Introduction

• The U.S. National Weather Service believes forecast consistency (e.g., forecast provided on day 1 the same as day 2) is important for user trust (1).

• Because weather models are constantly updating, growing more accurate on average (2, 3), preserving consistency can be at a cost to accuracy.

• The negative effect of inaccuracy on trust is well supported (4-6).

• And users tend to base their own estimate on the average of discrepant advisors (7).

• However, there is little to no evidence for the negative effect of sequential inconsistency on trust anticipated by the National Weather Service.

Research Questions

• Does inconsistency reduce user trust?

• How does it relate to the already established reduction in trust due to inaccuracy?

• To what degree are participants influenced by earlier forecasts when they are inconsistent?

Method

Task

• Undergraduate participants made several school closure decisions based on snow accumulation forecasts made 2- and 1-day prior to the expected snow storm.

• Participants earned a cash reward commensurate with performance.

Instructions: expect ≥ 6 inches of snow accumulation → Close

expect < 6 inches → Stay Open

Cost Structure

• Starting balance: 120pts

<table>
<thead>
<tr>
<th>Decision</th>
<th>Observed Accumulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>&lt; 6 in. snow</td>
</tr>
<tr>
<td>Close</td>
<td>≥ 6 in. snow</td>
</tr>
<tr>
<td></td>
<td>0 pts</td>
</tr>
<tr>
<td></td>
<td>6 pts penalty</td>
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<tr>
<td></td>
<td>2 pts cost</td>
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<tr>
<td></td>
<td>2 pts cost</td>
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</tbody>
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Independent Variables

Within subjects

• Consistency: Consistent: Monday=Tuesday snow forecast (in inches)

• Accuracy: Accurate: Tuesday snow forecast = Observed snow (in inches)

Inaccurate: Tuesday snow forecast ≠ Observed snow (difference = 2 in.)

Dependent Variables

• Trust 6-point scale: “Not at all” to “Completely”

• Snow Accumulation Estimates (in inches)

Control Variables (unless otherwise specified)

• Forecast range: 4-7 in. (M=5.5); Observed Accumulation range: 4-7 in. (M=5.5)

• Threshold crossing: Inaccuracies cross the 6 inch decision threshold

Trial Events (each shown on separate computer screens)

Monday Forecast for Wednesday

Tuesday Forecast for Wednesday

Decision

Wednesday Outcome

6” snow

Close

Stay Open

Trust Rating

In/Consistency

In/Accuracy

Experiments

Experiment 1 Results (N=363)

Inconsistencies: 1.5 in. on average; ½ cross decision threshold

• Trust for Consistent (M=3.21) > Inconsistent (M=3.07)**

• Trust for Accurate (M=3.48) > Inaccurate (M=3.21)**

• Inaccuracy effect, Inaccurate (M=3.05) > Inconsistent (M=3.21)**

• Interaction: Inconsistency reduces trust more when accurate*

Experiment 2 Results (N=162)

Inconsistencies: ½ cross decision threshold

• Inaccurate Forecast: Consistent (M=3.32) > Inconsistent (M=3.12)**

• Inaccurate Forecast: Accurate (M=3.41) > Inaccurate (M=3.03)**

• Inaccuracy effect, Inaccurate Forecast (M=3.25) > Inconsistent (M=3.12)**

Experiment 3 Results (N=158)

Inconsistencies: all cross decision threshold

• Fixed both inconsistency difference and threshold crossing confounds

• Inaccurate Forecast: Consistent (M=3.68) > Inconsistent (M=3.05)**

• Inaccurate Forecast: Accurate (M=3.44) > Inaccurate (M=3.00)**

• Inaccuracy effect, Inaccurate Forecast (M=3.30) > Inconsistent (M=3.05)**

• Interaction: Inconsistency reduces trust more when accurate***

Results: Snow Accumulation Estimates

Weighting of Tuesday forecast was more than 7 times greater than Monday forecast in every study.

Conclusions

• Inaccuracy and Inconsistency both reduce trust; the effect of inaccuracy was greater and inconsistency reduced trust primarily when forecasts were accurate.

• Therefore it is inadvisable for forecasters to sacrifice accuracy in favor of consistency.

• People weighted recent forecasts much more heavily than previous forecasts, suggesting they may understand that more recent forecasts are more accurate.

References