. La televisión todavía más. Hay poca cultura democrática y falta de libertad de expresión .”	20	Freedom of the media is compromised.
(0) “ Ausencia de libertad en la prensa para temas que puedan afectar intereses económicos o políticos influyentes.”	20	Freedom of the media is compromised.
(0) “El negocio de los medios .”	21	Mass media interests.
(0) “El interés de los grupos de comunicación.”	21	Mass media interests.
(1) “La falta de espacios especializados en televisión, que sigue siendo un gran medio de comunicación de masas.”	22	Lack of specialised science programmes on the media.

Appendix 9. Continuation. Qualitative analysis of question P39.

(1) “La escasez de espacios sobre ciencia y tecnología en los medios de comunicación.”	22	Lack of specialised science programmes on the media.
(0) “La dificultad de acceder a los medios. ”	23	The questionable priorities of mass media.
(0) “El funcionamiento de los medios de comunicación. Se busca la noticia de impacto inmediato y que el experto en ciencia responda aquello que gustaría a la sociedad o al medio de comunicación. “	23	The questionable priorities of mass media.
(0) “El espacio ocupado por la prensa rosa y amarilla.”	23	The questionable priorities of mass media.
(0) “El objetivo de los medios públicos es más entretener que no formar.”	23	The questionable priorities of mass media.
(1) “Se da más prioridad a otros temas de ‘supuesto’ interés. La ciencia no es todavía todo lo protagonista que debiera en la agenda de los medios. ”	23	The questionable priorities of mass media.
(1) “Los únicos factores limitantes que veo es que el interés comercial y la falta de ética de los medios prefiera mantener en el <i>primetime</i> el fútbol o programas como ‘Hombres, Mujeres y viceversa’.”	23	The questionable priorities of mass media.
(0) “Algunos periodistas sacan de contexto y publican afirmaciones alejándolas del propósito inicial de quien la formuló.”	24	Questionable journalistic practices.
(0) “ Falta de profesionalidad del periodismo científico. ”	24	Questionable journalistic practices.
(0) “Los medios de comunicación están demasiado dependientes del poder económico y político.”	25	Media dependence on political and economic powers.
(0) “El dominio de todos los medios , salvo las redes sociales, por los grupos de poder económico y político.”	25	Media dependence on political and economic powers.

Appendix 9. Continuation. Qualitative analysis of question P39.

(0) "El escaso nivel intelectual de los dirigentes de los medios ."	26	Media leaders' questionable competencies.
(0) "Hay que tener cuidado con el conflicto de intereses que se pueden dar entre empresas o fundaciones privadas que sustenten económicamente al <i>public intellectual</i> ."	27	Economic interests.
(0) "Intereses de la empresa privada."	27	Economic interests.
(0) "Intereses económicos."	27	Economic interests.
(1) "Grupos de presión económica o empresarial."	28	Economic pressures.
(1) "Muchos investigadores/-as no se posicionan por miedo a represalias o a perder subvenciones o apoyos. Faltaría que fueran más independientes económicamente para que pudieran expresarse sin miedos."	28	Economic pressures.
(1) "La politización de la ciencia."	28	Economic pressures (politicization of science).
(0) "Los propios valores que tiene esta sociedad."	29	The current social values.
(0) " Ningún tipo de aceptación social de lo que pueda decir este personaje."	30	Lack of social acceptance.
(0) "Lobbies."	31	The influence of power groups.
(0) "El conocimiento. Para el poder es mejor tener una sociedad ignorante que culta."	31	The influence of power groups.
(0) "Interés de ciertas esferas para perpetuar el " analfabetismo científico " como forma de control social ."	31	The influence of power groups.
(0) "El control de la información por los poderes fácticos de la sociedad española que controlan el discurso social ."	31	The influence of power groups.
(0) "Los poderes fácticos, el ' <i>establishment</i> ', las grandes corporaciones."	31	The influence of power groups.
(0) "La no separación de poderes."	31	The influence of power groups.
(0) "La poca visibilidad de colegios profesionales, sociedades científicas, academias, etc."	32	Limited visibility of scientific societies.

Appendix 9. Continuation. Qualitative analysis of question P39.

(1) "Creo que hay que incluir a los científicos en las comisiones legislativas, en los consejos de dirección de empresas públicas, etc."	33	Lack of scientists in governance institutions.
(0) "Usar su término en inglés."	34	English designation of the term 'public intellectual'.
(1) "La designación del término en inglés."	34	English designation of the term 'public intellectual'.
(1) "La pretensión de superioridad que tiene la propia acepción (puede provocar alejamiento del grueso de la sociedad)."	34	The characteristics designated for the term 'public intellectual'.
(0) "Falta de costumbre."	35	Lack of habit.
(0) "Religión."	36	Religion.
(0) "Intolerancia."	37	Intolerance.
(0) "Dogmatismo."	38	Dogmatism.

