

When facts lie: The impact of misleading numbers in climate change news

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### Abstract

This study examines how numerical misinformation in the news can bias readers' own judgment after a retraction. Building on theories of the continued influence effect and anchoring, the experimental research investigates the link between inaccurate facts, biased estimations, and the evaluation of climate change policies and risks. The results indicate that presenting participants with a low number on the carbon footprint of commuting traffic induces a bias into their own estimated values. This effect appears regardless of participants' level of issue involvement. However, the study finds no subsequent effect of this bias on participants' policy support or perceived threat of climate change. The results are discussed in light of anchoring and misinformation theories while also reflecting on the implications for the journalistic practice of fact checking.

## Introduction

“I wouldn’t be surprised if post-truth becomes one of the defining words of our time,” (Flood, 2016) Oxford Dictionaries president Casper Grathwohl said, according to the Guardian after the term had been announced word of the year in 2016. The journalistic usage of the word had increased by 2,000 percent within a year, mirroring the concern that instead of objective facts, personal beliefs increasingly dominate political debates (Flood, 2016). This trend has also surfaced in environmental news. More and more frequently, anthropogenic climate change has been questioned by prominent political figures such as the newly elected U.S. president Donald Trump (Kenny, 2016), and climate scientists increasingly have to withstand unsubstantiated attacks on their work as researchers (Lundberg, 2017).

However, a post-truth situation in climate change communication is not a novelty. As soon as climate change reached political salience, media reports moved from portraying the scientific consensus to ideological standpoints (Carvalho, 2007). Moreover, conservative think tanks strategically disseminated inaccurate claims on climate science through the media (Oreskes & Conway, 2012). Yet not every wrong statement is politically motivated as facts and figures also get distorted and disembodied from their context when they are translated from the scientific language of uncertainty into simplifying journalistic narratives (Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012).

How does this spread of scientifically incorrect information about climate change affect the public? Brüggemann (2017) argues that in the case of information on climate change, citizens are strongly dependent on scientific expertise since the complex issue is difficult to grasp by common sense alone. This has important consequences: If the electorate bases its opinions on inaccurate facts, this poses a threat to good governance on climate change issues and may influence citizens to support policies that may harm their own lives and those of others (Hochschild & Einstein, 2015).

This study empirically addresses these concerns by testing the effect of misinformation in the news on reader's policy support and climate change threat perceptions while also deepening societies understanding of the so-called "continued influence effect" . This phenomenon is central to research on misinformation in mass media, as previous studies have shown that inaccurate information in the news continues to promote divisive biases among readers even if it is corrected or retracted (for a review see Lewandowsky et al., 2012). This experiment contributes to current scholarly work by examining a type of misinformation that has rarely been addressed before: The effect of wrong numbers.

Facts presented as numbers are especially interesting for two reasons. Firstly, numbers on climate change issues such as energy production have been severely misused and distorted in the media (Kooimey et al., 2002). Secondly, theories on the anchoring effect provide a framework for understanding how wrong and irrelevant numbers can distort people's judgments (for a review, see Furnham & Boo, 2011). However, there is a dearth of research exploring this phenomenon in the context of mass mediated information.

On the basis of previous studies regarding misinformation and the anchoring effect, this study investigates to what extent numerical misinformation in the media influences climate policy support and the perceived risk of climate change. By employing an experimental design, this study tests a causal link between the exposure to a retracted high or low number and participants' own estimations on the carbon footprint of commuting traffic. This estimation, in turn, is expected to mediate respondents' evaluation of a mitigation policy and climate change threats. The results contribute to a deeper understanding of the effects of inaccurate numbers on the news audience and help to address the critical area of climate change policy support.

## Theoretical Framework

### Misinformation and its effects

More than 30 years of misinformation research have examined the powerful and lasting effects of inaccurate information on public knowledge and attitudes. These effects are often at the root of wrongly understood scientific theories and health information (Peter & Koch, 2016), distorted memories about news stories (Ecker, Lewandowsky, Fenton, & Martin, 2014; Johnson & Seifert, 1994), and they also influence people's beliefs about political matters (Garrett, Nisbet, & Lynch, 2013; Nyhan & Reifler, 2010).

Importantly, the effect of misinformation on public opinion differs from mere ignorance. While being uninformed leaves citizens with the possibility of filling their knowledge gaps or using heuristics to make judgments, misinformation, once it is spread and accepted, can lead people to refuse correct information and to build robust policy preferences on factually incorrect beliefs (Kuklinski, Quirk, Schwieder & Rich, 1998; Lewandowsky et al., 2012). Researchers investigating misinformation acknowledge that the line between right and wrong in political debates is often blurred (Kuklinski et al., 1998). A struggle over who defines which events and problems are central and how they should be interpreted is inherent in political communication – therefore facts, while giving the impression of neutrality, are often ideologically loaded (Carvalho, 2007). To separate correct from incorrect claims, academic studies have defined misinformation along two lines of reasoning. One main definition refers to it as “information that is initially assumed to be valid but is later corrected or retracted” (Ecker et al., 2014, p. 292). The second defines it as “cases in which people's beliefs about factual matters are not supported by clear evidence and expert opinion” (Nyhan & Reifler, 2010, p. 305). The latter definition empathizes that there are legitimate and non-legitimate sources for factual claims.

Once spread, the induced bias of such retracted or illegitimate claims is hard to eliminate. Ideally, correcting misinformation should have the same effect as not being

exposed to it in the first place. However, people fail to discount the initially presented, inaccurate information when they make further inferences. Seifert (2014) coined the term “continued influence effect” to describe how the phenomenon persists over time and occurs both when the retraction is presented immediately after the misinformation as well as when it is presented after a delay (Feinholdt, 2016; Johnson & Seifert 1994). In addition, the effect cannot be ascribed to poor memory of the retraction alone, as it is equally as present for people who can report that the misinformation was corrected (e.g. Ecker, Lewandowsky, Swire, & Chang, 2011).

Different explanations exist for the persistence with which misinformation continues to shape people’s beliefs. An early approach by Wilkes and Leatherbarrow (1988) hypothesized that individuals build mental models of how a story unfolds. In this process, they connect the misinformation to other parts of the storyline. When later confronted with a retraction, people fail to update the inferences they had made on the basis of the incorrect pieces of information. In contrast, having something labelled as misinformation should hinder participants from integrating it into their mental model of the storyline in the first place. However, this is inconsistent with the finding that people also fall back into incorrect beliefs when the misinformation is presented alongside the correction (Johnson & Seifert, 1994). Therefore, recent studies have examined cognitive heuristics as the underlying cause of the continued influence effect, most prominently, the accessibility and applicability of the presented misinformation.

Cognitive science has shown that more accessible information has greater influence on people’s judgments, as it is more easily retrieved from memory (Tversky & Kahneman, 1973). A correction that repeats the initial misinformation or gives consistent contextual information can therefore heighten the accessibility of misinformation (e.g., Garrett et al., 2013). Consequently, this inaccurate information is more fluently processed, and fluency in return tends to increase perceived trustworthiness (Song & Schwarz, 2008). Seifert (2014) argues

that accessibility is one part of this process, while applicability is a second necessary prerequisite for the continued influence effect. When the misinformation plausibly fills a causal gap that is otherwise left empty (applicability), and when it is readily available because it was mentioned earlier as a part of the storyline (accessibility), it will be accepted despite of corrections. Therefore, the continued influence effect can be seen as a tendency in people's thinking to use both accessible and story-coherent information, in which refutations can only interfere to a limited extent.

In recent years, research increasingly turned to the characteristics of the receivers, not only the message, to determine why corrections ultimately fail or succeed. To a large extent, the effectiveness of a correction seems to depend on whether or not it is consistent with the receiver's worldview. For instance, a study by Nyhan and Reifler (2010) found that corrections that run counter to people's political ideology can increase the reliance on misinformation. Ecker and colleagues (2014) have failed to reproduce this backfiring effect for the issue of racial prejudices, but suggest that their correction did not constitute a severe enough threat to readers' attitudes. These findings are also in-line with persuasion research. Rather than accommodating new information, people tend to defend their existing worldviews in order to resist persuasion and protect their free will. For example, numerous resistance strategies include counter-arguing or derogating the source (Knowles & Linn, 2004; Zuwerink Jacks & Cameron, 2003). When it comes to climate change communication, resistance can undermine the attempt to raise awareness for environmental issues (Hart & Nisbet, 2012). However, resistance can be seen as a positive phenomenon in the face of misinformation about climate change, as the next section will explain.

### **Misinformation in climate change communication**

Climate change communication poses an interesting subject for study in terms of the continued influence of misinformation. Although climate scientists have provided important and consistent evidence for a human-induced greenhouse effect since the 1960s, around 43

percent of the U.S. population expressed doubts on climate science as late as in 2009 (Oreskes & Conway, 2012). So far, only a small body of literature has examined the effects of misinformation on public opinion about climate change. A study on so-called “astroturf sites” found that even highly involved subjects were less certain about the causes of climate change after being exposed to biased information on a fake NGO-blog. This was also the case when the website was labelled as “funded by ExxonMobil” (Cho, Martens, Kim, & Rodrigue, 2011). While this finding lends some credibility to the assumption that misinformation plays a role in people’s beliefs and attitudes about climate change, more research is needed to determine and understand the impact of inaccurate information. Furthermore, this could also pose a fruitful extension to a large body of existing literature on climate change messages.

Current studies focus on the effect of frames (McCright, Charters, Dentzman, & Dietz, 2016; Nisbet, 2009; Nisbet, Hart, Myers, & Ellithorpe, 2013), the role of emotions in processing messages (Lu & Schuldt, 2015, 2016), and the impact of visual imagery (Leiserowitz, 2006). However, little attention has been paid to the role of numbers in messages about climate change. Hart (2013, p. 786) argues that “there is still a critical need to better understand how changes in message structures (e.g. using numeric or non-numeric descriptors) may influence the public perception of climate change”. So far, two studies find a stronger impact of statistical information on climate change beliefs as compared to narratives (Hart, 2013; Kim et al., 2012), which corresponds with a review on the persuasiveness of statistical versus narrative evidence in health communication (Zebregs, van den Putte, Neijens & de Graaf, 2015). Therefore, this study focuses on deepening the understanding of how numbers can shape people’s beliefs on climate change. To examine the role of inaccurate numbers in climate change communication, the paper draws on findings from anchoring theory.

### **Anchoring effects**

**Anchoring as a form of misinformation.** Just like the continued influence effect, the anchoring effect indicates that the cognitive processes underlying judgments are not infallible. Anchoring, as first systematically explored by Tversky and Kahneman (1974), describes how wrong or irrelevant numbers systematically distort future judgments. In their classic study, Tversky and Kahneman let participants turn a wheel of fortune that arrived at either a high or low number. When later asked about the number of African countries that are a member of the United Nations, the participants' responses leaned towards the irrelevant number – the anchor – that was displayed on the wheel of fortune.

Anchoring studies examine the strength of the anchoring effect by comparing the estimations of groups that are presented with a high or a low numerical anchor to estimations of a control group. The stronger the anchoring effect, the more these groups will deviate in their average estimation, with a high anchor leading to higher numbers and a low anchor leading to lower numbers than the control group average (Jacowitz & Kahneman, 1995). Anchoring research has produced insights into diverse fields such as jurisdiction (English, Mussweiler, & Strack, 2006), purchasing decisions (Mussweiler, Strack & Pfeiffer, 2000) or grading in schools (Dünnebier, Gräsel, & Krolak-Schwerdt, 2009).

Neither journalism studies nor misinformation research have specifically examined anchoring effects in the context of mass media and its impact on the audience. This is surprising since bridging gaps in these areas could provide an important and fruitful avenue for research. Both areas centre on the same question: How can inaccurate or even irrelevant information affect people's beliefs and attitudes? In addition, they share an experimental set-up in which initial information is declared as wrong and should not be used for later judgements. Taking into account anchoring's robust effects (Furnham & Boo, 2011) and the repeatedly shown impact of other forms of misinformation on a news audience (Lewandowsky et al., 2012), this study expects a similar effect of numerical anchors in climate change news on the audience's estimations:

*H1: Numerical anchors about climate change presented in a news item skew respondents' own estimations on the presented issue in direction of the anchor value.*

**Limits of anchoring in climate change communication.** Different theoretical models have been tested to explain why anchoring occurs, some of which show similarities to the processes underlying the continued influence effect. The “insufficient adjustment“ model suggests that an effortful process produces the anchoring effect, in which people start from the numerical anchor and insufficiently adjust their estimation into the direction in which they suspect the right value. In other words, each person has a range for which estimations on a topic seem plausible. If the anchor is outside of this range, people will adjust their judgment until they reach one end of this spectrum, arriving at the lower end in case of a low anchor or the higher end for a high anchor (Tversky & Kahneman, 1974).

Epley and Gilovich (2006) have shown that this is the case for self-generated anchors, but that a different mechanism seems to be at play when the number is externally provided: the cognitive process of selective accessibility. Selective accessibility in anchoring suggests that people generate thoughts that are in line with the anchor and therefore arrive in its vicinity with their own estimation (Strack, Bahnik, & Mussweiler, 2016). This theory is supported by a series of experiments, showing that plausible anchors increase the accessibility of applicable knowledge (Mussweiler & Strack, 1999), or that actively thinking about reasons that speak against the high or low anchor can weaken the anchoring effect (Mussweiler et al., 2000). This approach parallels assumptions of the continued influence effect as described above. Knowledge that is coherent with an inaccurate piece of information is activated and in return shapes later judgments through increased fluency.

Attitude change theory emerged as a third approach to anchoring which shares ideas on selective accessibility in some areas, but refines its predictions in others. This line of reasoning takes into account that people might also counterargue the presented value instead of solely generating confirming arguments (Wegener, Petty, Detweiler-Bedell, & Jarvis,

2001). Wegener and colleagues (2001) point out that the same moderators have been identified in both general theories of attitude change and anchoring, namely pre-existing knowledge and source credibility. This theoretical strand links well to findings on the continued influence effect, as both suggest that pre-existing attitudes play a strong role in the processing of inaccurate information. Building on these similarities, this study examines anchoring from a perspective of attitude change.

In the context of this study I expect that people who already have strong feelings and ideas on climate change might be more motivated and better equipped to counterargue presented anchors. This makes them less susceptible to their biasing effects. To test this assumption, I investigate whether involvement in the issue of climate change acts as a moderator on anchoring effects. Issue involvement – also referred to as issue importance – is an important predictor for people's ability to resist persuasive attempts, as it is a central indicator for the strength of pre-existing attitudes (Zuwerink Jacks & Cameron, 2003; Zuwerink Jacks & Devine, 2000). Studies on climate change framing also found that attitude change on this specific topic is especially difficult to induce, as people have developed strong opinions on global warming over the last decades (e.g., McCright et al., 2016; Nisbet et al., 2013). This resistance can be explained by the partisan nature of climate change attitudes (Drews & van den Bergh, 2016) and the fact that people's position on climate change forms a part of their identity (Kahan, 2015).

However, studies on anchoring show that numerical misinformation might still have the power to influence even highly involved people, as anchors also have an impact on experts in their fields (Englich et al., 2006; Mussweiler et al., 2000). I therefore hypothesize that the influence of inaccurate information will be less pronounced for people that already show strong involvement in the topic of climate change, but that those attitudes do not negate anchoring effects completely:

*H2: Respondents' issue involvement in climate change moderates the strength of the anchoring effect on the respondents' estimation.*

**Impact of anchoring on policy preferences.** Public support is crucial to ensuring costly climate change mitigation measures are politically viable (Nisbet, 2009). It is therefore highly relevant to understand if and how numerical misinformation could distort public opinion on certain policies. Therefore, I test if anchoring can have an impact on support for a specific and costly climate change mitigation measure, in this case, the compaction of cities to decrease CO<sub>2</sub> emissions from traffic. As Stoutenborough, Bromley-Trujillo and Vedlitz (2014) have shown, support for climate change mitigation measures varies largely between specific policies. Focusing on only one policy therefore lowers generalizability, but for the same reason it would not be legitimate to measure policy support as a consistent concept.

In addition, and complementing the measure of policy support, this study also tests if anchored high or low estimations affect people's threat perception of climate change in general. If a certain problem is expressed as more urgent through, e.g., the attribution of a high share of CO<sub>2</sub> emissions to it, this might alarm people and make them more concerned about the threat of climate change. If, on the other hand, a pollutant is displayed as marginal, people might be less alarmed. This assumption is consistent with the selective accessibility model of anchoring. However, coming from an attitudinal perspective, it is also possible that people counterargue the anchor and access information that will shift their preferences to the other direction. Lastly, since climate change attitudes are mostly stable, as noted earlier, policy preferences could be resistant to the influence of inaccurate facts.

As these theories and findings are conflicting, no clear prediction can be made, and the possible effect is investigated in a second research question:

*RQ2: To which extent does the anchoring effect alter climate change policy support and the risk perception of climate change?*

When combined, these hypotheses and the additional research question represent a model of moderated mediation, as can be seen in Figure B1.

## Methodology

### Pretest

Three stimuli and three related estimation questions and policies were pre-tested and evaluated by a snowball sample of environmentally-conscious Austrians ( $n = 35$ , ages 24 to 57,  $M = 32.23$ , 60% female, 77% university degree). The estimation questions asked participants to give their own guess on a number that was later introduced as the manipulation into the stimulus text of the main survey. These estimations help to see the range of estimations and to calibrate the numerical anchors according to the method used by Jacowitz and Kahneman (1995). All participants of the online questionnaire were recruited through Facebook.

One stimulus option (natural gas resources) had to be excluded because participants perceived the respective evaluation question as ambiguous. The two remaining stimuli issues, CO<sub>2</sub> emissions from commuting traffic and shortages in food supply, were highly relevant to the participants, reaching an average of 6.14 ( $SD = 1.14$ ) and 6.29 ( $SD = 1.20$ ) on issue importance on a 7-point scale, respectively. A series of paired t-tests revealed no significant differences between issue importance ( $t(34) = 0.51, p = .611$ ) or the perceived quality (e.g. trustworthiness,  $t(34) = -.87, p = .392$ ) of the two types of stimuli. No significant differences could be found for policy preferences in relation to the respective topics either,  $t(34) = -1.76, p = .087$ . For these reasons, the stimulus on commuters from the Viennese suburbs was selected on the basis of the estimation question, which shows a greater variation and range of values ( $M = 31.29, SD = 15.55$ , range 5 to 70) in comparison to the stimulus of crop failure ( $M = 14.71, SD = 11.67$ , range 1 to 60). This indicates a situation of uncertainty, under which the anchor effect is more likely to occur (Kahneman & Tversky, 1974).

### **Experimental design**

To test the presented model, an experimental between-subjects design was implemented, which allows for the establishment of a causal relationship in a controlled environment (e.g. Ecker et al., 2014; Feinholdt, 2016; Glöckern & Englich, 2015). One group was presented with a low anchor (LA) manipulation in the stimulus, one group with a high anchor (HA) and a control group (CG) saw the article without any numerical anchors.

### **Participants**

Data collection took place from April 4th to April 18th, 2017. 56 participants were recruited through e-mail by their professors, and 85 participants answered the survey in a lecture on environmental communication. All questions and materials were presented in German. A total of 138 Bachelor students enrolled in the program Management of Environmental and Bio-Resources at the University of Life Sciences, Vienna, and participated in the online experiment (ages 19 to 52,  $M = 24.08$ ,  $SD = 4.90$ , 60.3% female). Of the original 146 respondents, five were excluded because of missing data and three because of an unusual overall pattern of answers. The University of Life Sciences has a focus on environmental studies, and this sample is prone to have high awareness of climate change and related topics. Therefore, a model test with this sample provides rather conservative estimates of the investigated effects.

### **Research procedure**

Students were informed that they would take part in a study on environmental news. After giving their consent, they were randomly assigned to a stimulus or control group ( $n = 46$  per group). After exposure to the article, the groups in the numerical misinformation conditions were exposed to a retraction, followed by an estimation question about the CO<sub>2</sub> emissions caused by commuters, which all three groups had to answer. Then, participants indicated their policy support and were asked to assess the general threat of climate change, followed by questions about personal issue involvement and an evaluation of the quality of

the article. Before de-briefing, respondents filled in their demographical information. While all participants were presented with a debriefing message at the end of the survey, the lecture group was given an additional 30-minutes presentation on the underlying theories of this study by the researcher.

### **Stimulus material**

A newspaper article about the growing problems caused by the commute belt of Vienna was selected based on the pre-test. To increase the external validity of the stimulus material, it draws on an original published article (Putschögl, 2015) that was shortened and slightly modified. The text was formatted in the style of an online article and an author line, publishing date, and publishing section were added. All three experimental groups read identical versions of the article except for the expert statement that introduced the high or low anchor (see Appendix A). An important criterion for the issue was its relevance and tangibility to the participants. Commuters in Vienna are a controversial, publically debated issue (Putschögl, 2015), and the steadily growing CO<sub>2</sub>-emissions from traffic are one of the biggest challenges for climate change policies in Vienna (Magistrat der Stadt Wien, 2009). This makes this topic a relevant object of study in the light of mitigation efforts. In the LA and HA condition, respondents read a (later retracted) statement on the extent to which CO<sub>2</sub> emissions by commuting traffic contribute to the total CO<sub>2</sub> emissions of Vienna. The high and low anchors were set at the 15th and 85th percentile of estimations of the pre-test group, as proposed by Jacowitz and Kahneman (1995). As a result, the low anchor stated that “17 percent of CO<sub>2</sub> emissions of Vienna are due to commuting traffic”, while the high anchor stated that “50 percent of CO<sub>2</sub> emissions of Vienna are due to commuting traffic”.

### **Measurement**

**Mediator.** Following the procedure of previous anchoring studies (for a review, see Furnham & Boo, 2011), participants were asked to give their own estimation on the priority presented and retracted number in an open question (“Which percentage of the total CO<sub>2</sub>-

emissions of the city of Vienna is caused by commuting traffic?”,  $M = 31.62$ ,  $SD = 19.64$ , range: 3 to 80). In addition, they had to indicate how certain ( $M = 3.20$ ,  $SD = 1.44$ ) they are about their estimation on a seven-point Likert scale.

**Dependent variables.** All dependent variables and the moderator were measured on a seven-point Likert scale.

*Policy support.* Two items measured to which extent respondents favor a specific policy ( $M = 2.39$ ,  $SD = 1.39$ ) and if they think it is effective ( $M = 2.86$ ,  $SD = 1.20$ ).

Specifically, students had to indicate whether they would support the construction of affordable living space in order to attract commuters to permanently move to Vienna, even if this means eradicating green spaces throughout the city (for exact wording, see Appendix A). This subject was chosen because the losses (less green space  $M = 6.43$ ,  $SD = 0.85$ ) and the gains (less CO<sub>2</sub> from traffic,  $M = 6.14$ ,  $SD = 1.14$ ) involved in the policy were both highly important to the pre-test group. This balance between losses and gains was important, as it makes participants closely consider the policy instead of building on already fixed preferences. Apart from theoretical considerations, the policy is also of political relevance: The city of Vienna names the densification of the city as one of the most important climate change mitigation strategies. Subsequently, this could be a realistic strategy in the future (TINA Vienna GmbH, 2014).

*Threat of climate change.* The two items measuring participants' threat perception of climate change (Cronbach  $\alpha = .78$ ,  $M = 6.34$ ,  $SD = 0.96$ ) were adapted from Leiserowitz (2006). Participants indicated how strongly they agreed with two statements, e.g., “I am concerned about climate change.”

**Moderator.** Issue involvement (Cronbach  $\alpha = .74$ ,  $M = 4.07$ ,  $SD = 1.56$ ) was measured with two survey items based on a study by Zuwerink Jacks & Cameron (2003; e.g., “My attitude toward climate change helps define who I am as a person.”)

**Control variables.** Participants indicated their age and gender. In addition, they answered questions on their political leaning on a 11-point scale ( $M = 3.13$ ,  $SD = 1.42$ ), on their voting intention (coded as indicator variable, 35.5 % would vote for the Green Party), and their income on a 5-point scale ( $M = 3.57$ ,  $SD = 0.97$ ), as well as the device they have used (61.6 % used a smartphone) and whether they completed the survey in the lecture. The quality of the text (Cronbach  $\alpha = .81$ ,  $M = 4.39$ ,  $SD = 1.15$ ) was assessed using a 4-item scale, measured on a seven-point Likert scale. All detailed items can be found in Appendix A, Table A1.

## Results

### Randomization Check

In a first step, a one-way ANOVA was conducted to see if the randomization across conditions was successful. Subjects in the three experimental groups show no significant differences with regard to their political affiliation ( $F(2, 135) = .405$ ,  $p = .668$ ), gender ( $F(2, 135) = .028$ ,  $p = .972$ ), age ( $F(2, 135) = .642$ ,  $p = .528$ ), involvement ( $F(2, 135) = .604$ ,  $p = .548$ ), or income ( $F(2, 135) = .023$ ,  $p = .978$ ).

### Hypotheses Testing

An analysis of covariance (ANCOVA) was conducted to see whether the three experimental groups differ in their estimation of the carbon footprint created by commuting traffic in Vienna (H1). Participants who were exposed to numerical misinformation arrived at different estimations than the control group,  $F(14, 137) = 4.08$ ,  $p < .001$ ,  $\eta^2 = .32$ . Estimations in the low anchor condition (LA) were significantly lower compared to both the control group (CG),  $M_{\text{difference}} = -18.03$ ,  $p < .001$ , 95%  $CI [-25.21, -10.86]$  and the high anchor condition (HA),  $M_{\text{difference}} = -23.16$ ,  $p < .001$ , 95%  $CI [-30.34, -15.97]$ , as a LSD post-hoc test indicates. Participants in the HA group also estimated the share of commuters' CO<sub>2</sub> emissions to be higher as compared to the CG ( $M_{\text{difference}} = 5.12$ ). However, this difference was not significant,  $p = .160$ , 95%  $CI [-2.05, 12.29]$ . To rule out alternative explanations, the factors

gender, age, income, issue involvement, the device used to fill out the survey, and the test environment (i.e., whether people answered the survey in a lecture or not) were controlled for. No differences were found when including the respective controls. Therefore, hypothesis 1 is partly accepted: Numerical misinformation affects people's own estimation of the respective number, but only for participants in the LA condition.

In a next step, a moderated mediation model was tested in PROCESS (Hayes, 2013), using indicator variables for the LA and the HA group, and taking the CG as a reference category. The aim was to see if high involvement in the issue of climate change could limit the anchoring effect (H2), which in turn could affect policy support. As can be seen in Table B1, issue involvement did not moderate the anchoring effect for participants in the LA condition, because the interaction's direct effect ( $a_3 = -1.97, p = .232$ ) included zero (bias-corrected bootstrapping, 5,000 samples, 95%, CI [-5.21, 1.27]). A similar pattern occurred when testing the interaction between the HA condition and issue involvement, outlined by a 95 % bootstrap confidence interval for the interaction ( $a_3 = -1.40, p = .477$ ) from -5.30 to 2.49 (see Table B3). In other words, the anchoring effect appeared for participants in the LA condition irrespective of their level of issue involvement (see also Table B2). In addition, the model of moderated mediation for the LA condition and the HA condition was not supported by the moderated mediation index, with bias-corrected 95 % bootstrap confidence intervals of -0.07 to 0.11 and -0.02 to 0.10 respectively. Neither was an moderation found for the models of perceived policy effectiveness or perceived threat of climate change, as depicted in Figures B2, B3 and B4. Thus, hypothesis 2 is rejected.

Further analysis examined if participants' own estimations mediate the effect of numerical misinformation on policy support, the perceived effectiveness of this policy, and threat perception of climate change (H3). Since involvement does not act as a moderator, the model was retested using a simple mediation analysis in PROCESS, and issue involvement

was included as an additional control variable. All tests were performed using a 95 % bias-corrected bootstrapping procedure based on 5,000 samples.

Again, the models show that the LA condition led participants to give lower estimations ( $a_I = -18.387, p < .001$ ). However, as illustrated in Tables B4, B5 and B6, there was no evidence that a lower or higher estimation as such affected participants' support of the presented policy ( $b = -0.01, p = .077$ ), whether they found it effective ( $b = -0.003, p = .558$ ), or whether they felt threatened by climate change ( $b = -.001, p = .890$ ): In each model, the 95% bootstrap confidence intervals for the unstandardized coefficients include zero.

Next, the indirect effects of the numerical misinformation in the stimulus on policy support, perceived efficiency, and perceived threat were examined for each condition individually. Being exposed to the low anchor stimulus led participants to support the presented policy more through their biased estimation, with an unstandardized indirect coefficient of  $ab = 0.22$  and a 95% bootstrap confidence interval of 0.005 to 0.52. However, this result has to be interpreted with caution, as the overall model can only explain a marginal level of the examined variance in policy support,  $R^2 = 0.06$ . Overall, the additional research question (RQ2) arrives at the conclusion that the anchoring effect had no subsequent effect on how strongly people supported the policy, how effective they thought it is or how serious people perceived the threat of climate change.

### **Additional Analysis**

An additional regression analysis was conducted to see whether previous findings on anchoring effects can be replicated in the context of climate change news. Firstly, Kato and Hidano (2007) found that women's estimations tend to be more strongly biased towards the anchor than men's estimations. Secondly, Wegener and colleagues (2001) stated that contextual factors and pre-existing attitudes influence how strongly people are biased by an anchor and give source credibility as example. Therefore, gender and the assessed quality of the article were tested as possible moderators of anchoring effects. A regression model was

tested using the deviation from the anchor as dependent variable and the experimental condition, article quality, political affiliation, gender, age, income, device, and testing environment as predictors,  $F(8,91) = 8.04, p < 0.001$ . The model accounts for 44 percent of the variation examined in participants' deviations from the anchor value ( $R_2 = .44$ ). Female participants made estimations that were on average 3.63 percentage points closer to the anchor,  $t = -2.31, p = .023, 95\% \text{ CI} [-6.75, -0.50]$ , supporting Kato and Hidano's (2007) observation. Participants' quality assessment acted as a moderator as well: The lower they rated the quality of the news article, the further their estimations deviated from the anchor,  $b = -2.05, t = -2.92, p = .005, \text{ CI} [-6.75, -0.50]$ . None of the other predictors reached significant influence on the deviation from the anchor.

### Discussion

Research on anchoring effects and the continued influence of misinformation has produced important insights into how people's judgment can be affected by inaccurate information even when misinformation is retracted (Furnham & Boo, 2011; Lewandowsky et al., 2012). So far, both phenomena have been investigated separately. By examining anchoring effects in the context of a corrected news article, this study bridges anchoring and misinformation studies and tests to what extent wrong information in the media can create biased judgements and opinions in the context of climate change. Expanding on previous research, the experiment focused on three main questions: It investigated a) to what extent misleading numbers in the news can affect the audiences judgement on a particular subject; b) whether pre-existing attitudes mitigate this effect; and c) whether the resulting anchoring effect influences readers' opinions on climate change policies.

Results show that wrong numbers in news articles seem to affect people's own estimations on climate change facts even in a group of knowledgeable participants. Presenting participants with a low number of commuters' CO2 emissions made them arrive at significantly lower estimations after a retraction. Therefore, news consumption parallels a

number of other real life situations in which irrelevant or wrong numbers might induce biased judgments (for a review, see Furnham & Boo, 2011). The finding also supports the assumption that anchoring effects apply to knowledgeable individuals (Englich et al., 2006; Mussweiler et al., 2000). No effect could be detected when people were presented with a high anchor. This discrepancy between the effectiveness of low and high anchors can be explained in two ways: Firstly, the high anchor might have been outside of the plausible range of participants' estimations, making it easier for them to limit its influence on their judgment (Wegener et al., 2001). However, a closer look at the data suggests that the high anchor could have been too low for the HA group in order to find significant differences to the CG. Notably, more participants in the CG arrived at an estimation above the high anchor (30.4%) as compared to both the pre-test group used to calibrate the anchor (17%) and the HA group (26.1%). As a result, the high anchor might have led a substantial share of participants to give lower estimations. Thus, the calibration of the high anchor might have been unsuitable for this experiment. Either the pre-test group and the CG differed in their characteristics or the observed differences are due to a priming affect. This seems likely, as the participants in the experiment were exposed to the negative portrayal of commuters in the news item before giving their estimations, while the pre-test group answered the estimation question before they read the article. Previous research supports the notion that the frames and the effects of narrative misinformation interact (Feinhold, 2014). Thus, more research is needed to clarify how high and low anchors affect judgments in different contexts, frames, and for different populations.

This study was the first to investigate the moderating role of issue involvement for anchoring effects. In contrast to expectations and previous findings from misinformation studies (Cho et al., 2011), the anchoring effect appeared regardless of participants' involvement in the issue of climate change. These conflicting findings could stem from different types of misinformation, as it may be more difficult for people to ignore numbers

than other types of inaccurate facts in their later judgment (Zebregs et al., 2015). An alternative explanation emerges from the psychological processes underlying persuasion and attitude change. Scholars concerned with the mechanisms of persuasion argue that it is insufficient for people to have arguments and cognitive resources to withstand a persuasive attack – they also need to be motivated to use them (Sagarin, Cialdini, Rice, & Serna, 2002). In this study, receiving a higher or lower anchor about CO<sub>2</sub> emissions from commuting traffic might not have been perceived as an attack on individuals' stance on climate change for highly involved participants, thus there was no need to defend their attitudes (e.g. Ecker et al., 2014). A second motivator to discount misinformation is the feeling of distrust (Schul & Mayo, 2014). Additional analysis revealed that participants who rated the quality of the article as lower were more likely to give estimations that lie further away from the anchor. Therefore, the results support the notion that motivation or lack thereof is a key component to anchoring effects (Wegener et al., 2001).

This leads to the third main question of this research: When numerical misinformation about climate change is powerful enough to influence informed and involved people, could these misconceptions pose a threat to public support for mitigation policies? While this study alone cannot give a definite answer to this question, its results indicate that anchoring effects do not change people's policy support or their general threat perception by default. All experimental groups supported measures against commuting to an equal extent, regardless of their biased estimations.

From a theoretical perspective, this result comes as a surprise: Both the selective accessibility and attitudinal strand of anchoring theory suggests that in a case of low motivation to counterargue, a low anchor makes arguments more accessible that speak against the importance of commuting traffic for climate change mitigation. To give an example, the smaller number might evoke considerations on fuel-saving cars or on the amount of people that commute by train. Following the cognitive process of accessibility, these arguments

should also be more present in people's mind when they later evaluate a policy that is connected to this topic (Tversky & Kahneman, 1973).

There are a number of reasons why biased estimations seem to have no further implications for people's beliefs and attitudes. Firstly, numbers are subject to interpretation. As Kuklinski and colleagues (1998) state, despite of the fact itself, the relevance that is attributed to it is decisive in political matters as well. Gamson (1999) raises a similar point, stating that the meaning of facts depends on the frame in which they are embedded. It is important to note that this study's frame of the news article presented commuting traffic in a negative light. As a result, claiming that 17 or 50 percent of the carbon footprint of Vienna comes from commuting traffic could have had a similar effect – both numbers could be perceived as high in the eyes of climate change aware students. Moreover, a high concern about car emissions among participants ( $M = 6.04$ ,  $SD = 1.28$ ) points to a probable ceiling effect, as it may be difficult to induce further support on traffic reduction.

The choice for the specific policy in this experiment offers a second explanation for participants' inertia. While the importance of costs and benefits was balanced for the pre-test group ( $M_{\text{difference}} = 0.29$ ,  $SD = 1.56$ ),  $t(34) = 1.08$ ,  $p = .287$ , 95 % CI [-0.25, 0.82], the student sample significantly favored the preservation of green spaces in Vienna ( $M = 6.59$ ,  $SD = 0.95$ ) over CO<sub>2</sub>-reduction from traffic ( $M = 6.04$ ,  $SD = 1.28$ ),  $t(137) = 4.79$ ,  $p < 0.001$ , 95 % CI [0.32, 0.78]. This can be taken as evidence that participants have strong and stable preferences to protect Vienna's natural landscapes, irrespective of new information. Lastly, existing research on climate change mitigation policy identified a wide array of factors that determine policy support (Drews & van den Bergh, 2016) and found stable preferences in framing experiments (McCright et al., 2016; Nisbet et al., 2013). Therefore, it is not surprising that a *single* inaccurate fact failed to tip over participants' beliefs and attitudes.

Nevertheless, there are valid reasons to extend research on anchoring and its effects on public opinion. People encounter misinformation multiple times in a real news environment.

This repeated exposure might be influential in the long term, especially considering that wrong facts about climate change still circulate in the news (Oreskes & Conway, 2012). In addition, future research should test whether a less knowledgeable sample or a different policy might change the picture. Time might play a crucial role as well. An experiment by Feinhold (2016) suggests that the impact of misinformation only surfaces after some time has elapsed, referred to as the “sleeper effect”. Therefore, studies on the robustness of the anchor effect and delayed effects on attitudes could be insightful. Future research should also focus on a deeper integration of anchoring into the methodological set-up of misinformation studies. Specifically, testing different forms of retractions, different frames, counter-attitudinal corrections, or new moderators could produce new insights. Climate change communication poses a vital field for these explorations since the audience frequently encounters numbers in the discourse about CO<sub>2</sub> emissions, changing temperatures, or risks of natural disasters. In addition, other pressing issues could profit from a better understanding of the biases induced by inaccurate numerical information, including economic policies or the heated debate about the refugee crisis.

This study raises important ethical concerns about news reports on climate change. On the one hand, the findings suggest that post-hoc fact checking might be insufficient to reduce misconceptions (Garrett et al., 2013). This points to a heightened responsibility for media practitioners to carefully research facts before they are distributed to a mass audience. On the other hand, the influence of single inaccurate facts and figures on the broader picture of policy support should not be overestimated. This study shows that more critical individuals might be able to shield themselves from an anchoring bias. Therefore, the advancement of media literacy could pose a fruitful avenue to counter misinformation, for instance, by cultivating the audience’s skepticism towards unreliable sources and numbers without substantiation.

A few limitations need to be considered. While experiments offer the advantage of internal validity, the study did not resemble processes that take place in a real situation of

news consumption. Furthermore, it will be necessary to investigate other media, issues, and employ a different sample. Despite the common criticism of student samples (e.g., Hooghe, Stolle, Mahéo, & Vissers, 2010), this population was useful here, as it enabled the researcher to reach a great number of environmentally conscious participants. Another difficulty was the reliability of the issue involvement and perceived threat of climate change scales. While measures have shown high reliability in previous studies (Leiserowitz, 2006; Zuwerink Jacks & Cameron, 2003), they do not appear to translate smoothly into a European context, and these contextual differences should be considered in future studies.

This study set the stage for further research on the important topic of numerical misinformation in the news. As a quote attributed to Mark Twain goes: “It is not what you don’t know that gets you into trouble. It is what you know for sure that just ain’t so.” (Nyhan & Reifler, 2010, p. 303) In this sense, this study represents an important first step to see how much “trouble” is caused by wrong numbers in the mediated debate on climate change, one of the biggest challenges of international politics today.

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## Appendix A

**Operationalization of constructs****Item wording and scales**

The original survey items in German are set in italics in Table A1. Questions in parentheses were excluded from the scale because they negatively affected the reliability of the scale measured by Cronbach's alpha and have shown low factorial loadings measured by factor analysis.

Questions Q5 to Q13 were adapted from Leiserowitz (2006) by translating them into German and using a 7-point Likert Scale. In order to maintain a consistent wording of the answer options, the original questions were reformulated into statements. Questions Q14 to Q17 were adapted to the issue of climate change using items by Zuwerink Jacks and Cameron (2003).

Table A1. Measurement of key variables as presented in the survey.

Variable	Survey Items	Coded responses
<b>estimation</b>	Q1. <i>Wieviel Prozent der CO2-Emissionen der Stadt Wien entstehen durch den Pendlerverkehr?</i> [Which percentage of CO2 emissions in Vienna are due to commuting traffic?]	open question, numbers from 0-100
<b>certainty of estimation</b>	Q2. <i>Bitte geben Sie an, wie sicher Sie sich in Ihrer Schätzung sind.</i> [Please indicate how certain you are about your estimation.]	7-point Likertscale from (1) <i>Gar nicht sicher</i> [Not certain at all] to (7) <i>Sehr sicher</i> [Very certain]
<b>policy support</b>		
general policy support	Q3. <i>Wie sehr stimmen Sie einer Umsetzung dieser Maßnahme innerhalb der nächsten zehn Jahre zu oder lehnen diese ab?</i> [To which extend do you support or object the implementation of this policy within the next ten years]	7-point Likert scale from (1) <i>Stimme gar nicht zu</i> [don't agree at all] to (7) <i>Stimme voll zu</i> [Completely agree]
perceived effectiveness of policy	Q4. <i>Für wie effektiv halten Sie diese Maßnahme um den CO2-Ausstoß durch den Pendlerverkehr zu reduzieren?</i> [How effective do you think this policy is in order to reduce the carbon footprint of commuting traffic?]	7-point Likert scale from (1) <i>Gar nicht effektiv</i> [Not effective at all] to (7) <i>Sehr effektiv</i> [very effective]
<b>Perceived threat of climate change (adapted from Leiserowitz, 2006)</b>		
General concern	Q5. <i>Der globale Klimawandel bereitet mir Sorgen.</i> [I am concerned about global climate change.]	7-point Likert scale from (1) <i>Stimme gar nicht zu</i> [Completely disagree] to (7) <i>Stimme voll zu</i> [Completely agree]

Variable	Survey Items	Coded responses
Concerns about future impacts – on a global level	<p><i>Für wie wahrscheinlich halten Sie es, dass die folgenden Ereignisse in den nächsten 50 Jahren aufgrund des Klimawandels auftreten?</i> [How likely do you think it is that each of the following will occur during the next 50 years due to global warming?]</p> <p>(Q6. <i>Weltweit wird der Lebensstandard vieler Menschen sinken.</i> [Worldwide, many people's standard of living will decrease.])</p> <p>(Q7. <i>Weltweit wird es zu Wasserknappheit kommen.</i> [Worldwide, water shortages will occur.])</p> <p>(Q8. <i>Weltweit werden sich gefährliche Krankheiten stärker ausbreiten.</i> [Increased rates of serious disease will occur worldwide.])</p>	
Concerns about future impacts – on a personal level	<p>(Q9. <i>Mein Lebensstandard wird sinken.</i> [My standard of living will decrease.])</p> <p>(Q10. <i>In meiner Umgebung wird es zu Wasserknappheit kommen.</i> [Water shortages will occur where I live.])</p> <p>(Q11. <i>Die Gefahr, mich mit einer gefährlichen Krankheit anzustecken, steigt.</i> [My chance of getting a serious disease will increase.])</p>	
Concerns about the non-human nature	<p>Q12. <i>Der Klimawandel stellt eine Gefahr für die Tier- und Pflanzenwelt dar.</i> [Climate change is a threat to non-human nature.]</p>	
Concerns about current events	<p>(Q13. <i>Der momentane Einfluss des Klimawandels ist schwerwiegend.</i> [The current impacts of global warming are serious])</p>	

**Personal Involvement (adapted from Zuwerink Jacks & Cameron, 2003)**

Variable	Survey Items	Coded responses
	(Q14. <i>Das Thema Klimawandel ist mir persönlich nicht sehr wichtig. [reversed]</i> [The issue of climate change is not very important to me personally])	7-point Likert scale from (1) <i>Stimme gar nicht zu</i> [Completely disagree] to (7) <i>Stimme voll zu</i> [Completely agree]
	Q15. <i>Meine Einstellung zum Klimawandel ist entscheidend für mein Selbstbild (z.B. wie ich mich als Person wahrnehme.)</i> [My attitude toward climate change is central to my self-image/self-concept (i.e., how I see myself as a person).]	
	(Q16. <i>Mir persönlich ist der Klimawandel egal. [reversed]</i> [I do not care personally about climate change.])	
	Q17. <i>Ich definiere mich über meine Einstellung zum Klimawandel.</i> [My attitude toward climate change helps define who I am as a person.]	

### Control variables

issue importance – green spaces	Q18. <i>Die Grünflächen wie Parks, Wälder und Wiesen in der Stadt sind mir wichtig.</i> [Green spaces in the city like parks, forests and meadows are important to me]	7-point Likert scale from (1) <i>Stimme gar nicht zu</i> [Completely disagree] to (7) <i>Stimme voll zu</i> [Completely agree]
issue importance – green spaces	Q19. <i>Mir ist wichtig, dass der CO<sub>2</sub>-Ausstoß durch den Verkehr reduziert wird.</i> [The reduction of the CO <sub>2</sub> emissions due to traffic is important to me.]	
quality	<i>Bitte geben Sie an, wie Sie den soeben gelesenen Artikel am ehesten beschreiben würden.</i> [Please indicate how you would describe the previous article]: Q20. <i>unglaubwürdig (1) – glaubwürdig (7)</i> [untrustworthy – trustworthy] Q21. <i>schlecht recherchiert (1) – gut recherchiert (7)</i> [badly researched – well researched] Q22. <i>nicht überzeugend (1) – überzeugend (7)</i> [not compelling – compelling] Q23. <i>uninteressant (1) – interessant (7)</i> [not interesting – interesting]	Semantic differential from 1 (negative characteristic) to 7 (positive characteristic)

Variable	Survey Items	Coded responses
age	Q24. <i>Wie alt sind Sie in ganzen Jahren?</i> [How old are you in years?]	open question
gender	Sie sind ... (1) männlich/ (2) weiblich/ (3) anderes, nämlich... [You are ... (1) male / (2) female / (3) other, namely...]	Coded as dummy variable, with (1) indicating female participants
political affiliation	<i>Man spricht oft von “linken” oder “rechten” Positionen in der Politik. Wie würden Sie sich selbst verorten? Bitte geben Sie Ihre Einschätzung auf einer Skala von 0 bis 10 an, wobei 0 “sehr links” und 10 “sehr rechts” bedeutet.</i> [In political matters, people talk about “the left” and “the right”. What is your position? Please indicate your views using any number on a scale from 0 to 10, where 0 means “very left” and 10 means “very right”.]	11-point Likert scale from 0 (very left) to 10 (very right)
political party	<i>Stellen Sie sich vor am kommenden Sonntag würde eine neue österreichische Regierung gewählt und Sie dürften Ihre Stimme abgeben. Für welche Partei würden Sie wählen?</i> [Imagine the Austrian parliamentary elections would be held next Sunday and you are eligible to vote. Which party would you vote for?]	coded as a dummy variable, with (1) indicating a vote for the Green party
	<i>(1) ÖVP / (2) SPÖ (3) FPÖ / (4) Grüne / (5) Team Stronach/ (6)NEOS / (7) weiß nicht [don’t know]</i>	

Variable	Survey Items	Coded responses
income	<p><i>Wie würden Sie Ihre finanzielle Lage beschreiben?</i> [How would you describe your financial situation?]</p> <p>(5) Ich komme mit meinem Geld sehr gut aus [I get by very well with my available money]</p> <p>(4) Ich komme mit meinem Geld gut aus [I get by well with my available money]</p> <p>(3) Es könnte besser sein aber es geht sich aus [It could be better but I get by.]</p> <p>(2) Ich tue mir schwer am Monatsende [I have trouble getting by towards the end of the month.]</p> <p>(1) Es reicht hinten und vorne nicht [I don't get by at all.]</p>	coded from (1) financial difficulties to (5) financial security
device	<p><i>Auf welchem Gerät haben Sie diesen Fragebogen beantwortet?</i> [Which device did you use to answer this survey]</p> <p>(1) PC oder Laptop / (2) Tablet / (3) Smart Phone [(1) computer / (2) tablet / (3) smart phone]</p>	categorical variable
lecture	<p><i>Ich habe diesen Fragebogen in einer Vorlesung der Universität für Bodenkultur am 4. April ausgefüllt.</i> [I have filled out this survey in a lecture at the University of Life Science, Vienna on April, 4th]</p> <p>(0) Nein (1) Ja [(0) No (1) Yes]</p>	dummy coded with (1) indicating that the participant filled out the survey in the lecture.

**Stimulus Material**

Participants were informed that they read an article published in the Austrian daily broadsheet newspaper “der Standard”. The anchor manipulation is underlined and marked by square brackets. The text reads as follows:

**Original German Version.**

AUTOR: Martin Putschögl

RUBRIK: Panorama; S. 24

online veröffentlicht am 5. November 2016, 10:50

Hadern mit dem Gürtelspeck

Wer ins Umland der Stadt zieht, will in aller Regel ein Einfamilienhaus, womit ein Teufelskreis aus hohem Flächenverbrauch und Verkehrsaufkommen im Speckgürtel entsteht.

Mehr Zusammenarbeit zwischen Wien und seinem Speckgürtel wäre dringend nötig.

Die Stadt Wien hat sich knapp außerhalb ihrer Grenzen mittlerweile einen recht unansehnlichen Speckgürtel angefressen; oder vielmehr: anfressen lassen. Südlich von Wien, auf niederösterreichischem Boden, sind heute keine Gemeindegrenzen mehr wahrnehmbar, geschweige denn eine Landesgrenze; und zu den Hauptverkehrszeiten gleicht die ganze Gegend einer Verkehrshölle.

Der Speckgürtel wird wegen seiner völligen Ausrichtung aufs Auto und der schlechten Anbindung ans Zentrum langsam ein Problem bekommen, sagte Architekt Christian Seethaler kürzlich auf einer Podiumsdiskussion mit dem Titel „Miteinander oder gegeneinander? Der Wohnbau in Wien und im Speckgürtel“.

Neben Lärm und Luftverschmutzung sind Pendler aus dem Umland auch klimapolitisch für die Stadt Wien ein Thema. Denn mit dem wachsenden Speckgürtel steigt auch die Zahl derer, die morgens mit dem PKW zum Arbeitsplatz nach Wien fahren und dadurch Emissionen verursachen. Seethaler wünscht sich hier eine Diskussion, die sich abseits emotional geprägter

Debatten auf die größten CO<sub>2</sub>-Verursacher fokussiert. [High anchor condition: „Der Pendlerverkehr schlägt momentan mit einem Anteil von 50 Prozent an den Gesamtemissionen der Stadt Wien zu Buche.“ / Low anchor condition: „Der Pendlerverkehr schlägt momentan mit einem Anteil von 17 Prozent an den Gesamtemissionen der Stadt Wien zu Buche.“]

Wohnbauforscher Wolfgang Amann empfahl kürzlich in einer Studie, dass Niederösterreich nicht Wohnbaupolitik machen sollte, ohne den weißen Fleck auf der Landkarte namens Wien zu berücksichtigen. „Die Politik verhindert ein Miteinander“, resümierte Seethaler.

Optimierungspotenzial wäre also vorhanden. (pma, 5.11.2016)

### **Translated English Version.**

AUTHOR: Martin Putschögl

SECTION: Panorama; S. 24

Published online on November 5th, 2016, 10:50

#### Quarrels with the commuting belt

When moving to the suburbs of the city, people normally seek a single-family home, which causes a vicious circle of high land consumption and traffic in the commuting belt. More collaboration between Vienna and its suburbs is urgently needed.

The city of Vienna has accumulated a by now relatively unsightly commuting belt close to its borders; or more precisely, the city accepted its accumulation. South of Vienna, on the ground of Lower Austria, the borders separating one commune from the next are hardly noticeable, let alone the border between the federal states; and at rush hour, the entire area resembles a traffic hell.

The commuting belt will encounter a problem due to its absolute orientation towards cars and the bad connection to the city, stated architect Christian Seethaler recently in a panel discussion named “Cooperation or competition? Residential construction in Vienna and the commuting belt”.

Apart from noise disturbances and air pollution, commuters from the suburbs also concern the city of Vienna in regard to climate change policies. A growing commuting belt also increases the number of those, who take their car to their work in Vienna and therefore cause emissions. Seethaler wishes for a discussion that – free from emotionally loaded debates – focuses on the biggest emitters. [High anchor condition: “Commuting traffic causes a share of 50 percent out of the total emissions of the city of Vienna.” / Low anchor condition: “Commuting traffic causes a share of 17 percent out of the total emissions of the city of Vienna.”]

Residential construction researcher Wolfgang Amann recently proposed in a study that Lower Austria shouldn't do spatial planning without taking an empty space in its map called Vienna into consideration. “Politics inhibit cooperation”, concluded Seethaler. Thus, there is still optimization potential. (pma, November 5th, 2016)

**AUTOR:** Martin Putschögl  
**RUBRIK:** Panorama; S. 24  
 online veröffentlicht am 5. November 2016, 10:50

**Hadern mit dem Gürtelspeck**

Wer ins Umland der Stadt zieht, will in aller Regel ein Einfamilienhaus, womit ein Teufelskreis aus hohem Flächenverbrauch und Verkehrsaufkommen im Speckgürtel entsteht. Mehr Zusammenarbeit zwischen Wien und seinem Speckgürtel wäre dringend nötig.

Die Stadt Wien hat sich knapp außerhalb ihrer Grenzen mittlerweile einen recht unansehnlichen Speckgürtel angefressen; oder vielmehr: anfressen lassen. Südlich von Wien, auf niederösterreichischem Boden, sind heute keine Gemeindegrenzen mehr wahrnehmbar, geschweige denn eine Landesgrenze; und zu den

*Figure A1.* Screenshot of the stimulus as seen by participants in the online survey.

**Wording of the specific policy to measure policy support**

**Original.** Eine „Stadt der kurzen Wege“ ist ein zentrales Element in der Klimastrategie der Stadt Wien, um die Klimaziele bis 2050 zu erreichen. Teil dieser Strategie ist es, Menschen vom Speckgürtel durch neue günstige Wohnungen in den Stadtraum zu locken. Damit verringert sich die Anzahl an Pendlern und damit der CO<sub>2</sub>-Ausstoß durch Kraftfahrzeuge. Damit diese Strategie Wirkung zeigt, müssen innerhalb von zehn Jahren 30.000 zusätzliche Wohnungen geschaffen werden.

Um in diesem kurzen Zeitraum soviel Neubau möglich zu machen, würden Grünräume in Wien dem Wohnungsbau zum Opfer fallen. Das bedeutet, dass jetzige Grünflächen wie Parks oder Waldflächen verbaut werden.

**English Translation.** A "city of short distances" is central to the climate strategy followed by the City of Vienna in order to reach their 2050 climate goals. Part of this strategy is to attract residents from the commuting belt to settle in the urban area through newly built affordable housing. Thus, the number of commuters and therefore the CO<sub>2</sub> emissions from car traffic would decrease. In order for this strategy to be effective, 30.000 additional flats would be needed within the next ten years.

To enable the construction of this amount of new buildings within this short timeframe, green spaces within the city would fall victim to construction sites. This means, that existing green spaces like parks or forests will be built-up area.

## Appendix B

## Pathway analysis

## Analyses of moderated mediation in tables

Table B1. *Moderated mediation analysis: Effect of the low anchor condition on policy support through participants' numerical estimations at different levels of issue involvement.*

( $N=138$ )

Antecedent	Consequent					
	estimation (M)			policy support (Y)		
		Coefficient (SE)	<i>p</i>		Coefficient (SE)	<i>p</i>
low anchor (X)	$a_1$	-18.113 (3.696)	<.001	$c'$	-0.287 (0.335)	.393
estimation (Y)		---	---	$b$	-0.013 (0.007)	.055
involvement (W)	$a_2$	1.089 (1.037)	.296		---	---
interaction of X x W	$a_3$	-1.967 (1.636)	.232		---	---
Constant (control)	$i_1$	25.731 (15.300)	.095	$i_2$	3.360 (1.163)	.005
			$R^2 = .289$			
			$F(10,127) = 8.171, p < .001$			
				$R^2 = .051$		
				$F(9,128) = 0.788, p < .629$		

Note: Unstandardized coefficients are reported. The low anchor condition was coded as indicator variable, using the control group as a reference.

Table B2. *Statistical inference for conditional indirect effects: Effect of the low anchor on policy support at different levels of involvement in the issue of climate change. (N = 138)*

Moderator value (N = 138)	Conditional indirect effect at mean and $\pm 1$ SD			
	Boot effect	Boot SE	95BCI-LL	95BCI-UL
Low involvement, -1 SD (2.51)	.19	.11	.0268	.4864
Average involvement (4.07)	.23	.13	.0246	.5393
High involvement, +1 SD (5.63)	.27	.15	.0226	.6395

Note: The indirect effects were calculated based on 5,000 bootstrap samples.

Table B3. *Moderated mediation analysis: Effect of the high anchor condition on policy support through participants' numerical estimations at different levels of issue involvement.*

( $N=138$ )

Antecedent	Consequent					
	estimation ( $M$ )			policy support ( $Y$ )		
		Coefficient ( $SE$ )	$p$		Coefficient ( $SE$ )	$p$
high anchor ( $X$ )	$a_1$	5.172 (4.411)	.243	$c'$	-0.018 (0.310)	.953
estimation ( $Y$ )		---	---	$b$	-0.013 (0.007)	.055
involvement ( $W$ )	$a_2$	1.124 (1.017)	.271		---	---
interaction of $X \times W$	$a_3$	-1.403 (1.967)	.477		---	---
Constant (control)	$i_1$	33.745 (14.940)	.026	$i_2$	3.462 (1.164)	.004
		$R^2 = .283$ $F(10,127) = 8.065, p < .001$			$R^2 = .051$ $F(9,128) = 0.788, p < .628$	

Note: Unstandardized coefficients are reported. The high anchor condition was coded as indicator variable, using the control group as a reference.

Table B4. Simple mediation analysis: Effect of the experimental group (low anchor, high anchor) compared to the control condition on policy support through participants' numerical estimations. ( $N=138$ )

Antecedent	Consequent					
	estimation			policy support		
		Coefficient (SE)	<i>p</i>		Coefficient (SE)	<i>p</i>
low anchor	$a_1$	-18.387 (3.703)	<.001	$c_1'$	-0.286 (0.333)	.393
high anchor	$a_2$	4.949 (4.356)	.258	$c_2'$	-0.020 (0.313)	.948
Constant (control)	$i_1$	17.086 (12.212)	.164	$i_2$	3.523 (0.982)	.001
estimation		---	---	$b$	-0.012 (0.007)	.077
$R^2 = .284$			$R^2 = .055$			
$F(9,128) = 8.911, p < .001$			$F(10,127) = 0.676, p = .745$			

Note: Unstandardized coefficients are reported. The low and high anchor condition were coded as indicator variables, using the control group as a reference.

Table B5. Simple mediation analysis: Effect of the experimental group (low anchor, high anchor) compared to the control condition on perceived threat of climate change through participants' numerical estimations. ( $N=138$ )

Antecedent	Consequent					
	estimation			perceived threat of climate change		
		Coefficient (SE)	<i>p</i>		Coefficient (SE)	<i>p</i>
low anchor	$a_1$	-18.387 (3.703)	<.001	$c_1'$	0.185 (0.226)	.415
high anchor	$a_2$	4.949 (4.356)	.258	$c_2'$	0.238 (0.188)	.207
Constant (control)	$i_1$	17.086 (12.212)	.164	$i_2$	5.060 (0.644)	<.001
estimation		---	---	$b$	-0.001 (0.004)	.890
			$R^2 = .284$			
			$F(9,128) = 8.911, p < .001$			
				$R^2 = .244$		
				$F(10,127) = 2.896, p = .003$		

Note: Unstandardized coefficients are reported. The low and high anchor condition were coded as indicator variable, using the control group as a reference.

*Table B6.* Simple mediation analysis: Effect of the experimental group (low anchor, high anchor) compared to the control condition on perceived policy efficiency through participants' numerical estimations. ( $N=138$ )

Antecedent	Consequent					
	estimation			policy efficiency		
		Coefficient (SE)	<i>p</i>		Coefficient (SE)	<i>p</i>
low anchor	$a_1$	-18.387 (3.703)	<.001	$c_1'$	-0.513 (0.276)	.065
high anchor	$a_2$	4.949 (4.356)	.258	$c_2'$	-0.018 (0.270)	.947
Constant (control)	$i_1$	17.086 (12.212)	.164	$i_2$	2.333 (0.805)	.004
estimation		---	---	$b$	-0.003 (0.006)	.558
			$R^2 = .284$			
			$F(9,128) = 8.911, p < .001$			
				$R^2 = .077$		
				$F(10,127) = 1.270, p = .254$		

Note: Unstandardized coefficients are reported. The low and high anchor condition were coded as indicator variable, using the control group as a reference.

## Analysis of moderated mediation in figures

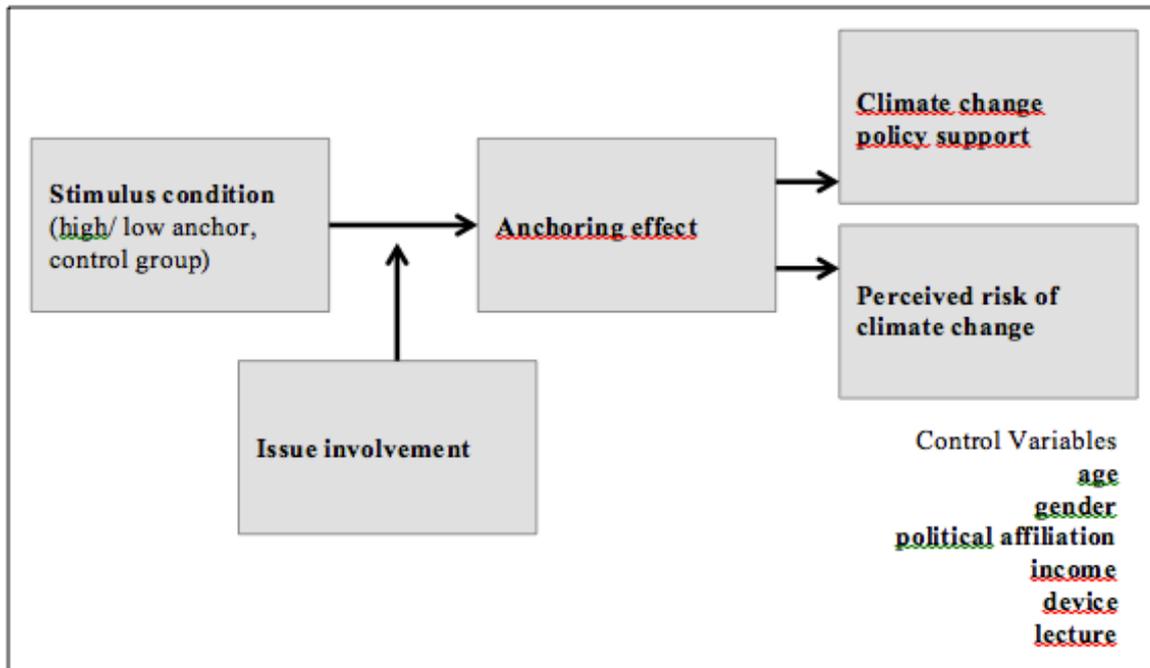
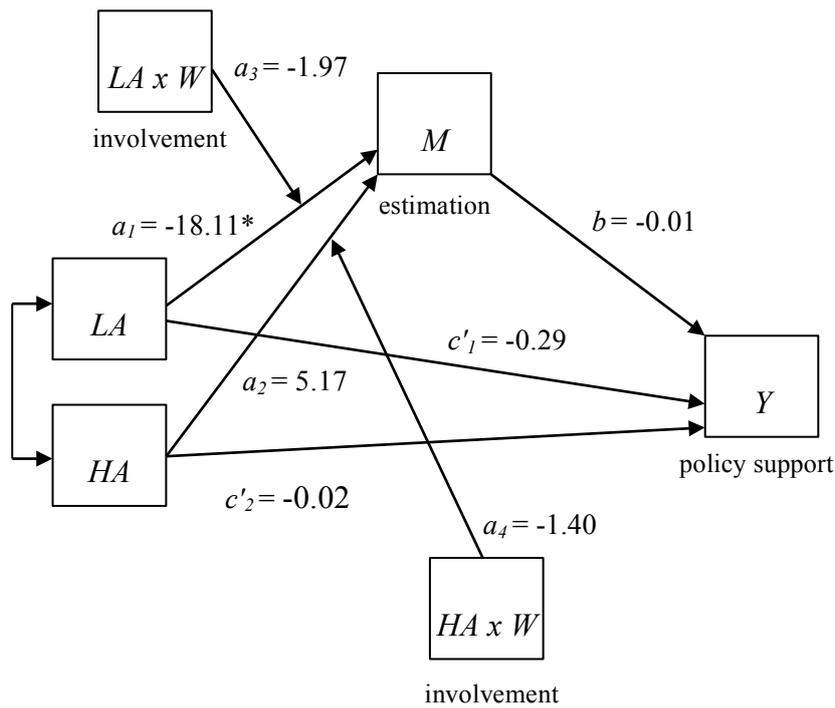
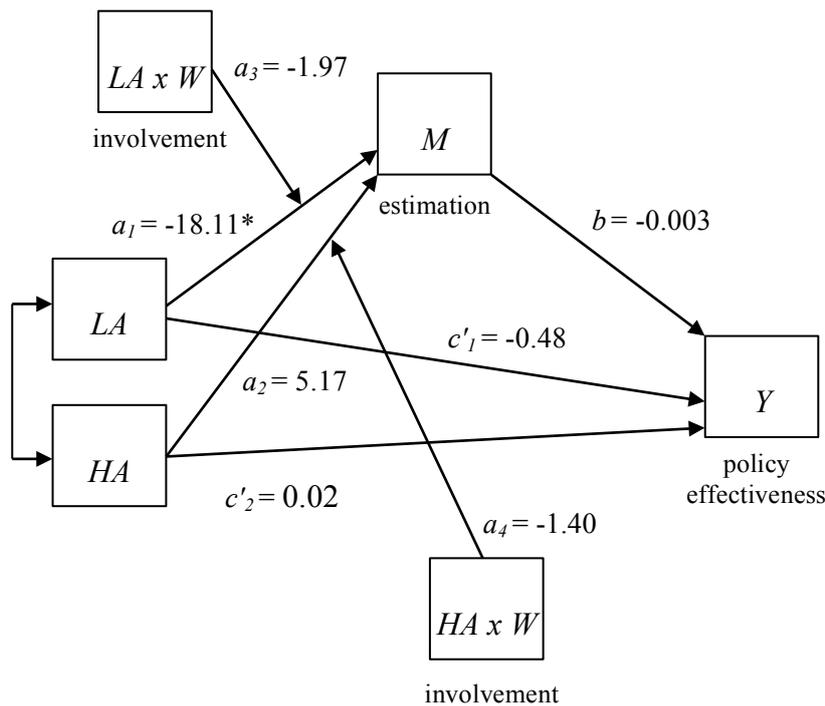


Figure B1. Conceptual model.



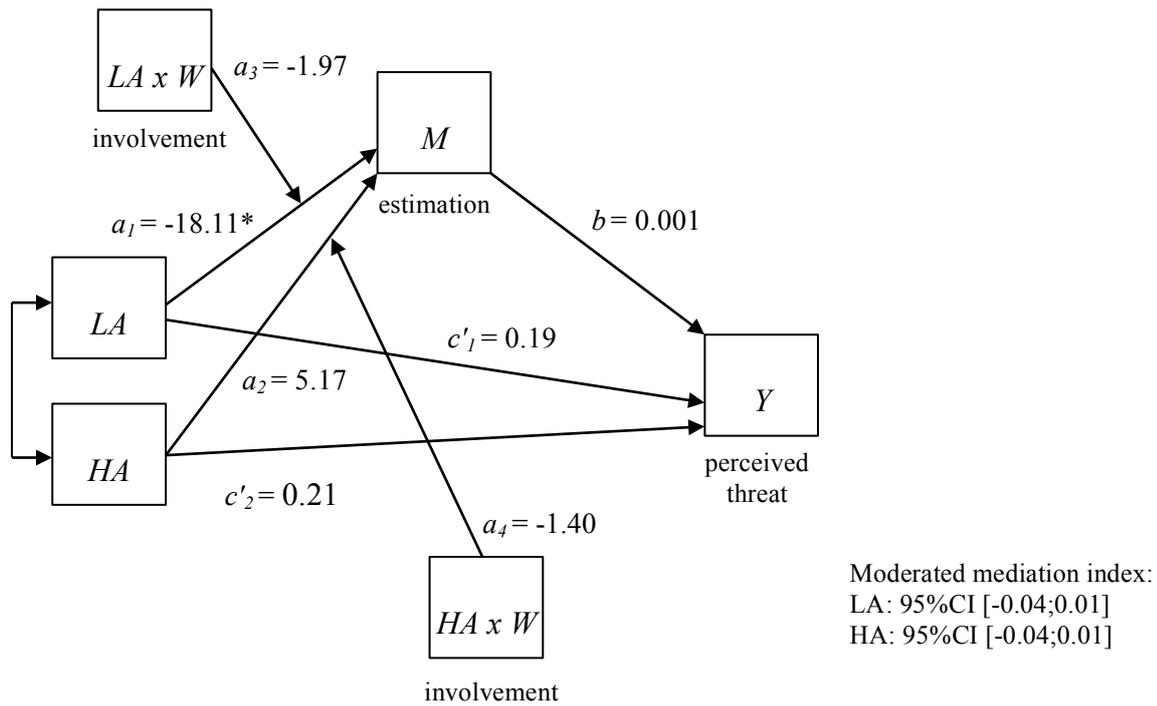
*Figure B2.* Moderated mediation model showing the indirect effects of low numerical anchors (LA) and high numerical anchors (HA) on policy support through participants' estimations and moderated by issue involvement.

*Note:* The analysis was conducted using indicator variables for LA and HA as compared to the control group. The figure shows unstandardized beta coefficients, \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < 0.1$ . Bias-corrected bootstrap confidence intervals using 5,000 bootstrap samples are shown for the moderated mediation model of the HA and LA condition separately at the bottom of the panel.  $N = 138$ .



*Figure B3.* Moderated mediation model showing the indirect effects of low numerical anchors (LA) and high numerical anchors (HA) on perceived policy effectiveness through participants' estimations and moderated by issue involvement.

*Note:* The analysis was conducted using indicator variables for LA and HA as compared to the control group. The figure shows unstandardized beta coefficients, \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < 0.1$ . Bias-corrected bootstrap confidence intervals using 5,000 bootstrap samples are shown for the moderated mediation model of the HA and LA condition separately at the bottom of the panel.  $N = 138$ .



*Figure B4.* Moderated mediation model showing the indirect effects of low numerical anchors (LA) and high numerical anchors (HA) on the perceived threat of climate change through participants' estimations moderated by issue involvement.

Note: The analysis was conducted using indicator variables for LA and HA as compared to the control group. The figure shows unstandardized beta coefficients, \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ . Bias-corrected bootstrap confidence intervals using 5,000 bootstrap samples are shown for the index of moderated mediation of the HA and LA condition separately at the bottom of the panel.  $N = 138$ .