

# Spatial Uncertainty in Forecasts Lowers Perceived Risk and Likelihood of Precautionary Action

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## Summary

People often do not take small probabilities seriously—a dangerous attitude in the context of low-probability high-impact events, such as extreme weather. One method to increase forecast probabilities for these events is to widen the area a forecast is made for (i.e., lowering the spatial resolution). However, a wider area means more uncertainty about where exactly the event may occur.

We found that lower spatial resolution reduced how likely participants estimated to be hit and how often they chose to protect themselves. At the same time, higher forecast probabilities increased participants' risk perception and likelihood to take precautionary action. The results constitute a starting point for investigating the trade-off between forecast probability and spatial uncertainty.

## Methods

### Design

- Online experiment (2 tasks, 12 trials per task)
- N = 149, within subject

- Three levels of forecast resolution (neighborhood, southwest, city)
- Four probability levels (20% - 30% - 40% - 50%)



### Scenario

- "You are the organizer of a small outdoor festival."
- Participants checked thunderstorm forecasts to avoid being hit.

### Measures

- Estimate: How likely is it that the event area is going to be hit? [in percent]

	Hit by thunderstorm	NOT hit by thunderstorm
Host event	-20.000	0
Cancel event	-5.000	-5.000

- Decide: Host or cancel the event?

- Select: Which forecast interpretation is the most appropriate?

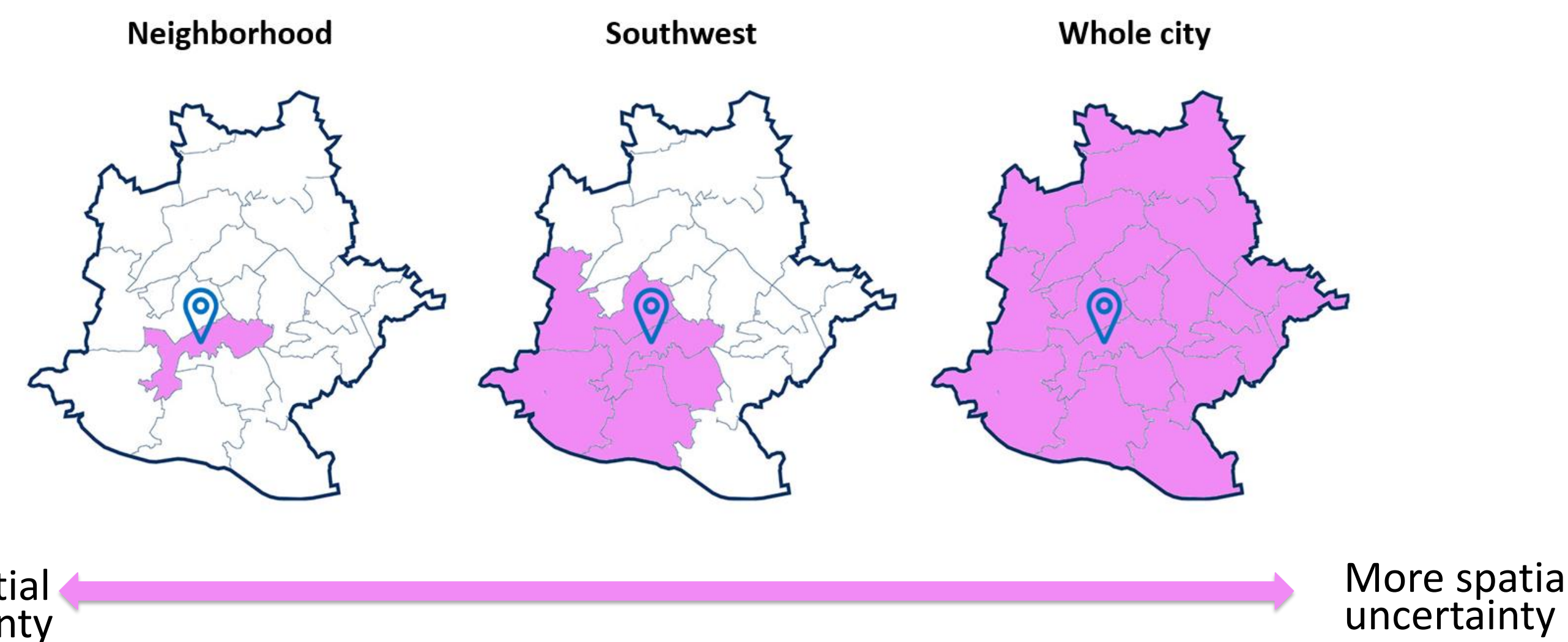


Fig. 1. Participants saw forecasts with three levels of resolution (Neighborhood = high, Southwest = medium, Whole city = low). The pink area marks the forecast region, the blue marker shows the area of interest (the event location).

## Results

### How likely is it that the event area is hit by thunder? Lower resolution, lower perceived risk!

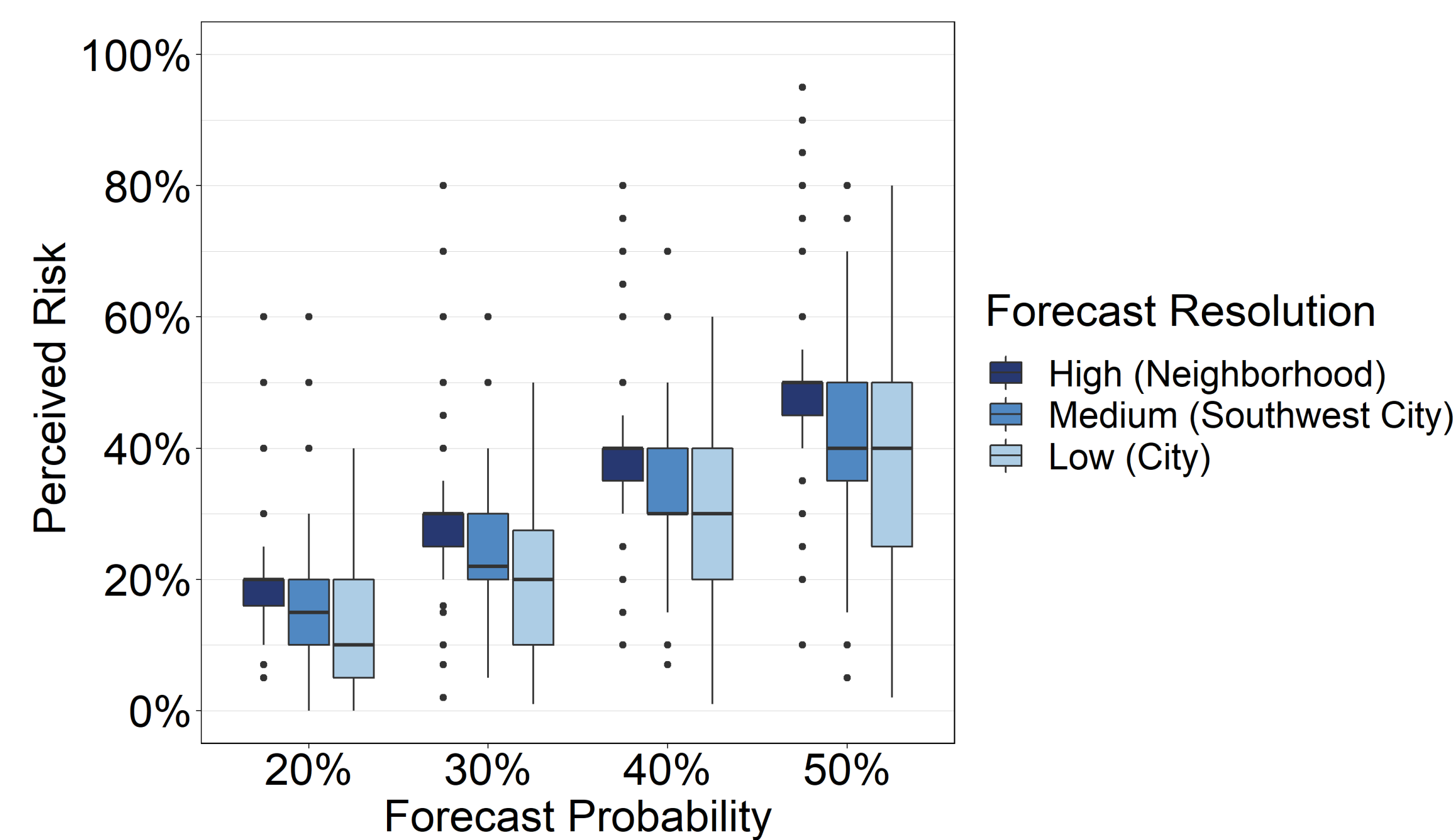


Fig. 2. Participants' likelihood estimates that the event area is going to be hit by thunderstorms.

- Higher forecast probability significantly increased perceived risk of being hit
- Lower forecast resolution significantly decreased perceived risk
- Interaction between higher forecast probability and lower resolution

### Host or cancel the event? Lower resolution, fewer cancelations!

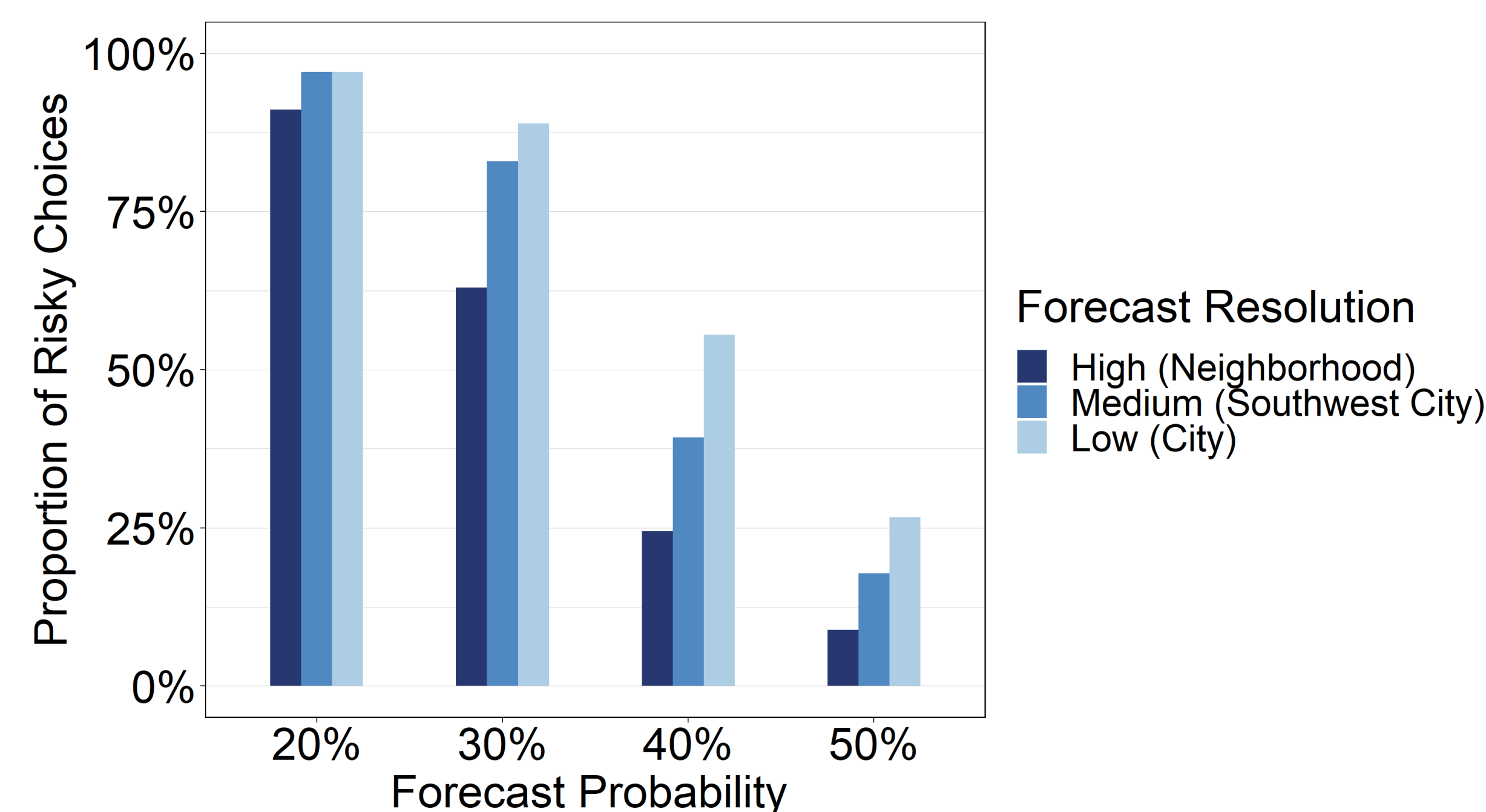


Fig. 3. Proportions of events hosted (risky choice) across participants.

- Higher forecast probability significantly decreased risky choices
- Lower forecast resolution significantly increases number of risky choices

## What does a 30% chance of thunderstorms tomorrow mean?

### „Any point“ interpretation (30% of participants)

At any one particular point in the area (e.g., at the townhall) there is a 30% chance that thunderstorms will occur tomorrow, and a 70% chance that thunderstorms will not occur tomorrow.

### „Somewhere“ interpretation (66% of participants)

There is a 30% chance that thunderstorms will occur somewhere (i.e., in at least one place) in the area tomorrow, and a 70% chance that thunderstorms will occur nowhere in the area tomorrow.

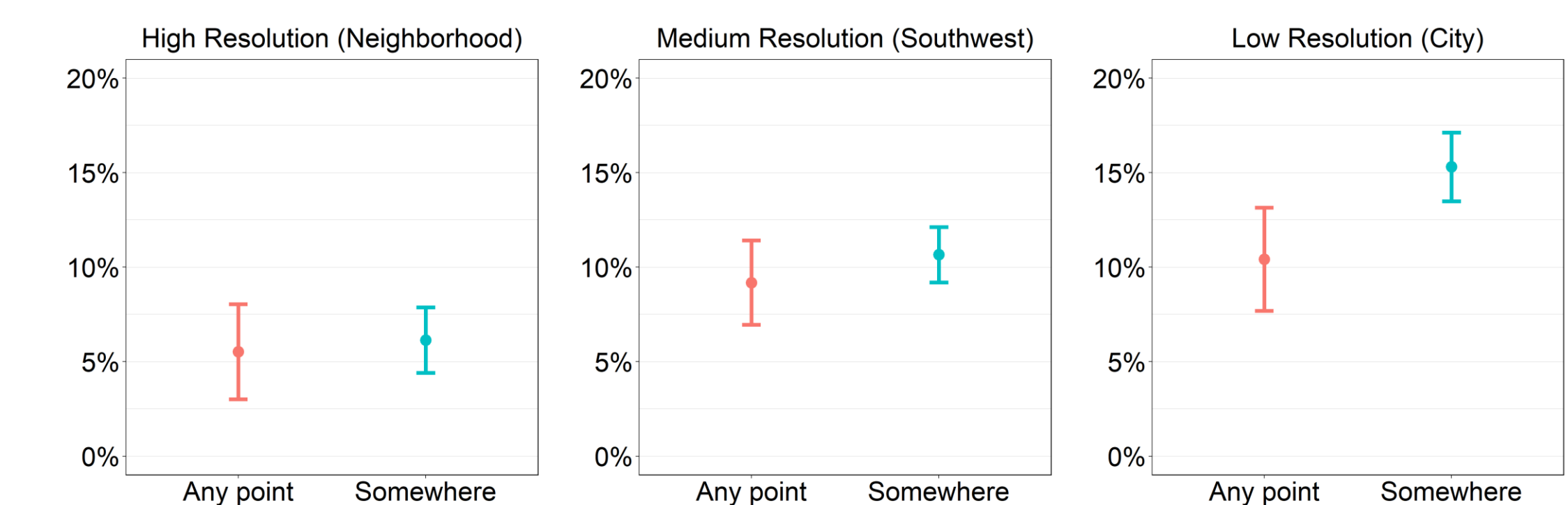


Fig. 4. Mean absolute deviation between likelihood estimates and forecasted probabilities by forecast interpretation. Significant difference only for low resolution forecasts,  $t(82.07) = -2.98, p < .01$ .

## Conclusion

- Lower forecast resolution **reduces** perceived risk and likelihood to take precautionary action
- So: Lowering the resolution increases communicated probabilities, but that does not necessarily increase perceived risk
- Is there a **sweet spot** in that **trade-off**?
- Interpretations of spatial reference class only **rough proxy** for observed risk perception and behavior

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