Perceptions of climate change risks and mitigation behaviors: understanding inconsistencies between representations and actions

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Abstract

Citizens' awareness of risks and responsibilities regarding climate change suggests that they can see themselves as agents of social change both in their daily lives and as part of a knowledgeable public opinion. However, research has shown that individual behavior to mitigate greenhouse gas emissions is not consistent with such awareness. A survey study with a sample of Portuguese university students investigated the relation between knowledge of climate change and perception of risks, attributions of responsibility for performing mitigation actions, and individuals' behavioral intentions and reported behaviors. Results show a moderate level of knowledge, a moderate-high level of concern and a moderate-high level of risk perception. Responsibilities are attributed to different agents, including the individual respondent, but there is resistance to some measures and a low level of reported individual behavior. This study has also aimed to analyze practices of media consumption, as well as the use of other sources of information, and people's perception of those sources. The news media, especially television, are reported to be the main sources of information on climate change and respondents make a positive assessment of their credibility. Inconsistencies between social representations and behaviors are discussed in relation to the communication of climate change in Portugal both in conventional media and the internet.

Introduction

The assumption that having an accurate knowledge of issues is a requirement for displaying attitudes and behaviors aimed at the resolution of specific environmental problems, as well as for being able to engage in informed discussions on scientific and policy aspects of such problems, has been quite influential in the study of lay representations (e.g. Dunlap, 1998). This perspective has also underpinned much of the research of lay representations of climate change. In fact, most studies have assessed people's level of knowledge on the issue and whether they show congruent perceptions of risk and responsibility, as well as congruent behaviors (e.g. Bord, Fisher, & O´Connor, 1998; Brechin, 2003; Dunlap, 1998; Stamm, Clark & Eblacas, 2000).

Previous research has shown that on the whole the level of knowledge of the causes of climate change is low (e.g. Brechin, 2003; Dunlap, 1998), that people often mention air pollution as a cause of climate change or global warming, and often confuse ozone depletion with climate change (Bord et al., 1998; Brechin, 2003; Dunlap, 1998; Stamm et al., 2000).

People's level of concern for climate change is rather high but not as high as concern for other environmental problems, such as air and water pollution (e.g. Brechin, 2003). It has been suggested that external factors such as weather and media coverage influence public concern for global warming – people show more concern under bad weather conditions (Ungar, 1992) and extended media coverage (Krosnick, Holbrook & Visser, 1998). Studies of risk perceptions have shown that people associate climate change with a moderate to high risk. The public tends to see the impacts of climate change as stronger in distant places and in the future rather than in the spatial and temporal proximity of the respondent (Leiserowitz, 2005). In the case of a Portuguese sample (Cabecinhas, Lázaro & Carvalho, 2006), impacts were viewed as strong both in distant places (hurricanes, tsunami) and locally (draughts, fires).

The surveys that have looked at perceptions of responsibility for mitigating and adapting to climate change have included questions about people's intentions to adopt individual measures and about the responsibility they assign to the individual and to local, national and international entities in promoting ways to deal with the problem (e.g. Bord et al. 1998; Nave & Schmidt, 2002). Some studies have shown that respondents portray themselves as willing to make some effort to mitigate emissions (e.g. acquiring domestic appliances and cars that are more energy-efficient) but do not support policies that interfere greatly with the convenience of their daily life (e.g. using the car less, carpooling, decreasing

the use of heating and air-conditioning; Bord et al. 1998). However, more recently, Nave & Schmidt (2002) have found that Portuguese respondents said they were willing to change car-related behaviors (e.g. carpooling, using the car less, reducing driving speed, and acquiring less pollutant vehicles) and were even more willing to make changes in their homes (e.g. acquiring more energy-efficient light bulbs and appliances, even if they were more expensive, installing thermal insulation). These behavioral intentions are congruent with attributions of responsibility – respondents think that citizens, and local, national and international institutions (e.g. city councils, government and government departments related to environmental issues, environmental groups, corporations, universities and research centers, European Union, United Nations) are equally responsible to search for solutions for climate change.

Some studies have also reported a gap between attitudes towards the environment and willingness to act on environmental problems (e.g. Bord et al., 1998; Nave & Schmidt, 2002). For instance, Nave and Schmidt (2002) found that most respondents in their study viewed climate change as a worrying problem and agreed that a solution was needed. However, they failed to recognize the importance of causes such as the use of fossil fuels and consumption of electricity, and no one reported using the car less in order to mitigate climate change. Overall, people attributed more importance to institutional solutions (e.g. increase of forested area, investment in renewable energies, use of more energy-efficient technologies) than to individual solutions that interfered with their lifestyle (e.g. reducing the use of the car, air-conditioning and domestic energy). Socio-demographic variables such as sex, education, age and place of residence have not been shown to affect systematically lay representations of climate change (Dunlap, 1998). For instance, Bord, O'Connor and Fisher (2000) found that the level of concern for climate change depended on perceptions of risk of environmental pollution in general rather than on educational background.

The media have been considered a key source of information for the public about science issues (e.g. Nelkin, 1987). For most individuals, unobtrusive environmental issues, such as climate change, also acquire meaning mainly through the media (Wilson, 1995; Corbett & Durfee, 2004). However, there is a clear lack of studies about the influence of media coverage of climate change on audience perceptions, attitudes and behaviors. Corbett & Durfee (2004) have reported interesting results regarding the impact of controversy and contextual information in news representations of scientific knowledge of climate change on reader's perceptions. In their study, the presence of controversy in media discourse reduced people's perception of scientific certainty while the inclusion of information about scientific context – a feature typically absent from the media – increased perceptions of certainty.

In some of the earliest studies about media and climate change, Bell (1994a; 1994b) pointed out various forms of misreporting (scientific/technical inaccuracies, as well as non-scientific ones, misquotations, omissions and overstatement) and a mix-up or 'blending' of information about ozone depletion and the greenhouse effect. Studies of US media discourses on climate change have highlighted the over-representation of the so-called 'contrarians' or 'skeptics,' who refute the idea that current climate change is anthropogenic and/or that it is at all taking place (e.g. Boykoff & Boykoff, 2004; McCright & Dunlap, 2000; 2003). Scholars have claimed that this can lead to confusion amongst the public about the significance and the causes of climate change. Wilson (2000) found that US reporters' knowledge of the enhanced greenhouse effect and climate change is rather deficient.

Research on media and climate change has also shown that the volume of coverage has fluctuated dramatically over the last two decades, with peaks and troughs associated with national and international political agendas, economic growth and editorial interest, amongst other factors (e.g. Mazur, 1998; McCommas & Shanahan, 1999; Carvalho & Burgess, 2005). However, since 1997, coverage has, in general, remained at very high levels in countries such as the United States and the United Kingdom. That is also the case of Portugal.

In this paper we report results from a survey study with a sample of Portuguese university students. The study aimed to investigate the relation between knowledge of the causes of climate change and perceptions of risk, attributions of responsibility for actions of mitigation, and individuals' behavioral intentions and actual behaviors. We expect the level of knowledge to affect perceptions of climate change but, based on results reported in the literature, do not expect socio-demographic variables to affect those perceptions. The media are expected to be the main source of information about climate change.

Portugal is an interesting case study because it has experienced a significant economic growth since 1990, the baseline year of the Kyoto agreement, and a transition from a low-energy economy to a more energy-dependent one, which is the current or foreseeable situation of many developing countries. Exceptionally, the country has been allowed by the European Union to increase its emissions of greenhouse gases by 27% until 2008-2012 but has gone largely beyond this limit. Most of the increase is in car use.

This preliminary study used a sample of university students mainly for reasons of convenience. Nevertheless, it is relevant to examine the views of the two groups of students that were involved in the study – Media Studies and Computer Engineering students – given the professional responsibilities that they are likely to hold in the next few years.

Method

Participants: 144 undergraduate students (59 students of Media Studies program, 40 women and 19 men; and 85 students of Computer Engineering program, 5 women, and 80 men). Mean age was 20.84 (*SD* = 2.81) and it was not significantly affected by sex and degree program.

Materials: Questionnaire covering the dimensions analyzed in this paper – knowledge of climate change, concern, risk perceptions and attributions of responsibility, behavioral intentions and practices, such as attitudes towards information sources and consumption of mass media – as well as other dimensions, such as perceptions of relative justice.

Procedure: The questionnaire was administered collectively in classrooms in October 2006. Individual participation was voluntary. Response durations varied from 15 to 35 minutes.

Results and Discussion

Knowledge of causes of climate change

Respondents were presented with nine items and asked to rate the level of contribution of each one to climate change with the following scale: 'contributes very much', 'contributes moderately', 'contributes a little', 'does not contribute', 'I don't know' (see table 1). A knowledge index was calculated by adding one point for each correct answer. It ranged from 0 to 9. This index allowed the formation of two groups of respondents – above-the-median (high knowledge) and below-the-median respondents (low knowledge). This new variable was used as a factor in the analysis of other dimensions such as concern, responsibility and risk perceptions and attitudes towards sources of information on climate change.

In the participants' answers, the most important contributor to climate change was the ozone hole, which was rated as contributing highly to the problem (see table 1). However, the ozone hole is not considered a cause of climate change by experts and our results suggest that respondents confused two phenomena: the depletion of the stratospheric ozone layer and the enhanced greenhouse effect/climate change. This is a finding commonly reported in the literature (Bord et al., 1998; Brechin, 2003; Dunlap, 1998; Stamm et al., 2000).

Industrial processes were correctly rated as an important cause for climate change. Causes rated as moderately important were the loss of rain forests, car use, and the functioning of coal and oil power plants, which are causes also identified by experts. However, participants considered that agriculture and animal husbandry, which are significant causes of greenhouse gas emissions, were not very important and awarded a higher importance to the use of chemicals in farming, which, in fact, has a lower contribution to climate change. The functioning of nuclear power plants, whose contribution to climate change is quite low, was, nonetheless, rated as a moderately important cause of climate change. Most interesting is that the functioning of nuclear power plants and of coal and oil-fuelled power plants obtained similar ratings, which indicated poor knowledge of the issue and maybe some confusion around the risks usually associated with nuclear energy and the risks of climate change. This pattern is similar to results from the Portuguese sample of the 1992 Gallup survey (Dunlap, 1998) – by then the major causes for global warming chosen by respondents were loss of rain forests (89%), nuclear power plants (85%), coal and oil power plants (83%), automobile exhaust (77%), aerosol sprays (67%) and refrigerators and air conditioners (45%). On the whole, knowledge of the causes of climate change is inconsistent as it combines correct and incorrect causes and does not seem to have changed significantly between 1992 and 2007.

Participants' degree program did not significantly affect knowledge of each of the causes mentioned. Participants' sex only affected significantly two of the causes – the use of chemicals in farming and the functioning of nuclear power plants. Women rated the contribution of these sources as higher than men did [respectively: $F(1,133) = 6.65$, $MSE = 0.46$, $p = .01$; $F(1,132) = 4.43$, $MSE = 0.82$, $p = .04$].

The knowledge index that we constructed shows that, overall, people demonstrate a moderate knowledge of the causes of climate change ($M = 4.76$, $SD = 1,34$), a result apparently slightly better than the low level reported by previous studies (e.g. Brechin, 2003; Dunlap, 1998). This index was not significantly affected by sex and degree program.

Despite this moderate level of knowledge, people continue, as noted above, to show some confusion in relation to the causes of climate change. Most importantly, as shown in table 1, they view the ozone hole as the main contributor to climate change, a result that may be worse than the one of the 1992 Gallup survey.

Table 1. Mean contribution of several factors to climate change

	Mean (SD)
Ozone hole	1.39 (0.64)
Industry	1.40 (0.60)
Car use	1.60 (0.70)
Loss of rain forests	1.65 (0.70)
Functioning of coal and oil power plants	1.99 (0.93)
Functioning of nuclear power plants	2.01 (0.94)
Use of chemicals in farming	2.14 (0.71)
Agriculture and animal husbandry	3.05 (0.79)
Functioning of hydroelectric power plants	3.20 (0.83)

Note: 4-point scale (1= contributes very much, 4 = does not contribute)

Respondents self-assessed their level of knowledge about climate change in a 5-point scale ranging from 1=very good to 5=very bad or inexistent. Overall, they considered that they had an average level of knowledge (M = 2.91, SD = 0.76) and this perception did not change significantly as a function of sex and degree program.

Concern with climate change

Respondents were asked how concerned they were with a set of environmental issues, including climate change, and answered in a 5-point scale ranging from 'very much worried' to 'not worried at all'. Respondents reported a moderate-high level of concern about climate change (M = 2.60, SD = 0.80) and said they were very or moderately concerned with all the other issues presented to them. The exception was genetically modified organisms, for which participants' concern was situated between the moderate and low levels. Issues such as pollution of rivers, lakes and oceans, air pollution and forest fires attained the highest levels of concern; the ozone whole was slightly above climate change. Concern ratings were not affected by levels of knowledge (high or low, that is, above or below the median), sex and degree program. Interactions were also non-significant.

Contrary to our expectations, higher-knowledge respondents were not more concerned about climate change than lower-knowledge respondents. This result suggests that participants in this study are reacting more affectively than cognitively to the problem of climate change (cf. Lorenzoni et al., 2006).

Risk perceptions associated with the impacts of climate change

Respondents rated a set of possible consequences of climate change according to level of perceived risk (5-point scale ranging from 'very serious' to 'not serious'; see table 2). All but two of the possible consequences were viewed as very serious or as moderately serious (see table 2). The exceptions were 'increased social unrest' and 'increased forced migrations', which were rated around the mid-point of the scale as neither very serious nor unserious.

Perceptions of climate change impacts were not significantly affected by levels of knowledge, sex and degree program. Interactions were also non-significant. Sea-level rise was the only exception – women rated it as more serious than men [$F(1,144) = 4.66$, $MSE = 0.63$, $p = .03$].

A risk index was created by calculating the arithmetic mean of the risk ratings for all the factors for each respondent. Overall, respondents rated possible consequences of climate change as serious (M = 1.88, SD = 0.49). This index was not significantly affected by level of knowledge and degree program but changed significantly as a function of the respondents' sex [$F(1,144) = 6.60$, $MSE = 0.22$, $p = .01$] – women rated possible impacts of climate change as more serious than men.

Table 2. Mean risk perception for possible impacts of climate change

	Mean (SD)
Water shortages	1.19 (0.46)
Increase of hunger around the world	1.42 (0.75)
Health problems	1.50 (0.66)
Fires	1.63 (0.73)
Loss of animal and vegetable species	1.69 (0.77)
Hurricanes and storms	1.73 (0.80)
Increase of extreme temperatures	1.81 (0.80)
Floods	1.81 (0.84)
Draughts	1.87 (0.79)
Sea-level rise	1.88 (0.80)
Heat waves	2.02 (0.77)
Increased inequity between rich and poor countries	2.04 (1.00)
Desertification	2.17 (0.96)
Changes in agricultural production	2.24 (0.81)
Increase of forced migrations	2.43 (0.97)
Increase of social unrest	2.59 (0.98)

Note: 5-point scale (1= very serious, 5 = not serious)

Attributions of responsibility

Participants were asked to indicate the main agent responsible for implementing possible measures of mitigation of climate change (see table 3). Decreasing consumption of domestic energy and use of the car, acquiring more energy-efficient domestic appliances, and reducing consumption of material goods were seen as the individual's main responsibility. Respondents also saw themselves as the agent mainly responsible for recycling, but some responsibility was also attributed to the government, corporations and local authorities.

The government and, in a lesser degree, local authorities were seen as responsible for fighting deforestation and improving public transport. The government and, in a lesser degree, corporations were considered responsible for implementing the use of renewable energies and for introducing energy-efficient technologies. Local authorities were rated as the main responsible agent only in the case of tree plantation, which was also viewed as a responsibility of governments and Non-Governmental Organizations (NGOs).

Our results show that, contrary to what was found by Nave and Schmidt (2002), respondents do assign different responsibilities to different agents depending on the specific action. However, the difference could be due to the fact that we measured attributions of responsibility towards specific actions rather than towards solving the problem of climate change in general, as Nave and Schmidt (2002) did.

Attributions of responsibility did not vary significantly and systematically with sex, degree program and level of knowledge of the causes of climate change. Media Studies students and women assigned greater responsibility to corporations than to the government in the introduction of more energy-efficient technologies while Computer Engineering students (almost all men) and men showed the inverse pattern [degree program: $\chi^2(1) = 8.54$, $p < .01$, $\phi = -.26$, $p < .01$; sex: $\chi^2(1) = 3.84$, $p = .05$, $\phi = -.18$, $p = .05$]. Lower-knowledge respondents assigned similar responsibilities to the government and to local authorities in improving public transport while higher-knowledge respondents assigned more responsibility to the government than to local authorities [$\chi^2(1) = 5.23$, $p = .02$, $\phi = -.20$, $p = .02$].

Table 3. Agents considered to have the main responsibility for implementing mitigation measures (percentages)

	Respondent	Government	Local authorities	Corporations	NGOs
Decreasing car use	82.1	6.2	7.6	1.4	1.4
Using renewable energies	4.8	57.9	5.5	21.4	4.8
Planting trees	4.1	18.6	49.0	3.4	18.6
Decreasing consumption of material goods	69.7	10.3	2.1	7.6	2.1
Introducing more energy-efficient technologies	5.5	47.6	2.1	38.6	2.8
Reducing consumption of domestic energy	85.5	6.2	2.1	2.1	1.4
Acquiring more energy-efficient domestic appliances	76.6	5.5	0	12.4	2.1
Fighting deforestation		54.5	20.0	1.4	16.6
Improving public transport networks	0.7	53.1	34.5	4.1	
Recycling	53.1	16.6	9.7	12.4	2.8

Attitudes towards mitigation measures

Participants were asked about their agreement towards a set of possible measures to fight climate change using a 5-point scale ranging from 'totally agree' to 'totally disagree' (see table 4).

Overall, measures that interfere with car use (reducing speed limits and increasing petrol prices) were negatively rated. In light of the fact that individuals tend to attribute responsibility to themselves for decreasing automobile use, this result suggests that individuals are still very resistant to specific actions (at least externally-imposed ones) to decrease what is probably one of the main causes of greenhouse gas emissions under their control.

There was moderate agreement in relation to the other proposed measures – respondents agreed partially with introducing compulsory energy-efficiency norms for all buildings, and neither agreed nor disagreed with increasing taxes for high-energy spending automobiles, with building nuclear energy power stations and with decreasing investment in the construction and maintenance of highways and increasing investment in public transport. This lack of attitude strength suggests that participants do not feel very engaged with the climate change issue.

Attitudes towards these measures were not significantly and systematically affected by levels of knowledge of the causes of climate change, respondents' sex and degree program.

Table 4. Mean ratings of possible measures to fight climate change (standard deviation in parenthesis)

	Mean (SD)
Increasing petrol prices	4.04 (1.18)
Reducing highway speed limit	3.59 (1.22)
Building nuclear power plants to produce electricity	3.08 (1.15)
Decreasing investment in highways and increasing it in public transport	2.98 (1.30)
Increasing taxes for high-energy consuming automobiles	2.52 (1.22)
Introducing compulsory energy standards for all buildings	1.54 (0.77)

Note: 5-point scale (1= totally agree, 5 = totally disagree)

Behavioral intentions to fight climate change

Respondents were asked to select three actions of mitigation of climate change that they would be willing to adopt within three months (see table 5). Most respondents said they intended to separate waste for recycling. Two other behaviors were chosen by almost half of the respondents – to

replace conventional light bulbs by low-consumption ones and to use public transport as much as possible. Given that this was a sample of undergraduate students it is understandable that actions related to improving a house from an environmental point of view were not planned for a near future.

Behavioral intentions were not significantly associated with level of knowledge of the causes of climate change – none of the qui-square analysis was significant. Some of the behaviors were significantly, but not systematically, associated with sex and degree program. Regarding respondents' sex, women intended to use public transport more than men [respectively, 65.2% and 38.1%; $\chi^2(1) = 9.18$, $\phi = .25$, $p < .01$] and also intended to take environmental aspects into consideration when acquiring high-budget items more than men [respectively, 21.7% and 9.2%; $\chi^2(1) = 4.31$, $\phi = .25$, $p = .04$]. Media Studies students intended to use public transport more than Computer Engineering students [respectively, 65.5% and 34.5%; $\chi^2(1) = 13.23$, $\phi = .31$, $p < .01$].

Table 5. Behaviors that respondents would be willing to adopt within three months to fight climate change

	Percentages
Separate waste for recycling	81.4
Replace conventional light bulbs by low-consumption bulbs	49.7
Use public transport as much as possible	46.2
Use less heating and air-conditioning	22.1
Install solar panels	17.9
Acquire more energy-efficient domestic appliances	16.6
Reduce waste by buying bigger packages, concentrated products, avoiding over-packed products, etc.	13.8
Take environmental aspects into account when acquiring high-budget items (e.g. a car, a house)	13.1
Reduce use of domestic appliances	9.0
Not to own a car	8.3
Reduce consumption of material goods	6.9
Improve insulation of home walls and roof	4.8
Pay more taxes for environmental protection	2.1

Participants were also asked to state whether they had done anything to help fight climate change. 44 participants (31%) did not answer the question or answered 'no'. Of the remaining respondents, most mentioned only one or two measures. The most commonly stated actions were related to domestic uses of energy and to the use of public transport (to be expected in this population).

Use and perception of various sources of information on climate change

Respondents were asked to rate how often they gathered information on climate change from different sources (5-point scale ranging from 'very often' to 'never'; see table 6).

As expected, the media topped the information sources on climate change. Overall, the most used source was TV news (see table 6), which was reported to be used frequently and significantly more often than the other sources [e.g. mean difference in relation to use of newspapers: $t(143) = 6.03$, $p < .01$]. The next most used sources of information were newspapers, internet and TV films and documentaries, which showed similar levels of use [non-significant differences among them; mean difference between films/documentaries and conversations with family and friends, for instance: $t(142) = -2.47$, $p = .02$]. These were followed by conversations with family, neighbors, friends or colleagues, and by magazines and school or university [non-significant differences between magazines and school/university; mean difference between magazines and conversations, for instance: $t(139) = 2.74$, $p = .01$]. Radio, books, and publications and leaflets came in the fifth place, followed by events such as conferences and exhibitions [mean difference between publications/leaflets and 'events', for instance: $t(140) = -4.87$, $p < .01$].

Women reported to use some sources of information significantly more often than men: TV news [$F(1,144) = 9.77$, $MSE = 0.77$, $p < .01$], TV films and documentaries [$F(1,143) = 7.36$, $MSE = 1.02$, $p = .01$], publications or leaflets [$F(1,140) = 6.01$, $MSE = 1.00$, $p = .02$], books [$F(1,141) = 6.75$,

MSE = 1.05, $p = .01$] and 'events' [$F(1,142) = 10.62$, *MSE* = 1.02, $p < .01$].

Media Studies students reported to use some sources of information significantly more often than Computer Engineering students: radio [$F(1,140) = 4.74$, *MSE* = 1.16, $p = .03$], school or university [$F(1,141) = 5.76$, *MSE* = 1.12, $p = .02$] and 'events' [$F(1,142) = 4.42$, *MSE* = 0.90, $p = .04$].

Respondents with less knowledge of the causes of climate change reported to use two sources more often than respondents with more knowledge: radio [$F(1,140) = 4.49$, *MSE* = 1.16, $p = .04$] and 'events' [$F(1,142) = 6.36$, *MSE* = 0.90, $p = .01$].

Male respondents with higher knowledge of the causes of climate change reported to use 'events' as a source of information for climate change issues more often than male respondents with less knowledge while all women, regardless of knowledge levels, reported to use them rarely [2-way interaction: $F(1,142) = 3.91$, *MSE* = 0.90, $p = .05$]. Media Studies respondents with higher knowledge used 'events' as a source of information for climate change issues more rarely than Media Studies respondents with lower knowledge; this pattern is reversed for Computer Engineering students [2-way interaction: $F(1,142) = 5.78$, *MSE* = 0.90, $p = .02$].

Table 6. Use of sources of information on climate change

	Mean (SD)
TV news	1.86 (0.94)
Newspapers (printed or online)	2.39 (1.00)
Internet (excluding sites of newspapers, radios and TVs)	2.39 (1.07)
TV films and documentaries	2.40 (1.03)
Family, neighbors, friends or colleagues	2.69 (1.03)
Magazines	2.99 (1.08)
School or university	3.00 (1.07)
Radio	3.38 (1.11)
Books	3.53 (1.09)
Publications or leaflets	3.56 (1.04)
Events (conferences, exhibitions, expositions, etc.)	3.98 (0.98)

Note: 5-point scale (1= very often, 5 = never)

Participants were asked to rate the trustworthiness of sources of information about climate change in a 5-point scale ranging from 'trust very much' to 'do not trust at all' (see table 7). Overall, respondents expressed a significant degree of trust towards information coming from scientists and experts, followed by information from health professionals, environmental or consumer associations and the European Union (see table 7). Respondents had some trust on mass media sources and people they know (family, friends, neighbors and colleagues) and they expressed mistrust of information coming from sources such as government, local authorities and corporations.

In general, the level of knowledge of the causes of climate change and the degree program did not affect trust in sources of information. The exceptions were that Media Studies respondents reported to trust information from journalists more than Computer Engineering respondents [$F(1,140) = 4.31$, *MSE* = 0.40, $p = .04$] and respondents with higher knowledge reported to trust teachers more than respondents with lower knowledge [$F(1,138) = 4.48$, *MSE* = 0.34, $p = .04$].

Women respondents reported to trust the following sources of information more than men: teachers [$F(1,138) = 11.47$, *MSE* = 0.34, $p < .01$], television [$F(1,142) = 3.81$, *MSE* = 0.49, $p = .05$], radio [$F(1,134) = 10.56$, *MSE* = 0.51, $p < .01$], newspapers [$F(1,142) = 6.48$, *MSE* = 0.52, $p < .01$] and family, friends, neighbors or colleagues [$F(1,142) = 9.85$, *MSE* = 0.46, $p < .01$].

The fact that the Portuguese media have given less emphasis to the 'skeptics' than the media of the United States and other countries and have, in general, represented scientific claims regarding climate change as consensual may help understand that people award scientists a high level of trust. Mistrust in relation to the state is culturally ingrained in Portugal and may, together with the fact that the country has not been able to meet its Kyoto Protocol's commitments, help explain the results of this survey in what concerns trust in government and local authorities.

Table 7. Trust in sources of information

	Mean (SD)
Scientists/experts	1.42 (0.58)
Health professionals/doctors	1.81 (0.77)
Environmental/consumer associations	1.91 (0.79)
European Union	2.01 (0.72)
Teachers	2.06 (0.63)
Newspapers	2.21 (0.75)
Internet (excluding sites of newspapers, radios and TVs)	2.26 (0.78)
Television	2.31 (0.73)
Journalists	2.36 (0.69)
Radio	2.36 (0.77)
Family, friends, neighbors or colleagues	2.48 (0.70)
Government	2.79 (0.77)
Local authorities	2.85 (0.75)
Corporations	2.91 (0.79)

Note: 5-point scale (1= trust very much, 5 = do not trust at all)

Participants were also asked to rate the medium they used most frequently in terms of clarity of explanation of the climate change issue, accuracy of scientific and technological information, and quality of analysis of policy and economic options to fight climate change. A 5-point scale ranging from 'very good' to 'very bad' was used.

Overall, the mass medium most used by each respondent was assessed as providing clear explanations of climate change issues and accurate scientific and technological information (see table 8). The analysis of policy and economic options to fight climate change was seen as neither good nor bad [non-significant difference with accuracy of information but significant difference with clarity of explanation: $t(138) = -0.89$, $p < .01$].

Clarity of media explanations of climate change was rated higher by women than men [$F(1,139) = 3.81$, $MSE = 0.51$, $p = .05$]. Accuracy of scientific and technological information on climate change was rated higher by women [$F(1,139) = 6.47$, $MSE = 0.55$, $p = .01$] and by Computer Engineering students [$F(1,139) = 7.77$, $MSE = 0.55$, $p = .01$] than by men and Media Studies respondents, respectively. Perceptions of the analysis of policy and economic options to fight climate change were not significantly affected by level of knowledge, sex and degree program.

Table 8. Assessment of the most used mass medium

	Mean (SD)
Clarity of explanations of climate change	2.21 (0.71)
Accuracy of scientific and technological information on climate change	2.31 (0.75)
Analysis of policy and economic options to fight climate change	2.40 (0.834)

Note: 5-point scale (1= very good, 5 = very bad)

The level of alarmism in the news about climate change was rated in a 5-point scale ranging from 'very high' to 'very low'. Overall, participants rated it as neither high nor low (M = 2.60, SD = 1.02) and it was not significantly affected by level of knowledge, sex and degree program.

Conclusion

Knowledge of the causes of climate change seems to have increased slightly in the past 15 years – the Portuguese sample in Gallup's 1992 survey showed a low level of knowledge (Dunlap, 1998) while knowledge is moderate in our sample, despite confusion about the role of the ozone hole and the relative contribution to the enhanced greenhouse effect of nuclear power plants and agriculture. A higher level of knowledge of climate change, particularly of its causes, did not lead to changes in concern towards climate change, attitudes towards measures to fight it and attributions of responsibility. This finding does not support the notion that more informed people have more congruent attitudes and behaviors (e.g. Dunlap, 1998). Nonetheless, this lack of coherence between knowledge, attitudes and actions has been acknowledged in social psychology since 1934 (e.g. LaPierre, 1934). The distance between people's values and attitudes, on the one hand, and their behavioral practices, on the other hand – the 'value-action gap' (e.g. Blake, 1999) – was also found by Nave and Schmidt (2002).

One important aspect is that participants did not exclude themselves from actions to fight climate change that can be under their control, even if their actions lag behind. Such awareness may work as a positive attitudinal basis for communication campaigns geared towards the adoption of given practices related to uses of energy. Widening social awareness of climate change and promoting positive behaviors will require the identification of specific areas of resistance and finding ways to counter it. For instance, respondents are aware that reducing car use is mainly their responsibility but showed resistance to measures interfering with that.

In the last few years, climate change has been much more salient in the media than other environmental issues, such as the ozone hole and air pollution. Yet, our survey indicates that, despite considering the impacts of climate change serious, individuals express lower levels of concern with this issue than with the above-mentioned ones. Crucially, this finding challenges the agenda-setting model and suggests that some issues remain ingrained in the 'public's agenda' over long periods of time. The metaphorical power of the concept of 'ozone hole' may be part of the explanation and Ungar's (2000) point that climate change never captured the public imagination may be a valid one. We should emphasize that this survey was taken in the Fall of 2006, soon after Al Gore's movie 'An Inconvenient Truth' opened in Portugal and before the attribution of the Nobel Peace Prize to Al Gore and the IPCC. It is possible that these events, together with a more intense media focus on climate change, may have contributed to some recent changes in public perceptions.

The fact that in an ongoing study of media discourse we have, in several occasions, detected confusion between climate change and ozone depletion in television news - the most important source of information for the participants in this study - may help understand the fact that people continue to view the latter as a cause of the former. Yet, people appear not be aware of these problems as they said that they trust the media and gave a positive rating to accuracy and clarity of news coverage. This appreciation is at least consistent with the fact that climate change 'skeptics' have not been put under the limelight in the Portuguese media (cf. Corbett & Durfee, 2004).

Part of the explanation for the inconsistencies between people's representations of climate change and their inclination to act upon the problem may lay in the discourse of a variety of social actors on the politics of climate change and the re-construction of such discourses in the media. Our analysis of the Portuguese conventional media and of internet sites has led us to conclude that there is a prevalent techno-managerial discourse on climate change, which suggests that international and national market regulation will be the adequate response to the problem. Most of the information made available by the state – and typically reproduced by the media – concerns either rather technical policy analyses or decisions on investment in renewable energies. This is a discourse that tends to construct the citizen as consumer rather than someone that can actively participate in the debate and decision-making process regarding greenhouse emissions (Carvalho, 2007).

As the voices of experts and politicians appear to be the only authorized ones, citizens may develop a weak sense of agency in relation to climate change. People do not believe that they can make a significant difference in deciding the course of the issue and expect that governments will find a way out. This form of political subjectivity, cultivated by various organizations and by the media, may be rather detrimental to finding socially sustainable solutions to climate change. The expectation that the state will solve the problem, on the one hand, and the declared suspicion of that same agent as a source of information, on the other, is in itself another inconsistency in the public's positions.

Similarly to other studies (e.g. Dunlap 1998), our results did not show any systematic influence of socio-demographic variables (sex and degree program) on concern about climate change, perceptions of risk associated with possible impacts, attributions of responsibility for mitigation, attitudes towards possible measures, and intentions to change behaviors. We had hypothesized that the level of knowledge of the causes of climate change could affect some of the results, but we did not obtain any systematic difference between perceptions of people with high and low knowledge. This questionnaire is currently being applied to a bigger and more heterogeneous sample, which is more diverse in relation to other socio-demographic variables such as age, schooling and occupation. We hope to test a complex model relating these and other variables and contribute to understanding important aspects in lay representations and behaviors associated with climate change. The relation between people's consumption of media and their views and dispositions regarding climate change will continue to be an important focus of the analysis.

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