

# The information about human evolution: An analysis of news published in Spanish communication media between 2015 and 2017

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## ABSTRACT

The present study examines a sample of 220 pieces of news related to human evolution, written in Spanish and published over a period of two years, both in digital and print media. The aim of this study is to assess the rigour and coherence of the information in the news in our sample with the scientific knowledge on the Theory of Evolution. To this end, errors and the incorrect use of concepts related to Biological Evolution are identified; classified according to criteria resulting from the review of previous studies and finally, the frequency of errors identified in news published in print media is compared with that identified in digital media. The results presented allow us to highlight the significantly high frequency of errors in the news analysed and the most frequent error categories. Results are discussed within the frame of the important role of dissemination of information played by scientific journalism in the processes of knowledge dissemination, in this case, related to human evolution.

*Key words: Scientific dissemination, human evolution, communication media, content analysis, science communication.*

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# INTRODUCTION

The Theory of Evolution is a field of research of undeniable scientific relevance within the current state of development of biological knowledge (Cofré, Santibáñez, Jiménez, Spotorno, Carmona, Navarrete & Vergara, 2018). Moreover, comprehension related to the evolutionary processes is an issue with important social and educational implications (Amundson, 1996; Gregory, 2009; Sepúlveda and El-Hani, 2012). Thus, the study of how the public makes sense of the new findings within the framework of biological evolution and progressively apprehend the new concepts emerging in this area of knowledge constitutes a field of research attracting increasing interest (Pobiner, 2016).

Within the context mentioned above, the study of the rigour and consistency with scientific knowledge of news and contents published by communication media around evolutionary processes stands out (Bohlin and Höst, 2015).

Nevertheless, although there is an increasing number of research studies that examine the treatment of scientific knowledge by the media in questions such as health (Miyawaki, Shibata, Ishii and Oka, 2017), energy (Koerner, 2014) and climate change (Boykoff and Yulsman, 2013), to mention just a few, the reality is that there are no studies focusing on the analysis of journalistic content linked to human evolution. This is the case in spite of the fact that analysing the information published by communication media is an unavoidable field of study, insomuch as these media are also a source of learning (Masterman, 2010; McCombs, 2014).

In this way, it is relevant to highlight that previous research insistently points to the deficiencies detected in present day societies in relation to the comprehension of processes related to biological evolution and the conceptual basis that sustain the Theory of Evolution (Borgerding, Klein, Ghosh, and Eibel, 2015; Fernández, and Sanjosé López, 2007; Isaak, 2003).

Within this context, the present study aims to examine a large sample of pieces of news related to the evolution of humankind, published over a two-year period and analyse their alignment with the scientific knowledge on the Theory of Evolution.

With this aim, the study develops the following specific objectives:

1. To identify errors and inappropriate use of scientific concepts related to the evolutionary processes of the human being in the news texts from the sample.
2. To classify the errors identified according to the categories derived from the previous research with the aim of analysing their prevalence and concluding the influence that these errors may have in the correct understanding of issues related to human evolution by the public.
3. To relate the errors detected with their source, differentiating between conceptual errors published in print media from those published in digital media, in order to establish whether there is a relationship between the type of error and its origin.

Ultimately, along the lines of the contributions by Joffe (2011), the present study seeks to provide evidence for the scientific community to assess the rigour of the information disseminated through the communication media regarding human evolution; an information that might be useful to improve the processes of dissemination of scientific knowledge in our society.

# METHOD

## Sample

A total of 220 pieces of news published in Spanish in different communication media between 1st December 2015 and 1st December 2017 are analysed. The pieces of news were collected through the digital periodical library MyNews (<https://www.mynews.es>), which offers press material from a wide range of communication media (Repiso, Rodríguez-Pinto and García-García, 2013), especially within Spain (Grau Moracho and Guallar, 2004).

The selection of the pieces of news was carried out by filtering the entire publications of the established period of time, using the key words *evolution*, *homo*, *human* and *man*. The initial search returned a total of 599 pieces of information. Of these, 379 were discarded for not being related with the subject of human evolution or for being repeated pieces of news.

## Study variables and coding procedure

Each piece of news in the sample was coded according to the following variables:

- (a) *Precision of the news*: Nominal variable with two possible values: correct or incorrect. This group includes those pieces of news containing at least one error related with misconceptions associated to scientific knowledge on the Theory of Evolution.
- (b) *Number of mistakes per incorrect piece of news*: discrete continuous variable that can have an integer value starting from 1.
- (c) *Communication medium*: nominal variable with two possible values, digital communication media or print media.
- (d) *Category of conceptual error*: qualitative nominal variable referring to the ascription of the errors found in the sample to the categories of improper uses of scientific concepts about human evolution considered in the present study. Table 1 presents a description of each category, together with the most habitual incorrect uses in each category and the references of the studies where these types of conceptual errors are previously cited.

Table 1: Description of the categories of conceptual errors used for the analysis of improper uses of scientific concepts related to the Theory of Evolution

Category	Description	Types of errors associated to the category
Linearity	Evolution as a one-way process, developed in one unequivocal sense towards the development of more evolved species.	References to <i>missing links</i> and evolutionary events circumscribed to very limited geographical contexts (Gregory, 2009). Reference to a radical species extinction with the purpose of giving room to other more modern species (Isaak, 2003). Reference to the existence of more advanced or evolved species.
Finalist	Evolution pursues an ultimate aim or purpose, providing evolutionary changes with intentionality.	Reference to supposed benefits, aims or aspirations guiding evolutionary processes (Heredia, Furtak and Morrison, 2016; Marrero-Delgado, 2017).  References to an alleged intentionality of biological functions (Grau Sánchez and de Manuel Barrabín, 2002; Marrero-Delgado, 2017).  Mention of the existence of a plan, design or project seeking the best-adapted individuals (de la Gándara and Gil, 2002).  References relating evolution with adaptations of specific individuals within the species, disregarding the concept of population (Nowak, 2006).  Evoking individual phenotypical characteristics as if these were inheritable <i>per se</i> , independently from their genetic basis (Gregory, 2009).  Statements that suggest that certain phenotypical traits are lost due to lack of use or function (Morales Ramos, 2016).
Anthropocentric	The human being as end and objective of evolution. Evolutionary processes are justified by the sole existence of human beings and present these as the ultimate purpose of evolution.	References to the fact the human beings are the object of evolutionary processes (Disinger and Tomsen, 1995).  Arguments that justify the evolutionary changes on the basis of the existence of human beings.  Statements implying that the natural environment and the changes taking place in it are subordinated to and

at the service of human beings (Clayton, 2000; Kahrman-Ozturk, Olgan and Tuncer, 2012)

Conceptual errors	Incorrect use of biological concepts and notions with the goal of explaining evolutionary changes.	<p>Taxonomic mistakes when explaining phylogenetic relations of humans with other species, including errors such as describing <i>Homo Sapiens</i> as <i>apes</i> and not as <i>hominids</i>.</p> <p>Statements attributing evolutionary capacities to certain organs, like for example the brain.</p> <p>References to social conducts and habits as inheritable.</p> <p>Overestimating the role of random processes in Biological Evolution (Gregory, 2009; Isaak, 2003).</p>
Human race	Use of the term race as a synonym of species and/or with the goal of dividing human groups on the basis of certain hereditary characteristics	<p>Explicit mention of the existence of <i>races</i> or subspecies within the <i>Homo sapiens</i> species (Kampourakis, 2018; Templeton, 1998).</p> <p>References to the <i>human race</i> instead to the human genus (McDonald, 2013).</p>
Science fiction	Speculation about future scenarios in which certain evolutionary changes, consequences of scientific or technical development or human action in the environment are considered inexorable.	<p>Statements extrapolating the current knowledge related to evolutionary processes to future scenarios, often predicting catastrophes, extinctions or radical changes in the biological environment with no scientific evidence (Alonso and Galán, 2004; Petit and Solbes, 2016).</p> <p>Unreal descriptions of changes in living beings or their biological environment as a consequence of scientific and technical development (Alcibar, 2004; Moreno Muñoz and Iáñez Pareja, 1997).</p> <p>Fantasy explanations of future evolutionary processes</p>
Other errors	Errors not classifiable within the previous categories.	Excessive interpretations lacking a theoretical basis or abusive simplifications (Ladle, Jepson and Whittaker, 2005).

## Analysis procedure of the pieces of news

The pieces of news in the sample were examined according to the variables mentioned above. To this end, the 7 categories of conceptual errors presented in Table 1 were first established by means of a bibliographical revision. Later, two members of the research team jointly classified 20% of the pieces of news in the sample. Then, both researchers completed the error classification of the remaining pieces of news in the sample independently and, finally, the level of agreement between the resulting classifications was analysed. It is worth noting that in relation to the cases where various errors belonging to the same category were identified in the same piece of news, these counted as one per category.

## Statistical procedures

The study of the level of concordance between the two researchers who assessed the errors detected in the pieces of news that make up the sample was carried out using Cohen's Kappa coefficient (Viera and Garrett, 2005). Furthermore, the differences between nominal variables were tested using Chi-square test, estimating the effect size by Cramer's V (Kline, 2004; Villanueva, 2017). The level of significance considered in the study is 0.05 and statistical procedures were carried out using a spreadsheet.

## RESULTS

The results of the present research project are presented below in two sections. In one section, the analysis of errors detected for the whole sample, with a detail of the frequencies for each of the 7 error categories considered in this study is presented. In the other section, the study of the proportion of pieces of news with errors and the possible relationship existing between the frequency of pieces of news with errors and the type of communication medium can be found.

### *a.) Review of errors found in the entire set of news pieces in the sample*

A total of 448 incorrect uses of scientific concepts related to the evolution of human beings were found in all 220 pieces of news comprising the sample analysed. Table 2 presents an overview of illustrative examples found in the pieces of news for each one of all 7 error categories, together with the relative frequency of each category compared to the total errors, and the level of concordance between the two reviewers (Cohen's kappa coefficient).

Table 2. Illustrative cases of errors corresponding to each category, along with the relative frequency of cases classified in the error categories ( $N=448$ ) and level of agreement between the two reviewers of the pieces of news (Cohen's kappa). The references of the pieces of news are available in the annex.

Category	Case examples	%	$k$
Linearity	<p>“In this way, Piltdown, and transitively the island, was transformed into the cradle of humankind” (Batalla, 2017).</p> <p>“The human being went from being a vulgar ape to dominating the rest of the natural world. On its way to the summit of the Universe, it invented gods, nations and limited companies.” (Pilar, 2016).</p> <p>“They had descended from walking apes, who eventually evolved into more advanced human beings” (“The fossil that changed everything”, 2017).</p>	19	0.95
Finalist	<p>“Our ancestors didn't eat meat, [...] As they had too much intestine, they gradually lost it, which allowed more energy for the brain to grow” (Velasco, 2017).</p> <p>“To address the lack of resources and premature deaths, the pygmies' bodies developed faster and are smaller” (Mediavilla, 2017).</p> <p>“Our body is designed to ingest sugar and fat, this meant survival in the past (“The dental health of primitive man was a lot better than today's man”, 2016).</p>	23.2	0.99
Anthropocentric	<p>“it does not add up for such primitive beings: this behaviour is supposed to be restricted to more advanced species, such as modern humans and Neanderthals” (Yanes, 2017).</p> <p>“This circumstance would imply an important challenge for homo sapiens, who would have to control their own creation and ultimately ensure the species' survival.” (Villahizán, 2017).</p> <p>“Humans are not so exposed to natural selection any more, but this is an anomaly in the species' story.” (Mediavilla, 2017).</p>	19.2	0.97
Conceptual errors	<p>“20.000 years ago there were five species of hominids on the planet; today there is one, <i>Homo sapiens</i>.” (Rodríguez, 2016).</p> <p>“We are almost the same as the Cro-Magnon and <i>Homo sapiens</i>, genetically there is no difference” (“The best of Spanish science in 2016”, 2016).</p> <p>“Indeed, evolution had until now been random” (Quijada, 2017).</p>	22.1	0.95

	<p>"Evolution depends on two fundamental aspects: mutations in the genes and environmental changes. Human beings will continue to experience mutations and most of these will make individuals non-viable", the scientist asserts" (Chaparro, 2017).</p> <p>"Cavemen beat their own kind to death, as much as great apes did, therefore it is very likely that we have inherited this violent conduct from our common ancestors throughout evolution." (de Jorge, 2016).</p>		
Race	<p>"The Ramapithecus, who became extinct about 8 million years ago, but left the genetic seed of our current human races" ("Chile and the world. A chronicle by ruperto concha: Sensorial thought", 2017).</p> <p>"Greed and ambition are represented in the creation of global empires with white man predominating as the superior race" (Cortés, 2017).</p> <p>"This illustration of the evolutionary stages from primate to Homo sapiens appears from it, therefore a black man is little more than a macaque" (Guaycochea de Onofri, 2016).</p>	2.5	0.99
Science fiction	<p>"In the same way that the triumph of Homo sapiens entailed the extinction of Neanderthals, the success of Robo sapiens will mean an evolutionary leap and will make the current human being obsolete" (Mediavilla, 2017).</p> <p>"...like with the creation of machine-men: hybrids that will give way to Homo sapiens 2.0 in the perspective of replacing man for a robot." (Barbería, 2016).</p> <p>"Scientific and technological advances have allowed humans to escape the effects of natural selection" (Soto, 2017).</p>	11.8	0.98
Other errors	<p>"Smartphones make us millions of times more intelligent than humans of just 20 years ago." (Zunni, 2017).</p> <p>"Scientists can quickly, cheaply and surprisingly precisely fix nature's grammatical errors" (Kusko, 2017).</p>	2.2	0.83

*b.) Review of the news comprised in the sample*

With regard to the analysis of the proportion of news with concept misuses, 79.1% (N=174) of pieces of news composing our sample present at least one conceptual error in discussing notions linked to the evolution of human beings. Among these pieces of news with errors, 51.7% (N=90) had two or three



errors, and 24.1% ( $N=42$ ) presented four errors or more. None of the pieces of news analysed presented more than 6 errors.

Besides that, 67.7% of the entire 220 pieces of news were published in digital media and 32.3% in print media (newspapers and magazines). Among the pieces of news published in digital media, 77.2% ( $N=115$ ) had at least one information error and presented 2.6 errors per piece of news on average. In the case of print media news, at least one error was found in 83.1% of them, and the average was 2.5 errors per piece of news. The differences between digital and print media regarding the presence of erroneous pieces of news are not significant ( $\chi^2 = (4, N = 220; p < 0.1) = 1.12$ ) and the effect size of the comparison indicated a weak association between variables ( $V$  de Cramer = 0,07).

## DISCUSSION OF RESULTS AND CONCLUSIONS

Studying the rigour of communication media in disseminating scientific knowledge is a matter of undeniable social relevance (Bohlin and Höst, 2015; García-Carmona, 2014; Miyawaki, Shibata, Ishii and Oka, 2017). In this sense, research studies have been carried out aimed at analysing the properness of information disseminated by communication media with scientific knowledge (Hayes and Grossman, 2006) in matters such as climate change (Boykoff and Boykoff, 2007), energy (Koerner, 2014) and food and agriculture (Lockie, 2006). However, research examining the rigour of journalistic dissemination of scientific knowledge with regard to human evolution happens to be much less frequent, in spite of the influence that the media news may have on this area of knowledge in particular.

In this context, the present research studies the information published in 220 pieces of news in digital and print communication media in Spanish, between the end of 2015 and the end of 2017 about biological evolution, with the aim of assessing the level of consistency with scientific knowledge.

The evidence presented is structured around three aspects; error frequency in the pieces of news, the categories of errors found and the relationship between these and the type of medium.

With regard to the first aspect, almost 8 out of 10 pieces of news analysed showed at least one error in the information they disseminate on human evolution, and among these, 3 out of 4 present two or more errors. The significant prevalence of errors in the news examined is consistent on the one hand, with the persistence of errors linked to the comprehension of evolutionary processes (Gregory, 2009) and on the other, with the significantly high rate of confusion or inaccuracies that can be found in the information that media spread about scientific and technical matters (Porlezza, Maier and Russ-Mohl, 2012).

With regard to the types of errors observed in the pieces of news analysed, the most frequent happen to be either those referring to the supposed intentionality or purpose of evolution (*Finalist* category), or those making a mistaken use of biological concepts with the aim of explaining evolutionary changes (category of *Conceptual errors*). This tendency is consistent with the results presented by previous research analysing the presence of finalist-type understandings related to the evolutionary processes (Heredia, Furtak and Morrison, 2016 and Marrero-Delgado, 2017) and also with studies examining conceptual errors related to the Theory of Evolution (Isaak, 2003).

Moreover, almost two out of ten errors presented assertions that induce readers to thinking that human beings are the ultimate end of evolution (category of *anthropocentric* errors); a fact that concurs with

previous studies revealing a tendency to give human characteristics and even shape to natural processes during initial stages of comprehension (Villarroel and Villanueva, 2017).

Mistaken expressions suggesting that evolution is a one-way process towards the development of more perfect species appear with a similar frequency (errors included in the category *linearity*). This frequency is similar in previous studies (Gregory, 2009 and Morales Ramos, 2016).

The errors linked to fictitious scenarios as in consonance with scientific evidence on the evolution of humankind (category *Science fiction*) show a lower prevalence than the previous categories, but are still relevant, as they imply slightly over 1 out of 10 errors found in the sample. Previous studies also indicate an increasing tendency in the appearance of these types of contents (Alfonseca, 2018), precisely for their simplicity and for being effectively suggestive (Alcíbar, 2004; Barceló, 2003).

With regard to the frequency of errors related to the use of the concept of *race*, it is certainly lower than the frequency for other categories. However, the qualitative importance that this type of error represents cannot go unmentioned (McChesney, 2015; Rufo, Capocasa, Marcari, D'arcangelo and Danubio, 2013) nor can the gravity of the errors in some of the evidence found in the sample. Thus, it is relevant to underline the role that communication media should play in avoiding the propagation of conceptual errors, such as using the term *race* to refer to phenotypical variations in the human being that can contribute to the persistence of beliefs with no scientific basis but with important social-type implications.

Finally, and regarding the differences found among media, the percentage of correct pieces of news turns out to be higher in the case of digital media, compared to print media (22.8% compared to 16.9%); and the frequency of pieces of news with only one mistake is lower in digital platforms (16.8% in digital media, compared to 24% in print media). These differences however, do not seem to be significant in the sample analysed, which reinforces the idea that there is uniformity among the contents of both types of media. These observations would seem to be in line with the case made in previous studies, in the sense that digital news has its origin in the traditional print press news (Alonso González, 2018).

To sum up, this set of evidences indicate that the news analysed have ample room for improvement regarding the information they communicate about evolutionary processes related to human beings. However, the need to complete the observations in this study with new research that allows to confirm or disprove the tendencies observed in this research project cannot go unmentioned. To accomplish this task, research studies should be carried out with samples from different contexts, including different language and cultural contexts; a line of research that can help avoid impaired quality in the research disseminated by scientific journalism (Calvo Hernando, 2003; Meyer, 2009).

## Annex

References of pieces of news with errors for each category presented in table 2

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