Estudos do CEPE

UM DISCURSO COM PRECONCEITO AMBIENTAL PODE MUDAR NOSSA PERCEPÇÃO EM RELAÇÃO ÁS QUESTÕES AMBIENTAIS? UM EXPERIMENTO RANDOMIZADO PARA O BRASIL

Can an environmentally biased speech change our perception regarding environmental issues? A randomized experiment for Brazil

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Resumo:. Um dos problemas que podem afetar o valor que os indivíduos atribuem ao meio ambiente está relacionado à qualidade e ao nível de informação que os agentes têm sobre o recurso ambiental. O objetivo deste artigo é testar a hipótese de que a comunicação persuasiva afeta as percepções dos indivíduos sobre o meio ambiente. Para testar a hipótese, aplicamos questionários randomizados aos alunos da Universidade Federal de Pelotas. Os resultados do experimento aleatório mostram que grupos formados por jovens, inexperientes e desinformados são mais influenciados por uma retórica ambiental. Além disso, os resultados mostram que a percepção individual pode ser alterada intencionalmente por informações enviesadas.

Palavras-chave: Comunicação persuasiva, viés de informação, percepção ambiental, experimento aleatório.

Abstract:. One of the problems that can affect the value that individuals attribute to the environment is related to the quality and level of information that agents have about the environmental resource. The purpose of this article is to test the hypothesis that persuasive communication affects individuals' perceptions of the environment. To test the hypothesis, we applied randomized questionnaires to students at the Federal University of Pelotas. The results of the random experiment show that groups formed by young, inexperienced and uninformed are more influenced by environmental rhetoric. Furthermore, the results show that individual perception can be intentionally altered by biased information.

Keywords: Persuasive communication; information bias; environmental perception; randomized experiment.

1. INTRODUCTION

One of the problems that might affect the value individuals give to the environment is related to the quality and level of information agents have regarding that resource. To allow them to make suitable uncertainty-free judgments, the contingent valuation literature points that researchers should provide a balanced description of the environmental resource. That is even more important among individuals that aren't direct users, that are inexperienced or have no *a priori* information about the studied resource. The amount and type of material provided may induce individuals to adopt certain positions, biasing their perception and, consequently, their valuation (HARRIS *et al*., 1989; AJZEN *et al*., 1996; BLOMQUIST and WHITEHEAD, 1998; BERRENS *et al*., 2004).

Researchers have tried to establish the effects of information on willingness to pay regarding issues such as the quantity and quality of information, new and redundant information, time to think or to gather new information, if men cause the environmental problem or if it's of personal relevance, among others (BERRENS *et al*., 2004; BLOMQUIST and WHITEHEAD, 1998; BULTE *et al*., 2005; COOK *et al*., 2012; CORRIGAN *et al*., 2008; CUMMINGS and TAYLOR, 1999; HOEHN and RANDALL, 2002; HOWLEY *et al*., 2010; MACMILLAN *et al*., 2006; TKAC, 1998). Most of the literature is based on the premise of providing a balanced description so that agents can become thoroughly acquainted with the public good. But what if someone purposely wanted to bias the information individuals receive about an environmental resource? As Ajzen *et al*. (1996) suggest, persuasive communication can be used to change the listener's beliefs and attitudes toward the intended direction. MacMillan *et al*. (2006) point that less informed individuals could be easily influenced by negative propaganda, such as catastrophic environmental stories propagated by the media.

We proposed ourselves to answer the following question: Can an environmentally biased speech change the perceptions of economic agents regarding environmental issues? To do this, we designed a randomized experiment addressing a fictitious problem. Questionnaires containing two types of descriptions, balanced and biased, were distributed between the control and treated groups to capture the effect of the intervention on individuals' perception regarding the seriousness of the proposed environmental problem. One might ask why would we want to bias information and if it would be ethical to use a fictitious problem as in the proposed experiment. The fact is that, as Akerlof and Shiller (2015) put it, the economic system is filled with manipulation and deception. For instance, interest groups with large influence and resources can buy space in newspapers, social media, and television. Recent discussions about media bias and "fake news" are also examples. These "information phishers" give costumers erroneous or even false descriptions intending to induce certain conclusions and/or to sell something. These costumers, or "information phools", make decisions based on propaganda that was intentionally designed to mislead them (AKERLOF and SHILLER, 2015). Although we might not agree with Akerlof and Shiller regarding regulation issues, we can't deny the fact that such phishers exist.

2. PROPOSED ENVIRONMENTAL PROBLEM AND EXPERIMENT DESIGN

To avoid difficulties associated with prior information and other valuation issues, the experiment was based on a fictitious environmental resource for which the individuals involved would have no knowledge. Regarding this issue, we must keep in mind that previous authors point that *a priori* knowledge makes null the effect of treatments with new information (TKAC, 1998). Therefore, by not using an actual environmental problem we avoid that situation because questionnaires were not applied at once, we could not reveal this deception at the end of the survey due to the risk of invalidating the

experiment. The idea was to verify if a short text containing a biased description would be able to alter agent's perceptions.

We divided the sample into two groups. The treated and control groups received the same basic questionnaire on social and economic attributes, and both contained the following binary questions: "Do you consider the environmental situation described in the text troubling?" and "Do you consider the environmental situation outlined in the text serious?". Also, both groups had to answer if the presented description was relevant and real. Before those questions, heading the questionnaires, each group received a different text about basalt extraction. Basalt is a mineral found in the northern region of Rio Grande do Sul which is used for civil construction and building, but not very common in the southern region. Both descriptions were constructed to mix real and fictitious information. We tried to keep both texts simple and short. Harris *et al*. (1989) and Hoehn and Randall (2002) point that too much information has the power to confuse individuals, causing them to ignore relevant aspects and making them adopt simplified positions regarding environmental problems.

The balanced description outlined the sector's contribution to local income and employment, the role of family companies for local economic development, and possible environmental effects such as water pollution, deforestation, reduction of wildlife, and other aspects of sustainable development. Following the text, we included a photo of a medium sized quarry surrounded by native vegetation and a label saying, "Basalt quarry." Alternatively, the biased description didn't include any clues about economic development but was focused on the detrimental effects of basalt extraction. It pointed that the quarries were in a forested area rich in biodiversity and close to water springs and that the sector's growth would certainly cause the pollution of major rivers, vast deforestation and severally affect sustainable development with consequences over the local fauna and population health. Following the text, a picture showing a beautiful valley and a label saying "Ferradura Valley can completely disappear because of basalt extraction." For both groups, we included two reading comprehension questions (multiple choice), so we could identify those individuals that jumped to the questionnaire without reading or comprehending the presented descriptions. Figures 1 and 2 present both texts and reading comprehension questions.

The reader should note that for this experiment it wouldn't be possible to not provide a description of the resource to the control group (as a "no information" group). The resource description is central to valuation since individuals' preferences are formed based on these informative materials. Other studies have shown that the amount of the provided information is also a source of possible valuation bias (AJZEN *et al*., 1996; BLOMQUIST and WHITEHEAD, 1998; HARRIS *et al*.,1989). Therefore, both groups had to receive similar texts in length differing only in emphasis (balanced or biased). Moreover, we wouldn't be able to ask the seriousness' questions without providing a description of the resource to the interviewees.

We conducted the experiment with first-year students from the Federal University of Pelotas, we included a question asking if the student was from the Serra Gaúcha to control possible caveats. This

town is located 5-6 hours' drive from the region of Serra Gaúcha and the students are predominantly from the southern region of Rio Grande do Sul. The sample size was calculated based on the number of students entering the University (freshmen). In the first semester of 2015, the University opened 3306 admission vacancies for 78 undergraduate courses, being obliged to occupy all of them through different forms of selection. To accurately represent this population, the minimum sample size at a confidence level of 99%, confidence interval at 5%, and expected proportion of 50% would be 553 respondents. We applied 682 questionnaires in 27 undergraduate courses (Questionnaires were applied randomly in the following courses: business administration, visual arts, dance, social science, architecture, pedagogy, law, economic science, philosophy, odontology, computer science, zootechny, hydropower engineering, materials engineering, production engineering, agricultural engineering, electronic engineering, petroleum engineering, geological engineering, civil construction, wood industry engineering, agronomy, management processes, language (literature and teaching), medicine, tourism) during the first semester of 2015 through room visits during class hours. Therefore, we have no external validity issues regarding the population of interest (freshmen from a specific University). We gave students 15 minutes to respond the questionnaire, and they couldn't talk to classmates during the process. Each undergraduate course received a single visit to avoid students responding the survey twice (duplicity).

Figure 1. Balanced information text and reading comprehension questions

The Serra Gaúcha, in the north of Rio Grande do Sul, is famous for its Italian colonization and gastronomy. The cities of Caxias do Sul, Farroupilha, Bento Gonçalves, Nova Prata, among others in the region, are also famous for their natural beauty, environmental tourism - for example, ecological trails and rafting.

Another important and little known economic activity is mining, mainly the extraction of basalt. The mineral is widely used in construction because of its rigidity and strength. The sector, which has been expanding since mid-2003 due to a building boom, has generated income and jobs for many families. The segment created 39 thousand jobs and R$ 378 million in GDP in the last year alone. Several family companies have taken advantage of the abundance of basalt, contributing to the socio-economic development of the region.

However, the primary reserves are in native forest sites. The expansion of the activity could have environmental effects such as pollution of rivers used for human consumption and recreation (rafting, diving, fishing) and disappearance of green areas used for leisure (green tourism, hiking trails), both rich in fauna/flora. That can jeopardize sustainable development in the region.
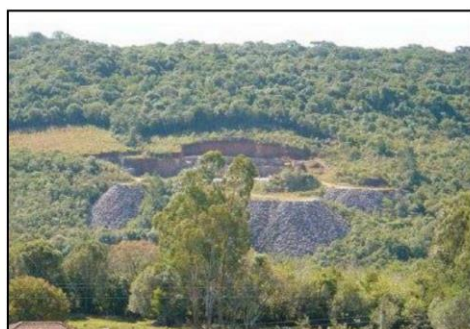
Basalt mine in Nova Prata

(1) According to the information provided above:
   (a) The main basalt reserves are of easy access.
   (b) The Serra Gaúcha is famous for bauxite production.
   (c) Basalt extraction generates employment and income in the Serra Gaúcha.
(2) An appropriate title for the text is:
   (a) Uses and history of Basalt.
   (b) Socio-economic effects of basalt extraction.
   (c) Tourism and gastronomy in the Serra Gaúcha.

The decision to conduct this experiment only with freshman had practical and theoretical reasons: first, we wanted to avoid failing students (duplicity); secondly, this group is formed, mostly, by young and inexperienced individuals. The literature suggests that people who are unfamiliar with the environmental resource (that are not direct users), and who are young and inexperienced, are more susceptible to persuasive communication (WHITEHEAD and BLOMQUIST, 1995; AJZEN *et al*, 1996; BLOMQUIST and WHITEHEAD, 1998; HOEHN and RANDALL, 2002, MACMILLAN *et al*, 2006).

Figure 2. Biased information text and reading comprehension questions

The Serra Gaúcha, in the north of Rio Grande do Sul, is famous for its Italian colonization and gastronomy. The cities of Caxias do Sul, Farroupilha, Bento Gonçalves, Nova Prata, among others in the region, are also famous for their natural beauty, environmental tourism - for example, ecological trails and rafting.

Another important and little known economic activity is mining, mainly the extraction of basalt. The mineral is widely used in construction because of its rigidity and strength. The sector has been expanding since mid-2003 due to a building boom. However, the main reserves are in native forest sites rich in biodiversity and close to river springs. The expansion of the activity will generate environmental effects such as the pollution of important rivers used for human consumption and recreation (rafting, diving, fishing) and disappearance of green areas used for leisure (green tourism, hiking trails), both rich in fauna/flora. That will heavily compromise sustainable development in the region.

In Nova Prata, the national capital of basalt, deforestation already threatens local birds and mammals, such as the Gralha Azul and the Bugio Ruivo. Also, the streams that supply the population are regularly contaminated by the productive process waste.

Ferradura Valley, in Bento Gonçalves, can completely disappear because of basalt extraction. The site is home to important species such as Ipê-da-Serra, Araucária, Gralha Azul and Cutia.

(1) According to the information provided above:
    (a) Mining expansion doesn't affect sustainable development.
    (b) The Serra Gaúcha is famous for bauxite production.
    (c) Basalt reserves are in native forest areas.
(2) Na appropriate title to the text is:
    (a) Uses and history of Basalt.
    (b) Serious environmental effects of basalt extraction.
    (c) Tourism and gastronomy in the Serra Gaúcha.

3. DATA AND METHOD

Of the 682 questionnaires applied we excluded 57 for not having the correct responses for the reading comprehension questions, and another 3-4 were eliminated because students did not answer one or both questions about the seriousness of the proposed environmental problem. The sample was reduced to 622 valid questionnaires. Many students did not answer one or more socioeconomic questions, so we ended up with 590 questionnaires to test the impact of a biased speech with all covariates. Table I presents the means off the covariates for treated and control groups.

Table I – Descriptive Statistics

Control Variables	Treated Group	Control Group	p-value for difference in means
Men	0.46	0.51	0.20
White	0.75	0.78	0.49
Age	22.42	23.46	0.12

Born in RS	0.82	0.83	0.85
Lived in Serra Gaucha	0.08	0.09	0.65
Attended private school	0.27	0.31	0.26
Contributed to envir. NGOs	0.10	0.10	0.94
Has another bachelor degree	0.10	0.12	0.40
Lives with parents	0.44	0.41	0.43
Lives with partner	0.21	0.16	0.17
Has kids	0.10	0.11	0.62
Has paid function	0.25	0.25	0.95
Individual monthly income (R$)	740.78	862.42	0.29
Mother's Education			
Incomplete primary	0.21	0.22	0.93
Complete primary	0.06	0.08	0.28
Incomplete secondary	0.06	0.06	0.89
Complete secondary	0.20	0.19	0.63
Incomplete higher education	0.10	0.11	0.68
Complete higher education	0.23	0.16	0.05
Postgraduate	0.14	0.18	0.16

Notes: both groups with the same proportion of the variable of interest (50%). We didn't include course dummies in the table due to a large number of required lines.

Control group received the balanced description, while the biased information text was given to treatment group. Most control variables are binary (yes or no) questions. Skin color originally had five categories, but we considered Asians as white individuals and other skin colors as non-white (binary variable). We also included age, monthly income, mother's education, and course dummies as control variables.

It's interesting to note that almost 92% of respondents agreed that the presented information about basalt extraction was relevant and only 1.96% disagreed with the statement that it was entirely accurate. For the control group, the percentages are 92.2% and 2%, respectively. Among treated respondents, the rates go to 91.8% and 1.89%, respectively. Those results indicate the low level of *a priori* knowledge among individuals in our sample for the proposed environmental problem (only 611 participants responded one or both questions from 621 valid questionnaires).

To attest the internal validity of the experiment we conducted a difference in means test on observable attributes to verify if the control group is statistically equivalent to the treatment group. According to Duflo et al. (2007) in a randomized process, the observed and unobserved characteristics must be distributed in a balanced way between the treated and control groups. The average of the observable characteristics should be the same in both groups, constituting an essential feature for the validity of the experiment. P-values (Table I) indicate that all controls are statistically equal between groups (except for one of the levels of mother's education), so we do have a balanced sample and don't incur in randomization (auto selection) issues.

To capture the mean effect of the biased speech on perception we ran the following regressions:

$$Troubling_i = \alpha + \emptyset T_i + X_i \beta + \varepsilon_i \qquad (1)$$

$$Serious_i = \alpha + \emptyset T_i + X_i\beta + \varepsilon_i \qquad\qquad\qquad (2)$$
$$TroublingandSerious_i = \alpha + \emptyset T_i + X_i\beta + \varepsilon_i \qquad\qquad (3)$$

In all three equations, the dependent variable is binary, α is constant; T_i indicates whether the individual received the treatment, and $\emptyset$ represents the effect of information bias; X is the vector of covariates with its respective vector of coefficients, β. Finally, ε_i accounts for the error term. For the third regression, the *TroublingandSerious* variable equals one if the responded answer was yes for both questions, and zero otherwise. This dummy was created as an alternative dependent variable to capture a stronger perception (perhaps individuals need to believe that an issue is both troubling and serious before they will be motivated to do anything about it).

The randomization process ensures that the observed and unobserved characteristics are independent of the applied treatment. Because of the distribution mechanism, the random experiment provides the estimation of the parameter of interest $\emptyset$, which measures the difference in perception given the type of description received (DUFLO *et al*., 2007).

4. ESTIMATING THE EFFECTS OF ENVIRONMENTALLY BIASED INFORMATION

During data analysis, we noticed that men and women responded differently to the seriousness' questions. When asked if the described environmental situation was troubling, 94% of individuals in control group answered yes (88.3% of men, 98.8% of women). For the treated group, the percentage goes up to 98.8% (97.6% of men, 100% of women). When asked if the described environmental situation was serious, 67.9% of individuals in control group responded yes (61.3% of men, 73.5% of women).

For the treated group, the percentage goes up to 87% (82.8% of men, 91.2% of women). The percentage of individuals that considered the environmental problem as both troubling and serious equals 66.8% for the control group (59.9% of men, 73% of women), and 86.1% for the treated group (81.7% of men, 91.2% of women).

Tables II, III and IV present the estimation results. All tables show a "general estimated impact" that considers both men and women, and the treatment effect by sex.

Table II – "Do you Consider the Environmental Situation Troubling?"

	General	Men	Women
Model with no controls			
Estimated Impact/treatment effect	0.048***	0.092***	0.012
	(0.015)	(0.029)	(0,009)
Sample	622	300	322

	General	Men	Women
Model with controls			
Estimated Impact/treatment effect	0.054***	0.101***	0.010
	(0.016)	(0.031)	(0.010)
Sample	590	289	301

Notes: OLS standard errors in parenthesis. *** p <0.001

Regression results indicate that the perception of seriousness regarding the environmental problem was higher among individuals in the treated group. For the "troubling question" (Table II), the estimated impact with and without controls is similar (around 5%). The estimated treatment effect is larger for the "serious question" (Table III, model with and without controls). The average number of respondents in the treatment group who considered the situation serious is 19% higher than the average of respondents in control group.

As said before, men and women had different responses to the treatment. Men seem to have been more affected than females. For instance, the estimated impacts for men and women in the "serious question" (Table III, model with controls) are 0.215 and 0.145, respectively. That means that, on average, 21.5% more men in the treatment group considered the situation serious in comparison to men in the control group, and 14.5% more women in treatment group considered the situation serious compared to women in the control group. However, this result may be reflecting the fact that women are more environmentally aware than men so that the treatment effect becomes smaller (Table III) or null (Table II), as shown by the above percentages.

Table III – "Do you consider the Environmental Situation Serious?"

	General	Men	Women
Model with no controls			
Estimated Impact/treatment effect	0.191***	0.215***	0,177***
	(0.033)	(0.050)	(0.042)
Sample	621	300	321
Model with controls			
Estimated Impact/treatment effect	0.188***	0.215***	0.145***
	(0.033)	(0.051)	(0.044)
Sample	590	289	301

Notes: OLS standard errors in parenthesis. *** p <0.001

Table IV – Both Troubling and Serious

	General	Men	Women
Model with no controls			

Estimated Impact/treatment effect	0.193***	0.219***	0.182***
	(0.033)	(0.051)	(0.042)
Sample	625	301	322
Model with controls			
Estimated Impact/treatment effect	0.189***	0.214***	0.145***
	(0.034)	(0.052)	(0.044)
Sample	591	290	301

Notes: OLS standard errors in parenthesis. *** $p < 0.001$

Table IV considers the case where respondents answered that the described issue was *both* troubling and serious as an alternative dependent variable. As it can be seen, results in Table IV are similar to Table III for men, women, and the "general estimated impact", so that the same comments for Table III apply for Table IV.

In general, the results found follow the same line as those found in the literature, because the persuasive material really induces individuals to assess the environmental situation differently (HARRIS et al., 1989; AJZEN et al., 1996; BLOMQUIST and WHITEHEAD, 1998; BERRENS et al., 2004). Thus, as Ajzen et al. (1996) and MacMillan et al. (2006) suggested, the results found in this study show that persuasive communication changes beliefs and attitudes towards perception of the environment, and less informed individuals are easily influenced by environmental stories propagated by persuasive communication.

5. FINAL REMARKS

Using a randomized experiment, we showed that an environmentally biased speech was able to alter agents' perceptions regarding the proposed environmental problem. On average, more individuals in treatment group considered the described situation troubling and/or serious as compared to control group. Also, men and women responded differently to the treatment. Some conditions apply: respondents had no prior knowledge, that is, they were unfamiliar with the environmental resource, and were young and inexperienced individuals. However, this result indicates that some groups could be easily influenced by a not so strong environmental rhetoric and media communication, that is, individuals' perceptions can be altered by intentionally misleading information. Although we cannot extend our conclusions to a larger population, we have no reason to believe that different results would occur for similar populations (young and inexperienced individuals that are unfamiliar with and have no prior knowledge about a specific resource).

Whereas we do not present political implications and do not hold a discussion about public policies we point out that interest groups can benefit from spreading environmentally biased information

throughout newspapers, social media, and television. By biasing perceptions, environmental propaganda can potentially increase people support for conservation and/or sustainability public programs which would not be required if the information provided to (or collected by) individuals was balanced. Public opinion, at least a significant parcel, could be biased to support pro-environmental public policies. This could create inefficiencies and welfare losses in the allocation of public resources.

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