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Analyzing the Existence and Relation of Optimistic Bias and First-Person Perception for an Impersonal Environmental Change

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Many changes in nature do not directly threaten humans, but do negatively influence nature itself, thereby posing an "impersonal" risk. We examine the optimistic bias (OB) for an impersonal risk, the first-person perception (FPP) of an impersonal risk, and the influence of media reporting and proximity of an impersonal risk on FPP and OB. Finally, we investigate the relationship between OB and FPP. We conducted a field experiment (N = 479) in 12 German cities where an invasive moth species had infested culturally important horse chestnut trees. We found OB for this nature change that decreased for people living in an area subject to this impersonal nature risk. After the treatments, neither the proximity of impersonal risk nor the journalistic style of media reporting had a significant effect on OB. An FPP was found that was not influenced significantly by

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either different journalistic styles or the proximity of impersonal risk. A nonsignificant swap-in-signs relation between OB and FPP was found depending on journalistic style.

Keywords: first-person perception, optimistic bias, media effects, nature change, impersonal risk

Changes to the environments in which humans live are heavily discussed worldwide. Many of these nature changes, such as flooding, entail serious consequences for humanity, whereas others, such as species extinction, have no or delayed direct personal effect on humans (Chapin et al., 2000). Different changes in nature may thus impact humans differently, thereby evoking different risk perceptions, bias in risk perceptions, and distortion in the perceived effects of media on the public. The aim of this study is to analyze whether a current nature change not threatening humans directly (impersonal risk) may evoke an "optimistic bias" (OB; Weinstein, 1980), that is, people thinking that others are at greater risk than they are themselves. Another perceptual distortion is the so-called third-person perception, which is people's perception that mass media influence others more strongly than themselves (Davison, 1983). Both theoretical concepts and their influencing variables (e.g., the proximity of impersonal risk [nature change] and journalistic style of written articles) have so far been analyzed mostly in cases involving personal risks. We intend to apply these concepts to impersonal risks.

Impersonal Risks

Most studies have evaluated people's personal environmental-risk perception, where a natural hazard such as flooding may actually be perceived and experienced as a personal threat. We are interested in the relevance of risk perception in a more removed sense involving a nature change that does not directly harm people, but changes their immediate living surroundings by harming nature with probable indirect, long-term consequences. Kahlor et al. introduced the term *impersonal risk*, in contrast to *personal risk* (Kahlor, Dunwoody, Griffin, & Neuwirth, 2006): An impersonal risk is a threat to the environment—not a direct threat to the individual; however, it entails probable direct, long-term consequences for the individual (e.g., species extinction). In contrast, personal risks, such as diseases and earthquakes (Wahlberg & Sjoberg, 2000), harm individuals directly.

Environmental risks may be either personal risks or impersonal risks, depending on the target audience and time. For example, climate change can be a personal risk for people living in areas at significant risk for flooding or drought, whereas climate change for many others is still mostly perceived as an impersonal risk because it does not significantly influence their daily lives. In addition, climate change, for instance, may not yet pose a personal problem for many Europeans, but it is likely to do so within the next 50 years, when it may affect food resources. One reason for a modest emotional response to climate change may be the perceived geographical and temporal distance from areas affected by climate change (Spence, Poortinga, & Pidgeon, 2012). Species loss might be classified as impersonal risk as long as it does not affect any of the ecosystem services on which human life is based.

Why should we worry about impersonal risks? The effects of many risks, such as species loss, are generally immutable for people at first. Yet many emerging social, economic, environmental, or physical consequences may be mitigated through the early adoption of risk-reduction behavior or voluntary actions before impersonal risks become personal. As Kahlor et al. (2006) state, there is great interest in how to raise people's awareness of risks that do not affect them directly, but that have consequences for nature and the environment that might affect people indirectly or possibly in the future. In the case of loss of biodiversity, the preemptive conservation of species will hinder the loss of species or changes in species composition, which may in turn reduce the negative effect on services humans need from ecosystems. Behavioral patterns may thus function to increase or decrease the physical risk itself (Kasperson et al., 1988). Understanding how humans perceive and react toward impersonal risks is consequently of great importance.

In this study, we focused on an impersonal nature risk, of which the public is able to observe the negative influence on nature, but which is not currently threatening human life: an invasive moth species (*Cameraria ohridella*). These moths are damaging the leaves of the culturally important *Aesculus hippocastanum* tree (white flowering horse chestnut) that are grown in urban areas and public places.

Risk Perception and Optimistic Bias

Various studies on risk perception in relation to environmental risks feature hazards and environmental changes with direct consequences for people, such as floods (Terpstra, Lindell, & Gutteling, 2009) or hurricanes (Sattler, Kaiser, & Hittner, 2000). These studies reveal the relevance of personal experience, and thus the presence of a nature change and its consequences, for individual risk perception. Individuals who have undergone a direct experience (e.g., health problems through air pollution or firsthand experience of floods) will more likely be concerned and are more likely to take action related to the risk (like saving energy to reduce climate change; Spence, Poortinga, Butler, & Pidgeon, 2011; Whitmarsh, 2008). Based on many studies and literature reviews, we may conclude that direct experience has thus been proven to exert a strong positive effect on risk perception (Plapp & Werner, 2006; Wachinger, Renn, Begg, & Kuhlicke, 2013). However, others have found that people living in endangered areas especially, who had no firsthand experience, estimate risk to be smaller than do those living farther away from the associated risk source (Heitz, Spaeter, Auzet, & Glatron, 2009). This raises the issue of the risk source's proximity and the importance of personal damage, or at least the possibility of perceiving nearby nature change in proximity.

People often tend to think that others are at a greater risk than they are themselves. This phenomenon is called *optimistic bias* (Weinstein, 1980). A study by Arnett shows that some smokers regard themselves as less likely to die from smoking than nonsmokers, even if the former have smoked for 30 or 40 years (Arnett, 2000). OB is therefore the tendency of individuals to harbor more positive expectations about their own future than about that of others (Dohle, 2013). Similar phenomena have also been observed in the field of environmental communication, especially in the area of climate-change communication. Most members of the American and Lithuanian public, for instance, consider climate change to be associated with a moderate risk, which is more likely to apply to people and places far removed from them in space and time (Balzekiene, Butkeviciene, Rinkevicius, & Gaidys, 2009;

Leiserowitz, 2006). As with risk perception, firsthand experience is also known to influence the degree of OB (Burger & Palmer, 1992; Van der Velde, Van der Pligt, & Hooykaas, 1994; Weinstein, 1980). Research on earthquakes found OB was not present directly after the earthquake, but only appeared several months later (Burger & Palmer, 1992; Helweg-Larsen, 1999). Individuals who experienced greater relative loss in the earthquake displayed the smallest OB. Similar phenomena can be observed for hurricanes (Trumbo, Lueck, Marlatt, & Peek, 2011; Trumbo, Meyer, Marlatt, Peek, & Morrissey, 2014). All these studies indicate that OB is rather low directly after a natural hazard has been perceived, often involving personal damage. The questions are, How are risk perceptions for impersonal risks, where nature change can be observed, but no personal damage is occurring? Might an OB be observed, and will the proximity of a nature change influence the OB?

Impact of Media

Information about natural scientific results is mostly communicated to the public by mass media (Dunwoody & Peters, 1992). In particular, when personal experience or perception of a nature change is difficult, risk perception is often based on information provided through mass media, which shapes risk perception to some degree (Wachinger et al., 2013). It is therefore interesting to analyze the effect of mass media on the perception of impersonal risk, and the corresponding OB.

Furthermore, it is useful to analyze the concept of third- or first-person perception (FPP), which is often analyzed together with the previously introduced concept of OB. FPP is the opposite of the well-known third-person perception (TPP). TPP is the perception that mass media influence others more heavily than oneself. This perceived difference between oneself and others is the first part of the third-person effect (TPE), which Davison first described in 1983. TPE consists of two parts: the perceptual component (TPP) and a behavioral component, which suggests that people's perceptions of the media impact their attitudes and behaviors (Tsfati, Cohen, & Gunther, 2011). One of the consistent findings with regard to TPP is the "social–distance corollary": The larger the perceived distance between oneself and "others," the stronger the TPP (Eveland, Nathanson, Detenber, & McLeod, 1999).

Several studies have observed that TPP may disappear or even turn into FPP if news content is positively framed or accords with the recipient's beliefs (Gunther & Mundy, 1993). This means that recipients believe mass media exercise greater influence on themselves than on others (Cohen & Davis, 1991). Lin demonstrated FPP of environmental risks in viewers of *An Inconvenient Truth*—a movie about climate change (Lin, 2013). Lin explains that people tend to overestimate the influence of negative news on others, but overestimate the influence of positive news on them. The key issue of social desirability has already been discussed in various publications (Jensen & Hurley, 2005). The third-person effect has been found to increase with socially undesirable messages and decrease with socially desirable messages (Henriksen & Flora, 1999). This phenomenon is often named as an example of self-image protection (Perloff, 2002). Self-image-protection theories assert, among other things, that individuals filter communication effects based on how they are thought to reflect on the self. For example, children from Grades 4, 6, and 8 believe that cigarette ads (socially undesirable) had a greater influence on others than on themselves and that antismoking PSAs (socially desirable) had a greater influence on themselves than on others (Henriksen & Flora, 1999). Following this line of thought, getting information from the climate

change movie *An Inconvenient Truth* was apparently associated with positive, socially desirable input, thereby causing an FPP to develop. The question arises regarding how this relationship looks for information concerning other nature changes, particularly for other impersonal risks that are already perceivable in the environment, but that do not harm people. In addition, Dohle (2013) highlighted variables such as perceived quality of media content, a newspaper's ranking, or generalized attitudes toward the media as intervening factors (Dohle, 2013). On the other side, Lin found that the influence of the movie *An Inconvenient Truth*'s message quality (among other things) did not significantly relate to FPP (Lin, 2013). Lin stressed the need for future research to expand the results to other forms of media content. We are therefore interested in analyzing whether different journalistic styles of written articles, varying in different qualitative elements, may influence the extent of FPP or TPP. In the context of FPP, we thus examine whether journalistic styles (of one media format) change the degree to which people perceive the influence of environmental-news coverage on themselves and others. We further analyze whether the presence of an impersonal risk influences TPP or FPP, as risk proximity might negate FPP or TPP effects (e.g., Jensen & Hurley, 2005).

The Connection Between OB and FPP

The concept of OB has many similarities with the concepts of TPP/FPP. For example, each incorporates a perceived difference between oneself and others. Both concepts also posit perceptual distortion. FPP and OB both promote individual self-esteem and might be regarded as "healthy" behaviors. However, taken to the extreme, optimism might have negative consequences (Gifford, 2011). In particular, people might discount their own personal risks, such as those associated with smoking or heart attack, and experience negative outcomes resulting from their own health-related behavior. This is also true for environmental risks, such as climate change.

Many researchers have investigated the relationship between OB and TPP (Gunther & Mundy, 1993; Li, 2008; Wei, Lo, & Lu, 2007). Whereas it was shown that self-aggrandizement is an explanatory factor for both phenomena, the connection between OB and TPP is not as strong as expected (Gunther & Mundy, 1993). Some studies found that TPP is unrelated to OB (Salwen & Dupagne, 2003; Wei et al., 2007) and that TPP and OB are two parallel processes of social judgment. Others have shown a significant positive correlation between TPP and OB (Li, 2008). To our knowledge, the relationship between OB and FPP has not yet been analyzed for impersonal risks.

Aim of This Study

In summary, our goal is to contribute to research into theoretical concepts such as OB and FPP in the context of impersonal environmental risks. Because we focus on an example of a truly impersonal risk, our results will augment current literature, which focuses mostly on personal risks. Our argumentation in the introduction forms the basis for investigation of the five hypotheses below.

Our study investigates whether the perception of an impersonal risk for oneself (own neighborhood) differs the perceptions of this risk for others on two geographical levels (rural district vs. the rest of Germany), resulting in a possible OB. We expect:

H1: Subjects perceive an impersonal nature change as a greater risk for others than for themselves (OB).

In a second analysis, we test whether the proximity of the impersonal risk (damage to trees) effects OB before and after information is received through treatments and how different styles of written articles may affect it. We argue that:

H2: The presence of an impersonal risk and the information provided by different styles of written articles will influence the degree of the OB.

In addition to analyzing the concept of OB for impersonal risks, we analyze the occurrence of FPP. We argue:

H3: Written articles are perceived to influence oneself more strongly than others (FPP).

We further analyzed how different qualitative elements of information about an impersonal nature change and the occurrence of it might influence the extent of FPP. We assume:

H4: Article style and the presence of impersonal risk will not impact the extent of FPP.

The last goal was to analyze the relation of FPP and OB, and we argue:

H5: OB will relate negatively to FPP.

Method

Case Example

The horse chestnut leaf miner (*Cameraria ohridella,* Lepidoptera, Gracillariidae) was chosen as a truly impersonal risk as it induces a change in nature that does not directly threaten human life. The *Cameraria ohridella* moth is an invasive species, that is, it is nonindigenous and recently invaded Europe along an unknown route. It was first discovered in Macedonia in 1985 (Simova-Timosic & Filev, 1985) and was subsequently identified as a new species (Deschka & Dimic, 1986).

The leaf miner causes considerable damage to the leaves of white flowering horse chestnut trees (*Aesculus hippocastanum*). The damage originates from the moth's natural life cycle. Immediately after hatching, the emerging larvae enter the leaves and start feeding (hence, "leaf miner"; Freise & Heitland, 2004). The leaves begin turning brown earlier than normal and can even fall off in July/August rather than in autumn (Freise & Heitland, 2004). The damage to the leaves is clearly observable.

The leaf miner attracted attention shortly after its invasion because of its clearly apparent damage pattern (Heitland, Freise, Sturm, & Lenz, 2005). Newspapers have reported about the bald trees every summer since 1997, with articles featuring titles such as "Horse Chestnut Trees in Our Beer Garden in Danger" (Heitland, Kopelke, & Freise, 2003).

Because of their mass appearance, measures against the leaf miner were investigated soon after their first appearance. It could be shown that the leaf miner is quite resistant to various controlling measures, which are often very time and money consuming (Arnold & Cetin, 2002). A time-consuming yet effective measure is collecting and destroying leaves with overwintering pupae to reduce the number of adult moths emerging the following spring and thus the amount of damage in the following year (Snieskiene, Stankeviciene, Zeimavicius, & Balezentiene, 2011).

One might argue that the moth should not be classified as an environmental risk if the damage is mostly aesthetic. However, even if trees do not die immediately, the damage affects rates of photosynthesis and processes such as water uptake (Raimondo, Ghirardelli, Nardini, & Salleo, 2003; Salleo et al., 2003; Thalmann, Freise, Heitland, & Bacher, 2003). Furthermore, the leaf miner has been only apparent here for some decades, and its effects on species composition, ecosystem functions, and therefore services to people have not yet been fully investigated. In addition, the white flowering horse chestnut tree possesses great cultural and historical value for German citizens. The use of this tree in historical parks, avenues, cemeteries, train stations, around public buildings, and as a typical tree in the world-famous beer gardens constitutes a cultural heritage in most parts of Germany and Austria (Heitland et al., 2003). Infected trees are often felled, so there is indeed a risk for a tree of being removed because of infection.

The horse chestnut leaf miner is an ideal case example of impersonal risk for various reasons: (1) Anyone can detect the damage to nature in infested areas, yet it does not involve personal damage.[2] (2) The extent of infestation varies widely so that regions with high and low infestation can be identified. (3) Scientific knowledge is sufficient to produce reasonable journalistic variations in written articles.

Sample and Procedure

In May–June 2014, we used CATI (Computer Assisted Telephone Interviews) recruitment and an online questionnaire to conduct a survey in 12 German cities as an element of a 2 (low vs. high infestation) × 3 (tabloid, quality press, popular/scientific magazine written article style) experiment. Test-region selection was based on the infestation level of the horse chestnut leaf miner on horse chestnut trees. Trained biologists conducted a semiquantitative rating procedure to assess moth damage in various cities and regions in Bavaria and Schleswig-Holstein. The same biologists assessed leaf infestation levels visually (infestation in percentages: <1%, 2%–10%, 10%–25%, 25%–50%, 50%–75%, >75%). Optical assessment of infestation within several infestation categories is precise enough to reflect the *Cameraria* population at the chosen site (Gilbert & Grégoire, 2003). The cities were categorized into locations of low (15 randomly chosen trees in the city's common public places with fewer than 10% infestation) and high infestation (15 randomly chosen trees at in the city's common public places with more than 25% infestation). Pairs of cities were chosen based on homogenous clusters of demographic data.

[2] Conducting research on climate change is often not truly using impersonal risks, because either the public cannot yet perceive the risk or personal damage is already being inflicted.

To test whether different journalistic styles change the extent of OB or FPP/TPP, we decided to use written articles as the medium, which could be published in a newspaper or online. We decided to focus on the print media, as the inclusion of audiovisual media would have required an entirely different type of analysis. Research has shown that newspapers are the public's primary source of information regarding environmental issues (McCallum, Hammond, & Covello, 1991). Although the online medium has been changing the media landscape, Germany's newspaper publishing industry is the largest in Europe (Pasquay, 2010), indicating a strong newspaper tradition. Furthermore, media content is increasingly used on the Internet. Research into the effects of written texts retains its great relevance for this reason. We therefore chose to use written articles, which could be published in a newspaper as well as online. Articles composed in three different journalistic styles were designed in cooperation with professional journalists. The three journalistic styles were named (1) *tabloid*, (2) *quality press*, and (3) *popular/scientific magazine*. As part of the variation of the journalistic style, different qualitative elements varied. The tabloid article contains fewer and less complex representations, and typical—simplifying—headlines. The quality-press article features not overly sophisticated, but still more demanding explanations, as well as easily understandable technical language. The popular/scientific magazine article is the most comprehensive report. It employs some Latin technical terms in brackets, scientific background information, and longer sentence constructions. Styles 1 to 3 include progressively more uncertainty, such as the origin of *C. ohridella* or control measures, as research shows that uncertainty can enhance message effects (Rabinovich & Morton, 2012). High uncertainty results when not one but several facts are presented, leaving no clear solution to the problems that the moth causes. Moreover, we included quotations from an expert. The mentioning of reliable experts lends seriousness and indirectly increases the reader's subjective perception of quality (Weingart, Engels, & Pansegrau, 2007). The same source was cited in each article, but the tabloid article cited him as "moth expert," whereas the popular/scientific article referred to "Dr. of forestry" along with the institution's name (Technical University of Munich). We did not include opposing viewpoints, as research shows that opposing viewpoints do not increase the credibility of reporting and may induce uncertainty effects (Kortenkamp & Basten, 2015). Personalization (addressing the reader and presenting issues with emotional reference) was moreover used as a reporting characteristic. Personalization decreased steadily when transitioning from the tabloid to the popular/scientific style. We omitted pictures because pictures can significantly influence the reading and interpretation of newspaper articles (Brantner, Lobinger, & Wetzstein, 2011) and might influence the readers' engagement with the article (Lazard & Atkinson, 2014). The same layout was used, because layout differences can result in different journalistic-quality ratings by the reader (Middlestadt & Barnhurst, 1999).

A pretest was conducted. For the survey, subjects were randomly assigned to one of the written articles. After the articles, various questions were asked about the perceived quality (complexity, objectivity, and so forth). Results from Kruskal–Wallis tests indicated that participants perceived the articles to be different, showing that article style made a significant difference in the perceived levels of characteristics.

Table 1. Questions Assessing Risk Perceptions Before and After Treatments and Perceived Media Influence.

Construct	Item(s)	Response options	*N*, *M* (*SD*), Cronbach's α
1. Individual risk perception (neighborhood)	a. How likely is it to you that the chestnut leaf miner will show up in your neighborhood? b. In my neighborhood, the chestnut leaf miner is a . . .	5-point scale: *very likely* (5) to *not likely at all* (1) *serious problem* (5) to *no problem at all* (1)	Before: 477, 2.96 (1.07), α = 0.80 After: 475, 3.34 (1.02), α = 0.82
2. Regional risk perception (rural district)	a. How likely is it to you that the chestnut leaf miner will show up in your region? b. In my region, the chestnut leaf miner is a . . .	5-point scale: *very likely* (5) to *not likely at all* (1) *serious problem* (5) to *no problem at all* (1)	Before: 477, 3.08 (1.03), α = 0.84 After: 474, 3.44 (0.97), α = 0.80
3. Country risk perception (Germany)	a. How likely is it for you that the chestnut leaf miner will show up in Germany? b. The chestnut leaf miner in Germany is a . . .	5-point scale: *very likely* (5) to *not likely at all* (1) *serious problem* (5) to *no problem at all* (1)	Before: 475, 3.49 (0.87), α = 0.72 After: 475, 3.72 (0.85), α = 0.74
4. Perceived influence of media	Reports have a strong influence on . . . a. my valuation of the horse chestnut leaf miner. b. the valuation of my family and friends. c. the valuation of people in my rural district. d. the valuation of the general public.	5-point scale: *totally agree* (5) to *don't agree at all* (1) + *I am not able to judge that*	a. 451, 3.70 (0.90) b. 402, 3.40 (0.92) c. 382, 3.37 (0.90) d. 394, 3.42 (0.98)

Note. The sample size varies due to the analysis setting "exclude cases pairwise" and people's option to leave spaces blank.

The survey's main variables were risk perception (before/after reading the article) and perceived influence of media coverage (after reading the article). OB testing was established with two types of questions examining risk perception, in which participants rated (a) the risk and (b) the problem of the moth for their neighborhood (individual risk perception), their rural district, and the rest of Germany. FPP was measured by asking the participants about the perceived influence of the media on themselves, family/friends, people in the rural district, and the general public. All relevant items for this study are

detailed in Table 1. Finally, our initial data collection provided a small set of demographic variables that have been previously examined in relation to risk perception and OB (Avis, Smith, & McKinlay, 1989; Chock, 2011; Peterson, Helweg-Larsen, Volpp, & Kimmel, 2012). We briefly examined age (six categories), sex (male/female), and education (five categories) in relation to risk perceptions and perception of media influence.

A market research company recruited a random sample of participants in the 12 selected cities. Callers asked respondents to participate in the survey. If the latter agreed, each received a link to an online questionnaire. Sample sizes were reported for the corresponding analyses since answering a question was not commonly compulsory. Data were analyzed using SPSS 18.0 and AMOS Graphics 23.

Results

A total of 479 respondents (18–70 years old) completed the questionnaire (43%, n = 205, male; 53%, n = 256, female; 4%, n = 18, no gender information). About half of the participants (51%) had heard the reason for the early brown coloring of leaves; 45% recognized the horse chestnut leaf miner by name.

Hypothesis 1

We analyzed for a possible OB before reading one of the three randomly assigned written articles (one-way repeated-measures ANOVA). The means of the perceived risk of three different groups were compared: neighborhood (personal), rural district, and Germany (see Table 2). Since sociodemographic variables showed no effect, they were excluded from the analysis of OB. Mauchley's test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 182.27$, $p < .001$; the Greenhouse–Geisser corrected tests are therefore reported ($\varepsilon = .76$).[3] The results show significant differences among the three risk perceptions, indicating that perceived risk is a function of the distance between the subject and other social groups, $F(1.52, 720.12) = 150.62$, $p < .001$. The respondents perceive that Germany is at greater risk than their rural district, which in turn is at greater risk than their neighborhood (see Table 2). The resulting difference in the mean of OB before people read one of the articles is OB (neighborhood–Germany) = 0.52 (0.83). Cohen's d reflects a medium effect (d = 0.54) for the difference of risk perception between *neighborhood* and *Germany*.[4]

Table 2. Perceived Risk for the Neighborhood, the Rural District, and Germany Before and After the Treatment.

Level	Neighborhood	Rural district	Germany
Before, *M* (*SD*)	2.97[a] (1.07)	3.08[b] (1.03)	3.50[c] (0.87)
After, *M* (*SD*)	3.34[a] (1.02)	3.44[b] (0.97)	3.72[c] (0.85)

Note. Values range from 1 (*low risk perception*) to 5 (*high risk perception*). Means with no superscript in common differ at the 5% significance level according to Bonferroni's post hoc test.

[3] The ε values range from ε = 0.33 to ε = 1.00. The latter value indicates that the data are perfectly spherical.

[4] Cohen identifies an effect of d = 0.2 as small, d = 0.5 as medium, and d = 0.8 as large.

After people had read one of the three articles, risk perception increased on all geographical levels (see Table 2) and the differences among the three risk perceptions after the treatment was again significant (second repeated measures ANOVA), $F(1.41, 665.69) = 82.62$, $p < .001$. The mean difference for the OB after reading the articles is smaller than that before people have read them, OB = 0.37(0.81), with a small effect of Cohen's $d = 0.41$.

These results support our H1: Perceived risk before and after reading the articles was always significantly greater for one's own neighborhood (oneself) than for geographical areas farther away (others) leading to a significant OB. OB is greater before people have read information through written articles.

Hypothesis 2

To investigate the influence of our 2 × 3 experimental design on the extent of these OBs (before and after the treatment), we first conducted a univariate ANOVA to identify the influence of infestation level on the extent of an OB before one of the articles was read. We found that the level of infestation of test regions significantly influences the extent of OB, $F(1, 462) = 23.84$, $p < .001$. A greater OB (difference between self and others) was identified for areas with low infestations, OB = 0.74 (0.88), whereas for areas with high infestation, the mean extent of the OB is significantly smaller, OB = 0.37 (0.75). A Cohen's d of 0.46 reflects a small effect of cities' infestation level on the OB of people.

Furthermore, we analyzed the influence of the two levels of infestation (low, high) and the three styles of articles (tabloid, quality press, popular/scientific magazine) as independent variables on the OB after the treatment. Results revealed that neither infestation level, $F(1, 457) = 1.74$, $p = .19$, nor article style, $F(2, 457) = 1.16$, $p = .32$, significantly impacted the degree of OB after the treatments.

We therefore only partly support H2. Infestation level significantly influenced the extent of the OB before participants read the information. After the articles, participants living in heavily infested areas who read the tabloid or the popular/scientific-magazine articles evinced lower levels of OB compared with those living in areas of low infestation (see Table 3). Nonetheless, participants who read the quality-press article displayed no difference in the extent of OB as a function of their city's infestation level.

Table 3. Means and Standard Deviations for OB After the Treatment, Depending on the City's Infestation Level and the Treatment.

Infestation level	**Treatment**	***M* (*SD*)**
Low	Tabloid	0.37 (0.94)
	Quality press	0.39 (0.97)
	Popular/scientific magazine	0.53 (0.93)
High	Tabloid	0.25 (0.63)
	Quality press	0.38 (0.83)
	Popular/scientific magazine	0.37 (0.61)

Hypothesis 3

The self–other disparity of perceived media influence was checked (one-way repeated-measures ANOVA). Because of missing values resulting from participants not being compelled to answer every question, 113 cases had to be omitted from the analysis, leaving 366 valid cases.[5] Four different levels were compared (see Table 4). Sociodemographic variables are omitted from the analysis because they demonstrated no significant effect on the perceived effect of media. Mauchley's test indicated that the assumption of sphericity was violated, $\chi^2(5) = 195.40$, $p < .001$; the Greenhouse–Geisser corrected tests are therefore reported ($\varepsilon = .73$). The results show that the differences among the four perceptions of media influence is significant, $F(2.18, 795.10) = 22.69$, $p < .001$. Nevertheless, post hoc tests reveal that only the mean of the perceived influence on *myself* is significantly higher from that of the other groups, which do not differ significantly among themselves (see Table 4). FPP (calculated as the difference between *myself* and *general public*) is 0.29 (1.15). Cohen's *d* reflects a small effect ($d = 0.30$). Thus, we support H3. The results indicate that people perceive reports about the leaf miner influencing themselves more strongly than their family/friends, people in their rural district, or the general public (see Table 4). Yet we do not find any social–distance corollary effect, because the means of *family/friends, people in the rural district*, and *general public* do not differ significantly.

Table 4. Means and Standard Deviations for Perceptions of Media Influence.

Level	Myself	Family/ friends	People in the rural district	General public
After reading article, *M* (*SD*)	3.70^a (0.90)	3.40^b (0.92)	3.37^b (0.90)	3.42^b (0.98)

Note. Values range from 1 (*influence of the media perceived as minor*) to 5 (*influence of the media perceived as major*). Means with no superscript in common differ at the 5% significance level according to Bonferroni's post hoc test.

Hypothesis 4

We analyzed whether our 2 × 3 design creates different degrees of FPP (univariate ANOVA). Age was the only sociodemographic variable that showed a significant influence (on a 10% level) within this model and was thus included as control variable. Neither article style, $F(2, 368) = 0.37$, $p = .69$, nor

[5] Compared with the continuous cases, the missing cases include slightly less educated people, although they are normally distributed over all educational levels. We determined a lack of age and gender differences. A few more of the people who read the popular/scientific article dropped out, yet this contributes to an equal distribution of read articles with n(tabloid) = 131, n(quality press) = 133, and n(popular/scientific magazine) = 128. The missing cases are evenly distributed over areas with high and low infestation; thus, a slightly higher percentage of people living in areas with low infestation dropped out. We nonetheless argue that the greater number of missing cases is not problematic for the data, because the differences are very small, sample sizes are still rather large, and the analyses produce similar results when we conduct all of the previous analyses (H1, H2) using only the continuous cases.

infestation level, $F(1, 368) = 0.09$, $p = .76$, significantly affected the magnitude of FPP (see Table 5). The FPP of people who read the popular/scientific articles was stronger in areas with high infestation, FPP = 0.40 (1.20), than with low infestation, FPP = 0.24 (1.05), whereas the FPP of people who read the tabloid article was much smaller in areas with high infestation, FPP = 0.08 (1.10), compared with low infestation, FPP = 0.37 (1.10). The FPPs of people who read the quality press stayed equal. Nevertheless, H4 is supported because infestation level and article style evinced no significant effects.

Table 5. Means and Standard Deviations for FPP, Depending on the City's Level of Infestation and the Treatment.

Infestation level	Treatment	*M* (*SD*)
Low	Tabloid	0.37 (1.10)
	Quality press	0.35 (1.27)
	Popular/scientific magazine	0.24 (1.05)
High	Tabloid	0.08 (1.10)
	Quality press	0.30 (1.17)
	Popular/scientific magazine	0.40 (1.20)

Hypothesis 5

We used AMOS Graphics 23 and specified a model based on maximum likelihood estimates to test H5. Multigroups are formed based on the three written articles. Age was included as a control variable because this sociodemographic variable influences the FPP of participants who read the tabloid article or the popular/scientific magazine article. Standardized solutions are reported. The model provides a good fit with $\chi^2 = 3.52$, $p = .318$. Further indices support the good model fit (RMSEA = .02, GFI = .99, AGFI = .96, CFI = .94). OB does not significantly relate to FPP in any of the three groups, although we see an interesting trend in the form of a sign swap. The tabloid article group, exhibits an insignificant positive relation of FPP to OB ($\beta = +.14$, $p = .20$). The quality-press and the popular/scientific-magazine article showed a nonsignificant negative relation to OB (quality-press articles: $\beta = -.06$, $p = .67$; popular/scientific-magazine article: $\beta = -.07$, $p = .61$). Adding the infestation level to the model as two additional groups shows that for neither of the two distinct infestation levels is the relation between OB and FPP significant (low infestation: $\beta = .05$, $p = .69$; high infestation: $\beta = .04$, $p = .71$). Overall, H5 is not supported, as there is no significant relation between OB and FPP.

Discussion

Overall, the current study has advanced our knowledge about the first-person perception and optimistic bias in several key areas in general and about the relatively new field of impersonal environmental risks in particular.

This study confirms that an OB is associated with impersonal environmental risks. Many other studies have found that OB is associated with personal risks such as smoking (Arnett, 2000; Bränström, Kristjansson, & Ullén, 2006) or personal environmental risks such as hurricanes (Hopkins, 2015; Trumbo

et al., 2011; Trumbo et al., 2014). The apparent OB is important because it shows that perceptions of impersonal risks may resemble those of personal risks, although the former do not cause direct harm to people. Furthermore, we were able to show that risk perception increased with increasing geographical distance. This result resembles results observed in the context of TPP (social–distance corollary; Eveland et al., 1999). We were able to show that the occurrence of the infestation significantly lowered the degree of the OB prior to people having read the print articles. A possible explanation is that people living in areas with high infestation have the possibility to directly observe the nature change, evoked by the moth, and thus acquired some prior experience without personal damage. Even though the environmental change represented by leaf damage poses no direct threat to humans, its obvious appearance influenced risk perception on different levels and consequently diminished the OB in places that exhibited high leaf damage. These results are similar to those of OB research where people suffered some personal damage (Burger & Palmer, 1992; Helweg-Larsen, 1999).

We have been observing an increase in (personal) risk perceptions through the treatments leading to a decrease in the extents of OB. Yet, after the treatments, neither the infestation level nor the treatment proved to affect the extent of OB. The quality-press article held OB most stable across infestation levels. However, people living in highly infested areas who read the tabloid or the popular/scientific-magazine article displayed smaller amounts of OB than those living in areas with low infestation.

Second, an FPP was present in our case example of impersonal risk. Our results accord with Lin, who also recorded FPP in the context of environmental communication (Lin, 2013). Our results do not show the effect of the social–distance corollary in FPP between family/friends, people in the rural district, and the general public. FPP was, however, observed between self and others in general. Our assumption about why FPP and not TPP was apparent for this nature change is in line with Lin, who concluded that "positively" formulated statements create FPPs, whereas a negatively formulated statement creates TPP (Lin, 2013). Concerning the key issue of "social desirability" (Jensen & Hurley, 2005), the third-person effect has been found to increase with socially undesirable messages and decrease with socially desirable messages (Henriksen & Flora, 1999). We thus conclude that the public may perceive information about environmental issues, especially those involving impersonal risks, as socially desirable information. People seem to interpret media information about the leaf miner as a positive statement because it enables them to better understand the perceived nature change. Imparting knowledge about nature changes is therefore apparently regarded as one of the media's duties. Even though there was no significant difference in the degree of FPP, the tabloid article produced the weakest FPP overall, whereas the quality-press article and the popular/scientific-magazine article produced stronger FPPs. This accords with earlier findings about environmental communication (Lin, 2013). One explanation is that participants obviously noted the low quality of tabloid information, especially in highly infested areas, where people might know more about this environmental change as it is a present issue. This may have reduced their positive attitude or turned it into a negative one. The quality-press article held FPP stable across both levels of infestation. The popular/scientific article evoked stronger FPP in highly infested areas. The reason could be that residents in heavily infested areas might have dealt with the issue more thoroughly and can therefore cope with the most complex articles, whereas they believe that such complex articles will not influence others. Nevertheless, for the case example involving impersonal risks, a risk's proximity does not significantly influence FPP/TPP, as other researchers have shown (Jensen & Hurley, 2005).

Some studies show that TPP is unrelated to OB (Salwen & Dupagne, 2003; Wei et al., 2007), while others have shown that there is a significantly positive relation of TPP to OB (Li, 2008). For FPP, we found no significant negative relation between FPP and OB. One reason might be that the FPP was not strong enough to enable us to detect correlations. This assumption needs to be tested.

However, our study also has some limitations. We had no control group for the article styles to check manipulation of the treatments, as information about the leaf miner was essential for analyzing FPP. Additionally, our FPP was rather weak, which may have led to the insignificant results of H4 and H5. Further research on actual behavior is needed. Several studies have shown that OB serves to maintain certain behavior (e.g., continuing smoking instead of quitting; Arnett, 2000). First-person-effect studies are ambiguous with respect to the effect of FPP on intention and behavior (Xu & Gonzenbach, 2008). Future studies should further analyze the impact of OB and FPP for impersonal environmental risks on behavior.

Conclusion

Despite of these limitations, our research's key findings develop our knowledge about OB and FPP, and open up avenues for future research into impersonal environmental risks. Our results indicate that an OB is present even if a risk is not threatening humans themselves, but, instead, nature. Thus, also for a nature change, people tend to think that others are at greater risk of being affected than they are themselves. The presence of an impersonal risk was found to influence the extent of OB to some degree. These results show that even though a nature change does not pose a personal threat, its mere existence weakens OB. People living in infested areas are thus less likely to perceive the nature change as affecting others more than themselves. We were further able to show that a FPP can be developed for an environmental impersonal risk. Infestation level together with article style exhibited no significant influence on the extent of FPP. Future research here should also analyze how OB and FPP are connected to environment-relevant behavior. Understanding and learning more about these theoretical concepts within the field of impersonal environmental risks might be interesting not only for communication scholars but also for natural scientists and political actors, who need to make an effort to understand the public's perceptual attitudes and behaviors in the face of impersonal environmental risks such as biodiversity loss.

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