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## Are audiences receptive to humour in popular science articles? An exploratory study using articles on environmental issues

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### Abstract

This study aims to test the perceptions of audiences to positive and non-aggressive humour in two popular articles. The themes were the effects of climate change on biodiversity and the over-exploitation of species. Both articles were published on-line at a Portuguese environmental site, and readers were asked to answer to an on-line survey. A total of 159 participants submitted their answers concerning their receptiveness to the humour, demographic information and comments. Results showed that the use of humour in popular articles is considered valuable for the majority of these readers, but different degrees of receptiveness suggest caution in its use.

### Keywords

Environmental communication; Popularization of science and technology; Science and media

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### Introduction

Science communication books often stress that using humour is an important device through which to communicate with the audience [e.g. Bowater and Yeoman, 2012]. Though this is not always written up uncritically [Wilkinson and Weitkamp, 2016], this piece of advice rarely relies on evidence as to humour's effectiveness in furthering the goals that science communicators might set themselves.

Humour has started to be frequently used within science communication, an at least so far informally acknowledged recent trend [Leach, 2016]. Communicators hope to use humour to make science communication events or texts more enjoyable, accessible, to enhance learning about scientific concepts and to increase positive attitudes towards science and scientists. This trend manifests itself in various forms: in the UK, some established comedians such as Dara O'Briain, Lee Mack and Robin Ince have hosted popular science TV and radio shows (with Ince having recently won the Crick award in science journalism for his work on the BBC Radio 4 popular science magazine *The Infinite Monkey Cage*; Chortle [2016]). Scientists and scientific institutions have also started using comedy, with the "Bright Club" format at University College London — which trains researchers to perform short comedy routines about their research — having been widely imitated [Bultitude, 2011].

In the US, comedians such as Brian Malow [Malow, 2015] use humour to communicate science, and science advisors at the successful TV situation comedy *The Big Bang Theory* likewise believe that the show can be used to educate about science [Saltzberg, 2010; Li and Orthia, 2016]. Humour also exists in other science communication formats, such as webcomics (PhD comics by Jorge Cham), popular science books (Ben Miller, Pratchett) and social media platforms (IFLS).

### Using humour in communication: risks and opportunities

Previous researchers have tried to conceptualise the use of humour [Riesch, 2015] or investigated the views of science communication performers and their audiences [Pinto, Marçal and Vaz, 2015; Bore and Reid, 2014]. For example, recent research focused on a science stand-up comedy project in Portugal, in which both scientists-performers and audience members argued that this medium has the potential to make science more appealing [Pinto, Marçal and Vaz, 2015]. Nevertheless, issues such as the fact that the audiences were usually highly educated people, the peculiarities of the format implying a simplified view of science and the possibility of misinterpretation of messages due to the humour were also mentioned. Moreover, Bore and Reid [2014] studied the benefits and challenges of a satire stage play about climate change and concluded that it promoted audience engagement, but that the use of humour also encompassed risks such as the difficulty of catering for different humour preferences in the audiences, or “preaching to the choir”. Given that the topic was climate change and therefore a pressing social as well as scientific problem, they also warned that the use of humour may discourage the audience from taking action. Marsh [2013] contends that the constraints of comedy performances — where a fairly passive audience absorbs talk provided by a speaker on stage — may not be ideal for conducting two-way public engagement dialogues. While Marsh was explicitly talking about stand-up comedy, similar consideration would apply to popular science magazine articles.

There is also extensive research about the use of humour in formal education, which spans over the last four decades. In this long endeavour, some authors have found that humour is good in the classroom and should be used by teachers [e.g. Garner, 2006; Brown and Tomlin, 1996; Kher, Molstad and Donahue, 1999; Huss, 2008] whereas others have argued it can have negative consequences [e.g. Lei, Cohen and Russler, 2010; Wanzer and Frymier, 1999; Wanzer et al., 2006]. To make sense of this apparently contradictory information, Banas et al. [2011] conducted an extensive literature review about the use of humour by teachers in school classes. These authors concluded that humour is potentially beneficial in formal education, but that this outcome largely depends on the type of humour and how it is used. More specifically, they found that positive, non-aggressive humour can aid learning and recall, whereas negative and aggressive humour has the opposite effect. The explanation for this result is probably related to the power imbalance between teachers and students in the classroom, in which the use of negative and aggressive humour by the teachers could further increase this disequilibrium [Holmes, 2000]. Studies specifically concerning the use of humour in science education are much less frequent and usually focus on positive, non-aggressive humour [e.g. Weitkamp and Burnet, 2007; Roth et al., 2011; Flannery, 1993]. According to Roth et al. [2011], one possible explanation for this reduced research is that science is considered a serious matter and, therefore, less prone to comedy. Nevertheless, these authors argued that laughter can help science classes become

more life-like, and enhance the relationship between teachers and students. As another example, a study about a comic book used to explain basic principles of chemistry in primary classes of the United Kingdom concluded that humour was one of the most important factors contributing for the effectiveness of communication with this media [Weitkamp and Burnet, 2007].

Another relevant area to review is political humour, especially the more recent trends that have seen politicians become active participants in its production [Coleman, Kuik and Zoonen, 2009]. The parallel here is that, certainly in countries like the UK and Australia that place huge cultural value on a sense of humour, politicians have learned that participating in humorous dialogue — especially when self-deprecating — can improve their image as non-elitist, close to the public and approachable. Image improvement as non-elite and showing the human side of science is also a frequently claimed benefit of using humour in science communication. Though mostly seen as a positive development, these interventions are not without their risks. One of the worries articulated by some politicians in Coleman et al's [2009] study was that of the loss of personal reputation and/or dignity of public office. Higgie [2015] argues that the “political co-option” of satire has shifted the accepted roles of permissible discourse among politicians but also politicized the discourse of satirists: “Politicians have gained a license to play, just as satirists have been licensed to provide serious political commentary” (p. 73). However, she cautions that, as a consequence, politicians can hijack the cultural status of comedy for their own political ends and thus end up “damaging the often-celebrated democratic potential of satire” (p. 74; see also Basu [2014]). If in line with most current opinions, in the field we conceive of science communication and public engagement as a two-way democratic dialogue; this points to a potential risk similar to the one highlighted above by Marsh [2013].

There are many different types of humour, ranging from slapstick to puns, and it can have various targets, from racist and disparaging humour to self-deprecating humour. It can be fairly benign or aggressive, though there are debates as to whether all forms of humour are in some way aggressive [see Martin, 2010]. Traditional humour theory divides into three main explanations of why people find something funny [see Billig, 2005]: relief theory which sees humour as a release of tensions, superiority theory which holds humour as arising from our need to feel superior over others and incongruity theory which sees humour as arising from the unexpected juxtaposition of unrelated concepts. Studies of audience reception have shown reactions to humour and comedy to be influenced by the audiences' cultural capital [Friedman, 2014], nationality [Bore, 2010] and ethnicity [Weaver and Bradley, 2016], all of which modify what type of humour people will find acceptable and/or funny.

There are thus several risks that can be associated with the use of humour in science communication. Different types of audience may react differently and interpret the often polysemic message of a humorous communication in multiple ways. Humour can be interpreted as aggressive even when not meant to be, or dull and “trying too hard” if effort is expended not to be aggressive; what may please one audience might alienate another. The co-option of humour by scientists may have consequences for attempts to democratize science, similar to the effects Higgie warns about within political satire co-opted by politicians. Finally, there is a danger that humour might trivialize important issues [see also Moyer-Gusé, Mahood and Brookes, 2011].

Considering the uncertainties of using humour in science communication, the main objective of this exploratory study is to test if audiences appreciated the inclusion of humour in popular science articles about environmental issues published on-line at a Portuguese magazine (“Visão”). The adoption of this format is based on previous research which suggests that popular articles can make science more accessible to general audiences [Hyland, 2010]. These articles were written by one of the authors of the current research, who has previous experience on science humour. Since positive, non-aggressive humour is acknowledged in the literature as the most benign form in science communication and education, only this type of humour was tested [Fisher, 1997; Meyer, 2000]. Implications of this study on science communication are also discussed.

## Methods

### *Popular science articles*

Since the written format to be tested was the popular science article, two original articles with similar size and style were created by one of the researchers specifically for this study: “Climate change and biodiversity” (about the effects of climate change on fauna and flora species) and “The over-exploitation of species” (about the management of renewable natural resources, with specific information about fishing stocks) (see Table 1 and 2 for details). The author of these articles has previous experience in using humour in science communication activities in both oral and written formats. The fact that the tested articles were not written with the aid of one or more professional comedians had the purpose of simulating what a science communicator or a scientist could do in terms of using humour in their activities.

The articles had one to two humorous sentences inserted either at the beginning or at the end of each of the six paragraphs, thus integrating it with the serious information (Fisher [1997]; see Tables 1 and 2 for details). This choice in the placing of humour was done to decrease the disruption in the flow of scientific information. Both articles had a length of about 700 words, in which the humorous parts represented about 20% of the number of words.

Disparaging, hostile or tendentious humour was not used, which means that it was not insulting, aggressive, gross or obscene [Janes and Olson, 2000; Fisher, 1997; Meyer, 2000]. Although it is acknowledged that this type of humour can be a valuable social tool [Billig, 2005], it is also more difficult to be well accepted by audiences than non-aggressive forms of humour [Cann, Zapata and Davis, 2009]. During a pilot study conducted before data collection, three environmental scientists and one social scientist were asked to review the humorous version of the two popular articles and the closed questionnaire. The purpose of this preliminary study was to assess if the popular articles and questionnaire were simple, clear and scientifically correct, and if inserts were considered appropriate and reasonably humorous. The popular articles and questionnaire were then revised, taking into account the comments of the four consulted scientists.

The reviewed version of this questionnaire had a first part of a quantitative assessment with 5 questions using a 7 point Likert scale from 1 (strongly disagree) to 7 (strongly agree) which concerned the satisfaction with the article, the importance of the focused scientific issues and the enjoyability of the humour. In

**Table 1.** Topics of each paragraph and humorous inserts in the article 1 entitled “Climate change and biodiversity”.

Paragraph	Topics of the paragraph	Humorous insert
1	Changes in climate and adaptations of biodiversity	“This is what happens, when you don’t have access to air conditioning.”
2	Difficulties associated to the fast pace of current climate change and habitat destruction	“Given these difficulties, the least we could do is to tell other species that we are very sorry for the disturbances we are causing. Otherwise, they might complain about us to God in relation to climate change.”
3	Climate models and implications of climate change in the Portuguese forest	“Some people like to predict the future whilst staring at crystal balls which look like bedside table lamps. But for some strange reason,” [scientists use climate models...].
4	Impacts of climate change in the migration of birds	“Fortunately, they don’t have to pay additional fees to change their travel dates, otherwise they would spend quite a bit of money.”
5	Climate change and the Portuguese aquatic fauna	“I just don’t know what is going to happen to the Portuguese fish stew with all these changes.”
6	Uncertainties associated to climate change and actions to prevent future consequences	“[...we will leave a poorer natural heritage than what we have received]. And that’s not very nice of us.”

the second part of the questionnaire, respondents were asked to provide information concerning four demographic factors. In the last question, participants had an open question regarding “Comments” (see appendix A for details).

These two popular science articles were published online at a Portuguese site of a magazine (“Visão”), in a section dedicated to environmental issues (for more details: <http://visao.sapo.pt/verde>; article 1 was published on 17/03/2015; article 2 was published on 9/04/2015). At the end of each article, there was a short sentence asking readers to participate anonymously in the current study by answering to a brief online questionnaire using the software survey tool SurveyMonkey (SurveyMonkey Inc.). These two popular articles were disseminated on the site of the magazine, as well as social networks and mailing lists concerning environmental sciences. In total, 159 participants submitted their answers, in the period between 17 of March and 22 May of 2015.

This study has the limitation of having surveyed only two popular science articles. The reason for this option was that the inclusion of reference to the study in the website depended upon the goodwill of the publishers. Therefore, the authors considered that it was not appropriate to include the link to the questionnaire in more articles, since the website is a public platform without any research purposes.

The analysis of the questionnaire was quantitative for the first nine questions, using basic descriptive statistics [Sokal and Rohlf, 1995]. The results obtained were expressed both as an average value, as well as percentage divided into disagree (1 to 3), neither disagree or agree (4) and agree (5 to 7). In the variable “age”, data was

**Table 2.** Topics of each paragraph and humorous inserts in the article 2 entitled “The over-exploitation of species”.

Paragraph	Topics of the paragraph	Humorous insert
1	The Neolithic in Portugal and fisheries as the only significant source of wild food	“And fishing is not exactly a rudimentary process, since there is fishing gear, GPS and sophisticated sonars that should lead fishes and other marine animals to think: But how can these humans catch us so easily?”
2	The concepts of “over-exploitation” and “tragedy of the commons”	“Moreover, it seems that the whole story of magicians being able to pull rabbits from empty top hats is just a trick. Bummer.”
3	Fisheries in the world	“Anyway, we can always pick up a fishing cane and catch <i>Peixinhos da horta</i> .” (note: <i>peixinhos da horta</i> this is a Portuguese dish prepared with vegetables in a wheat flour based batter, which is then deep fried; the literal translation of this dish is “little fishes from the garden”)
4	The sustainability of fishing resources in Portugal	“In Portugal, there are also cases of over-exploitation of marine resources, which means that this problem goes beyond the working conditions in our country.”
5	Fishing practices in Portugal	“And I’m glad they did it, since it would be very difficult to get such a fine fish like the sardine to eat with bread during the Popular Saints” (note: this is a typical food during these celebrations, which happen in Portugal during the month of June)
6	The sustainability of fisheries in the World	“But if all goes wrong, we should not despair: just pray for a miracle of the multiplication of the fishes.”

aggregated in four different age groups (groups: 18–25 years; 26–40 years; 41–65 years; >65 years). Correlation analysis was also performed between the five questions, controlling for sex.

For the comments section, the analysis was qualitative and began with reading all the comments to assess if they were related to the research issues [O’Cathain and Thomas, 2004]. Since the authors considered that they did, the process of analysis consisted in organizing information and creating emergent categories (defined after working with the data), identifying patterns and connections within and between these categories and interpreting them collectively [Taylor-Powell and Renner, 2003]. Additionally, the numbers of comments in each defined category and verbatim comments were also presented in the results [O’Cathain and Thomas, 2004].

## Results

In this study, 62.89% ( $n = 100$ ) of participants were women, 36.48% ( $n = 58$ ) were men and 0.6% ( $n = 1$ ) did not reply. There was a prevalence of the age group 41–65 years which represented 42.14% ( $n = 67$ ) and the age group 26–40 years representing 38.36% ( $n = 61$ ) (see Table 3 for details). The average age of the 159 participants was 46.36 years ( $SD = 13.887$ ).

**Table 3.** Respondents of the study per age group.

	18-25 years	26-40 years	41-65 years	>65 years	NA	Total
Number and percentage of respondents	7 (4.4%)	61 (38.36%)	67 (42.14%)	21 (13.21%)	3 (1.89%)	159

Employed participants represented 65.81% ( $n = 102$ ), 20% ( $n = 31$ ) of participants were retired, 7.74% ( $n = 12$ ) were students, 5.16% ( $n = 8$ ) were unemployed, 1.3% ( $n = 2$ ) were homemakers and 2.52% ( $n = 4$ ) did not reply. Most of participants had higher education degrees, with 42.76% ( $n = 68$ ) at bachelor level, 23.9% ( $n = 38$ ) at master level and 18.24% ( $n = 29$ ) at PhD level, whereas only 15,09% ( $n = 24$ ) had up to secondary education. Since only 17.1% of the Portuguese resident population in 2015 had BSc degrees or superior education levels [Pordata, 2015], it was considered that the participants in this study represented mainly this small part of the Portuguese population with university degrees.

The results obtained regarding the appreciation of the humour showed that the majority of participants liked reading the articles with humorous inserts, expressed desire to read more articles and thought that they focused important scientific issues (see Table 4). However, the opinions about the specific role of humour in the articles were more divided: about 65% of the participants thought that the humour of the article made science more appealing. A similar percentage of about 63.5% expressed their agreement to the use of humour in the articles, whereas about 24.5% expressed their disagreement with the use of humour in these articles and about 12% had a neutral opinion.

**Table 4.** Receptiveness of general audiences to on-line articles with humorous inserts using a questionnaire with 7-point Likert scale.

	Average and standard deviation	Receptiveness of respondents in percentages		
		Agree	Neither agree or disagree	Disagree
1. I liked reading this article	5.761 (SD=1.329)	88.05%	3.14%	8.81%
2. I would like to read more articles like this in the future	5.594 (SD=1.345)	86.08%	5.06%	8.86%
3. The scientific issues focused on this article are not important	2.224 (SD=1.882)	15.38%	1.92%	82.69%
4. In this article, humour makes science more appealing	4.809 (SD=1.794)	64.97%	11.46%	23.57%
5. I would prefer if this article did not have humour	3.164 (SD= 1.824)	24.53%	11.94%	63.52%

Correlation analysis between the five questions showed a high value (ie. above 0.7) between questions 1 and 2 (see Table 5). In this case, the enjoyability and the desire to read more articles were very closely linked. It was also found moderate to weak correlations between the readers' appreciation to the articles measured in questions 1 and 2, and of the humour in the articles assessed in questions 4 and 5. This indicates that humour has some influence in the enjoyment of reading these articles, although this connection is moderate. Considering the results presented above, this seems to be the result of mixed reactions of the respondents to the humour in the tested popular articles. The perceived importance of scientific issues was not related to the receptiveness of readers to the articles.

**Table 5.** Correlation between questions of the questionnaire, controlling for gender.

Comparison	Correlation
Q1 vs. Q2	R=0.825 p <0.001
Q1 vs. Q3	R=-0.106 p = 0.187
Q1 vs. Q4	R=0.634 p <0.001
Q1 vs. Q5	R=-0.413 p <0.001
Q2 vs. Q3	R=-0.061 p = 0.445
Q2 vs. Q4	R=0.608 p <0.001
Q2 vs. Q5	R=-0.443 p <0.001
Q3 vs. Q4	R=-0.014 p = 0.857
Q3 vs. Q5	R=0.014 p = 0.861
Q4 vs. Q5	R=-0.678 p <0.001

The comments collected in the questionnaire add meaning to these results, despite the fact that some of them were indirectly related to science communication (e.g. style of writing). According to the chosen method to analyse this information, these comments were grouped in six different categories (see Table 6 for details). There was a division between participants who agreed with the use of humour in science communication ( $n = 16$ ), those who did not agree with this approach ( $n = 2$ ) and a third group who only agreed with the use of humour if certain conditions were met ( $n = 8$ ). Therefore, humour was considered by some participants as pleasant, with potential to increase the transmission of information and critical thinking, and especially useful to stimulate audiences who were less interested in science. On the other hand, it was also argued that science is a serious matter and that humour should not be used because it can undermine its credibility, distort the message and decrease its importance. A third view considered that humour should only be used if it is very well done or if the whole article is written in a humorous style.

In what concerns the specific use of humour in the two tested articles some of the respondents claimed that the inserts were not enough, that it was not their kind of humour, that it was silly and that it deviated attention from scientific content. Others considered that the humour used was a fresh approach to traditional popular science articles, thus presenting a pleasant contrast to the serious scientific information. There were also respondents which found that the humour was not enough and that the choice of placing humour either at the beginning or at the end of paragraphs made it predictable and slightly "forced". One participant added that the main drawback of using humour in these articles was that its receptiveness depended on the personal sense of humour of each reader.



**Table 6.** Characterization of comments in the questionnaire.

Categories (total=6)	Number of comments (total=78)	Examples of comments
Importance of humour	4	"Humour softens the reception of bad news" "Humour adds flavour, and the speech becomes less boring"
Humour in science communication	22	"I think that humour can help in the transmission of knowledge in texts about science" "In this kind of communication, humour only works if its very well done"
Humour in popular science articles	24	" I thought that it was very interesting to have a humorous approach to such a serious and up to date issue" "In this article, I felt that the humour was distracting me from the information instead of reinforcing it"
Writing style of tested popular articles	11	"The article is very pleasant to read and contains information which can induce the common citizen to change habits" "Humour and stupidity are two different things"
Scientific issues in the popular articles	12	"There are scientists that talk about climate change; and other scientists claim this is false (...). Climatic variations have always existed and always will. They are natural, and not caused by human action" "I consider this issue relevant and a priority (...). It is necessary to create [environmental] laws and punish the ones which do not respect them"
Characterization of participants	5	"I work in science communication, and more specifically in a group which studies the relationship between climate change and biodiversity" "I am a biology student"

As for the writing style of these tested articles, those which approved of it thought it was clear, synthetic, interesting and adequate, whereas those who disapproved of it considered that there was a use of careless language, sentences badly written or written in colloquial style, a frivolous view or too generalist approach to scientific issues, and that it should include more scientific data.

The remaining categories of comments had more homogeneous responses. Humour was considered valuable by most of the readers, despite several comments with negative appreciations. As for the focused science issues, most of the comments attributed relevance and reinforced the importance of informing audiences about environmental issues. Finally, several participants commented that they were biologists, biology students, environmentalists or science communicators.

## Discussion

One of the main objectives of this exploratory research was to assess how positive, non-aggressive humour in popular science articles is perceived by audiences. The novelty of this study was the consistency of results in different types of analysis, which corroborate the views of other authors that humour used in science communication can have various outcomes and limitations [e.g. Bore and Reid, 2014; Weitkamp and Burnet, 2007; Pinto, Marçal and Vaz, 2015]. Research in science education has previously associated this type of humour with a more interesting and relaxed learning environment, which does not happen with the use of negative and aggressive humour [Banas et al., 2011]. However, using this type of humour alone in science engagement is not a guarantee that it will be well received by the public.

For example, in the case of a satire theatre play concerning climate change, 63% of audience members liked the humour used [Bore and Reid, 2014], which is a very similar value of about 65% of approval rate to the humour of the popular articles in our research. As another example, in the testing of a comic book about chemistry directed at children, the humour was usually viewed as good [Weitkamp and Burnet, 2007]. However, even among such a young audience, there was a minority of children which found that this comic book was not funny. We also found a moderate level of correlation between the pleasure of reading and the desire to read more popular articles with the use of humour, as well as mixed reactions to the humour used in the comments. Therefore, there was a majority of respondents supporting and complimenting the use of humour, as well as a significant minority giving their negative feedback in an equally effusive way, and few others reacting with indifference.

On the other hand, Pinto, Marçal and Vaz [2015] reported an indicative survey of the audience perceptions of a science stand-up comedy show, with 51% of respondents as very satisfied and 49% as satisfied. The justification for this very high level of approval rate to the humour may be that their performances were intensively scrutinized and re-written before the final presentations. Also, each stand-up comedy show had a mixed group of comedians, thus using different styles of humour and themes which may have increased the probability of pleasing the audience [Pinto, Marçal and Vaz, 2015].

Also, other authors have shown that audience receptiveness to humour can depend on factors such as context, culture and type of audiences, which in many cases may be difficult to control [Holmes, 2000; Hackman and Barthel-Hackman, 1993; Bore and Reid, 2014]. In particular, with the audiences' cultural capital resources influencing appreciation of humour [Friedman, 2014], the social make-up of the audience in our research (mainly highly educated with high cultural capital) will make widening our conclusions to a more representative population impossible. This limitation was also reported in other research concerning the use of humour in science communication such as Pinto, Marçal and Vaz [2015] and Bore and Reid [2014]. This is probably related to the fact that science communication usually attracts this specific kind of audience, and therefore a problem more widely for science engagement and outreach activities. Broadening up the types of audiences is often one of the reasons why more popular cultural forms such as comedy get enlisted in science communication [see Weitkamp, 2015], however our study is still limited by that fact.

A particular concern shared by participants was that humour is risky and can undermine the credibility of these articles, which was also previously mentioned by other authors [e.g. Pinto, Marçal and Vaz, 2015; Bore and Reid, 2014; Riesch, 2015; see also Moyer-Gusé, Mahood and Brookes, 2011, in health communication; and Coleman, Kuik and Zoonen, 2009, in political satire]. For example, Bore and Reid [2014] argued that the balance between humour and seriousness during a play about climate change was raised by several members of the audience. Moreover, some scientists themselves have previously described science communication in general as a “risky or potentially dangerous process” due to misunderstanding or misuse of information [Davies, 2008]. Therefore, the humour can add risk to this communication, and simultaneously become a strength and a weakness according to the way it is received by the members of the audience.

The implications of this study for science engagement are that it is advisable to consider preferences of targeted audiences, in order to have a more consensual humour [Bore and Reid, 2014]. One possibility is to test and reformulate the humorous parts (if necessary, several times) used in science communication in order to increase its acceptance [Pinto, Marçal and Vaz, 2015]. Since this may not be feasible in many cases, one possible approach for a science communicator (or a group of science communicators) is to accept that the comedy will only be appealing to a part of the audiences. In this case, a good option is to create a niche for audience members which appreciate to read about science with a certain kind of humour. This is already happening in venues such as the U.S. *Scientific American* blog “But Seriously” [Malow, 2015] and the UK *Guardian* blog “Brain flapping” [Burnett, 2015], in which scientific issues are presented with a specific humorous perspective. However, results also show that there is a significant part of the audience which disagrees with the presence of humour in popular science articles overall. In this case, the use of any kind of humour will likely be rejected by these readers.

These results also point to possible future studies that will investigate these issues more directly. For example, it was not possible in the current design to test versions with and without humour in order to distinguish the humour effect from other possible effects, or different types of humour. Moreover, the fact that the audience was highly educated underlines the need of doing research about the use of humour in science communication in other kinds of venues which have the potential to reach different types of audiences [e.g. Bultitude and Sardo, 2012].

In conclusion, this study confirms the views of previous authors that the use of humour in science communication implies risks, thus creating the possibility of polarizing the opinions of readers. Even among participants which supported the use of humour in these popular articles, results suggest that some liked it more than others, showing also different preferences in the frequency of humorous inserts in these articles. In this scenario, it is recommended a cautious approach to the use of humour in outreach science articles, with an awareness that it can simultaneously attract, be indifferent or repel readers [Riesch, 2015; Pinto, Marçal and Vaz, 2015].

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**Appendix A.  
Questionnaire  
used in the current  
study**

In the first five questions, please choose only one answer on a scale between “1- completely disagree” to “7- completely agree”

1. I liked reading this article
2. I would like to read more articles like this in the future
3. The scientific issues focused on this article are not important
4. In this article, humour makes science more appealing
5. I would prefer if this article did not have humour
6. Age
7. Sex (Male; Female)
8. Education level (Secondary school; Bsc; Msc; PhD)
9. Professional situation (Employed; Unemployed; Student; Retired)
10. Comments

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