The Brain in the Public Space: Social Neuroscience and the Media

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Abstract Here we analyze public communication of neuroscience, in general, and social neuroscience, in particular, as well as the circulation of its particular discourse in mass media. We discuss particular issues of neuroscience communications in the context of science popularization. As an example, we offer an analysis of neuroscience coverage in a national newspaper of widespread distribution and conclude that even though news articles on social neuroscience do not represent a significant proportion of scientific reports in the press, they are important platforms to disseminate neuroscientific accounts of social processes. This is especially so as regards the topics of interpersonal ties and emotional mechanisms, two concepts traditionally dominated by the social sciences. Finally, we offer some recommendations for bridging the gap between academic research in the field and its popularization.

Keywords Brain • Neuroscience • Communication • Science • Print media • Health

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1 Introduction

Expert knowledge on the brain has expanded significantly in recent decades and now circulates outside traditional academic spheres. Moreover, it has been established as a valid framework to understand everyday phenomena—in particular, those related to human behavior. The presence of neuroscientists in communication media, the growing appearance of journalism articles, and the emergence of popularization books (sometimes in the boundary with self-help literature), theater plays, social networks, and webpages are just some examples of this outbreak. The wealth of cultural spaces in which neuroscience is present shows the importance of the penetration of brain-centered discourses in the social arena.

Indeed, this is not a completely new phenomenon. The so-called decade of the brain in the 1990s identified cognitive psychology—one of the components on which social neuroscience is based—as one of its pillars, and, indeed, neuroscience has become a communicational tool for clinical psychologists [1, 2]. The guidelines for such a decade emphasized the need for studying the brain also in its sociocultural context, taking advantage of all the then-emerging technologies available for research (e.g., [3]). Indeed, cognitive psychology has also received considerable attention in the media, as well as other disciplines which also complement the general social neuroscience scheme, notably behavioral genetics [4]. However, neuroscience, in general, and social neuroscience, in particular, have experimented a tremendous growth in terms of their popular visibility, a fact that demands a specific analysis, both of its causes and its consequences. This translation from the lab and the clinic into the media also comprises an ethical dimension and, moreover, should also reflect an intention derived from public policies in science communication [5–8].

It is possible that neuroscientific explanations are somewhat more appealing to the general public. Indeed, there is evidence that, when provided, neuroscience information generates significant interest and might even interfere with the ability of critical analysis of judging the information. When neuroscientific terms were present, subjects judged explanations as better and more satisfying than those without brain jargon [9]. There is something special about neuroscience in current public communication, and this is obviously pervading the analysis and popularization of social research.

This chapter aims to analyze neuroscience circulation in the media, with a particular example based on the graphic press in Argentina. Will data analysis help us to cope with questions such as “when did this so-called neuro-boom start”? What kinds of themes are covered in the media? Have they changed in recent years? How are social processes described from a neuroscientific perspective? We focus on the rhetoric of the social neuroscience in the media, since this dimension is key in terms of public opinion, persuasion, and circulation [10], and, as such, the tone of journalism is as important as its content.

2 From Science Communication to Neuroscience Communication

The communication of science has turned into an autonomous research area, focused on the translational processes between the scientific field and the general public. According to Schäfer [11], mass media has become the most important public forum in contemporary society, including scientific information, providing a framework of societal self-observation and public opinion formation, among other aspects. This research area has developed in the context of increased lay publication of scientific information in newspapers, television, blogs, forums, among other outlets. Several authors (e.g., [12]) have shown, in different contexts, the growing publication trends of science-related content in newspapers, and how this boosts the circulation of scientific ideas in the public sphere.

In addition, in the current context of an increasing prevalence of online environments, traditional formats are being redefined, as revealed by the decrease in scientific sections in newspapers and the increase in blogs, forums, and webpages administered by both journalists and scientists [13]. These new communication environments have changed not only how information is disseminated—and its potential audience—but also a more frequent and extensive entailment of the audience with scientific information as reported by the media.

In his classic work about the political uses of science communication, Hilgartner [14] has stated that the culturally dominant view of the popularization of science suffers from conceptual problems which result in oversimplifying this process. While it is assumed that communication is based on a two-stage process—first the production of knowledge and then its dissemination—the actual diffusion of scientific ideas evidences the existence of ingrained beliefs in the purity of science and the potential pollution of knowledge by outsiders. In this context, the key question is what "appropriate simplification" is and who can draw the boundaries between oversimplified scientific information and insufficient translation of knowledge.

In particular, the communication of neuroscience-related news has been closely scrutinized by this field. Discussions arise regarding the sources of information of neuroscientists or the difficulties in the interaction between journalists and scientists [15], the possibility of spreading mistakes and polarized beliefs [16], and the effects of the so-called neuro-realism in the representations of the general audience [17]. As expected for most disciplines, the visibility of neuroscience-related news are closely related to their timing (i.e., whether the concept being communicated has become fashionable) and the specific media (e.g., newspaper type) [16].

In recent years, several studies have shown a growing interest in brain research and in cognitive and social neuroscience in particular [18–22]. One of the main focuses is the interest in a better public communication or areas related to clinical developments of neuroscience investigations. As we shall see, data derived from such studies are sometimes hard to interpret and can result in erroneous conclusions in the mass media [23], which stresses the need for a more informed and critical press that ensures a more precise communication [21, 24]. It is not uncommon to

raise false or exaggerated expectations in the public, including the possibility of thought-reading [7, 22, 24]. Moreover, popular communication of neuroscience tends to argue for the *value* of the research and not necessarily for its content [25]. Among these values, the novelty and relevance of knowledge, together with its applicability, are usually emphasized. This is not qualitatively different from what happens in public communication of science in general, where the most frequently employed category of "value" is that representing technoscience as an activity extending the frontiers of knowledge [12].

3 Images in the Brain and in the Media

As stated above, neuroscience is particularly susceptible to false or exaggerated information in the media, giving raise to inaccurate perceptions of its real strength and limits. *Neurologisms* are a vivid example of this, with the popular use of terms such as neuromarketing, neuroeducation, neurogym, and many others. Illes et al. [26] suggest that the main challenges faced by neuroscience communication are (a) the complexity of the brain; (b) the personal, philosophical, and religious salience of the field; and (c) the burden of central nervous disease together with the stigma of neurological and mental disorders.

Indeed, an additional source for this complicated state of affairs is the intrinsic complexity (and, in some cases, inscrutability) of the most recent technologies used in order to understand the neural basis of individual and, in some cases, social behavior. Among these, neuroimaging techniques have certainly played an important role in the current expansion of neuroscience research and its mingling with other, more social, disciplines. In particular, functional imaging technologies have provided strong candidates for neural correlates of behavior and cognition. However, there is a frequent confusion between the actual realities of the experimental conclusions and its promises—and even perils—a confusion that is also spread to popularization products and media. Recent data suggests that media reporting of the results of functional imaging studies are "mostly positive and framed in terms of healthcare progress (…) (Without a) balance between technology opportunities and applications (…) and seems to favour oversimplification" [6]. Another analysis of press coverage of functional imaging studies concluded that the media "largely provided no explanation of the capabilities and limitations of fMRI (…) (and) had a mostly optimistic tone [20]." Moreover, even if the news coverage of neuroscientific research is relatively accurate, this does not guarantee and adequate reception by the general population. An extreme example is provided by the analysis of the media coverage of a single article ("Does bilingualism influence cognitive aging?", published by Thomas Bak in the *Annals of Neurology*) which, according to the authors, received a fair coverage from the international press but, nonetheless, the comments of readers throughout the world indicate that the public understanding of the main concepts of the study was, at the most, far from precise [27].

This increasing coverage, and sometimes misrepresentation, of neuroscience research seems to be a worldwide phenomenon. We shall now present some local data and analysis of press reports in this particular field.

3.1 An Example of Neuroscience Coverage in Mass Media

The analysis of news allows observing the emergence and evolution of scientific discourse on the brain in this particular framework of an increasing interest in the field [10, 11, 28]. Indeed, two of the authors of the present chapter (MJM and MDM) have recently reported a marked increase in news related to neuroscience in the last 15 years in Argentina [29]. Even considering the widespread of the areas being covered, they found that health- and disease-related news were prioritized, with content tending to construct a narrative of a healthy way of life. The combination between expert knowledge and medical recommendations, which characterizes some of these reports, certainly aids in the social legitimation of the ideas about the brain.

Here we present an initial approximation to the installation of social neuroscience in a popular context, by means of analyzing some of the main products of science popularization in the field. We have analyzed how new ideas about the brain and social neurosciences have emerged in the public agenda in Argentina and how they have been disseminated in print media. In order to achieve this objective, the publication trends and main topics of newspaper articles about neurosciences were analyzed. Furthermore, in-depth qualitative analysis of newspaper articles about social neuroscience was carried out, emphasizing new conceptions about the relation between the individual and society and the transformations of traditional views of social phenomena.

In order to build the *corpus* of analysis, all digital articles from *La Nación* (one of the main national newspapers in Argentina which, in addition, has more coverage on scientific news than other mainstream media; www.lanacion.com.ar) were compiled from 1996 to 2016. Articles were identified using the online browser of *La Nación*'s webpage, with the term "neurosciences" (*neurociencias,* in Spanish). Indeed, these two decades coincide with a significant historical moment when the neuroscientific field gained importance in Argentina, while images and ideas related to the brain and its study spread across the media, among other aspects.

For the selection of the cases, headlines of the newspaper articles were read and, in case of ambiguity, the entire article was read in order to evaluate its pertinence. The final *corpus* was composed of 754 articles, which were analyzed using qualitative and quantitative methods. All types of newspaper articles were gathered, including interviews, feature articles, editorials, columns, and opinion pieces.

In order to identify the newspaper articles about social neurosciences within the broader *corpus*, the headlines and lead paragraphs of all articles were read. No specific keywords were used to identify these articles in *La Nación*'s online browser, as social neuroscience is a subdiscipline with a particular approach on social

phenomena that tend to tackle a wide range of topics. Hence pertinent articles were identified manually considering that they tackled social issues (such as interactions, morality, organizational aspects of society, relationships, etc.) from a neuroscientific perspective (i.e., relating the specific topic to the brain, its functioning, neurobiology, or neurochemistry).

For the quantitative analysis, a structured database was designed using SPSS (v. 19), and all the data was added manually. Variables included information about the article's approach and topics (type of newspaper article, publication year, source mention, type of source mentioned, main topic, origin, and section in the newspaper), although not all of them are analyzed in this chapter. These variables were selected to characterize key features of the dissemination of neuroscientific news and its evolution in time. For the qualitative analysis, the entire text of the articles were codified and analyzed with thematic content analysis. Preestablished, as well as emergent, dimensions of analysis were used to codify and organize the description of the articles.

The first finding is that the local trend resembled that from the rest of the world, where the "decade of the brain" was giving a boost to the rise of popular neuroculture [30], which implied the diffusion of representations of contemporary brain science in the means of communication—e.g., television, newspapers and magazines, blogs, and webpages [31].

Figure 1 shows the evolution of neuroscience-related newspaper articles in *La Nación*, from 1996 until 2016, supporting the hypothesis that Argentina—along other countries—also witnessed the rise and dissemination of neuroscientific discourses in the general public [32].

The two-decade period witnessed an increase in the number of articles published, with fluctuations between 2000 and 2010 that did not modify the overall growing tendency in the lay dissemination of neuroscientific ideas and discourses. From

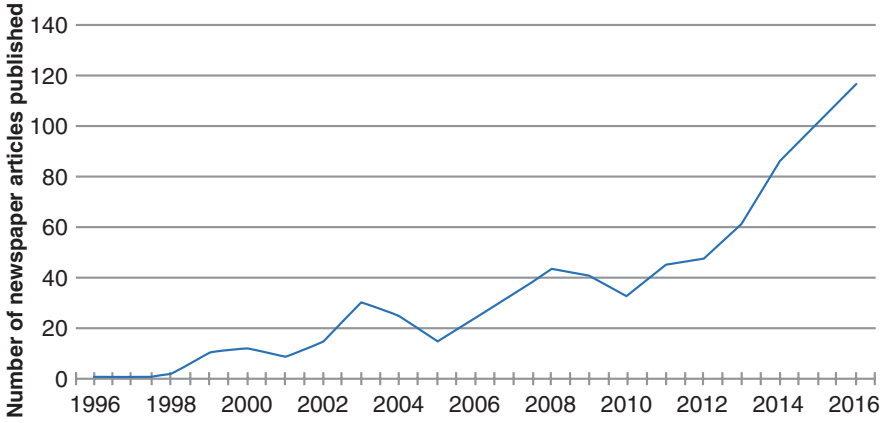

Fig. 1 Publication trend of newspaper articles about neurosciences. La Nación, 1996–2016. Source: prepared with information available in *La Nación*'s webpage (www.lanacion.com.ar). Total number of articles: 754

2010 onward, a steady rise in the number of articles can be seen, comprising the 65% of the entire number of articles (i.e., 491).

This growing tendency in the diffusion of neuroscientific ideas and news in the media confirms previous studies that have found a substantial rise in the communication of general scientific ideas [11], as well as in neuroscientific information in particular [21, 22, 26, 33, 34] to the lay public.

Table 1 illustrates the main neuroscience-related topics of the newspaper articles in *La Nación* during the period 1996–2016. Thirty two percent of these articles tackle health-disease issues. The majority of these articles are related to diseases (a 44% of health-related articles and a 14% of the overall articles about neurosciences in the 21-year period). Articles about diseases include neurodegenerative conditions (namely, Alzheimer's syndrome, Parkinson's disease, and multiple sclerosis), as well as a wide range of mental illnesses (e.g., depression, phobias, schizophrenia, autism), and other neurologically based disorders (e.g., epilepsy, migraine, stroke). Furthermore, a significant number of the articles tackle health-disease issues related to aging, including current theories to understand the aging process and treatments to specific health problems. While health-disease and brain topography (the latter representing 9% of the articles throughout this period) are among the most commonly and traditionally associated topics related to the brain and the emergence of neuroscience [29], the table shows that several other topics were covered by print media. The heterogeneity of topics ranges from education (10%) and emotions (11%) to decision-making (4%) and child development (3%).

Table 1 Main topics in newspaper articles about neurosciences. *La Nación*, 1996–2016

Topics	*N*	%
Health-disease	244	32
Emotions	80	11
Education	76	10
Brain topography	64	9
Others	38	5
Neuroscience and communication	34	5
Memory	33	4
Decision-making	32	4
Creativity	30	4
Technology	26	3
Child development	19	3
Psychoanalysis	17	2
Spirituality	15	2
Language	13	2
Cultural expressions	13	2
Gender	10	1
Economy	10	1
	754	100

Table prepared with information available in *La Nación*'s webpage (www.lanacion.com.ar)

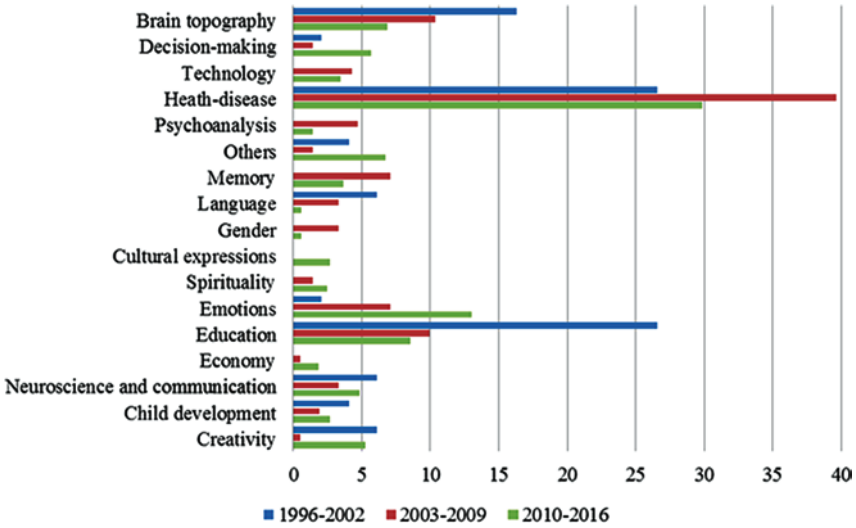

Fig. 2 Percentage of topics in newspaper articles: comparison between periods 1996–2009, 2003–2009, 2010–2016. La Nación newspaper, 1996–2016. Source: prepared with information available in *La Nación*'s webpage (www.lanacion.com.ar). Total number of articles: 754

Moreover, articles about communication of neuroscientific knowledge to the lay public represent 5% of the articles in this period. Despite the fact that this percentage is comparatively small, its presence indicates that articles which examine the nature of expertise, the communication of science and technology among professionals and to the public, and the scientific-lay translation barriers and strategies have contributed to the emergence of neuroscientific ideas among the general public. Furthermore, the fact that this category had a steady decrease in the number of articles throughout the period (as can be seen in Fig. 2) would support the hypothesis that the 1990s witnessed the emergence of neurosciences in the Argentine public agenda and, therefore, that the dissemination of scientific ideas was focused on communicating what the neurosciences are, the different subfields that have been developed, and its current and potential applications [22].

Figure 2 shows how much each topic was tackled comparatively in news articles during three periods: 1996–2002, 2003–2009 and 2010–2016. The chart shows that, despite the fact that the main patterns of topics dealt remain fairly constant throughout these 21 years, several significant transformations took place.

While health-disease issues remain the most recurrent in the newspaper articles during the period of analysis, other topics gained more visibility and dissemination. For instance, emotions, decision-making, and creativity were more represented during the third period, showing a subtle shift in the lay communication of scientific ideas. At the same time, news related to education gradually lost representation.

Moreover, during the second and third periods of analysis, previously unmentioned topics emerged, namely, economy and neuromarketing and cultural expressions. Both of these groups of articles are closely related to social neurosciences,

since neurobiological explanations are given to understand fields that have been traditionally studied by social sciences and humanities. On the one hand, articles about economic and business-related news approach this social phenomenon from neurobiological standpoints. Whether it is to understand how companies are organized and what institutional structures could be used to encourage individual productivity, or how the neurochemistry of consumers conditions their decision-making process, articles about neuromarketing provide a new insight on old topics. On the other hand, articles about cultural expressions and activities provide explanations about the functions and changes in music, television, and literature. For example, the popularity of television series characterized by violence is explained by the neurochemical response of fear, which is associated with the release of dopamine and a consequential adrenaline state in the viewers.

Furthermore, the fact that the number of articles included in the category "Others" also increased during the last period can be seen as an indicator of the emergence of new specific topics that are being tackled by neurosciences and spread by popular means of communication.

As Racine, Waldman, and Rosenberg [22] have stated, the public interest in neurosciences and the brain and the expectations of the general population on this discipline have raised concerns and discussions about their potential implications. The growing interest that neurosciences have gained for social phenomena and the following dissemination of ideas from social neuroscience in the media (which can be seen in the rising number of articles about gender, cultural expressions, economy, and neuromarketing in Argentina) have created a new field where human and social sciences meet neurosciences [35, 36]. Fundamental dilemmas about human interactions and social organization—traditionally faced by social sciences and philosophy—are now being tackled by both scientific areas, bringing up new questions about the boundaries of scientific disciplines, the diffusion of current theories, and the discourses raised by the shifts in science.

3.2 The Social Brain in the Print Media

The previous section described the media coverage of neuroscience news in general, emphasizing the broader features of media dissemination of scientific ideas about the brain. The focus of this section, however, is to describe the newspaper articles that specifically dealt with social neurosciences.

Nonetheless, a clarification regarding the categorization of articles is needed, due to the complexity of dividing neurosciences and social neuroscience. The main reason why social neuroscience was not included as a category per se was that this specific academic area covers a wide range of the previously mentioned topics, such as emotions. In this case, emotions and attitudes are not exclusively researched from the "social perspective" of neurosciences. Therefore, the entire corpus of articles was recategorized in order to identify the newspaper articles that specifically tackled social neuroscience, namely, articles that dealt with social phenomena (morality,

interactions, relationships, social organizations) from a neuroscientific perspective. The key criterion used to incorporate articles was that they linked neurobiology and neurochemistry to social issues and, in most cases, discussed the potentiality of this new approach on social topics.

Before exploring in-depth the ideas about the brain, individuals and society conveyed in these articles, several questions are relevant to understand some of the basic aspects of lay diffusion in the media: How quantitatively important is the social neuroscience in relation to neurosciences in general? Which are the main topics explored from this specific perspective?

Figure 3 shows the publication trend where the evolution of articles about neurosciences in general and social neuroscience in particular can be compared and analyzed. As the line chart depicts, the total number of newspaper articles published about social neuroscience is considerably small in comparison with the broad field of neurosciences. While the first article related to social neuroscience was published in 2001, most of the articles were published from 2006 onward. The fact that news dealing with social neuroscience have gained more dissemination indicates that, while social neuroscience is not the most quantitatively significant area in the lay communication of science, it may be a current growing research field.

Figure 4 illustrates the main topics tackled by the newspaper articles about social neuroscience. The majority of the articles (57%) focus on issues related to emotions and attitudes, ranging from scientific debates about the biological causes of violence and aggression to the neurochemical basis of morality and empathy. The second and third most common topics are economy and neuromarketing (9%) and brain topography (7%). The fact that most of the articles are concentrated in just one category, and that the other topics sum up comparatively small percentages, shows that the articles about social neuroscience have a similar publication pattern as the articles about neuroscience in general. Therefore, there is a high heterogeneity of topics in the newspaper articles.

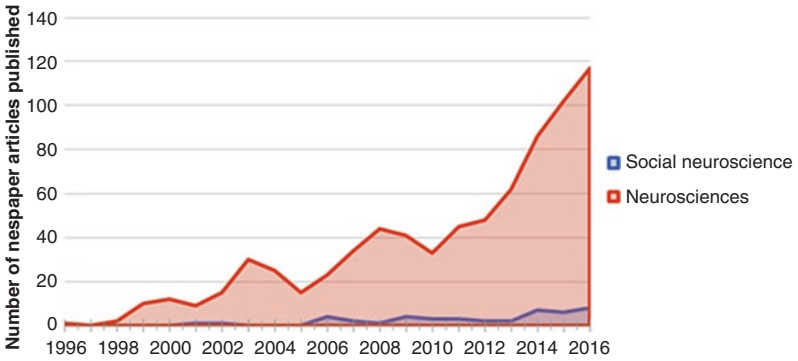

Fig. 3 Comparative publication trends of newspaper articles about neuroscience and social neuroscience. La Nación, 1996–2016. Source: prepared with information available in *La Nación*'s webpage (www.lanacion.com.ar). Total number of articles: 754

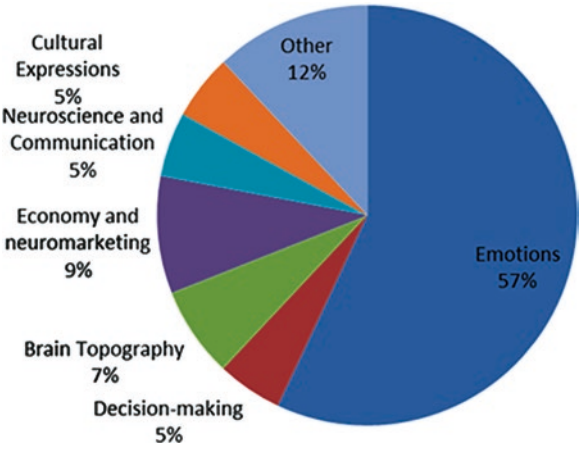

Fig. 4 Main topics of newspaper articles about social neuroscience. La Nación, 1996–2016. Source: prepared with information available in *La Nación*'s webpage (www.lanacion.com.ar). Total number of articles: 44

The fact that newspaper articles about social neurosciences are almost marginal in relation to the overall publication trend of articles about neurosciences sets a number of crucial questions that can only be tackled from a qualitative perspective. In this sense, it is tempting to conclude that the interest in social neuroscience for a popular audience resides in the fact that they integrate science to everyday experiences and is able to explain—at least partially—our personal problems, social ties, and emotional reactions.

Furthermore, it should be noted that media coverage of social neurosciences might be influenced by political interests as well as moral values circulating in the media. Several social studies have shown the influence of editorial policies on news coverage—e.g., the political and ideological affinity between media and right-wing parties in Latin American countries [37]. Moreover, other studies indicate that the ideological bias of editorial policies influence which news are published and how they are reported, including news related to violence [38, 39].

Indeed, it is clear that most, if not all, major newspapers are strongly politically biased, selecting both the type of topics covered and the particular point of view conveyed in the news. Social neuroscience is particularly prone to such kind of biases, as we have already shown in this chapter. An additional example relates to adolescence violence, which is being debated in social and political forums, including the possibility of decreasing the legal age for imprisonment. Indeed, several neuroscientific studies argue against lowering this age limit, considering the neurodevelopmental events taking place during this stage, including major modifications of cortical circuits during adolescence [40, 41], which should have important consequences from the neuroethical point of view [42]. However, these neuroscientific arguments are lacking in the newspaper reports and debates, which in some cases could reflect the political view of the editors.

Another example could be the growing evidence on the effects of poverty and malnutrition on brain development in children (e.g., [43–45]). Social communication of the scourge of poverty on children and youth does not usually consider sci-

entific findings and might be adding, consciously or not, to the considerable stigmatization of its consequences.

A complete analysis of editorial policies and media coverage of social neurosciences would require a specific research study and therefore exceeds this chapter's objective.

4 What Does "Social" Mean From a Neuroscientific Perspective?

News report scientific information from areas such as the neural basis of racial prejudice, the rules for social behavior, the role of mirror neurons in social interaction, brain correlates of decision-making, moral judgment and theory of mind, etc. Indeed, the conception of what is "social" derived from the analysis of printed news is centered around interpersonal relationships [46], an area that is traditionally in the realm of sociology. In most, if not all, reports, the link between subjects is analyzed from a neuroscientific perspective that illuminates the neural basis of interpersonal actions.

News reports usually provide information by two mechanisms: first, by providing a summarized story of the scientific experiment and, second, by quoting the authors of such experiments. There is also another kind of report which does not convey a certain scientific finding but introduces the opinion of experts who judge the specific social problems from a neuroscientific point of view (e.g., violence at school, the rise of crime, etc.). This kind of opinion columns aids in the generation of consent regarding the legitimacy of neuroscience as a perspective to intervene in social problems. For instance, this type of news report is clearly illustrated in the following article about morality:

> Neurosciences have shown interest in aspects of human life that certain traditions considered distant and separate from science. One of these aspects is morality. The so-called 'values' translate into concrete facts that can be studied and understood scientifically. (…) A more detailed understanding of moral issues allows us to distinguish between different ways to live in society, and gives us a possibility to judge actions as better or worse, more or less ethical (Can morality be understood by science?, February 24, 2016).

Neuroscientific ideas that circulate in the graphic press explain, metaphorically speaking, how society is inscribed in the brain, by providing information about two-way processes: (1) how the brain mediates social interactions and (2) how social processes shape brain function. In other words, news validate the notion that human behavior results from neural activity. Two examples will be useful to interpret such processes, which have in common biological explanations of social experience.

Let's first consider the media analysis of cerebral architecture, stating that it is particularly adapted for social interactions. Recalling neuroscientific theory and experiments that aim to determine the precise localization of brain regions underlying specific behaviors, news convey the idea that human beings are especially (and anatomically) gifted for such interpersonal interactions. Quoting a report from the *La Nación* newspaper:

> For example, we can identify specific areas of the brain that act to inhibit violent and antisocial responses; other areas intervene in the moral process of socialization and in the capacity of responding to others' needs and not only to our own. (The importance of a happy brain, March 17, 2002)

Other than communicating the results of specific experiments, some of the news reports convey positive expectations about the promising character of neuroscience to explain social conduct. In this sense, sometimes the strategy is to put the scientific findings in an imprecise background, thus constructing a level of universality that favors the construction of an unrestricted realm for neuroscience. This strategy is common to journalists and scientists when writing for the general public. The notions of "correlation," "intervention," "cause," and "responsible" are loosely defined, without providing enough explanation about their reach.

On the other hand, the interpretation of social neuroscience experiments in the media is usually extremely general, without the proper context and specificity with which they are reported in the academic world. Indeed, the hypothetical nature of scientific results turns into certainties when depicted in mass media, probably due to a certain "cultural reputation of certainty" which, by translating academic discourses into popular texts, risks losing the necessary "nuances of science" that allow an ample interpretation of results [25].

A second example regards the invocation of "healthy behaviors," i.e., the reconceptualization of social links as a source for health or disease. In our data, most reports of social neuroscience mention the fact that emotions are closely related to the processes of social interaction, and the latter can become patterns for a healthy way of life. For example, the piece "Friendship has a surprising healing effect" (*La Nación*, October 15, 2006) states that subjects with a large network of social ties recover more quickly from disease and, indeed, it is neuroscience the area to study how do brains relate to each other and affect health.

Yet another example is a report on moral attitudes, stating that "neuroscience has proven that resentment and the difficulties to forgive potentiate chronic stress, cardiac injury, increases in blood pressure and even a higher alcohol or drug intake ("To forgive is always healthy," *La Nación* May 4, 2016). As we have pointed out in previous reports [29], the information regarding the relation between cerebral processes and health becomes even more relevant in a social context where a healthy lifestyle has become a moral imperative [47]. In this sense, considering social interactions as potential foes or friends of good health involves the inclusion of social life in health issues—a view that was not traditional in medicine and generates a myriad of novel metaphors and imagery about a biology molded by social context.

In summary, we have provided evidence about the typical way in which the graphic press depicts social neuroscience, which departs from the academic perspective of a neuroscientific view of society. This study of the rhetoric of neuroscience popularization is quite relevant taking into account that it is the main channel through which a general audience receives scientific information and therefore helps to construct cultural representations and social appropriation of science.

Moreover, it is remarkable that news about neuroscience also cover other spaces in the media. This can be seen in women's magazines, in weekend newspaper sup-

plements, or in popular TV shows where neuroscientists are invited to express their views about a diversity of areas apparently unrelated to scientific scrutiny. Social neuroscience popularization certainly favors this kind of transmission, and journalism aids in their appropriation of scientific explanations about love, infidelity, maternity, and other themes in which hormones, the brain, and neurotransmitters become protagonists.

5 Concluding Remarks

We have shown the evolution of news about neuroscience in recent years, as well as the emergence of social neuroscience as a theme in the media. Although the latter has not become mainstream so far, their relevance relies in the kind of ideas it convey about the usefulness of brain science to understand interpersonal and emotional ties in society.

The analysis of the media coverage shows several key aspects of the communication of neurosciences. First, the number of articles related to this discipline has been steadily increasing in the last two decades, indicating the rise of neuroscientific ideas and discourses in the public space in Argentina. Second, these newspaper articles tackle a wide range of topics. Despite the fact that the majority focus on health-disease issues, the heterogeneity of topics illustrate the thematic diversification of neurosciences and, at the same time, the spectrum of aspects to which the public might relate to. Lastly, the specific analysis of articles about social neuroscience would indicate that, while it was not initially a popular topic in media coverage (the first articles were published in 2001), it is now gaining visibility, particularly with articles about emotions. Essential dilemmas about society and social interactions traditionally studied by social sciences—such as violence, morality, and empathy—are now faced by neurosciences.

The analysis suggests that public communication of social neuroscience generates new imagery, fantasies, and beliefs under the light of new findings of the social brain, by means of constructing a linear—and somewhat ambiguous—narrative of the relation between social and cerebral processes and mechanisms. The typical characteristics of science popularization (i.e., simplification and generalization of scientific results) do collaborate in this conception of a linear link between social and biological explanations. On the contrary, the journalistic language oscillates between causal and correlational explanations that link the brain to the social processes under study. Indeed, the use of undefined terms such as “correlates,” “basis,” “foundations,” or “substrates” favors this ambiguous perspective about the nature of the link between social and biological operations. Moreover, the social representations arising from neuroscience popularization tend to reduce social relations to those of interactions between individuals, discarding other social dimensions which are traditionally studied by social sciences.

In summary, the novelty of neuroscience comprises not only the new and expanding areas of research but also novel ways of describing the social experiences to a

lay audience. In this sense, the legitimacy of neuroscience relies, at least in part, outside the scientific expertise, since it encompasses a diversity of explanations that are absorbed by society as alternative interpretations of social experiences. The analysis of news in mass media contributes to unveil one of the circuits through which these ideas circulate in society. In other words, spreading of social neuroscience by the media collaborates in the hierarchy awarded to the brain in social behavior, as well as brings some legitimacy to the role of neuroscience as the most suitable area to study social processes that are traditionally the subject matter of other disciplines.

Having analyzed and somewhat diagnosed the current state of affairs of social neuroscience in the media as accessed by the general public, we should end with specific recommendations in order to shorten the gap between contemporary research in the area and its public communication. Universities and neuroscience schools certainly have a say in the process, since this is one of the fields where the gap begins. Among other proposals, social neuroscience courses could take advantage of social media as a tool for sharing up-to-date information on the subject and thus provide pathways for interactions between experts and the lay public [48].

On the other hand, although science communication has been professionalized in recent years, there is much to be done in terms of specialized training of both neuroscientists and journalists in neuroscience communication, a field that could also benefit from specific research which is currently quite scarce and fragmented [26]. In addition, social neuroscience deserves to be part of an "open science agenda" in which appropriately informed citizens can deliberate and discuss the reach and application derived from academic investigations. Citizens need (and demand) a realistic understanding of the dynamic and sometimes controversial nature of scientific authority. For this, it is necessary that scientists and specialized journalists describe the main features of experimental methods, the process of interpretation of scientific results, and their link with putative debatable issues, all of which show science as a social space of changing definitions (sometimes even competing), not as a closed an indisputable activity which does not represent the true everyday work of researchers. After all, neuroscience, much like social neuroscience in particular, refers to us, what we do, what we are, and what we feel, both as individuals and as a society.

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