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Statements about climate researchers' carbon footprints affect their credibility and the impact of their advice

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Abstract Would you follow advice about personal energy conservation from a climate specialist with a large carbon footprint? Many climate researchers report anecdotes in which their sincerity was challenged based on their alleged failure to reduce carbon emissions. Here, we report the results of two large online surveys that measure the perceived credibility of a climate researcher who provides advice on how to reduce energy use (by flying less, conserving home energy, and taking public transportation), as a function of that researcher's personal carbon footprint description. Across the two studies, we randomly assigned participants to one of 18 vignettes about a climate scientist. We show that alleged large carbon footprints can greatly reduce the researcher's credibility compared to low footprints. We also show that these differences in perceived credibility strongly affect participants' reported intentions to change personal energy consumption. These effects are large, both for participants who believe climate change is important and for those who do not. Participants' politics do affect their attitudes toward researchers, and have an extra effect on reported intentions to use public transportation (but not on intentions to fly less or conserve home energy). Credibility effects are similar for male and female climate scientists.

Keywords Persuasion · Advocacy · Credibility · Carbon footprint · *ad hominem* attacks · Energy conservation

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When research findings suggest sharp changes in policy or practice, controversy often ensues. The controversy may include *ad hominem* attacks, questioning the credentials or the sincerity of experts on each side of the issue. Such attacks can have considerable persuasive power, especially in situations where people not in a position to evaluate the research must rely on the recommendations of experts. In current debates about policies to curb emission of greenhouse gases, there is a fairly strong consensus among climate experts that emissions need to be cut sharply. In response, climate experts often encounter attacks on their credentials or sincerity. Attacks on sincerity are often based on claims that the experts' personal carbon footprints are large. For example, a press release attacked Al Gore's credibility, based on his home energy use, reporting that in 2006, he "devoured nearly 221,000 kWh—more than 20 times the national average." (Tennessee Center for Policy Research 2007).

There is a long history of research on audience persuasion (e.g., Hollingworth 1935; Hovland et al. 1963). Recent studies have focused specifically on communicating scientific information, investigating learning instruction, attitudes about science, and trust in scientists (Bromme and Goldman 2014). Previous scholarship addresses ad hominem arguments (Walton 1998) and has looked specifically at communication of climate science related to conflicts of interests between the individual and the collective (Kahan et al. 2012; Nordhagen et al. 2014).

It seems important, however, to investigate directly and quantitatively the persuasiveness of *ad hominem* attacks, as a function of both the audience and the details of the climate expert's personal behavior. Some attacks may be based on true facts, as climate experts tend to fly a great deal, leading to a high travel-related carbon footprint (Le Quéré et al. 2015; Editorial 2015; Stohl 2008), even though such immediate carbon expenditures may have longer-term paybacks of decreasing global carbon emissions. Which are more persuasive, attacks based on frequent air travel (often an important feature of the expert's job function) or attacks based on home energy consumption? Which audiences are most affected, people personally concerned about global climate change, or climate-change skeptics? Are there persuasive ad hominem defenses? And do attacks and defenses affect both assessments of the expert's credibility and inclinations to follow the expert's recommendations? The answers to this suite of questions are relevant to strategies for persuasive communication about the importance of personal energy conservation, and may also be relevant to more general questions of persuasive communication when there is controversy about research findings.

To address these questions, we conducted two online surveys in which participants read a brief vignette describing a presentation by an eminent climate researcher that also included a partial description of that researcher's own energy consumption. The first parts of the vignettes were identical in their account of facts presented and recommendations for behavior change: fly less, reduce home energy use, and use public transportation more often. The vignettes differed in their descriptions of the climate researcher's own behavior and in the way this latter description was introduced. These different descriptions turn out to have a large and important impact on both the participants' stated intentions to change their behavior and their views of the climate researcher's credibility. We find these strong effects both for participants who believe climate change is important and for doubters. The detailed analysis of the magnitudes of these effects on both perceived credibility and behavioral intentions contains several lessons relevant to communication about climate change and raises many additional questions.

An implication of these findings is that climate researchers, including the three authors of this study, need to make strong efforts to reduce our own carbon footprints. To communicate effectively, advocates of energy conservation need to *be the change that they wish to see.*

1 Method

1.1 Survey 1

1.1.1 Participants

In October 2014, we recruited 2028 participants via Amazon's Mechanical Turk (MTurk) Internet panel who completed the survey online. Each participant received a $3 gift certificate to Amazon.com on completion. Mean age was 34 years and 51 % of participants were male. The mean family income was $20,000–$40,000 and mean education was some college experience. Fifty-four percent self-identified as liberals, 25 % as moderates, and 21 % as conservatives. Note that although our samples are non-random, random assignment to groups makes it unlikely that our results are strongly biased. MTurk has been shown to provide high quality and reliable data, and sample characteristics differ little from standard Internet samples (Buhrmester et al. 2011).

1.1.2 Survey 1 questions

Participants read one of seven vignettes (randomly assigned) about a climate research talk. All vignettes began with a common narrative about the talk and then continued with a paragraph that described something about the speaker's personal energy use, either in air travel or at home. Participants were given one of seven descriptions of that researcher's personal energy use. Three of the descriptions concerned his/her air travel: flies often, flies little, or flies often but purchases carbon offsets. Two other descriptions concerned the researcher's personal home energy use: high versus low. The "high fly" and "low fly" descriptions also varied the gender of the researcher (marked by male or female pronouns) to test whether gender differences of the researcher make any difference in the way information is interpreted. The offset and high/low home energy descriptions had only one version, with a male protagonist. The common narrative and the continuation paragraphs describing personal energy use follow. (The narrative labels, "High Fly", etc. and the boldface font for pronouns were absent in the vignettes shown to participants.)

Common narrative You are attending a talk by a leading climate researcher. ***He*/*She*** has been publishing scholarly articles in the field of climate science since 1974, and has over 150 publications in top journals, including many in *Science* and *Nature*.

The researcher explains how an individual's actions can collectively have a large impact on the environment. ***He*/*She*** gives examples of these actions, such as air travel and amount of energy used in the home. ***He*/*She*** also explains how these actions can have negative effects on the environment. Near the end of the talk, the researcher gives advice to the audience on how they can reduce their own energy use. ***He*/*She*** gives examples such as flying less, using less energy at home, and taking public transportation. ***He*/*She*** urges the audience to make these changes.

High fly (male/female) You later find out that the researcher flew across the country to the talk that you attended and that ***he*/*she*** regularly flies to lectures and conferences all over the world. Flying like this leads to increased negative climate impacts.

Low fly (male/female) You later find out that the researcher flew to the talk that you attended, but chooses to only fly two times per year. ***He***/***She*** also regularly calls in to meetings and conferences, choosing not to travel whenever ***he***/***she*** can possibly avoid it. ***He***/***She*** also takes public transit (trains/buses/subway) whenever possible rather than driving or using cabs. This leads to a much lower environmental impact than the average for someone in ***his***/***her*** position.

Offset You later find out that the researcher flew to the talk that you attended and he regularly flies to lectures and conferences. Flying regularly like this can contribute to negative effects on the environment. However, to make up for his emissions while flying, he buys commercially available offsets for flying. Buying offsets will fund projects to reduce emissions elsewhere.

High home You later find out that the researcher consumes much more energy than the average person at home. He has a large home with a high lighting, heating, and cooling bill, has not switched to a slightly more expensive but green energy provider and has not invested in energy efficient appliances that would decrease his energy use at home.

Low home You later find out that the researcher consumes much less energy than the average person at home. He has a modest home with a low lighting, heating, and cooling bill, has switched to a slightly more expensive but green energy provider, and has invested in energy efficient appliances that decreases his energy use at home.

Open-ended question probing response Following the full vignette (any of the seven versions), participants were asked in an open-ended question for their immediate thoughts about the research presented and the researcher's own behavior.

Probing behavioral intentions Next, participants were asked about their intentions to reduce energy use, by flying less, conserving energy at home, or making greater use of public transport. This query yielded seven yes/no answers: Based on the advice provided by the researcher, please check which of the following actions you would be willing to incorporate in your life. (*Check all that apply*). The seven response options were: Fly less, Use less energy in my home, Take public transportation more often, Think about changing some actions, Change no actions, I already conserve energy, and Other (please specify).

Researcher credibility Participants then rated their agreement with statements about the researcher's credibility: (1) I believe that the researcher's behavior is consistent with their advice; (2) I believe the researcher's advocacy is sincere; (3) I do not trust the researcher's authority with respect to climate science; (4) I believe that the researcher has good reasons for their behavior; (5) I am doubtful of the researcher's credibility; (6) I believe that the researcher provides quality advice. These six statements were coded numerically in the direction of increasing researcher credibility, rescaled such that the maximum score (+1) represents strong agreement in the direction of researcher credibility for all six items and the minimum score (−1) represents strong disagreement, and summed. The Supplemental Text includes a detailed analysis of the correlations between these six ratings and a reliability estimate for the combined scale.

Attitude questions and demographics Following questions on researcher credibility, there were further questions pertaining to climate change beliefs inspired by other research (Leiserowitz et al. 2013). Next, participants completed questions to probe science literacy, such as "what is an example of a chemical reaction?" with response options: water boiling, sugar dissolving, or nails rusting. These questions were followed by questions about their own energy use. Socio-demographic questions, including questions on political beliefs, gender, age, income, and education concluded the survey.

1.2 Survey 2

1.2.1 Participants

In December 2014, we recruited 2915 participants via Amazon's Mechanical Turk Internet panel who completed the survey online. We ensured that participants who completed the first survey were not allowed to complete the second survey. Each participant received a $3 gift certificate to Amazon.com on completion. Mean age was 33 years and 51 % of participants were male. The mean family income was $20,000–$40,000 and mean education was some college experience. Fifty-four percent self-identified as liberals, 24 % as moderates, and 21 % as conservatives.

1.2.2 Survey 2 questions

The different descriptions of the researcher's personal energy use in Survey 1 produced extremely large differences both in judgments of researcher credibility and in reported behavior intentions, as detailed below in the Section 2. We noted that the initial open-ended question was apt to direct participants' attention to the relationship between the researcher's advice and his/her personal behavior. We therefore conducted a second survey, in which this open-ended question was omitted and the transition between the talk description and the researcher's personal behavior description was either artificial ("later you learn …") or story-like (response to an audience question about the researcher's behavior) to test whether framing the vignette in a more natural setting would make any difference in the way information is interpreted. Because we did not observe any effects of researcher gender in Survey 1, the protagonist was male for all descriptions in Survey 2.

The common narrative was the same in this survey as survey 1. Additionally, High Fly, Low Fly, Offset, High Home and Low Home vignettes were the same. There were six additional vignettes as described below.

High fly audience question During the question period a member of the audience asks the researcher whether he flew across the country to give this talk. He replies that he regularly flies to lectures and conferences all over the world. It is part of his job, though flying like this does lead to negative impacts on climate.

Low fly audience question During the question period a member of the audience asks the researcher whether he flew across the country to give this talk. He replies that he did, but that he chooses to fly only two times per year. He adds that he regularly

calls in to meetings and conferences, choosing not to travel whenever he can possibly avoid it. He also takes public transit (trains/buses/subway) whenever possible rather than driving or using cabs. This leads to a much lower environmental impact than the average for someone in his position.

High home audience question During the question period a member of the audience asks the researcher how much energy he himself uses at home. He admits that he has a large home with a high lighting, heating, and cooling bill and has not yet switched to a slightly more expensive but green energy provider and has not yet invested in energy efficient appliances that would decrease his energy use at home.

Low home audience question During the question period a member of the audience asks the researcher how much energy he himself uses at home. He replies that he has a modest home with a low lighting, heating, and cooling bill, has switched to a slightly more expensive but green energy provider, and has invested in energy efficient appliances that decrease his energy use at home.

Offset carefully chosen and effective You later find out that the researcher flew to the talk that you attended and he regularly flies to lectures and conferences. Flying regularly like this can contribute to negative effects on the environment. However, to undo these negative effects, he looks carefully for effective carbon offsets and buys them. These contributions fund projects that reduce carbon emissions elsewhere by amounts at least as large as his share of the effects of flying.

Offset carefully chosen and effective, with audience question During the question period a member of the audience asks the researcher whether he flew across the country to give this talk. He replies that he regularly flies to lectures and conferences all over the world. It is part of his job. Although flying like this does lead to negative impacts on climate, to undo these negative effects he looks carefully for effective carbon offsets and buys them. These contributions fund projects that reduce carbon emissions elsewhere by amounts at least as large as his share of the effects of flying.

The rest of the survey was the same as Survey 1 except that the open-ended question was removed to avoid drawing attention directly to the relation between the researcher's advice and own behavior.

1.3 Statistical methods

Direct comparisons between subgroups are made graphically via boxplots (Figs 1 and 3) or by plotting group means with error bars indicating ±1.65 estimated standard errors (approximately a 90 %-confidence interval, Fig. 2). Where statistical significance of a pairwise comparison in Fig. 2 or Fig. 3 needed to be checked, this was done using the Welch approximate *t*-test. The coefficients for linear or logistic models are presented, where relevant, as point estimates ±1 estimated standard error. Figures 4 and 5 graph the observed proportions of behavioral intentions along with corresponding fitted proportions from a log-linear model.

1.4 Results

Effects of vignettes Figure 1 displays boxplots summarizing the distributions of researcher credibility for the seven descriptions of researcher personal behavior in Survey 1. (Sample size is about 290 per group.) The main results are striking: researchers described as flying often tend to be judged much less credible than ones described as flying little. Buying carbon offsets yields an intermediate distribution of credibility scores. The effect of information about researcher personal home energy use is even larger than that of information about flying behavior. Credibility distributions for researchers identified as male or female are about equal.

Survey 2 showed similar effects, displayed in Fig. 2. The effect of the leading open-ended question in Survey 1 is shown by the less extreme ratings for the "LL" condition in Survey 2 compared with Survey 1. A small additional effect of embedding the information about researcher behavior in a story about an audience question (AQ) is shown by the even less extreme ratings for "AQ" in Survey 2.

The difference between the Survey 1 mean and the corresponding Survey 2 AQ mean is statistically significant ($p < .01$) for all Fly and Home conditions. The combination of omitting the initial open-ended item and using the story about an Audience Question reliably reduces the credibility differences between researchers described as low vs. high flying and as having low vs. high personal home energy use. Nonetheless, these mean credibility differences remain large: over ½ a scale point for home energy use (0.55 ± 0.03) and nearly 1/3 of a scale point for flying (0.31 ± 0.03).

Effects of participant characteristics Participant characteristics, including beliefs and attitudes about climate change, also affected their judgments of researcher credibility. Figure 3 displays the most important of such effects: the boxplots of Fig. 1 are redrawn for two extreme subsets of

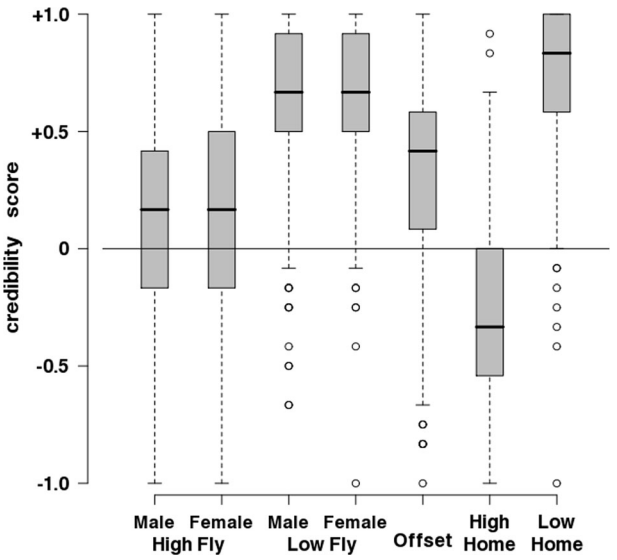

Fig. 1 Distributions of researcher credibility scores for Survey 1, shown as boxplots. (Boxplots show 1st quartile, median, 3rd quartile, range of scores deviating no more than 1.5 times the interquartile range from the box, and outliers beyond this range.) Note the substantial ceiling effects for the *Low Fly* and *Low Home* vignettes: the score + 1 falls at the 77th, 84th, and 72nd percentile for *Low Fly Male*, *Low Fly Female*, and *Low Home* respectively

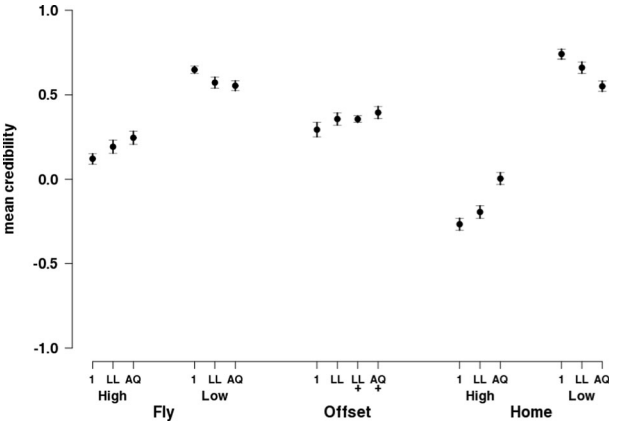

Fig. 2 Means (and their 90 % confidence intervals) of researcher credibility scores for Surveys 1 and 2 as a function of researcher behavior. Results from Survey 1 are labeled "1" on the horizontal axis. For High Fly and Low Fly, the Survey 1 groups with male and female researcher were averaged (thus N ≈ 580); the other results from Survey 1 are based on N ≈ 290. Survey 2 results (each N ≈ 265) are labeled "LL" ("Later you learn …") or "AQ" (story about an audience question). The results with the additional label "+" are for groups where the story about buying offsets for flying was reworded in an attempt to maximally excuse the researcher behavior of flying often

participants, those who state that the issue of climate change is "very important" versus "not at all important" to them personally. Here, the number of participants involved in the boxplots is much smaller than in Fig. 1, i.e., 72–96 per group for the light gray boxes and 10–18 per group for dark gray. It is obvious that the effect of the difference in importance of climate change is very large. Even the smallest observed difference between subgroups, for the "high home" description, is statistically significant (difference in means =0.31 ± 0.11, with 22.6 df for the Welch approximate t-test).

However, the difference in researcher credibility as a function of personal energy use shown in Fig. 1 occurs for both subsets of participants. Both of these effects were also observed in Survey 2 (whose boxplots are not shown).

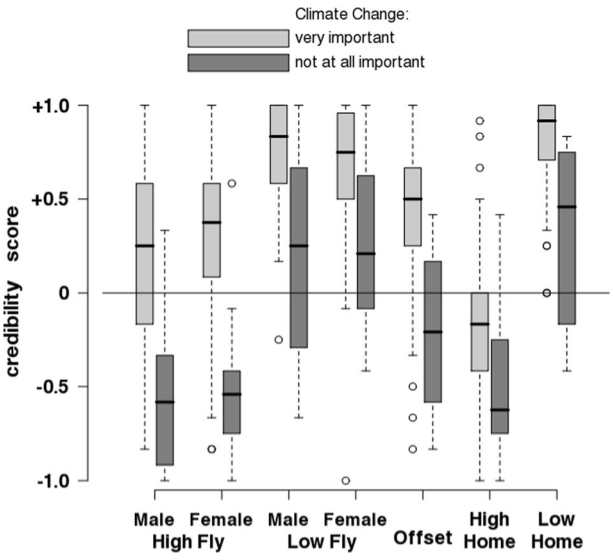

Fig. 3 Distributions of perceived researcher credibility, as a function of described personal profile, reported separately for participants for whom climate change is of low vs. high personal importance

Figure 3 shows that information about the researcher's personal energy behavior affects both people very concerned about climate change and those not at all concerned, despite the large overall difference on perceived researcher credibility for these attitudinal extremes. Thus, for a wide range of audiences, advocates of CO_2 emission reduction through change in personal behavior may lose credibility unless they act on their own advice.

We examined the effects of several attitudinal and demographic variables on judgments of researcher credibility using linear models (see the Supplemental Text for details). Figure 3 showed that perceived importance of climate change strongly affects researcher credibility. Other important variables influencing perceived researcher credibility were political orientation and belief that climate change is actually happening. Conservatives differ from liberals in both their perceived importance of climate change and their beliefs that it is happening. In addition, conservatives judge researchers as less credible than do liberals. The linear coefficients are respectively +.066 ± .007 (climate change importance, 1–4 scale, reversed so that 1 = not at all important), +.087 ± .008 (climate change happening, 1–4 scale averaging two items, reversed so that 1 = no / not at all sure) and −.028 ± .003 (political orientation, 1–7 scale from extreme liberal to extreme conservative). Our regression model predicts that an extreme liberal who is quite sure that climate change is occurring and to whom this is personally very important would rate researcher credibility higher by about 0.63 scale points than an extreme conservative who believes climate change is not happening and to whom this is not at all important [(7–1) × 0.028 + (4–1) × 0.066 + (4–1) × 0.087 ≈ 0.63]. This large difference is roughly comparable to the estimated effect of learning that the researcher is sparing vs. profligate in his or her personal home energy use.

Participants' age, education, income, miles driven per year and flights taken per year had no consistent effects on judged researcher credibility, once attitude and beliefs about climate change and political orientation are taken into account. Participants' gender had a small effect: males rated researcher credibility a bit higher than females for High Fly and High Home (about .08 scale points) and slightly lower than females for Low Fly and Low Home (about .03 scale points). Thus, overall, the difference between Low and High researcher personal energy use descriptions is somewhat greater for female than for male participants, a small, but clear and statistically significant effect ($F = 2.9$, $df = (17, 4871)$).

Reported behavioral intentions How does judgment of researcher credibility translate into reported intention to follow his or her advice? In the Supplemental Text we report the multivariate patterns of response to the question about intentions; here, we examine separately the relationship between perceived researcher credibility and the intentions to conserve energy at home, to fly less, and to use public transportation more.

Figure 4 exhibits the second main result of this article. Earlier we established that researchers lose public credibility if they do not follow their own advice. Figure 4 shows that for all three actions, flying less, conserving energy at home and using more public transport, researcher credibility is closely tied to the audience's reported intention to change their own behavior.

Table 1 shows the coefficients of the log-linear model fitted to each behavioral intention. Each model includes seven explanatory variables: four demographics, Political Orientation, Climate Change Importance, and Researcher Credibility. The coefficients and their standard errors are estimated based on all 18 vignettes (4943 participants) in Surveys 1 and 2, and thus assume equal slopes across the vignettes. While the vignettes describing the researcher's behavior do strongly affect reported behavioral intentions, this is mainly mediated by the differences in credibility of the researcher (Fig. 2). Because of limited sample size and

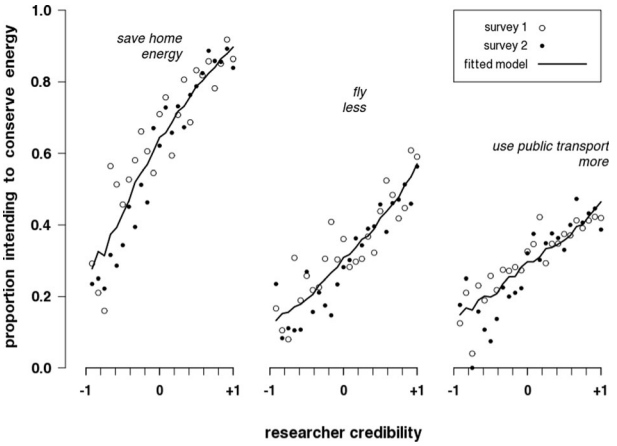

Fig. 4 Behavioral intentions as a function of perceived researcher credibility. Data points in each panel show observed proportions of participants stating a particular intention, to save home energy, to fly less, or to use public transportation more, for each possible value of the credibility score. Open symbols show Survey 1 results, closed symbols Survey 2 results. (The data for the two lowest credibility scores were combined, since counts of participants showing those scores were only 16 and 8 in survey 1 and 14 and 4 in survey 2.) The solid line connects points giving mean fitted values for each credibility score, using the model described briefly in the text (see Table 1) and more fully in the SI text. Simple logistic models would look very similar but would be represented by segments of smooth logistic curves; here, the jaggedness comes from the variations in relevant attitudes, beliefs, and demographics among the participants at any one level of credibility score

intercorrelation of the explanatory variables, there is too much noise to sort out the small but statistically significant component deviances associated with variations in slope as a function of the vignette. For example, for the intention to fly less, the incremental deviance reduction associated with Researcher Credibility is 165 (df = 1) while the additional deviance reduction associated with variations among the 18 vignettes in intercept and Credibility coefficient is only 53 (df = 34).

Returning to Fig. 4, we note that according to these fitted models, the proportion planning to save energy at home increases from 28.8 % at the lowest credibility to 89.8 % at the highest.

Table 1 Coefficients for logistic regression models for reported intentions (*$p < 0.01$; **$p < 0.001$)

Coefficient	Scale of variable	Less home energy		Fly less		More public transport	
		Estimate	s.e.	Estimate	s.e.	Estimate	s.e.
Intercept	logit scale	−1.040 **	.238	−1.653 **	.219	−1.787 **	.225
Age	18–76 yrs	−0.004	.003	+0.009 *	.003	−0.011 **	.003
Education	1–6 scale	+0.087 *	.033	−0.133 **	.029	+0.120 **	.029
Gender	0 = female 1 = male	−0.275 **	.070	+0.259 **	.063	+0.308 **	.064
Income	1–7 scale	+0.051	.030	−0.112 **	.027	−0.089 *	.028
Political orientation	1–7 (liberal to conservative)	−0.008	.024	−0.017	.022	−0.127 **	.022
Climate Chg importance	1–4 (not at all to very)	+0.485 **	.046	+0.442 **	.043	+0.469 **	.045
Researcher credibility	−1 to +1 scale	+1.411 **	.077	+0.920 **	.074	+0.503 **	.074

For flying less, the corresponding increase is from 13.5 % to 57.3 %. The increase for public transportation is smaller, yet still substantial, from 15.1 % to 46.7 %.

The data and fitted curves in Fig. 4 are steepest for home energy and most shallow for public transport, and this is reflected in the coefficients for Researcher Credibility: +1.41, +0.92, and +0.50. Climate Change Importance has a large effect for all three behavioral intentions. Political Orientation, though included in the models, actually matters only for the intention to use public transport more. For intentions to save energy at home and to fly less, effects of Political Orientation appear to be mediated fully by their effects on researcher credibility and attitude about climate change. Public transportation, however, seems from these results to be a politically polarized topic, above and beyond political differences concerning scientific information and climate change: Table 1 shows that conservatives are less likely to intend to use public transport, controlling for other factors. This result may be partly due to liberals living in urban areas with access to public transit and conservatives living in rural areas without access.

There are some minor but interesting lessons in the effects of the demographic variables. Males show stronger intention than females to limit flying and use public transport but females show stronger intention to conserve home energy. Those with higher household income show weaker intentions to limit flying and increase use of public transport, but slightly stronger intentions to save energy at home. Those with more education are a bit more reluctant to reduce flying, but are more ready to use public transport. Note that despite the correlation between education and income, the sample size is sufficient to suggest strongly this difference in their effects on conservation intentions.

Figure 5 emphasizes the effect of attitude toward climate change. The plotted points are simply aggregated proportions for the various reports of intentions, for groups defined by their rating of the importance of climate change to them personally. The fitted models are the same as for Fig. 4. Omitting climate change importance from the model would produce a poor fit.

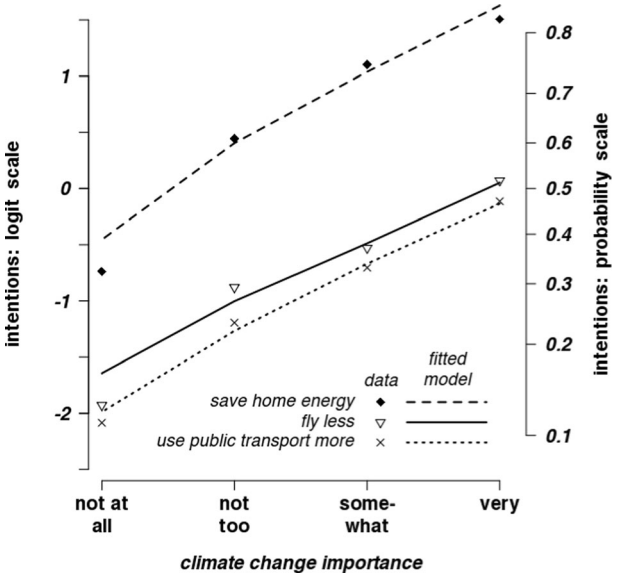

Fig. 5 Reported intentions as a function of personal importance of climate change. Data points show observed proportions of participants stating a particular intention, to save home energy, to fly less, or to use public transportation more, for each level of climate change importance. Results for the two surveys are aggregated. The lines connect averages of predicted proportions at each level of climate change importance, based on the fitted models (same models as in Fig. 4)

2 Discussion

Our results demonstrate the potential power of *ad hominem* attacks based on the personal energy use of a climate researcher, especially home energy use. We find that revealing large carbon footprints reduce the researcher's credibility compared to low footprints, and that these differences in perceived credibility strongly affect participants' inclinations to change their own energy consumption. We note that participants are not sensitive to the gender of the climate researcher, and male and female researchers have similar effects on credibility and intentions to change the participant's behavior. Although buying carbon offsets can be viewed as a way of becoming carbon neutral, offsets do not wipe the slate clean for researchers, as our results place their credibility between that of researchers who fly frequently and those who do not. On the other hand, strenuous efforts to conserve energy at home seem to enhance researcher credibility, as shown by some of the comparisons in Fig. 2, where credibility ratings are appreciably higher for the low home than for the low fly condition for Survey 1 and for Survey 2 LL. This suggests a defense against *ad hominem attacks* for those who can credibly claim such strenuous efforts.

In Survey 1 an open-ended question drew attention to conflict or consonance between the advice and the behavior of the researcher, and this produced very large effects. This may represent a situation where an overt attack or a deliberate defense draws audience attention to such a conflict or consonance. The effects remained quite large in Survey 2, which did not include the open-ended question and where the behavior of the researcher emerged as a more integral part of the account of the presentation (audience question). Conflict versus consonance produce large differences in judged researcher credibility; and judged credibility in turn correlates strongly with reported behavioral intentions of the audience. Figure 3 shows that the effects of researcher behavior on credibility hold both for those who consider climate change important and for the politically much more conservative subgroup that views climate change as not at all important.

One might ask under what conditions such effects on credibility and on intentions to conserve are temporary versus enduring. This seems worth investigating in further research. One might also ask how *reported intentions* relate to *actual behavior changes*. An initial intention is but a first step toward change, but one that is needed (Stern et al. 1999). There are also limitations to the *reported intentions* measure, because participants were not asked to indicate whether or not these specific intentions were applicable to their situation. For example, if a participant lived in a rural community without access to public transit, the intention of *take public transportation more often* would not apply. Future research can be designed to delve more deeply into unraveling actual and perceived situational constraints related to behavioral intentions.

Our descriptions contrast potential *ad hominem* attacks (based on conflict between advice and behavior) with potential pre-emptive ad hominem defenses (based on consonance rather than conflict). We don't yet know the relative magnitudes of these two presumably opposite effects. We note, anecdotally, that effective communicators about climate change do sometimes discuss their own behavior. Sometimes this is implicit, e.g., when a speaker communicates by a remote video connection rather than in person.

Although "in science, it is not where you come from or your motives that should have any relevance to the debate, but rather the strength of your arguments" (Schneider 1984), we find that for members of the general public, the personal behavior of climate researchers seems to matter when these researchers ask the public to change their behavior. The degree to which experts are trusted depends on multiple factors, including their personal behaviors (Hoffman

2015). Our results show that recommendations made by climate researchers are followed when they practice what they preach. The prescription that climate researchers ought to reduce their carbon footprints to improve their credibility is challenging, as even significant steps taken in that direction may never be viewed as going far enough to address the problem. An alternative and accompanying prescription could be to educate audiences about why such logic is faulty and to train scientists to mitigate such threats to credibility head-on.

Given we have only tested credibility when the researcher is advocating that others decrease their carbon footprints, an important question concerns whether communicator energy conservation behavior affects policy-support intentions as well as behavior-change intentions. Suppose that a researcher advocates a cap-and-trade regime for CO_2 emissions or a large-scale investment in renewable energy development. Such policy advocacy may be seen as less connected than conservation advocacy to the researcher's personal carbon footprint and thus less affected by it.

Finally, how should climate researchers practice what they preach? Credibility may require climate researchers to decrease their carbon footprint, and some researchers have already given up flying or flying as much (Anderson 2013; Watson 2014). Our results show that participants are even less forgiving of high home energy use, thus credibility may require that climate researchers who wish to be effective communicators make strenuous efforts to decrease carbon emissions in this sector as well.

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