The Impact of Inconsistent Forecasts on Trust

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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

Observed Accumulation

Decision	**< 6 in. snow**	**=>6 in. snow**
Open	0 pts	6 pts penalty
Close	2 pts cost	2 pts cost

Independent Variables

Within subjects

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

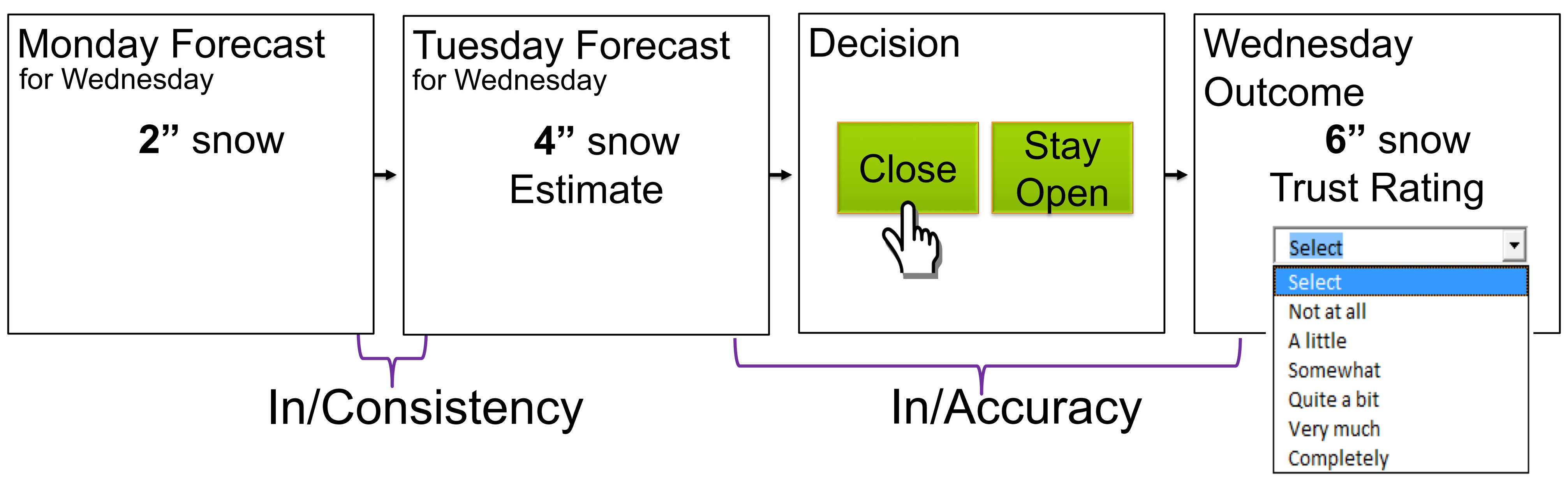
Dependent Variables

- 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)



Stimuli

2x2 within subjects designs; only Day 1 Inaccurate/Inconsistent forecasts differed between experiments.

Experiment 1

	Accurate Day 1	Accurate Day2	Accurate Outcome	Inaccurate Day 1	Inaccurate Day 2	Inaccurate Outcome
Consistent	A			B		
	4	4	4	4	4	6
	5	5	5	5	5	7
	6	6	6	6	6	4
	7	7	7	7	7	5
Inconsistent	C			D		
	4	6	6	4	5	7
	5	7	7	5	4	6
	6	4	4	6	7	5
	7	5	5	7	6	4

Experiment 2

Changes:

- wider range of forecasts made all inconsistencies & inaccuracies 2"

3
2
9
8

Experiment 3

Changes:

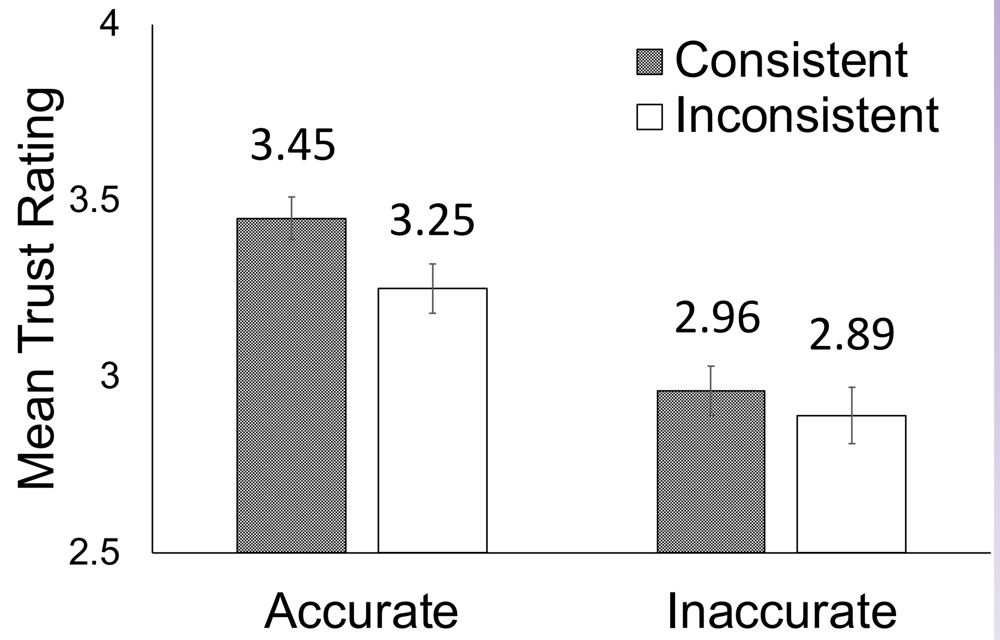
- all inconsistencies & inaccuracies crossed decision threshold, but some Day 1 = outcome

7
6
5
4

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=3.35) > Inaccurate (M=2.93)***
- Inaccuracy effect, η_p^2=.26 > Inconsistency effect, η_p^2=.05
- Interaction: Inconsistency reduces trust more when accurate**



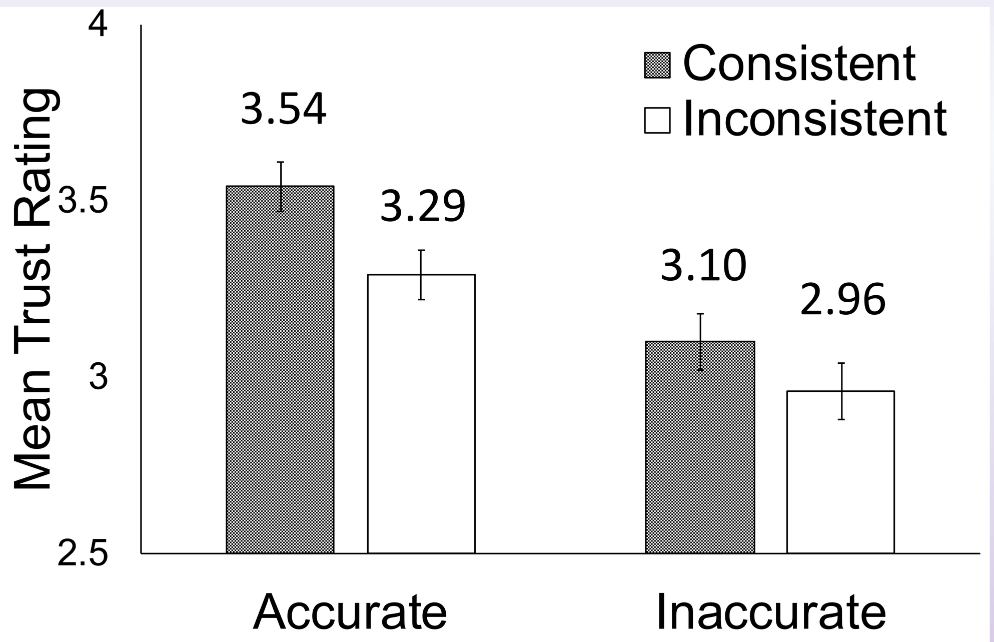
*p<.05, **p<.01, ***p<.001

Mean trust rating by trial type. Error bars show 95% CI.

Experiment 2 Results (N=162)

Inconsistencies: ½ cross decision threshold
Inaccurate Inconsistent forecasts: 2-9 in.
Fixed inconsistency difference confound

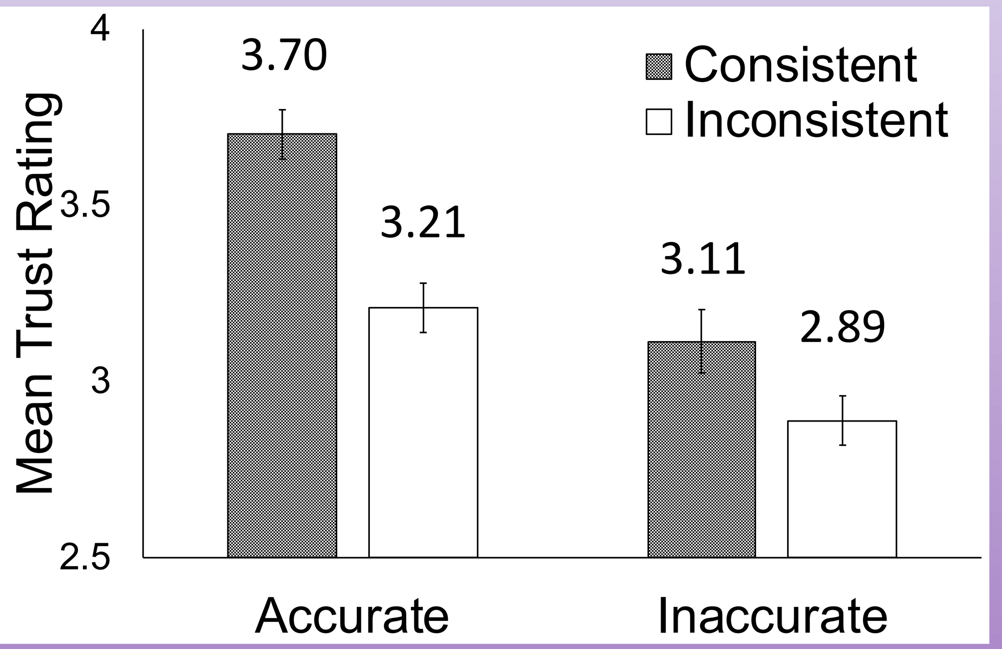
- Trust for Consistent (M=3.32) > Inconsistent (M=3.12)***
- Trust for Accurate (M=3.41) > Inaccurate (M=3.03)***
- Inaccuracy effect, η_p^2=.25 > Inconsistency effect, η_p^2=.07



Experiment 3 Results (N=158)

Inconsistencies: all cross decision threshold
Fixed both inconsistency difference and threshold crossing confounds

- Trust for Consistent (M=3.68) > Inconsistent (M=3.05)***
  Trust for Accurate (M=3.44) > Inaccurate (M=3.00)***
- Inaccuracy effect, η_p^2=.30 > Inconsistency effect, η_p^2=.21
- 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

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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.