Border Bias: The Belief That State Borders Can Protect Against Disasters

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Abstract
In this research, we documented a bias in which people underestimate the potential risk of a disaster to a target location when the disaster spreads from a different state, but not when it spreads from an equally distant location within the same state. We term this the border bias. Following research on categorization, we propose that people consider locations within a state to be part of the same superordinate category, but consider locations in two different states to be parts of different superordinate categories. The border bias occurs because people apply state-based categorization to events that are not governed by human-made boundaries. Such categorization results in state borders being considered physical barriers that can keep disasters at bay. We demonstrated the border bias for different types of disasters (earthquake, environmental risk) and tested the underlying process in three studies.

Keywords
risk estimation, bias, categorization, subjective probability, risk management, cognitive maps, environmental risk, mental maps, visual illusion

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Sometimes people ignore warnings of impending natural disasters and suffer the consequences (e.g., many Hurricane Katrina victims). What makes people underestimate the risks of disasters? Here, we document one factor—state borders—that can lead to such underestimation. We propose that state borders can influence risk perception by helping people maintain illusions of safety. By perceiving state borders to be physical barriers that keep disaster at bay, people underestimate the severity of a disaster spreading from a different state, but not the severity of an equally distant disaster approaching from within a state. We call this bias in risk assessment the border bias.

Research has amply documented that cognitive maps (mental representations for maps and environments) tend not to be actual replications of maps, but rather are representations of the manner in which people categorize geographic locations (Tversky, 1981, 1992). Therefore, we used categorization research to understand how people use state borders to maintain an illusion of safety. Categories are groups of distinct abstract or concrete units that the cognitive system treats as equivalent. Placing a unit in a category affects subsequent judgments about it (Tversky, 1985). Categorization allows individuals to reason from the general to the specific by allowing unobserved features to be inferred on the basis of category membership (Krueger & Clement, 1994; Rehder & Hastie, 2001). Pertinent to the border bias, research on geographic categorization has found that people establish hierarchical relationships between different geographical categories. For instance, a city (a subordinate category) is nested within a state (a superordinate category; Stevens & Coupe, 1978). Although such categorization provides a context for understanding various geographic units (Krueger & Clement, 1994; Rehder & Hastie, 2001), at times it leads to geographic biases (Friedman & Brown, 2000). Stevens and Coupe (1978) found that instead of remembering the exact location of every city or remembering the relative locations of all cities, people store in memory the relative locations of the cities’ states and then store the locations of cities relative to the states that contain them. Hence, participants’ judgments about the relative location of cities were driven by knowledge of the relative location of the states (superordinate category) that contained the cities (subordinate category). For example, participants believed that Reno was northeast of San Diego (it is actually northwest of San Diego) because Nevada is east of California. In other words, people (at times erroneously) expect units to possess the attributes of...
the superordinate category (e.g., all cities in Nevada should be east of all cities in California).

People perceive two locations belonging to the same superordinate category as similar to each other but different from another location that belongs to a different superordinate category (Maddox, Rapp, Brion, & Taylor, 2008). Perceived similarities within a geographic category could emerge because category membership dominates comparisons made along other dimensions (e.g., euclidean coordinates of two locations) or because the category boundary serves as a reference point that makes two locations across categories more discriminable than two locations within a category (Maki, 1982; Tversky, 1992). In sum, studies suggest that people categorize each city to be part of a distinct superordinate category (i.e., state). Therefore, they consider locations within a state to be similar but locations in two different states (parts of two different superordinate categories) to be different.

Extending these findings, we propose that the border bias emerges because people use state-based categorization even while assessing the risk of disasters that are not restricted by state borders. When people hear that an earthquake has occurred in Nevada, they categorize it as an event of Nevada that is more likely to spread to other locations within Nevada than to equidistant locations outside Nevada. Therefore, they believe that a disaster is more likely to have an influence on a target location if that location is in the state where the disaster originates (i.e., a location within the superordinate category) rather than in another state. Such a belief results in state borders being considered physical barriers that can contain or restrict disasters. Actual physical distance, a normative indicator of spread, is not incorporated in such a biased risk assessment.

We demonstrated the border bias and tested the underlying process in three studies. In all three studies, we presented participants with maps showing affected in-state and out-of-state locations. For all conditions, we provided participants with the exact distance between the target location and the affected location so that they did not distort estimates of perceived distance.

**Study 1: Choice of In-State or Out-of-State Vacation Home**

Study 1 tested the border bias in a mixed design. One hundred fifty-four participants residing in 32 states (not including Washington and Oregon) took part in the study in return for monetary compensation. They were randomly assigned to one of three conditions. In all three conditions, participants were asked to imagine that they were contemplating the purchase of a vacation home in the mountains. Their final choices were North Mountain Resort, Washington, and West Mountain Resort, Oregon. While the participants were deciding, a third of them were told that an earthquake had hit Wells, Washington, 200 miles from both vacation homes (Washington condition; n = 54). Participants were shown a map with all three locations. The news report mentioned that the area was still experiencing seismic activity that could affect surrounding regions up to several hundred miles away. Another third of the participants were told that an earthquake had hit Wells, Oregon (Oregon condition; n = 47). Participants were shown a map depicting Wells\(^2\) as 200 miles from both vacation homes. (See Description Provided to Participants in Study 1 in the Supplemental Material available online for the detailed description given to the participants.) The final third of the participants (control condition; n = 53) received the same information about the two vacation homes but were not told about any earthquake. After reading the scenario, all participants were asked to choose between the two vacation homes. The responses in the control condition served as a baseline in our analysis.

A logistic regression analysis showed that condition (Oregon vs. Washington vs. control) had a significant influence on choice, Wald \(\chi^2(1, N = 154) = 19.22, p < .001\). Participants’ odds of choosing a vacation home in Oregon were 2.72 times greater in the Washington condition than in the control condition, Wald \(\chi^2(1, N = 107) = 16.77, p < .001\). Similarly, participants’ odds of choosing a vacation home in Washington were 2.61 times greater in the Oregon condition than in the control condition, Wald \(\chi^2(1, N = 100) = 13.04, p < .001\). Figure 1 depicts the choice shares in each condition.

The mixed design tested the robustness of the border bias. Despite knowing that both vacation homes were 200 miles from the earthquake’s location, participants found in-state locations to be riskier than out-of-state locations. This indicates that people used their state-based category beliefs in estimating risk, but did not incorporate distance information.

**Study 2: Influence of Light Versus Dark State Boundaries**

To test our proposed account of the border bias based on categorization, we conducted another study in the context of an environmental risk and made the state borders appear either dark or light on the map. The dark borders enhanced the boundaries of the superordinate categories (states), and therefore we predicted that the dark borders would facilitate the border bias. The light borders, in contrast, minimized the illusion that the location of origin and a target location in another state were parts of two distinct superordinate categories, thereby making it appear easy for the event to affect the target location. We did not expect the darkness of the boundaries to influence probability estimates when the target location was in the same state where the risky event took place.

One hundred twenty-five undergraduate students from Salt Lake City, Utah, took part in this study for partial course credit. This study utilized a 2 (location: in state vs. out of state) × 2 (border: dark vs. light) between-participants design. Participants were randomly assigned to one of the four conditions. Participants in the in-state condition were informed that a
a radioactive waste facility had opened near Sevier Lake, Utah, whereas participants in the out-of-state condition were informed that the facility had opened in Spring Creek, Nevada. Participants were shown a map and told that the location of the facility was 165 miles away from Salt Lake City (see Description Provided to Participants in Study 2 in the Supplemental Material). Participants were informed that if radioactive waste is not contained properly, it can contaminate soil, water, and air within a several-hundred-mile radius. Participants assigned to the dark-border condition saw the Utah-Nevada border marked as a dark, thick line on a map, whereas those in the light-border condition saw the border as a thin, dotted line. Finally, participants indicated the probability that radioactive waste in the disposal facility would adversely affect Salt Lake City, on a scale ranging from 0% to 100%.

A significant Location × Border interaction emerged, $F(1, 121) = 3.76, p < .05, \eta^2 = .03$. When the environmental risk was in an out-of-state location (Nevada), probability estimates were higher among participants in the light-border condition ($M = 60.85\%$) than among participants in the dark-border condition ($M = 46.29\%$), $F(1, 121) = 8.84, p < .01$. However, when the location was in state (Utah), the type of border did not influence probability estimates ($M_{\text{light}} = 60.32\%$ vs. $M_{\text{dark}} = 61.56\%$), $F < 0.1, p = .80$. The results support the categorization-based account of the border bias. Dark borders enhanced category separation (increasing the border bias), whereas light boundaries reduced category separation (decreasing the border bias).

However, one could argue that residents in Salt Lake City are constantly reminded by the media and activists of the harmful effects of the radioactive waste facility already located in their state. Hence, they might be highly cognizant of the threat and motivated to deny that a disaster is going to befall them. This alternate, motivation-based account of the pattern of results is consistent with past findings that news about imminent disaster puts people in denial mode (Ager, 2008). They know that danger exists but seek out information that reinforces their desired conclusion that the threat does not affect them (Kunda, 1990). Study 3 tested this alternative account.

**Study 3: Motivational Versus Cognitive Underpinnings**

This study used earthquakes as the disaster that could affect residents of Salt Lake City. We collected responses from two groups of participants: motivated individuals (residents of Salt Lake City whose lives would be severely disrupted by an earthquake) and nonmotivated individuals (residents of states other than Utah or Nevada). This study used a 2 (motivation: motivated vs. nonmotivated) × 2 (earthquake location: in state vs. out of state) between-participants design. Our proposed categorization-based account for the border bias suggests that both motivated and nonmotivated participants would show the border bias because they categorize Utah and Nevada to be two distinct superordinate categories. Conversely, the motivation-based account suggests that news about imminent disaster puts people in denial mode so that the border bias would emerge only among the motivated participants (i.e., residents of Salt Lake City).

Three hundred two participants from various states took part in this online study and were randomly assigned to the in-state or out-of-state condition. They were shown a map and told that an earthquake had affected either Hatch, Utah (in-state condition), or Eureka, Nevada (out-of-state condition), each of which is 230 miles from Salt Lake City (see the Description Provided to Participants in Study 3 in the Supplemental Material). Participants then indicated the probability of an earthquake occurring in Salt Lake City, using a scale from 0% to 100%.
0% to 100%. Subsequently, they indicated whether they would be personally affected if an earthquake struck Salt Lake City (scale from 1, not affected, to 7, highly affected). This rating served as another proxy for motivation.

The border bias emerged for both motivated participants ($M_{\text{in-state}} = 55.1\%$ vs. $M_{\text{out-of-state}} = 46.71\%$), $F(1, 298) = 4.58$, $p < .03$, $\eta^2 = .02$, and nonmotivated participants ($M_{\text{in-state}} = 53.6\%$ vs. $M_{\text{out-of-state}} = 45.9\%$), $F(1, 298) = 3.89$, $p < .04$, $\eta^2 = .02$. The Motivation x Earthquake Location interaction was not significant ($F < 0.5$, $p > .6$). The border bias also emerged when we used participants’ ratings of how much the earthquake would affect them personally as a proxy for motivation: Participants in the in-state condition ($M = 54.32\%$) reported a higher probability of the earthquake occurring in Salt Lake City than participants in the out-of-state condition reported ($M = 46.32\%$), $F(1, 298) = 5.67$, $p < .01$, $\eta^2 = .02$. However, the probability estimates were not moderated by the ratings of how much participants would be personally affected ($F < 1$, $p > .32$).

### Conclusion and Implications

We demonstrated that people consider a threat to a target location to be greater when the threat originates within the same state than when it originates in a different state, even if the two target locations are equidistant from the source of the threat. We suggest that such a border bias occurs because people categorize states as distinct superordinate categories that are less likely to share events than are locations within a state. People consider political boundaries (i.e., state borders) to be physical barriers that can limit the spread of disasters.

From a theoretical perspective, these findings supplement research suggesting that people allow internal and external (and, at times, nondiagnostic) factors to distort their probability estimates of events (Labella & Koehler, 2004; Windschitl, 2002). We found that people underestimated the threat of a disaster when they focused on state borders. These findings also add to research on risk management, which is concerned with processes of risk communication, risk mitigation, and public decision making. Perceptions of risk play a prominent role in the decisions people make. If the risk perceived by experts is not properly communicated to or not understood by laypeople, experts’ risk assessment will be discrepant from people’s preventive actions (Slovic & Weber, 2002). Our findings also contribute to the categorization literature by demonstrating a new bias that emerges when people make judgments about the spread of disasters on the basis of abstract political lines drawn on a map.

From a policy perspective, our findings have implications for disaster-warning procedures, consumer practices, and citizen activism. First, although researchers have studied how people react to disaster warnings, very little is known about how facets of a disaster warning itself can hinder its effectiveness. Our findings suggest that disaster warnings would be more effective if greater emphasis were placed on distances than on state borders. Second, people might neglect to purchase insurance if a disaster has occurred in a nearby but out-of-state location; however, they might purchase excessive insurance when the affected area is far away but in their own state. Helping people to focus on their distance from the affected location, rather than its in-state or out-of-state location, would encourage better insurance choices. A third implication involves citizen activism against the construction of facilities for disposal of toxic chemicals, including radioactive waste. Generally, residents of the state that would house such a facility organize such protests. Our findings suggest that people should overcome the illusion of safety offered by state borders and consider the threat real even when the facility is in a different state.

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### Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

### Supplemental Material

Additional supporting information may be found at http://pss.sagepub.com/content/by/supplemental-data

### Notes

1. This categorization might be based on years of observing and learning that each state functions as a unit with distinct history, governance, civic structure, laws, resources, and problems, and that there is little interstate sharing.
2. We kept the name of the affected city the same to avoid name-related differences in response.
3. For these people, the threat of an earthquake was very salient because a major fault line crosses the city. In fact, 5 days before the study was conducted, tremors from a 4.9-magnitude earthquake, considered the biggest in 18 years, were felt in Salt Lake City.

### References


