Max Wertheimer Minerva Center for Cognitive Processes and Human Performance

Confidence and consensus: A theory and some remote implications

Asher Koriat and Shiri Adiv

University of Haifa

Minerva meeting

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Confidence and consensus: A theory and some remote implications

1. The Self-Consistency Model of confidence

2. Majority views are associated with higher confidence and shorter latency regardless of conformity pressures

3. When two heads are better or worse than one

Confidence and Consensus

1. The Self-consistency model (SCM) of subjective confidence

Resolution or Relative Accuracy

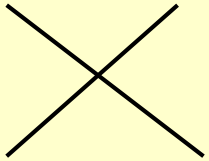
The within-person correlation between confidence and accuracy

Quite high for general-knowledge questions, perceptual judgments etc.

Phonetic symbolism in natural languages
(Koriat,1975)

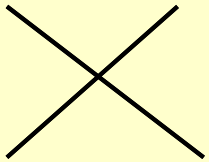
chung **light** _____

ching **heavy** _____



Haritavada **sharp** _____

Mondavada **dull** _____



Confidence: 1- 4

Word Matching (Koriat,1975)

The results indicated that

1. **Participant were correct better than chance**

2. **And they were successful in discriminating between Correct and wrong responses.**

Dissociating Correctness from Consensuality

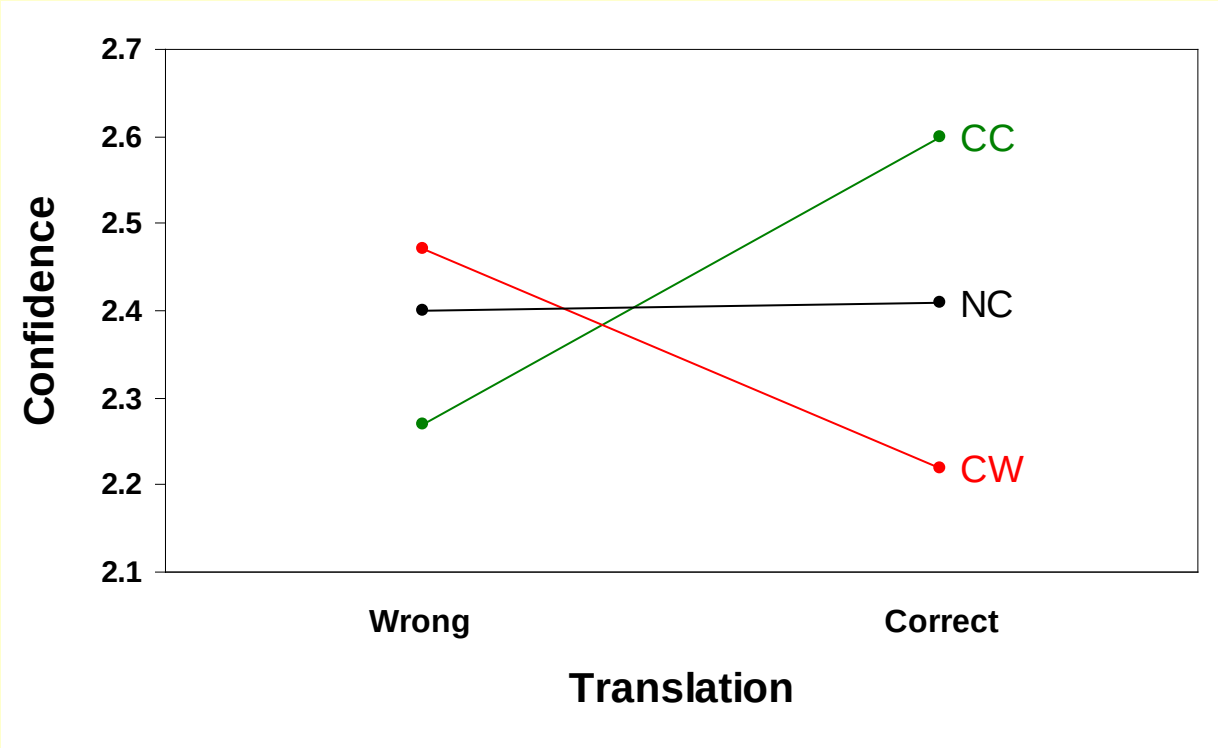
A subsequent study (Koriat, 1976) divided the item into 3 categories

CC – Consensually Correct

NC – Nonconsensual

CW – Consensually Wrong

Word Matching (Koriat, 1976)



General Information (Koriat, JEPLMC, 2008)

What actress played Dorothy in the original version of the movie The Wizard of Oz?

a. Judy Garland

b. Greta Garbo

Confidence: 50% - 100%

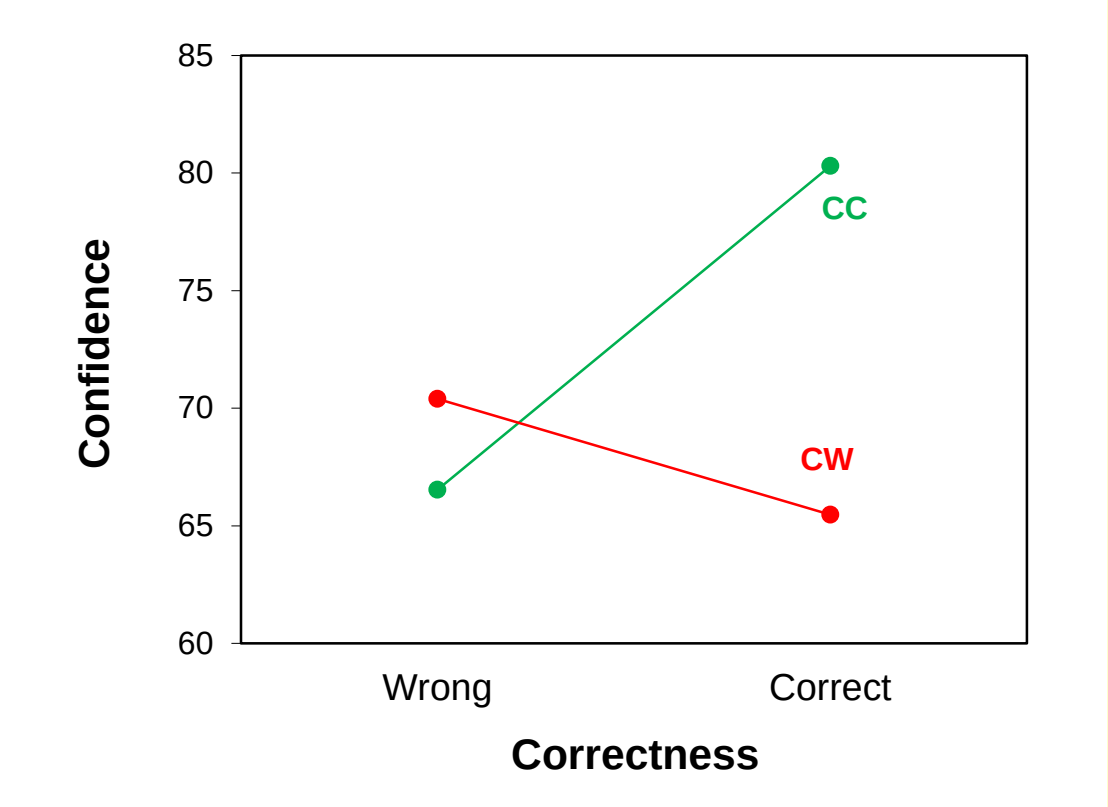
Koriat (2008)

A deliberate inclusion of “deceptive” items

Ad-hoc classification of items:

- 35 Consensually-correct (**CC**)
- 57 Nonconsensual (**NC**)
- 13 Consensually-Wrong (**CW**)

General Knowledge (Koriat, 2008)



Mean confidence for correct and wrong answers, plotted separately for the consensually correct (CC), and for the consensually wrong (CW) items.

The Consensuality Principle

(Koriat, 2008)

- **Confidence is correlated with consensuality rather than with correctness**

- **People discriminate between correct and wrong answers only because their answers tend to be correct by and large**

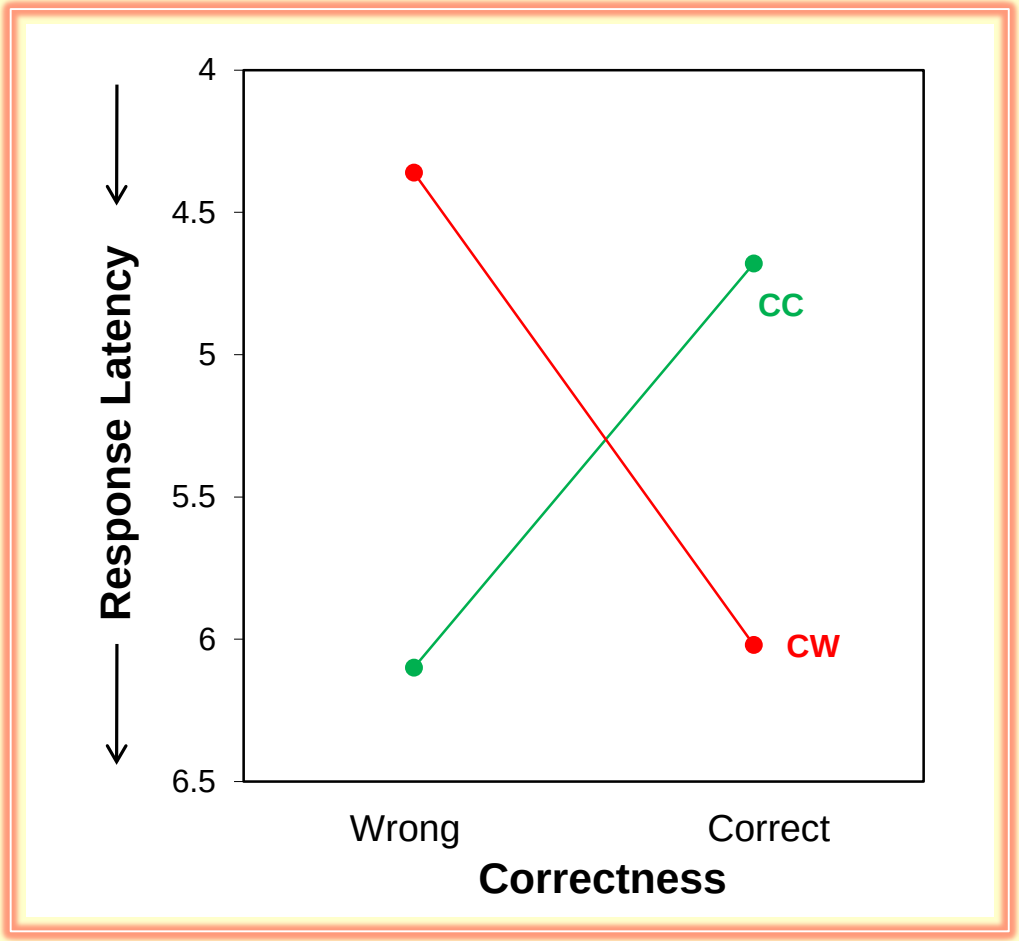
- **The implication: Metaknowledge accuracy is highly correlated with knowledge accuracy**

The Consensuality Principle for Response Latency

- **Latency is also correlated with consensuality rather than with correctness**

- **Speed of responding is diagnostic of accuracy only when the consensual answer is the correct answer**

General Knowledge (Koriat, 2008)
Response Latency

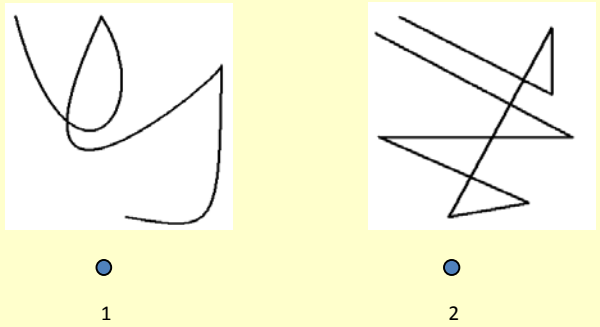


Mean decision time for correct and wrong answers, plotted separately for the consensually correct (CC), and for the consensually wrong (CW) items.

Perceptual Comparisons: Lines

(Koriat, JEPG, 2011)

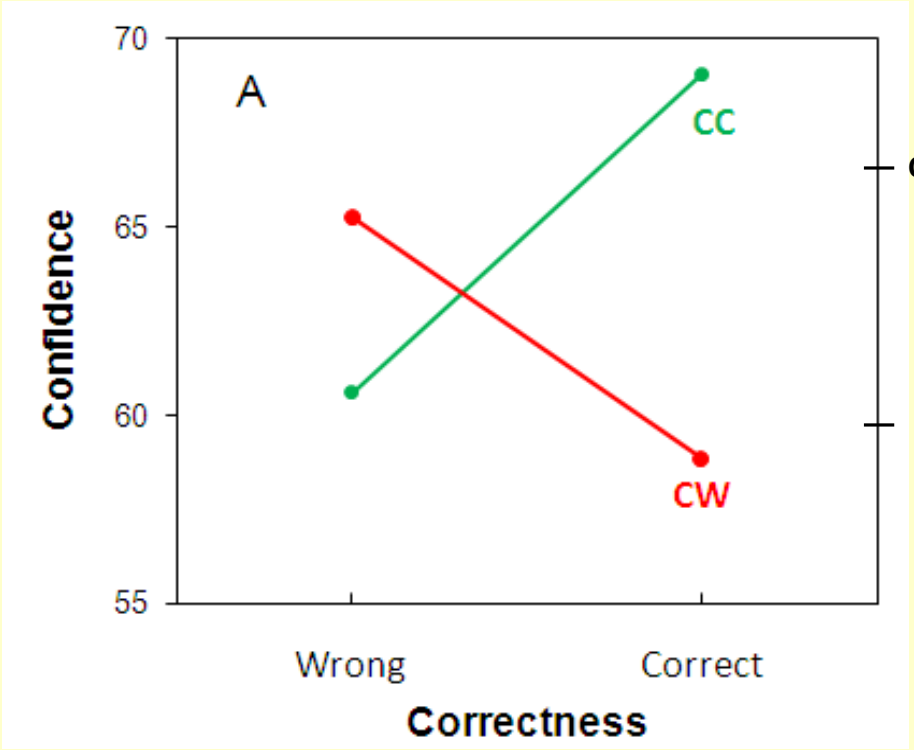
Which of the two lines is longer?



Confidence: 0 - 100

Perceptual Comparisons: Length

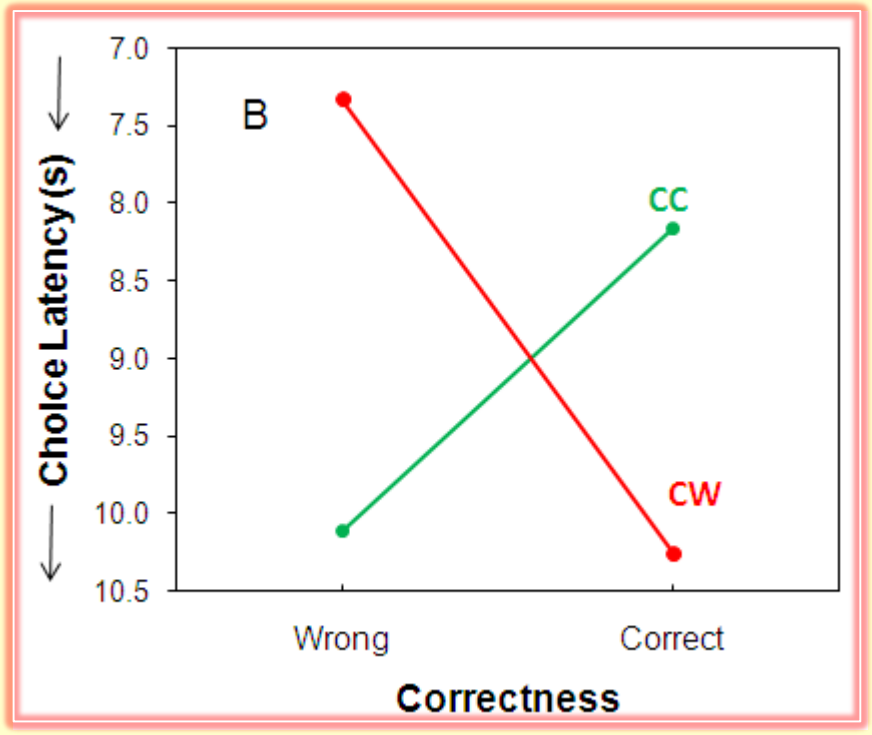
(Koriat, 2011)



Mean confidence for correct and wrong answers, plotted separately for the consensually correct (CC), and for the consensually wrong (CW) items.

Perceptual Comparisons: Length

(Koriat, JEPG, 2011)



Mean choice latency for correct and wrong answers, plotted separately for the consensually correct (CC), and for the consensually wrong (CW) items.

Perceptual Comparisons: Shapes

(Koriat, 2011)

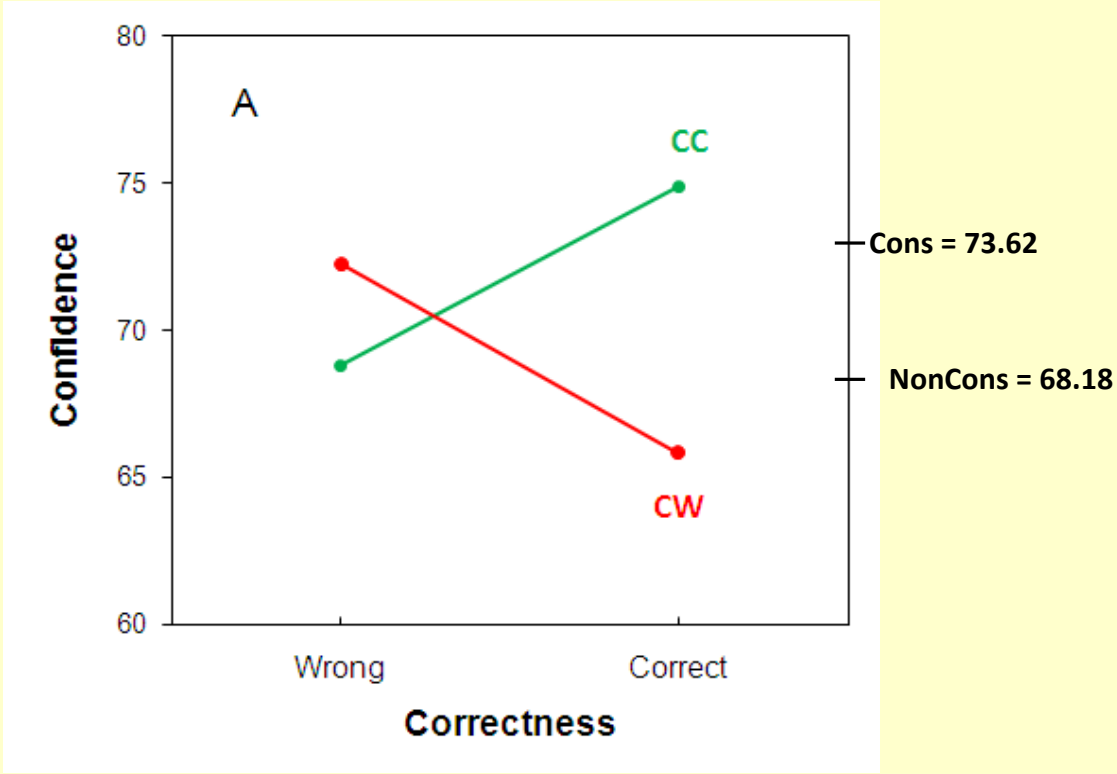
Which of the two shapes has a larger black area?

1 2

Confidence: 50% - 100%

Perceptual Comparisons: Shapes

(Koriat, 2011)



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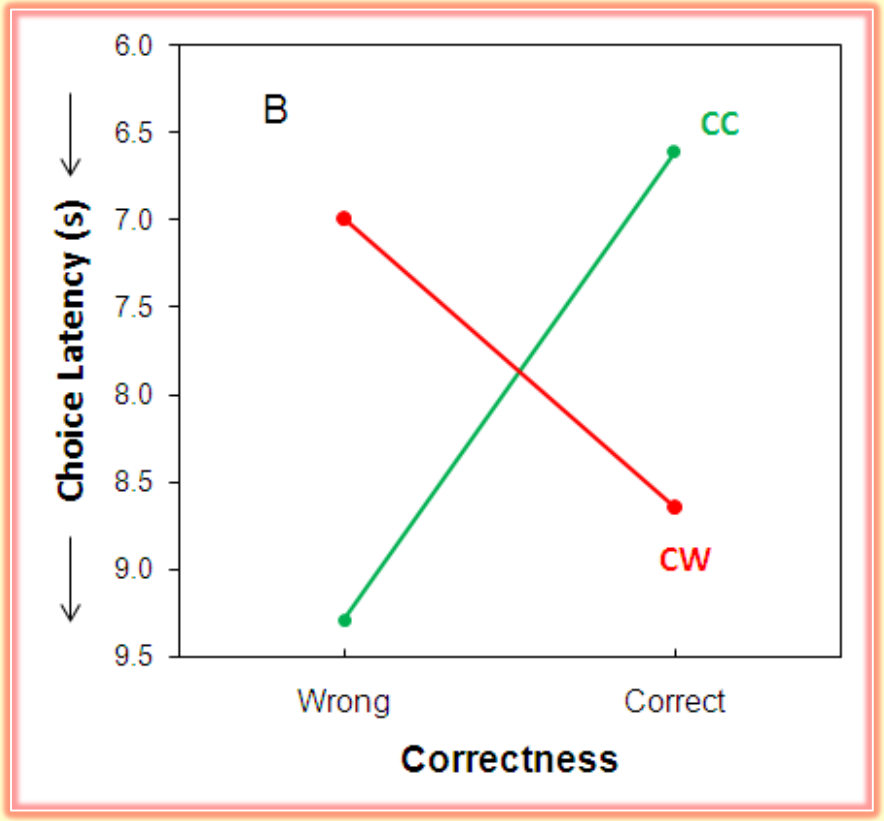
Perceptual Comparisons: Shapes

(Koriat, 2011)



Mean choice latency for correct and wrong answers, plotted separately for the consensually correct (CC), and for the consensually wrong (CW) items.

Question:
Why Consensuality?

Why is my confidence in a choice correlated with what others choose?

The Self-Consistency Model of Subjective Confidence

(Koriat, Psych Rev. 2012)

How do we choose between two answers to a question?

- The decision can be modeled by a **sampling process** in which a small sample of clues is drawn from a population of representations associated with the item.
- Confidence is based on the **consistency** with which the sampled clues support the choice.
- Subjective confidence represents an assessment of **reproducibility**: the likelihood of making the same choice in the future.

“Collective wisdom”

A critical assumption:

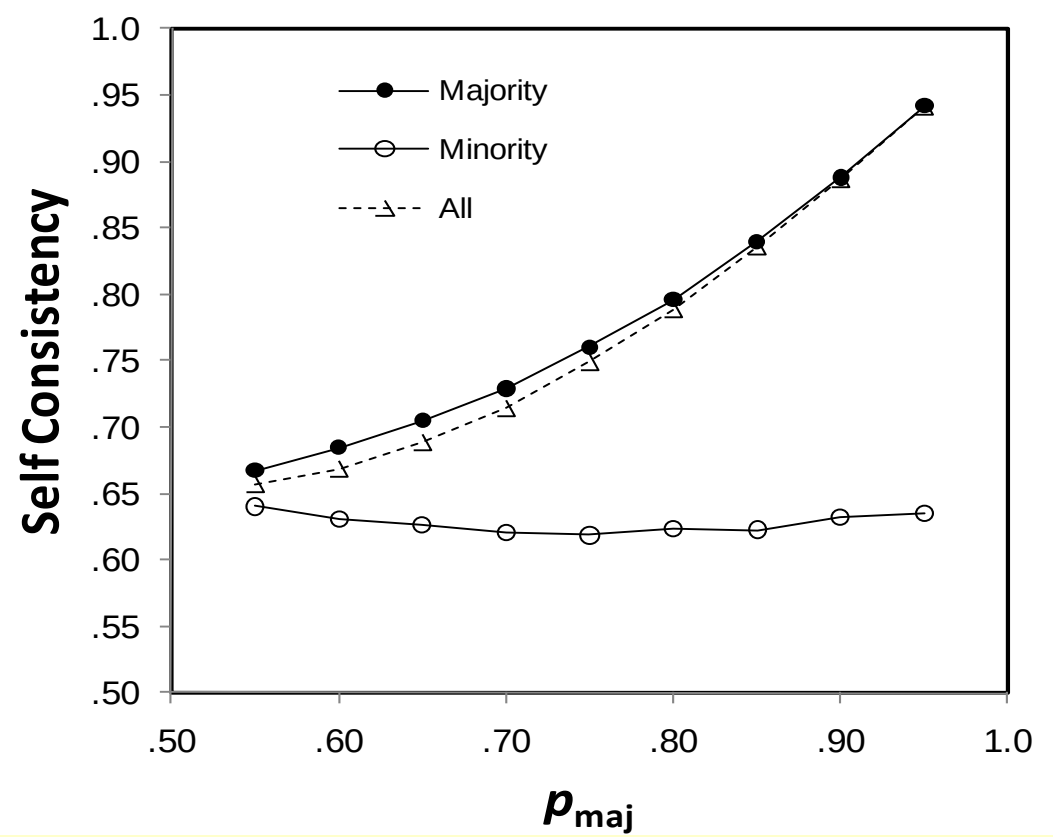
- In many domains, people sample their clues from a population of clues that is **largely shared** across all participants with the same background.

- The idea of **wisdom of crowds**: Information that is aggregated across participants may be closer to the truth than the information provided by each participant.

A version of the Self-Consistency Model

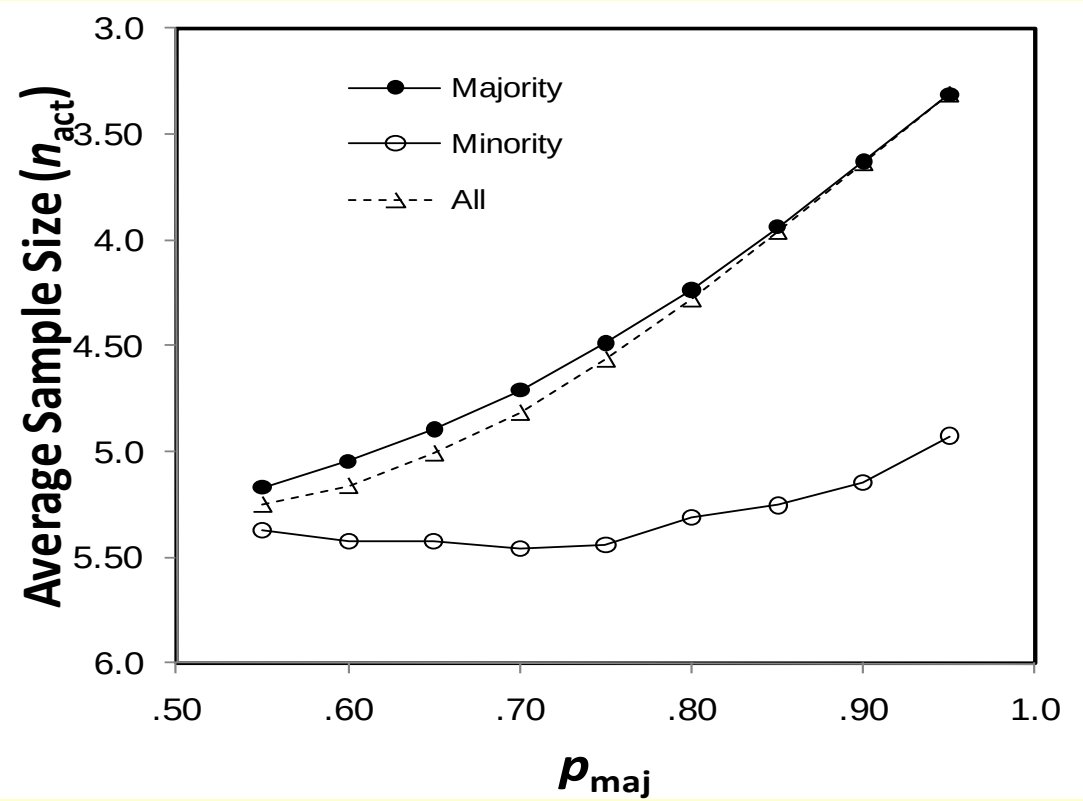
- Draw 7 clues sequentially
- Stop if 3 in a row favor the same answer
- Choose the answer that is favored across all sampled clues
- Compute confidence as the consistency with which the choice is favored across the clues

Confidence as a function of P_{maj}



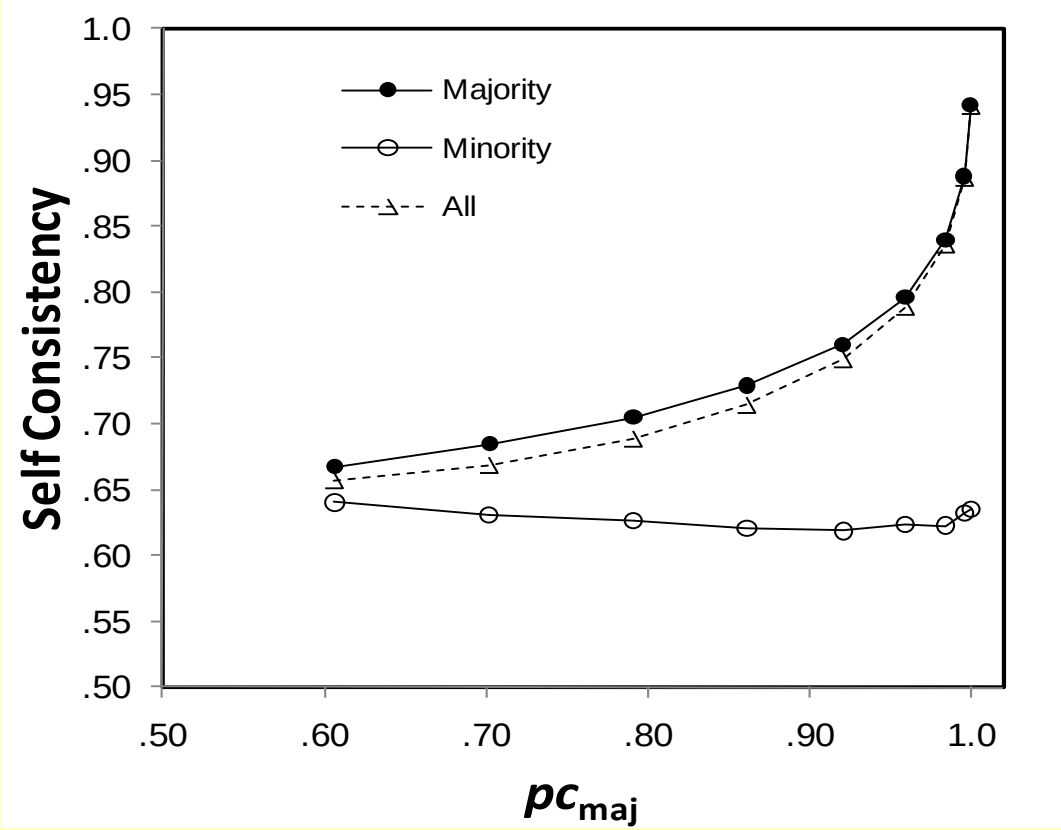
p_{maj} = proportion of clues favoring the majority option in the population

Response latency as a function of P_{maj}



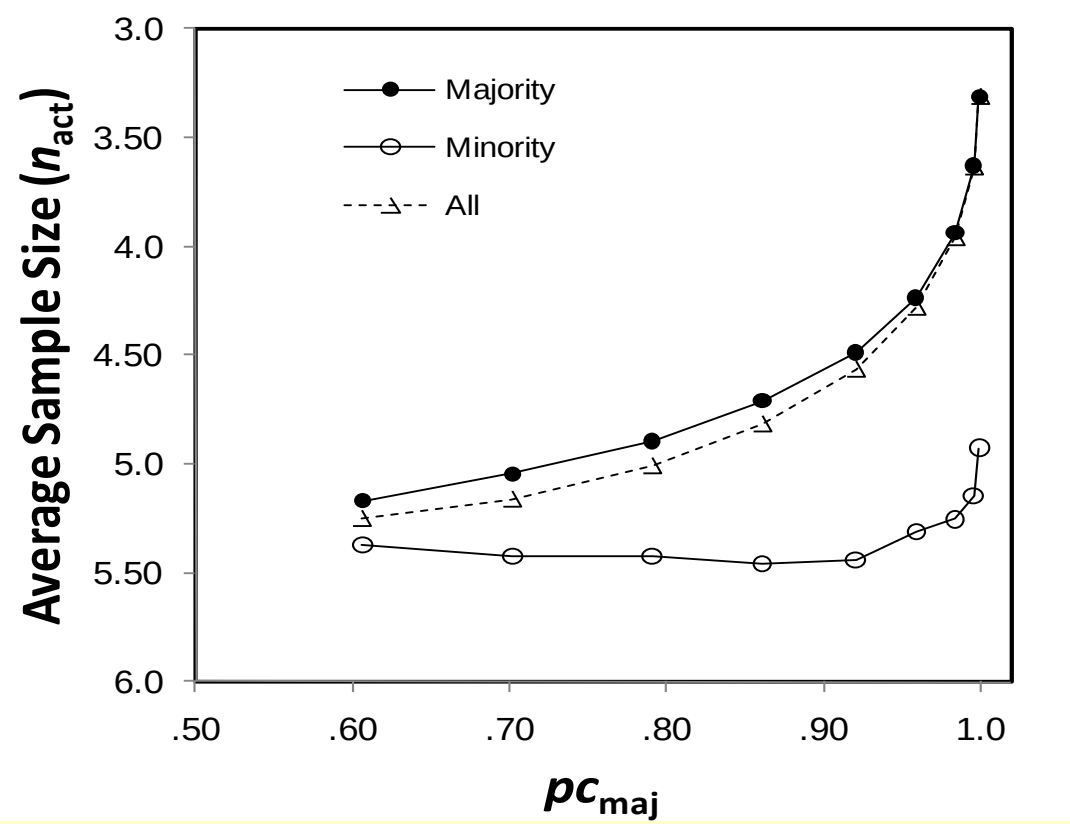
p_{maj} = proportion of clues favoring the majority option in the population

Confidence as a function of consensus



pc_{maj} = proportion of participants who choose the majority answer

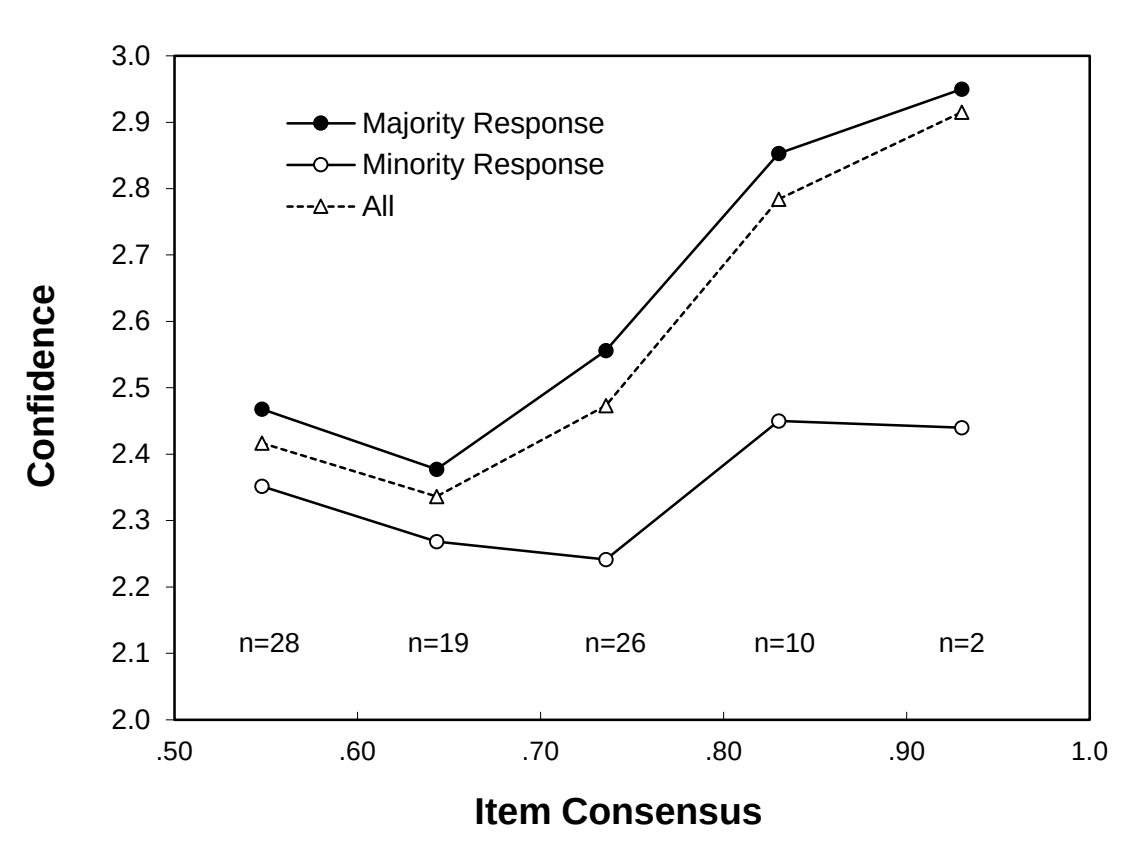
Latency as a function of consensus



pc_{maj} = proportion of participants who choose the majority answer

Word Matching (Koriat,1976)

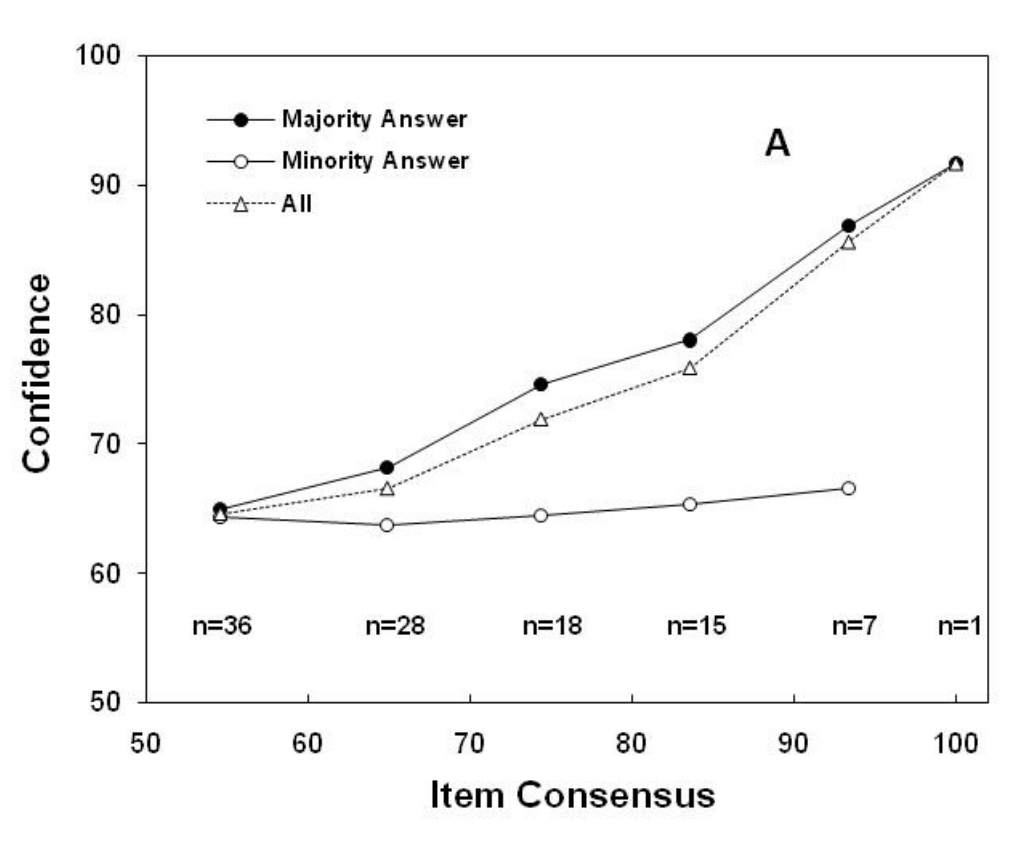
Guessing the meaning of foreign words



Mean confidence ratings (1-4) in the correctness of word matching for majority response, minority response, and all responses combined as a function of item consensus.

General Knowledge (Koriat, 2008)

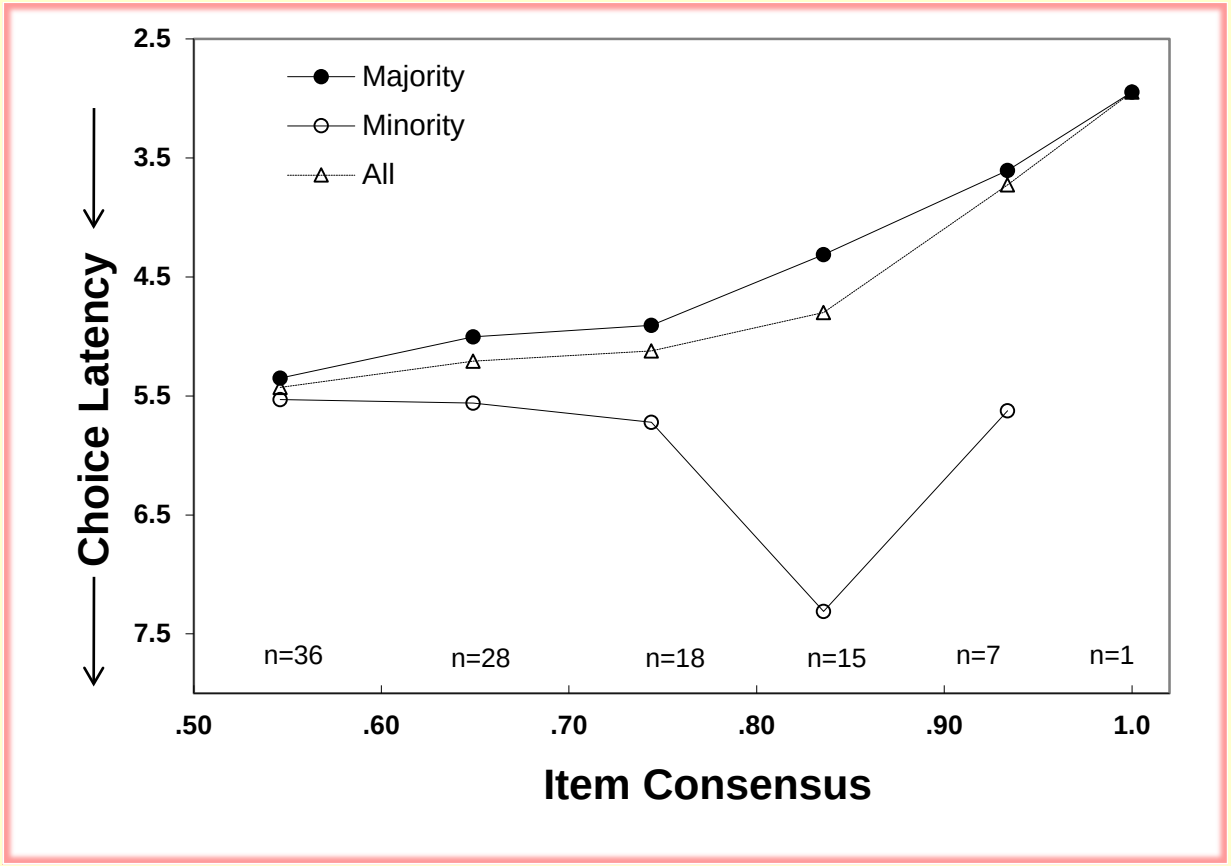
Item consensus



Mean confidence ratings (50-100) in the correctness of answer to general-information questions for majority response ,minority response, and all responses combined.

General Knowledge (Koriat, 2008)

Item consensus

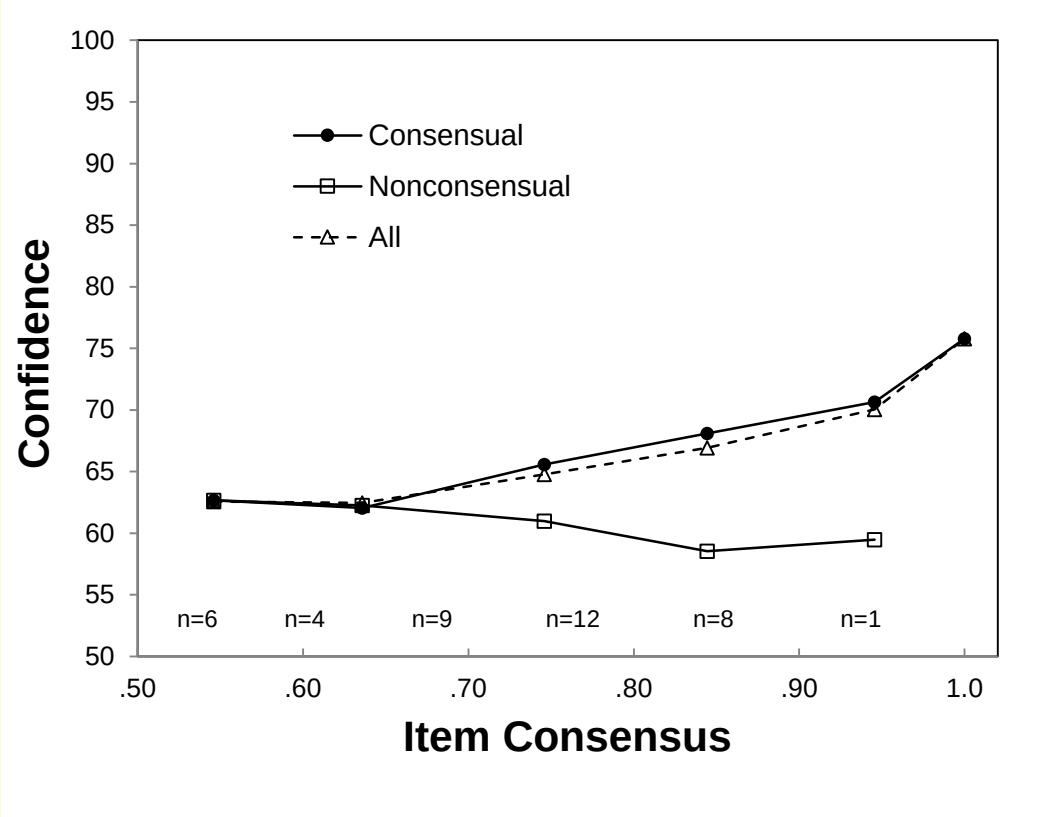


Choice latency as a function of item consensus for majority ,minority response, and all answers combined as a function.

Perceptual Comparisons: Lines

Item consensus

(Koriat, 2011)

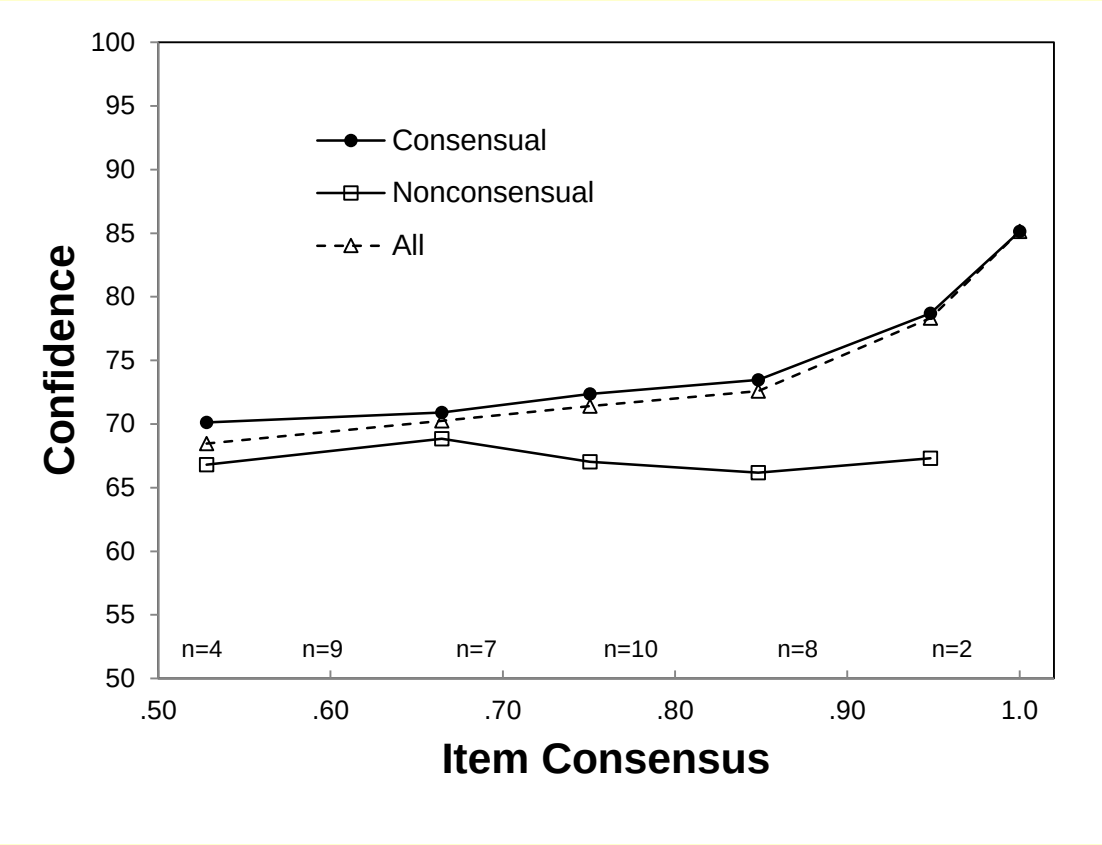


Mean confidence for majority and minority choices as a function of item consensus.

Perceptual Comparisons: Area

Item consensus

(Koriat, 2011)



Mean confidence for majority and minority choices as a function of item consensus.

Agreement with Others
and
Agreement with Oneself

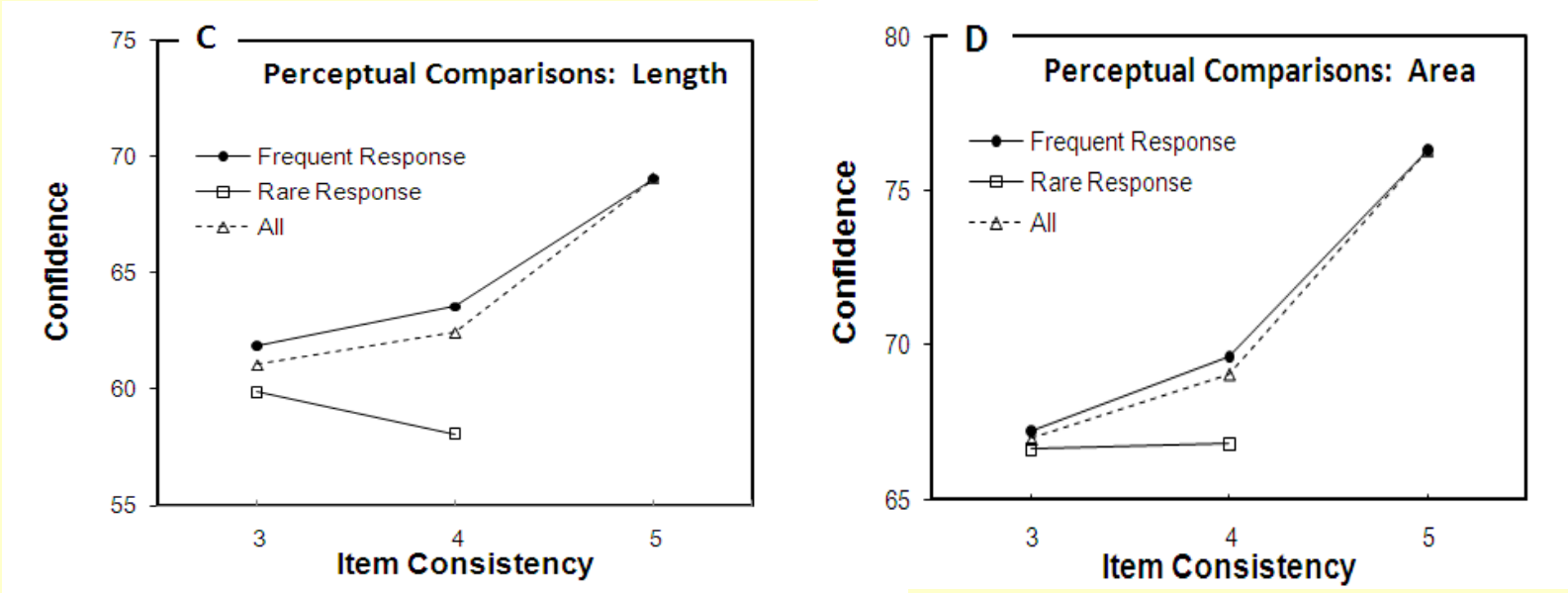
Within-person consistency

- Confidence is correlated with **cross-person consensus** – the percentage of participants who choose the consensual answer.

- However, it is also correlated with **within-person consistency** in responding to the same item across repetitions.

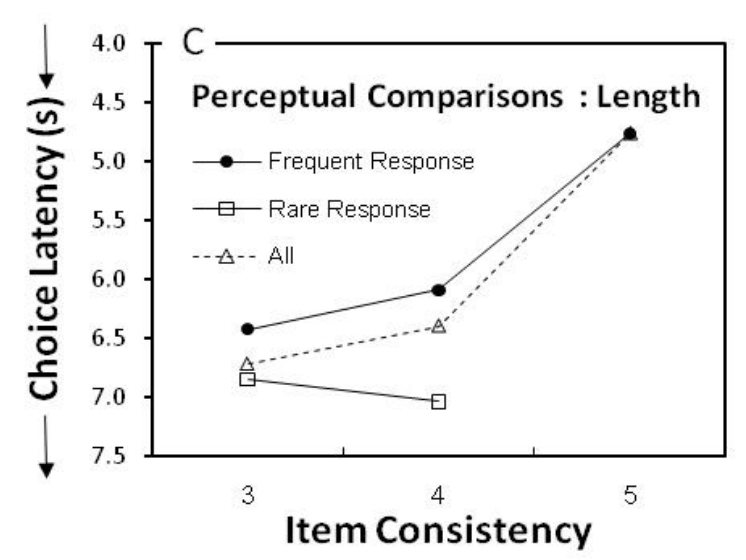
Consistency – Confidence

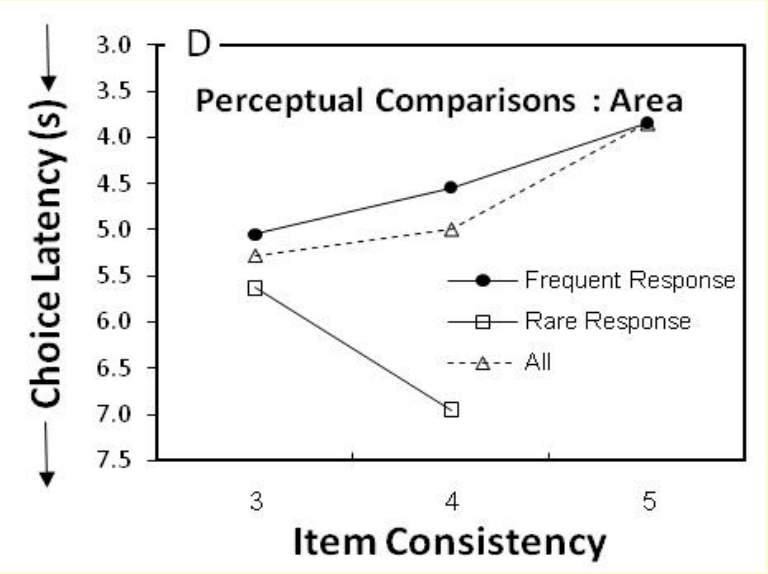
(Koriat & Adiv, 2011, 2012)

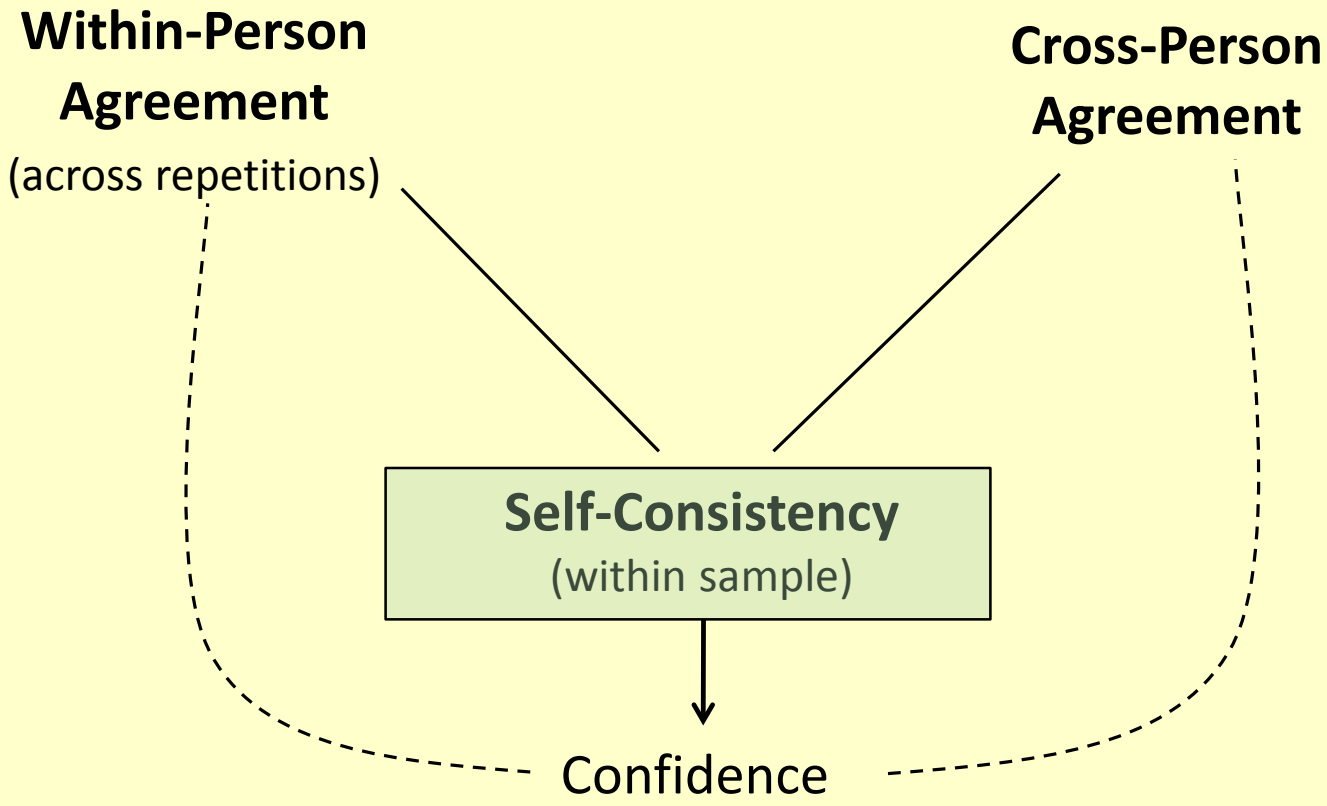


Consistency – Latency

(Koriat & Adiv, 2011, 2012)






Within-Person Agreement
(across repetitions)
Cross-Person Agreement
Self-Consistency
(within sample)
Confidence

Confidence and Consensus

2. Majority views are associated with higher confidence and shorter latency regardless of conformity pressures

The Effects of Group Pressure

- Extensive research in social psychology has documented dramatic effects of group consensus on the judgments of individual members.

- **Object-Level Response**

  Most studies of social influence focused on **object-level** responses:

  The tendency to make the same response as that of others.

- However, it was proposed that social influence is also reflected in subtle **meta-level indicators**:

  1. Response speed
  2. Confidence

Response Speed:
The Minority Slowness Effect (MSE)

Bassili (2003):

Bassili proposed that response speed reveals implicit, subtle effects of the influence of group pressure: Disagreement with the group causes hesitancy and inhibition in venturing a deviant opinion.

Indeed, in a series of studies, he found that people who hold a minority opinion express that opinion less quickly than those who hold the majority opinion.

Furthermore, the minority slowness effect increases with the size of the majority.

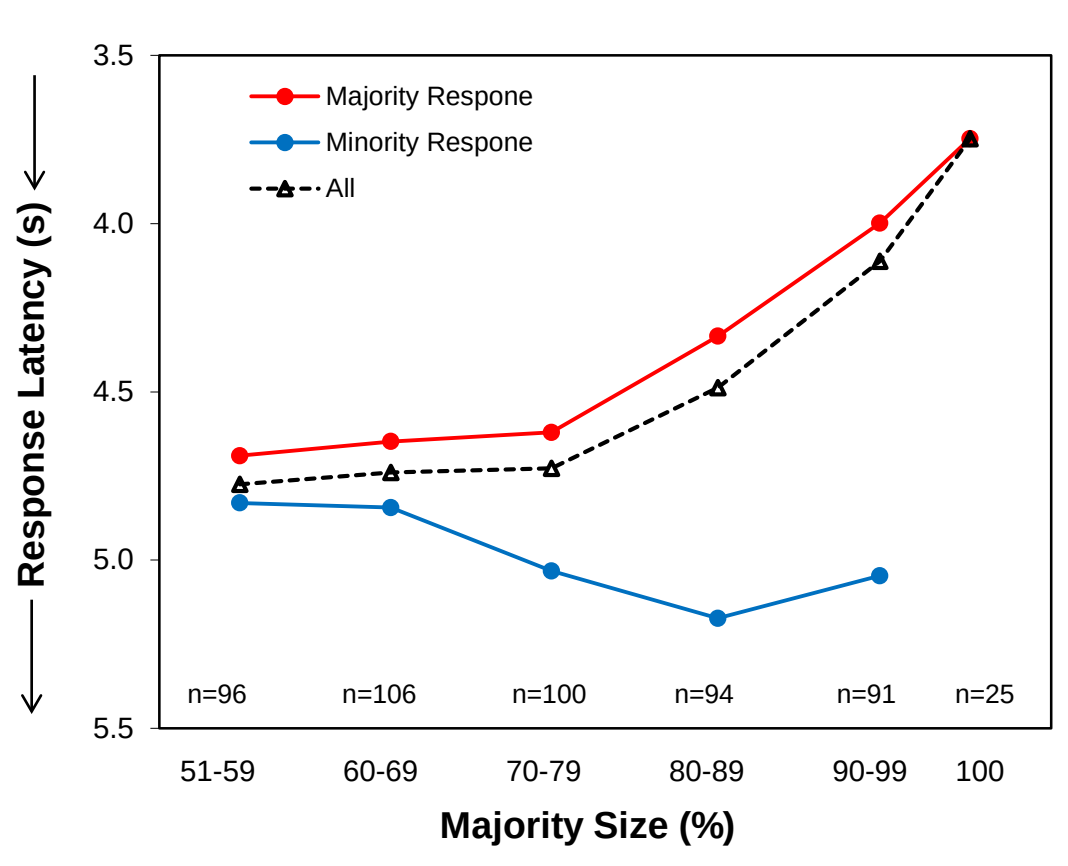
Behavioral Implications

Noelle-Neumann: **The spiral of silence**

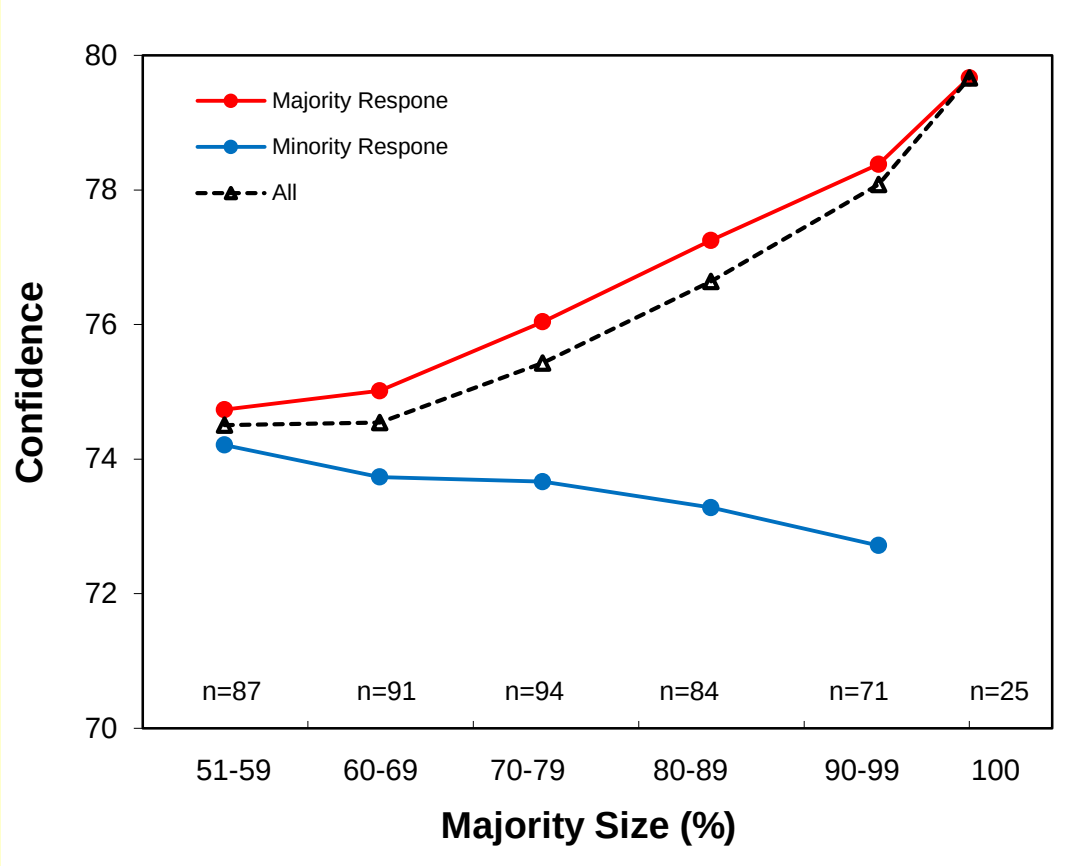
Individuals who perceive that they are in the minority feel pressure to remain silent.

The result: Convergence of public opinion on the commonly shared positions.

The Minority Slowness Effect Across 8 Studies



Majority-Minority Differences in Confidence Across 8 Studies



Our Proposal

- The PME in our results has nothing to do with conformity pressures, i.e., with the influence of the group on the responses of individuals.

- There exists an inherent link between social consensus, on the one hand, and confidence and fluency, on the other hand, independent of any social influence.

E-PME: Externally-driven PME that derives from group influence.

I-PME: A process-based, internally-driven PME

Derives from the processes by which participants form their confidence in their choice (Koriat, 2012a), independent of the causal influence of the group on its members.

Personality and Social Psychology Review

(in Press, appeared online)

Views that are Shared with Others are Expressed with Greater Confidence and Greater Fluency Independent of any Social Influence

Asher Koriat and Shiri Adiv

University of Haifa

Norbert Schwarz

University of Southern California

Socially-Neutral and Socially-Sensitive Tasks

4 socially neutral tasks

- General Knowledge
- Line lengths
- Area of geometric shapes
- Category membership judgments

3 socially-sensitive tasks

- Social beliefs
- Social attitudes
- Personal Preferences

The PME within individuals

Prediction of Others' Responses

The I-PME

1. **The I-PME mimics precisely the pattern of confidence and latency that is expected to ensue from conformity pressures.**
2. **It also has the same behavioral consequences as those of the E-PME:**

   Degree of confidence in one's beliefs affects the likelihood that participants will translate their beliefs into action (Gill et al., 1998; Koriat & Goldsmith, 1996).

   Similarly, response speed also predicts the likelihood of acting on one's attitudes (Bassili, 1995).

   Thus, the I-PME should lead to the same convergence on majority opinions as that expected to ensue from conformity pressures ("The spiral of silence").

Confidence and Consensus

3. Implications for group decisions

When Are Two Heads Better Than One and Why?

(Koriat, *Science* 2012**)**

Maximum Confidence Slating (MCS)

Maximum-Confidence Slating (MCS)

For each trial, the decision that is made with higher confidence by one member of the dyad is selected, circumventing dyadic interaction altogether.

HP **LP**

D-HC **D-LC**

When Are Two Heads Better Than One and Why?

	HP	LP	D-HC	D-LC
Study 1: Bahrami et al.				
Oddball Target	**67.82%**	**66.98%**	**69.88%**	**64.93%**
Study 2: Countries				
Area	**78.44%**	**77.93%**	**81.44%**	**74.93%**
Population	**79.67%**	**79.41%**	**81.96%**	**77.11 %**

Study 1: D-HC > HP, $t(18) = 6.69$, $p < .0001$

Study 2: **Area:** D-HC > HP, $t(29) = 5.93$, $p < .0001$

Population: D-HC > HP, $t(29) = 4.95$, $p < .0001$

When Are Two Heads Better Than One and Why?

		HP	LP	D-HC	D-LC
Study 3: Perceptual					
Lines	**CC**	**81.58%**	**80.59%**	**85.03%**	**77.14%**
	CW	**25.00%**	**26.31%**	**17.10%**	**34.21%**
Shapes	**CC**	**83.33%**	**84.58%**	**86.67%**	**81.25%**
	CW	**28.13%**	**24.06%**	**22.50%**	**29.69%**
Study 4: General Information					
	CC	**80.57%**	**79.71%**	**85.57%**	**74.71%**
	CW	**23.08%**	**22.69%**	**19.23%**	**26.53%**

Individuals vs. Dyadic Decisions:

In vivo

Questions

1. **Can MCS explain the accuracy performance of empirical groups for CC item?**

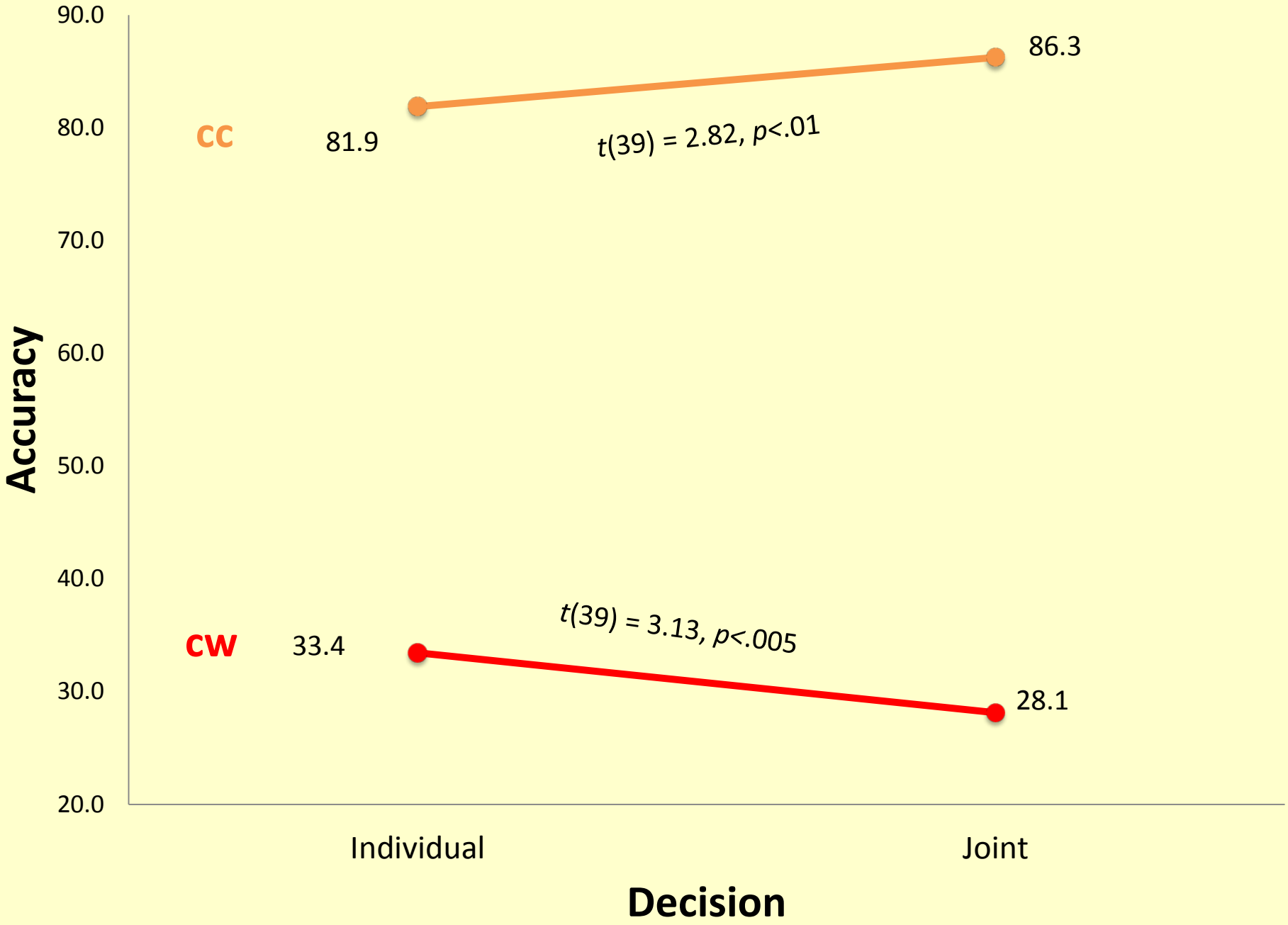
1. **Would group deliberation help <u>mitigate</u> the fallible performance for CW items, or would it <u>amplify</u> error?**

Experiment 1

Participants: 80 college students
(40 dyads)

Materials: Comparing line lengths
8 CC items and 8 CW items

Procedure: For each item:
Individual decision + confidence
Dyadic Decision + confidence

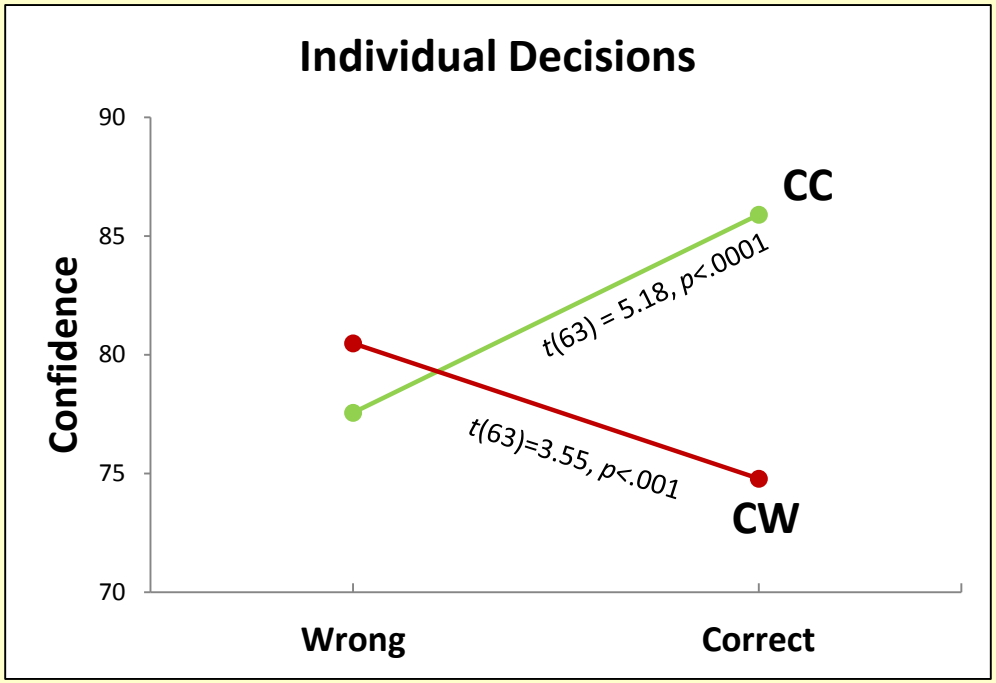

90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
Accuracy
CC
81.9
86.3
t(39) = 2.82, p<.01
CW
33.4
28.1
t(39) = 3.13, p<.005
Individual
Joint
Decision

What happened to confidence?

For CC items, dyadic interaction improved accuracy and also enhanced confidence.

For CW items, in contrast, **it impaired accuracy while enhancing confidence**.

The consensuality pattern



In sum

1. Group deliberation had an added effect over confidence-based judgments, possibly due to the exchange of arguments within a dyad.
2. But both confidence slating and group deliberation affected performance in the same direction, improving accuracy when individual accuracy was better than chance, but impairing it when individual accuracy was below chance.

Thank you!

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