Confidence in the Aggregated Opinions of Multiple Correlated Sources

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Publications

The Situation Being Modeled in the Present Studies

- A single DM aggregates probabilistic forecasts from multiple judges regarding the probability of occurrence of unique events.
- The cues are symmetric: they are equally diagnostic of the occurrence of the target event.
- The judges operate individually and independently: they do not communicate and are not aware of the existence (and the opinions) of the other judges.
- The DM does not have a prior opinion about the target event.
- The judges and the DM are properly motivated to maximize accuracy of the forecasts.
- The judges may be asymmetric:
  - They may have access to different amounts of (not necessarily distinct) relevant and informative cues.
  - They may vary in individuating features such as qualifications, expertise, experience, reliability, validity, accuracy, etc.

We study the cases of symmetric and asymmetric judges separately.
The Present Studies

- We assume that under these circumstances the DM is combining the various opinions by taking a weighted average, and the weights are proportional to the asymmetry factors.
- We are primarily interested in the confidence associated with this aggregation process and its determinants.
- We present a mathematical model of the DM's confidence and report several experiments testing some of its predictions.
- More specifically, we examine the DMs’ expressed confidence in aggregated opinions as a function of several factors:
  - The total number of cues (amount of information)
  - The distribution of information (cues) across judges
  - The total number of judges
  - The structural overlap among judges
  - The perceived agreement between the judges' opinions
  - The mean probability of the target event
  - The number of judges
Setup and Some Notation

- $J$ judges
- $N$ distinct cues
- Symmetry in the environment: The $N$ cues are equally reliable and diagnostic
- The cues are positively correlated: The average inter-cue correlation is $\rho$
- Overlap in information: Let $n_{jj'}$ (where, $0 \leq n_{jj'} \leq \min(n_j, n_{j'})$) be the number of common cues seen by a pair of judges ($j$ and $j'$)

- Possible sources of asymmetry among judges:
  * The $J$ judges are not equally qualified and/or accurate
  * The $j$'th judge has access to $n_j$ cues ($1 < n_j \leq N$)

- The DM has no direct access to the cues and relies, exclusively, on the judges' opinions. These are presented in the form of the subjective probabilities, $X_1, X_2, \ldots X_J$, that a target event is true (or will occur).
The Model's Assumptions

- The opinions of the judges are aggregated by a weighted average
- The DM’s confidence in the aggregate is a monotonic function of his/her perception of the “variance” associated with a given aggregate:

  \textit{The lower (higher) the variance, the higher (lower) the confidence}

The same factors that increase (reduce) the variance of the estimate should reduce (increase) the DM’s confidence
DM’s Intuitive Model of the Judge

Judge $j$ sees cue $i$, and forms an impression, $x_{ij}$, that consists of the “true” $\pi_i$, perturbed by a random component, $e_{ij}$

$$x_{ij} = \pi_i + e_{ij}$$

Assume:

$E(e_{ij})=0$; $\text{Var}(e_{ij})=\sigma^2$ (All judges are equally accurate)
Errors are uncorrelated across judges and across cues
The cues are equally valid ($\pi$) and are correlated ($\rho$)

The judge's final forecast, $X_j$, as communicated to the DM is the average of all the cue-specific internal judgments of that advisor:

$$X_j = \frac{1}{n_j} \sum_{i=1}^{n_j} X_{ij} = \frac{1}{n_j} \sum_{i=1}^{n_j} (\pi_i + e_{ij})$$
DM’s Intuitive Model of the Judge (cont.)

It is possible to derive the variance of this quantity for any advisor, $\sigma_{x_j}^2$, as well as the co-variance between any pair of advisors, $\sigma_{x_jx_j'}$:

$$\sigma_{x_j}^2 = \{\sigma^2 + [1 + (n_j - 1) \rho] \sigma_\pi^2\} / n_j,$$

$$\sigma_{x_jx_j'} = \{[n_{jj'} + (n_j n_{j'} - n_{jj'}) \rho] \sigma_\pi^2\} / n_j n_{j'}.$$
DM’s Aggregation Process

DMs use a mean model, given by:

$$\overline{P} = \frac{\sum_{j=1}^{J} n_j X_j}{\sum_{j=1}^{J} n_j}$$

Its expected variance (across all possible patterns of overlap) is given by:

$$E\{\sigma_P^2\} = \frac{\sigma^2}{T} + \frac{\sigma^2}{NT} \{N(1 - \rho) + T[1 + [N - 1]\rho]\} - \frac{\sigma^2}{NT^2} \sum_{j=1}^{J} n_j^2$$

(T is the total number of cues seen by the J judges)
Some Special Cases

* Judges are symmetric:*

Let \( n_j = n = gN \) (where \( 0 < g \leq 1 \)), and let \( n_{jj'} = n^* = fn = gfN \) (where \( 0 \leq f \leq 1 \)). Then:

\[
\sigma_p^2 = \frac{1}{nJ} \left[ \sigma^2 + \sigma_{\pi} \{1 + (J-1)f + (nJ-1)\rho - (J-1)f\rho\} \right]
\]

* Cues are uncorrelated (\( \rho = 0 \)):*

\[
E\{\sigma_p^2\} = \frac{\sigma^2}{T} + \frac{\sigma_{\pi}^2}{NT}[N+T] - \frac{\sigma_{\pi}^2(1-\rho)}{NT^2} \sum_{j=1}^{J} n_j^2
\]
Structural Overlap

We distinguish between three qualitatively different levels:

(a) *Complementarity:* the cues are distributed among the judges with no overlap in information. In this case, $\Sigma n_j = N$.

(b) *Redundancy:* each judge has access to all the cues. In this case, $\Sigma n_j = JN$.

(c) *Partial overlap:* some cues are seen by more than one (but not by all) judges. In this case $N < T = \Sigma n_j < JN$.

Note: Structural overlap describes the joint (interactive) effects of level of individual information, and pair-wise overlap among judges.
Expert # | Info n_j | Cues 1 .. N | Judgment p_j | DM Aggregate

1   | n_1   | * *   | p_1   | P
2   | n_2   | * *   | p_2   |
.   | .     | *     | .     |
.   | .     | * *   | .     |
.   | .     | * *   | .     |
J   | n_j   | * *   | .     |

* *
Some Special Cases

*Complementarity: T=N:*

\[ \sigma^2_P = \frac{\sigma^2}{N} + \frac{\sigma^2_\pi}{N^2} \{N(1 - \rho) + T[1 + [N - 1]\rho]\} - \frac{\sigma^2_\pi(1 - \rho)}{N^3} \sum_{j=1}^{J} n_j^2 \]

*Redundancy: T=JN:*

\[ \sigma^2_P = \frac{\sigma^2}{JN} + \frac{\sigma^2_\pi}{JN^2} \{N(1 - \rho) + T[1 + [N - 1]\rho]\} - \frac{\sigma^2_\pi(1 - \rho)}{NJ} \]
The Experiments

- Large samples of undergraduate students are presented with questionnaires describing a variety of aggregation problems in a well-defined context (medical, business, etc.).

- Subjects were run in small (5-20) groups.

- They are paid according to performance to induce and reinforce truthful responding.

- *Two Dependent Variables:*
  - Aggregate Probability (0 - 100)
  - Confidence Ratings (1 - 7)
  (Standardized within-subject for most analyses)
**Sample Question (Medical Scenario)**

In this case, 3 different doctors will be giving you their probability estimates (on a 0-100 scale), in light of the evidence available to them, that the patient has a given condition. There were 18 pieces of information available overall. **Each of the 3 doctors saw different pieces of information.**

<table>
<thead>
<tr>
<th>Source</th>
<th>Information Pieces</th>
<th>Estimate (0-100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor 1</td>
<td>6</td>
<td>19%</td>
</tr>
<tr>
<td>Doctor 2</td>
<td>6</td>
<td>32%</td>
</tr>
<tr>
<td>Doctor 3</td>
<td>6</td>
<td>39%</td>
</tr>
</tbody>
</table>

Total Information: 18

Based on this information, what is your best estimate of the probability that this patient has the condition (on a 0-100 scale)?

How confident are you in this estimate?

Not at all 1 2 3 4 5 6 7 Very
Predicted Changes in Confidence for the *Symmetric* Case

<table>
<thead>
<tr>
<th>Factor Increased</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Cues (N&gt;1)</td>
<td>Increases</td>
</tr>
<tr>
<td>No. of Judges (J&gt;1)</td>
<td>Increases</td>
</tr>
<tr>
<td>Fraction of the Cues Shown to Judge (g&gt;0)</td>
<td>Increases</td>
</tr>
<tr>
<td>Inaccuracy of Judges ($\sigma^2$)</td>
<td>Decreases</td>
</tr>
<tr>
<td>Unpredictability of the Event ($\sigma^2_\pi$)</td>
<td>Decreases</td>
</tr>
<tr>
<td>Inter-Cue Correlation ($\rho&gt;0$)</td>
<td>Decreases</td>
</tr>
<tr>
<td>Number of Common Cues to Each Pair of Judges (f&gt;0)</td>
<td>Decreases</td>
</tr>
<tr>
<td>Structural Overlap (f and g)</td>
<td>Increases</td>
</tr>
</tbody>
</table>
Experiment 1

*Subjects:* 88 undergraduate UIUC students

*Stimuli:* 36 aggregation problems

*Independent variables:*
Between-Subjects: 4 scenarios (medical, investment, weather, AI)

Within-Subjects: \( N = 6, 12 \)
\( J = 2, 3, 6 \)
Mean Probability = 0.25, 0.50, 0.75
Overlap = Independence, Redundancy

* Four random orders of the 36 scenarios;
* Forecasts for the various mean probabilities were matched (linear transformation)
Experiment 2

Subjects: 73 (primarily undergraduate) UIUC students

Stimuli: 72 aggregation problems

Independent variables (Within-Subjects):
N = 4, 8; J = 2, 4
Mean Probability = 0.30, 0.70
Range of judgments = 0.10, 0.20, 0.40
Overlap = Complementary, Partial, Redundant

Partial Overlap: Each of the J(J-1)/2 distinct pairs of judges saw N/2 common cues.

* Single (medical) scenario;
* Two random orders of the 72 scenarios;
* Forecasts for the two mean probabilities were matched (linear transformation)
Subjects' responses are consistent with simple averaging

Study 2

Mean Probabilities = 30, 70
Standardized Confidence Ratings (Exp. 2)
Marginal Effects

1. Confidence increases (slightly) as number of judges increases Consistent with expectations

<table>
<thead>
<tr>
<th>J</th>
<th>Mean C(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-.043 (.017)</td>
</tr>
<tr>
<td>4</td>
<td>.043 (.017)</td>
</tr>
</tbody>
</table>

2. Confidence increases as level of structural overlap increases Consistent with expectations

<table>
<thead>
<tr>
<th>Overlap</th>
<th>Mean C(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complementarity</td>
<td>-.270 (.044)</td>
</tr>
<tr>
<td>Partial</td>
<td>-.206 (.027)</td>
</tr>
<tr>
<td>Redundancy</td>
<td>.476 (.042)</td>
</tr>
</tbody>
</table>

3. Confidence increases (slightly) as N, the number of distinct cues, increases Consistent with expectations

<table>
<thead>
<tr>
<th>N</th>
<th>Mean C(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>-.029 (.013)</td>
</tr>
<tr>
<td>8</td>
<td>.029 (.013)</td>
</tr>
</tbody>
</table>
Standardized Confidence Ratings (Exp. 2)  
Marginal Effects

4. Confidence increases as a function of mean probability *Contrary to expectations*  

<table>
<thead>
<tr>
<th>Mean P</th>
<th>Mean C(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.30</td>
<td>-.101 (.016)</td>
</tr>
<tr>
<td>.70</td>
<td>.101 (.016)</td>
</tr>
</tbody>
</table>

5. Confidence increases as consensus among judges increases *Consistent with expectations*  

<table>
<thead>
<tr>
<th>Range of J probabilities</th>
<th>Mean C(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10</td>
<td>.285 (.030)</td>
</tr>
<tr>
<td>0.20</td>
<td>.027 (.019)</td>
</tr>
<tr>
<td>0.40</td>
<td>-.312 (.037)</td>
</tr>
</tbody>
</table>
Study 2 Confidence

Overlap x Cues (N) x Judges (J)

Condition
- N = 8, J = 4
- N = 8, J = 2
- N = 4, J = 4
- N = 4, J = 2

Structural Overlap

Mean Z-Confidence
Study 2 Confidence

Overlap x Range

Mean Z-Confidence

-1.0
-0.8
-0.6
-0.4
-0.2
0.0
0.2
0.4
0.6
0.8
1.0

Range

Low
Medium
High

Structural Overlap

Complmen.
Partial
Redundant
Summary of Results for the Symmetric Case

- The subjects aggregated the judges' opinions by, simply, averaging them.
- Confidence judgments depend on the DMs' intuitive theories about the decision task, the judges, the evidence and the various interactions between these components.
- These judgments are sensitive (at various degrees) to all the (normatively) relevant factors. In most cases were affected by these factors in the anticipated direction:
  - Higher confidence when forecasts tend to agree
  - Higher confidence for more judges
  - Higher confidence for more cues
  - Conf.(Redund) > Conf.(Overlap) > Conf.(Compl)
- In some cases where these factors conveyed mixed signals, the subjects reported considerably lower levels of confidence:
- Such inconsistent patterns (high disagreement between judges who saw large amounts of common information) "signal" to the DMs that the evidence is ambiguous, inconclusive or unreliable. This is the most likely source of the "anomaly" of high disagreement.
**Predicted Changes in Confidence for the Asymmetric Case**

<table>
<thead>
<tr>
<th>Factor Increased</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Cues ((N&gt;1))</td>
<td>Increases</td>
</tr>
<tr>
<td>Number of Judges ((J&gt;1))</td>
<td>Increases</td>
</tr>
<tr>
<td>Asymmetry Among Judges</td>
<td>Increases</td>
</tr>
<tr>
<td>Inaccuracy of Judges (\sigma^2)</td>
<td>Decreases</td>
</tr>
<tr>
<td>Unpredictability of the Event (\sigma^2_{\pi})</td>
<td>Decreases</td>
</tr>
<tr>
<td>Inter-Cue Correlation (\rho&gt;0)</td>
<td>Decreases</td>
</tr>
<tr>
<td>Overlap in Cues Presented</td>
<td>Decreases</td>
</tr>
<tr>
<td>Structural Overlap</td>
<td>Increases</td>
</tr>
</tbody>
</table>
Experiment 3

We investigate the effects of asymmetry in information (number of cues) among judges on the aggregators (DMs).

As assumed in our model, we expect the final aggregate to be a weighted average of the forecasts, where the weights are proportional to the number of cues on which the forecasts are based.

As predicted by our model we expect the DMs' confidence to be higher when:
- the inter-judges agreement is higher
- the structural overlap among judges is higher, and
- the distribution of cues among judges is asymmetric

As predicted by our model we expect the DMs' confidence to be invariant under:
- various scenarios, and
- different levels of (mean) forecasts
Experiment 3

*Subjects:* 81 undergraduate UIUC students  
*Stimuli:* 104 aggregation scenarios (based on N = 18, J = 3)

*Independent variables:*
- Between-Subjects: 2 scenarios (medical, investment) in two random orders
- Within-Subjects:  
  Unweighted Mean of Forecasts = 0.30, 0.70  
  Range of forecasts = 0.20, 0.40  
  Structural Overlap = Complementarity, Partial Overlap  
  Asymmetry = Max(no of cues) / Min(no. of cues) = 1,2,3  
  Number of cues leading to the Lowest, Median and Highest Estimate: (HML, HLM, MHL, MLH, LHM, LMH).

- Forecasts for the various mean probabilities were matched (linear transformation)
Rank order of four aggregation models for each subject (across 104 judgements). The weighted mean is the best fitting model for most subjects, and on the average (MAD=8.50).
### Mean Responses and Standardized Confidence as a Function of Pattern (Exp. 3)

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Max(n) / Min(n)</th>
<th>Stimuli</th>
<th>Response</th>
<th>Standardized Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>W. Mean</td>
<td>Mean</td>
<td>SE</td>
</tr>
<tr>
<td>HML</td>
<td>3</td>
<td>45.00</td>
<td>42.06</td>
<td>0.82</td>
</tr>
<tr>
<td>HML</td>
<td>2</td>
<td>46.67</td>
<td>44.47</td>
<td>1.01</td>
</tr>
<tr>
<td>HLM</td>
<td>3</td>
<td>46.88</td>
<td>43.72</td>
<td>0.80</td>
</tr>
<tr>
<td>HLM</td>
<td>2</td>
<td>47.92</td>
<td>44.80</td>
<td>0.86</td>
</tr>
<tr>
<td>MLH</td>
<td>3</td>
<td>48.13</td>
<td>48.95</td>
<td>0.60</td>
</tr>
<tr>
<td>MHL</td>
<td>2</td>
<td>48.75</td>
<td>50.11</td>
<td>0.73</td>
</tr>
<tr>
<td>MMM</td>
<td>1</td>
<td>50.00</td>
<td>51.02</td>
<td>0.68</td>
</tr>
<tr>
<td>MLH</td>
<td>2</td>
<td>51.25</td>
<td>53.49</td>
<td>0.81</td>
</tr>
<tr>
<td>MHL</td>
<td>3</td>
<td>51.88</td>
<td>56.09</td>
<td>0.71</td>
</tr>
<tr>
<td>LHM</td>
<td>2</td>
<td>52.08</td>
<td>52.64</td>
<td>0.74</td>
</tr>
<tr>
<td>LHM</td>
<td>3</td>
<td>53.13</td>
<td>52.68</td>
<td>0.65</td>
</tr>
<tr>
<td>LMH</td>
<td>2</td>
<td>53.33</td>
<td>58.36</td>
<td>0.88</td>
</tr>
<tr>
<td>LMH</td>
<td>3</td>
<td>55.00</td>
<td>59.04</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Note: The letters indicate number of cues associated with the smallest, median and highest estimate, respectively.

**Correlations:** Stimuli and Estimate = 0.95; Estimates and Confidence = 0.56.
Standardized Confidence Ratings (Exp. 3)
Marginal Effects

Confidence *higher in the partial overlap case* (*Consistent with expectations*)

- **Complementarity**  - .16 (.04)
- **Partial Overlap**  .15 (.04)

Confidence *higher when judges are in higher agreement* (*Consistent with expectations*):

- **Low agreement**  - .06 (.03)
- **High agreement**  .06 (.04)

Confidence *peaks under asymmetric distribution of cues* (*Consistent with expectations*)

- **Symmetry (ratio=1)**  -0.00 (.07)
- **Asymmetry (Rattio=3)**  0.12 (.03)
Standardized Confidence Ratings (Exp. 3)  
Marginal Effects

Confidence is invariant across the two scenarios (Consistent with expectations)

Confidence increases as a function of mean probability (Contrary to expectations):
Mean = .30  -.09 (.03)
Mean = .70  .08 (.03)

Mean within-subject correlation (Estimate & Confidence) = 0.14 (82% > 0).
Standardized Confidence as a Function of the Mean Forecast, Overlap and Asymmetry in Information
Summary of Experiment 3

- Subjects aggregated the judges' opinions by taking a weighted average and displayed a good deal of sensitivity to the differential amount of information available to judges.

- Most of the model's predictions regarding confidence in the aggregate were supported.

- Most impressive is the predicted, yet counterintuitive, effect of asymmetry of information on confidence.

- Confidence was, unexpectedly, related to the mean of the probability distribution of the J opinions. Everything else being equal, subjects were more confident in aggregating higher probabilities:
Experiment 4

We investigate the joint effects of two sources of asymmetry among judges: Amount of information (number of cues), and Record of past performance (level of accuracy)

As assumed in our model, we expect the final aggregate to be a weighted average of the forecasts. In this case the weights could be proportional to (a) the number of cues, (b) level of accuracy, or (c) a combination of the two.

As predicted by our model we expect the DMs' confidence to be higher when:
• the structural overlap among judges is higher,
• the judges are more accurate, and
• the distribution of cues among judges is asymmetric

As predicted by our model we expect the DMs' confidence to be invariant under various scenarios.
Experiment 4

Subjects: 74 undergraduate UIUC students

Stimuli: 96 aggregation scenarios
(based on N = 18, J = 3, Mean forecast = 0.60, Range of forecasts ≈ 0.30).

Independent variables:
• Between-Subjects: 2 scenarios (medical, investment) in two random orders
• Within-Subjects:
  Structural Overlap = Complementarity, Partial Overlap
  Distribution of cues = Symmetric, Asymmetric \{\text{Max}(n_j) / \text{Min}(n_j)\} = 3
  Accuracy = Each judge has a record of
    Low (≈ 55%), Medium (≈70%) or High (≈85%) Accuracy
  Four types of triples were used: HHH, LLL, LMH and HML.
Number of cues leading to the Lowest, Median and Highest Estimate:
  HML, HLM, MHL, MLH, LHM, LMH.
Results (Exp. 4): Modeling the responses

Rank order of seven aggregation models for each subject (across 96 judgements). The combined weighted mean (by no. of cues X accuracy rank) is the best fitting model for most subjects, and on the average (MAD=5.80).
Standardized Confidence Ratings  (Exp. 4)
Marginal Effects

Confidence higher in the partial overlap case (Consistent with expectations)
Complementarity - .12 (.03)
Partial Overlap .18 (.03)

Confidence higher with more accurate judges (Consistent with expectations)
LLL - .51 (.04)
LMH + HML -.18 (.04)
HHH .50 (.04)

Confidence not affected by distribution of cues (Contrary to expectations)
Symmetry -.04 (.06)
Asymmetry .05 (.05)

Confidence higher in the Medical scenario (Contrary to expectations)
Medical .06 (.03)
Business -.00 (.03)
Mean Standardized Confidence as a Function of Overlap and Distribution of Cues (Exp. 4)
Mean Standardized Confidence as a Function of Overlap, Accuracy and Distribution of Cues (Exp. 4)
Summary of Experiment 4

- Subjects aggregated the judges' opinions by taking a weighted average and displayed a good deal of sensitivity to both sources of asymmetry (a) the differential amount of information available to judges, and (b) the judges' previous accuracy.

- Most of the model's predictions regarding confidence in the aggregate were supported.

- The predicted effect of asymmetry of information on confidence was not significant, but in all the interactions the rate of increase in confidence was higher when the information was distributed unevenly across judges.
Conclusions and Practical Implications

- Subjects aggregate opinions by averaging them.
- When valid individuating information is available, subjects weight the judges’ opinions accordingly (also, Harvey & Fischer, 1997; Fischer & Harvey, 1999), and display a good deal of sensitivity to
  (a) the differential amount of information available to judges, and
  (b) the judges' previous accuracy.

- Confidence judgments depend on the DMs' intuitive theories and relevant cues about the task, the environment and the judges (also, Sniezek & Buckley, 1995; Sniezek & Van Swol, 2001). They are sensitive to the relevant factors, in a fashion consistent with the model’s predictions:
  - Higher confidence when forecasts tend to agree
  - Higher confidence when there are more judges
  - Higher confidence when there is more information (more cues)
  - Higher confidence for asymmetric distribution of information
  - Higher confidence at higher levels of shared information.
Conclusions and Practical Implications

• The subjects’ confidence peaks when these factors are consistent

• When these factors convey contradictory information (e.g. high disagreement between judges who saw large amounts of common information), the subjects report considerably lower confidence. Such inconsistent patterns may "signal" that the evidence is ambiguous, inconclusive or unreliable.

Q: How can we increase the DM’s confidence in (and willingness to act upon) the advice of his/her advisors?

A: Confidence peaks if:
   (1) The advice relies on many cues,
   (2) The judges are perceived as being accurate (and in agreement)
   (3) Evidence is distributed unevenly and/or shared by all advisors
Future Directions

- Examine the aggregation process in cases where the DM can choose their advisors
- Examine the aggregation process in cases where the DM can choose among groups of advisors with distinct patterns of information
- Examine the aggregation process in "real-time" decision situations involving "real" (not hypothetical) judges
- Use these situations to study the joint effects of structural overlap and inter-cue correlations on the DM's confidence
- Examine the (joint) effects of other sources of inter-judge asymmetry
Future Directions

• There is a close correspondence between the factors that determine the quality of the mechanical averaging of probabilities (see Wallsten et al. 1997; Ariely et al., 2000) forecasts, and some of the factors that affect the subjects’ confidence in the aggregated forecast
  • Both confidence and expected quality improve as a function of the number of judges
  • Confidence and diagnostic value of unique events improve when information is distributed unevenly among judges (increasing the likelihood of lower inter-judge dependence)
  • Confidence and accuracy improve more judges share the same information (reducing the effect of the individual random components)

We plan to study this parallelism and hope to establish that subjects’ judgments are sensitive to the distinction between cases where the judges share information and those where they poses unique cues.