The Impact of Inconsistent Forecasts on User Trust

Jessica N. Burgeno & Susan L. Joslyn
University of Washington

Introduction
- The National Weather Service believes forecast consistency (ex: forecast provided on day 1 the same as day 2) is important for user trust.
- Because weather models are constantly updating, growing more accurate on average (2, 3), preserving consistency can be at a cost to accuracy.
- While the negative effect of inaccuracy on trust is well supported (4-6), there’s little to no support for the anticipated negative effect of sequential inconsistency on trust.
- However, consistency among multiple simultaneous advisors has been found to enhance confidence in decisions made based on their advice.

Research Questions
- Does inconsistency impact user trust?
- How does it relate to the already established impact of inaccuracy on trust?
- To what degree are participants influenced by earlier forecasts when they are inconsistent?

Method
- Task: Undergraduate participants (N=162) made several school closure decisions based on snow accumulation forecasts made 1 and 2 days prior to the expected snowstorm.
- Participants earned a cash reward commensurate with performance, and course credit.

Cost Structure:

<table>
<thead>
<tr>
<th>Decision</th>
<th>Observed Accumulation</th>
<th>6” snow</th>
<th>&gt;6” snow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>0pts</td>
<td>6pts</td>
<td></td>
</tr>
<tr>
<td>Close</td>
<td>2pts</td>
<td>2pts</td>
<td></td>
</tr>
</tbody>
</table>

Independent Variables
- Consistency: Consistent: Day 1 = Day 2 snow forecast (in inches)
  - Inconsistent: Day 1 ≠ Day 2 snow forecast (difference = 2 in.)
- Accuracy: Accurate: Day 2 snow forecast = Observed snow (in inches)
  - Inaccurate: Day 2 snow forecast ≠ Observed snow (difference = 2 in.)

Forecast Type was also manipulated between subjects in a previous experiment (Deterministic, Probabilistic), however there was no effect perhaps because forecasts were not reliable.

Dependent Variables
- Trust (6-point scale: “Not at all” to “Completely”)
- Snow Accumulation Estimates (in inches)

Trial Events
- Monday Forecast: 2” snow
- Tuesday Forecast: 4” snow
- Decision: Close / Stay Open
- Wednesday Outcome: 6” snow

Results: Trust
- Consistent: M=3.32
- Inconsistent: M=3.12

Results: Weighting Forecasts
- Research question: Arguably users should ignore Forecast 1 as updated Forecast 2 replaces it. Do they?
  - A 2 factor regression model explained 56% of variance in snow accumulation estimates, \( F(2,1293)=825.36, p<.001, R^2=.56 \)
  - Weighting of Day 2, \( \beta=.71 \) (p<.001) > Day 1 forecast, \( \beta=.80 \) (p<.001)

Conclusions
- Forecast inconsistency reduces trust in forecasts but not to the extent that inaccuracy does in this experimental paradigm.
- To preserve trust, meteorologists should prioritize accuracy over the maintenance of consistency.
- People demonstrated much greater weighting of more recent forecasts, suggesting they may understand it more accurately.

References

This material is based upon work supported by the NSF under grant number 1559126. For further information please contact Jessica Burgeno at jburgeno@uw.edu.