Evidence-based Decision Making: Session 4

Rui Mata, FS 2022

Session information

Sessions take place Tuesdays, 16.15-17.45. Currently, the course is planned to be held in person but a change to an online format is possible depending on the current epidemiological situation.

#	Date	Topic	Slides
1	22.02.2022	The Scientific Method(s)	pdf
2	01.03.2022	Algorithms	pdf
3	22.03.2022	Algorithms	pdf
4	29.03.2022	Consensus	pdf
5	05.04.2022	Consensus	pdf
6	12.04.2022	Counterfactuals	pdf
7	19.04.2022	Counterfactuals	pdf
8	26.04.2022	Synthesis	pdf
9	03.05.2022	Synthesis	pdf
10	10.05.2022	Interventions	pdf
11	17.05.2022	Interventions	pdf
12	24.05.2022	Exam	

“If research in psychology had a Dr. Jekyll and Mr. Hyde Award, it would go to—drum roll, please—the group as a decision-making instrument. Since the late 19th century, the group (also known as jury, team, crowd, and swarm) has been deplored as a source of intellectual inferiority (1) and disastrous policy decisions (2) and hailed as a source of near-magical creativity (3) and unparalleled wisdom and forecast accuracy (4, 5). Some of these attributions have proved to be unfounded. For instance, with respect to creative potential, groups that engage in brainstorming lag hopelessly behind the same number of individuals working alone (6). The key to benefiting from other minds is to know when to rely on the group and when to walk alone.”

Hertwig, R. (2012). Tapping into the Wisdom of the Crowd—With Confidence. *Science*, *336*(6079), 303–304. https://doi.org/10.1126/science.1221403

Goals

Understand that group processes can range from very complex (processes requiring intensive communication and deliberation) to simple (members never communicate)

Understand that groups can sometimes (but not always) outperform individual decision makers

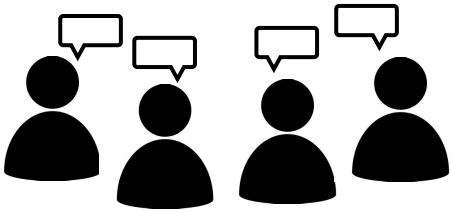
Understand the advantages of group decision making can be understood via (simple) principles (aggregation)

From Individuals to Groups

Individual level

The cognitive process of a single individual guides the decision

Deliberative group



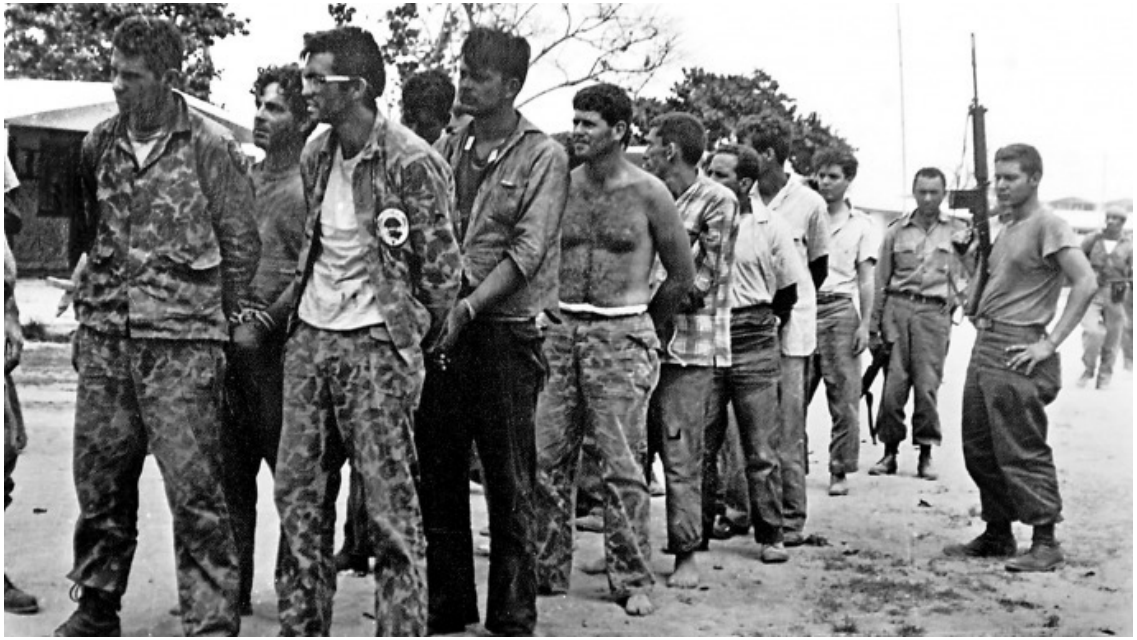
A group process determines the outcome, and individual decisions are dependent on the actions of other group members

Staticized group

A group process determines the outcome, but individual decisions are not dependent on group activity


WE NEED MORE DISSENTING OPINIONS.
ABSOLUTELY, SIR
WE AGREE 100%
Carol Simpson ©2004

Groupthink



The Bay of Pigs Invasion was a failed attempt to invade Cuba by a brigade of former Cuban military officers backed by the Central Intelligence Agency (CIA)

"[At] each meeting, instead of opening up the agenda to permit a full airing of the opposing considerations, he allowed the CIA representatives to dominate the entire discussion. The president permitted them to refute immediately each tentative doubt that one of the others might express, instead of asking whether anyone else had the same doubt or wanted to pursue the implications of the new worrisome issue that had been raised"

Janis, I. L. (1971). Groupthink. ***Psychology Today***.

Groupthink

In order to make groupthink testable, Irving Janis devised eight symptoms that are indicative of groupthink.

1. Illusions of invulnerability creating excessive optimism and encouraging risk taking.
2. Rationalising warnings that might challenge the group's assumptions.
3. Unquestioned belief in the morality of the group, causing members to ignore the consequences of their actions.
4. Stereotyping those who are opposed to the group as weak, evil or stupid.
5. Direct pressure to conform placed on any member who questions the group, couched in terms of "disloyalty".
6. Self censorship of ideas that deviate from the apparent group consensus.
7. Illusions of unanimity among group members, silence is viewed as agreement.
8. Mindguards — self-appointed members who shield the group from dissenting information.

Janis, I L. & Mann, L. (1977). *Decision making: A psychological analysis of conflict, choice, and commitment*. New York: Free Press.

Hidden Profile

Hidden profile refers to a paradigm in group decision making that shows some limitations of group decisions. The paradigm involves a situation in which part of some information is shared among group members, whereas other information is unshared (e.g., information known to only one member prior to discussion). Typically, shared information and unshared information lead to different decisions, and the alternative implied by the unshared information is the correct one given all information available to the group. Most often, groups cannot pick this best solution, suggesting that group discussion does not provide a good way to make decisions!

Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision making: Biased information sampling during discussion. ***Journal of Personality and Social Psychology, 48***(6), 1467-1478.

Hidden Profile: The Seminal Paper

Decision-making groups can potentially benefit from pooling members' information, particularly when members individually have partial and biased information but collectively can compose an unbiased characterization of the decision alternatives. The proposed biased sampling model of group discussion, however, suggests that group members often fail to effectively pool their information because discussion tends to be dominated by (a) information that members hold in common before discussion and (b) information that supports members' existent preferences. In a political caucus simulation, group members individually read candidate descriptions that contained partial information biased against the most favorable candidate and then discussed the candidates as a group. Even though groups could have produced unbiased composites of the candidates through discussion, they decided in favor of the candidate initially preferred by a plurality rather than the most favorable candidate. Group members' pre- and postdiscussion recall of candidate attributes indicated that discussion tended to perpetuate, not to correct, members' distorted pictures of the candidates.

Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision making: Biased information sampling during discussion. *Journal of Personality and Social Psychology, 48*(6), 1467-1478.

Hidden Profile: The Seminal Paper

Case 4: Severely biased distribution

Pro-A			
Shared	a_1	a_1	a_1
Unshared	a_2, a_3	a_4, a_5	a_6, a_7
Pro-B[a]	b_1, b_2, b_3, b_4	b_1, b_2, b_3, b_4	b_1, b_2, b_3, b_4

	Mary	Joan
a1, b1: Hard working	✓	✓
a2, b2: Motivated	✓	✓
a3, b3: Conscientious	✓	✓
a4, b4: Nice	✓	✓
a5: Modest	✓	
a6: Autonomous	✓	
a7: Attentive	✓	
TOTAL	7	4

Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision making: Biased information sampling during discussion. *Journal of Personality and Social Psychology, 48*(6), 1467-1478.

Hidden Profile: Meta-analyses

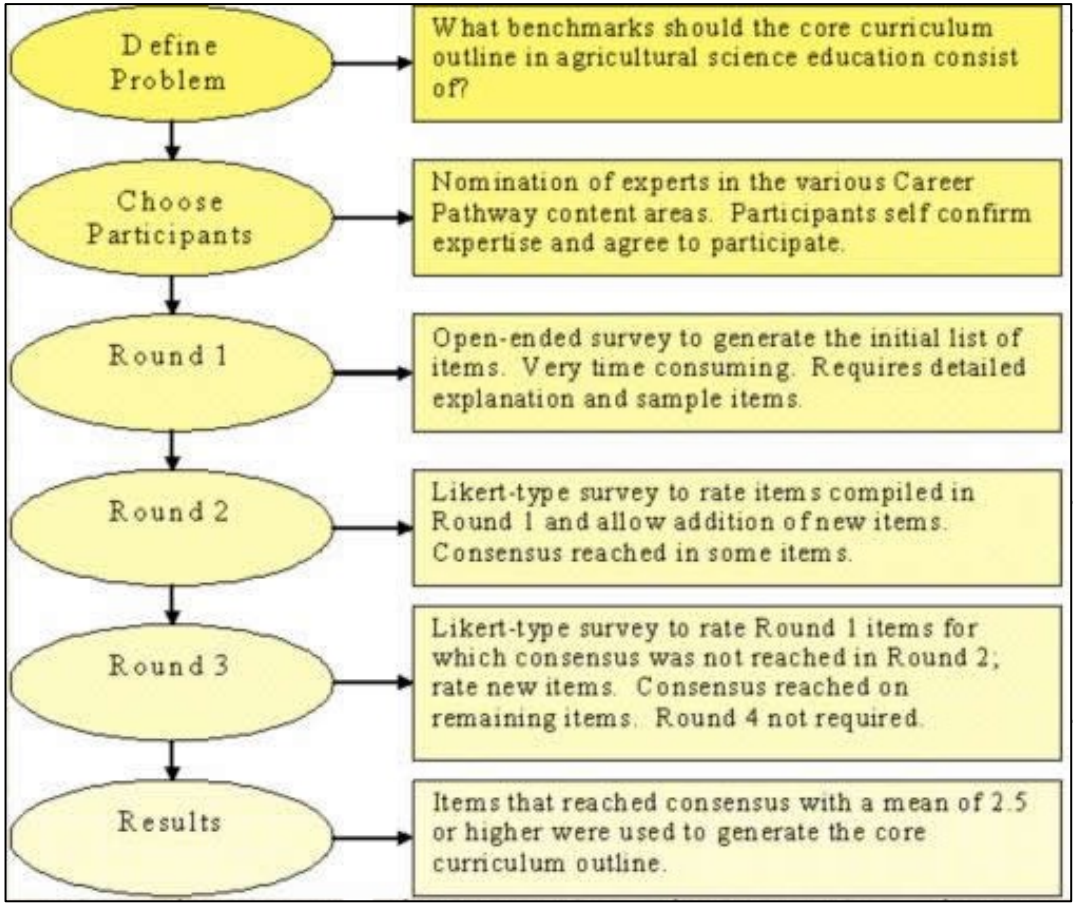
Summary	Reference
Most complete meta-analysis on hidden profile to date (k = 101). A few results: About 2 SDs more of common information is shared relative to unique information; b) hidden profile groups are 8 times less likely to find the solution relative to groups that share all the information.	Lu, L., Yuan, Y. C., & McLeod, P. L. (2012). Twenty-Five Years of Hidden Profiles in Group Decision Making. ***Personality and Social Psychology Review***, ***16***(1), 54–75.
Focus on information sharing (k = 23). Intellective tasks (i.e., with a demonstrably correct criterion) with hidden-profiles show higher correlation between information sharing and team performance, r = .46, relative to non hidden-profile tasks, r = .34 (this is not the case in non-intellective tasks, .32 vs. .30).	Mesmer-Magnus, J. R., & DeChurch, L. A. (2009). Information sharing and team performance: A meta-analysis. ***Journal of Applied Psychology***, ***94***(2), 535–546.

Different types of structured interaction methods

Focus groups	Face-to-face discussions between human forecasters on a predefined forecasting topic under the supervision of a moderator.	The advantages of this method are the simplicity of setting up the group, fast and easy sharing of information, and supposedly high acceptance of the group opinion by individual forecasters. The method suffers from several downsides, including susceptibility to groupthink, due to reliance on face-to-face discussions, a desire to be accepted, and incongruences due to the social status of group members. The method does not define how individual judgements are to be combined and the choice of the combination rule depends on the moderator and the social dynamics of the group. The method violates the forecasting principle of independent generation of a forecast by each group member.
Nominal Group Technique	Structured method can be divided into five steps: first, the moderator poses the forecasting question. Then each forecaster individually produces a forecast, which is then explained to other members of the group to generate debate. These forecasts are subsequently anonymously assessed and ranked by each individual, before being combined by the moderator, commonly using a linear opinion pool.	In contrast to a focus group, the nominal group technique follows a clear structure and is not as prone to groupthink and social pressure. It is better than Delphi when it comes to stimulating creativity and tends to be less time consuming because it does not involve multiple iterations. Nevertheless, several studies suggest that the nominal group technique is less accurate and reliable than Delphi.
Delphi Method	The key features are anonymity, iteration, controlled feedback and statistical combination of the group response. Anonymity is ensured by giving forecasters a questionnaire containing the forecasting problem, whose responses the other judges cannot discern. This is supposed to prevent social pressures from changing a forecaster's judgement. The anonymous responses are then statistically analysed, and the mean and variance are supplied to all the forecasters to update their prior belief. If someone's update is an outlier, the forecaster usually has to provide a reason. The process is then repeated for several rounds. To combine the individual judgements, the Delphi method often employs a linear opinion pool. There exist several variations of this technique. For example, the first round can be unstructured to not constrain the forecaster, or structured to make the procedure simpler for the monitoring team.	Studies comparing forecasts produced by the Delphi method with individual human forecasts have shown an improvement in accuracy and reduction in variance, favouring the former approach. Despite anonymity in eliciting judgements, a main criticism of the Delphi technique is the inherent pressure to conform to group opinion after the first round of iteration. Psychological studies have found that the forecasting accuracy of the Delphi method benefits from emphasizing reasoning, if judges have to provide detailed explanations for their judgement. The provided reasons could then be used in the feedback process, making it more convincing to other judges who tend to be biased toward their own assessments.

Zellner, M., Abbas, A. E., Budescu, D. V., & Galstyan, A. (2021). A survey of human judgement and quantitative forecasting methods. *Royal Society Open Science*, *8*(2), rsos.201187, 201187. https://doi.org/10.1098/rsos.201187

Different types of structured interaction methods



Example: Developing a structured core curriculum

Systematic interactive aggregation method obtained from a panel of experts:

- Anonymity of the participants
- Structured of information flow
- Regular feedback

Seems to perform better than standard interaction groups in reducing biased outcomes

May be more feasible/ethically defensible relative to quantified approaches (e.g., prediction markets) for some domains (e.g., deaths, terrorist attacks)

Armstrong, J. S. (2008). Methods to elicit forecasts from groups: Delphi and prediction markets compared.

From Individuals to Groups

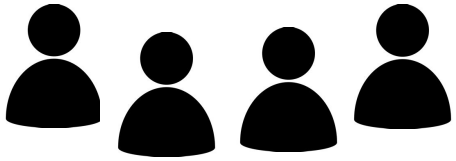
Individual level

The cognitive process of a single individual guides the decision

Deliberative group

A group process determines the outcome, and individual decisions are dependent on the actions of other group members

Staticized group

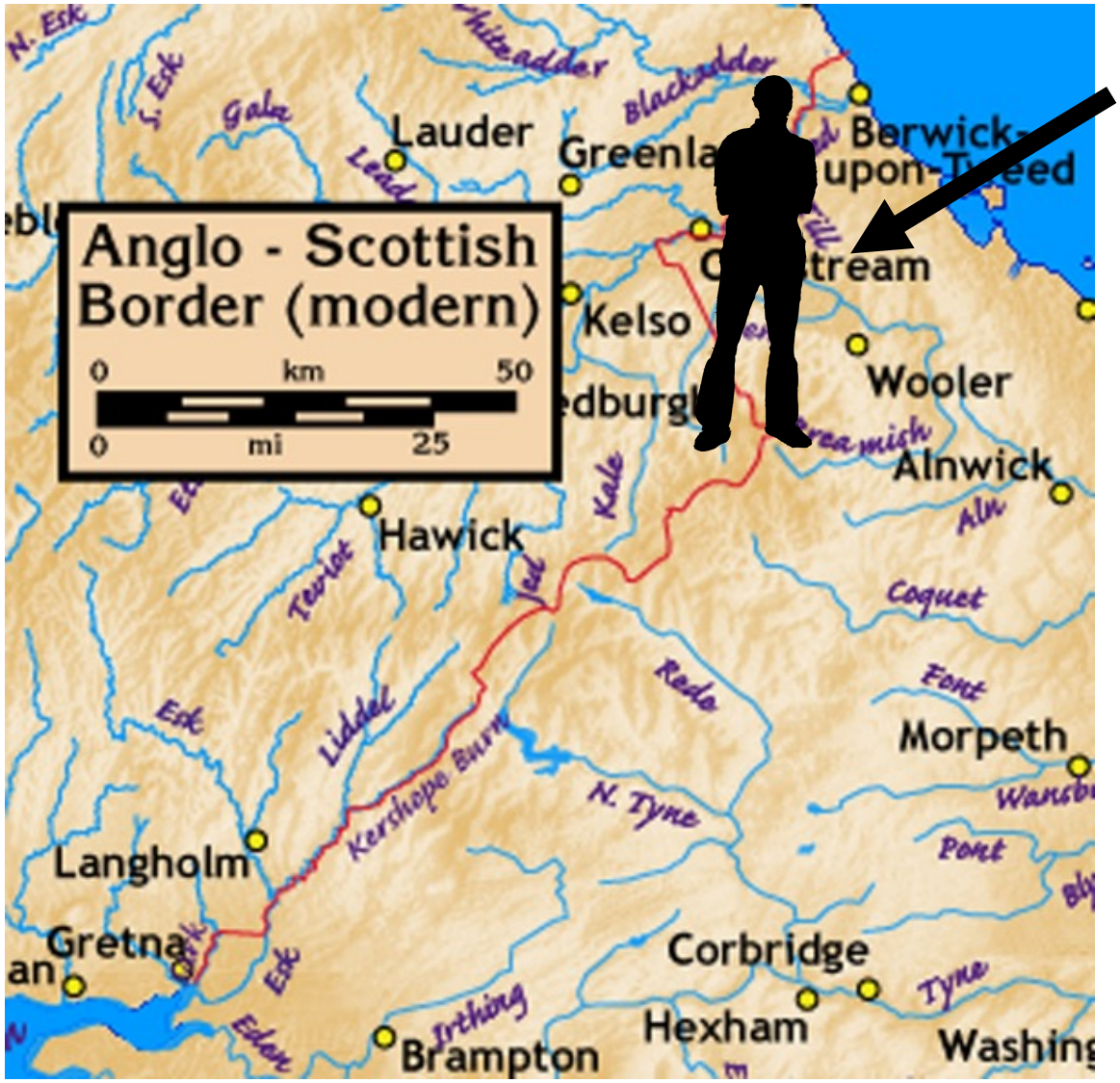


A group process determines the outcome, but individual decisions are not dependent on group activity

Marquis de Condorcet (1743-1794)

- French philosopher, mathematician, and pioneer political scientist; introduced the first formal treatment of group decision making
- **Why** group decision making works
  - Jury theorem
- **When** group decision making fail
  - Condorcet's paradox

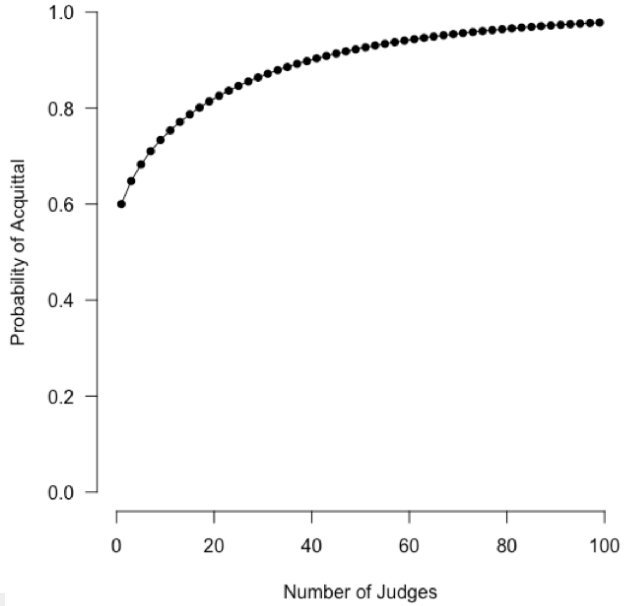
https://en.wikipedia.org/wiki/Marquis_de_Condorcet



An innocent man is accused of murder on the border between England and Scotland. All other considerations aside, he would be wiser to hand himself over in Scotland than England. This is because, given exactly the same evidence, a jury of fifteen persons is more likely to reach a true verdict than a jury of twelve.

Jury theorem

- Majorities of individuals are likely to be more often correct than individuals
- The law of large numbers
- Each vote is independent



Condorcet's jury theorem calculates the probability, P_N, that a jury gives the correct answer, given:

- N = the number of jurors
- p = the probability of an individual juror being right
- m = the number of jurors required for a majority

Condorcet's jury theorem in its simplest form has the following formula:

$$P_N = \sum_{i=m}^{N} \left(\frac{N!}{(N-i)!\,i!} \right) (p)^i (1-p)^{N-i}$$

Condorcet, J.-A.-N. de Caritat, (1785). Essai sur l'application de l'analyse à la probabilité des décisions rendues à la pluralité des voix. Paris: Imprimerie Royale.

Condorcet's paradox

- Intransitivity of majority preferences
- Majority wishes can be in conflict with each other

Individual 1: $a \succ_1 b \succ_1 c.$

Individual 2: $b \succ_2 c \succ_2 a.$

Individual 3: $c \succ_3 a \succ_3 b.$

Simple Majority Vote

$a \succ_g b,$ since 2 out of 3 prefer a to $b.$

$b \succ_g c,$ since 2 out of 3 prefer b to $c.$

$c \succ_g a,$ since 2 out of 3 prefer c to $a.$

Voting Methods

Hypothetical Preference Profile of 13 Voters for Three Choice Options, B, P, and S

Individual preference ranking (from best to worst)	Number of voters who have that preference
$B > S > P$	3
$P > B > S$	5
$P > S > B$	1
$S > B > P$	3
$S > P > B$	1

Method	Description	Winner
Condorcet	Chose the option that beats all competitors in pairwise competition	
Plurality	Each voter gives one vote to one option, namely the option he or she ranks first. Chose the option with most votes.	
Single transferable vote	If seeking a single consensus option, choose the plurality winner if that option was ranked first by more than half of the voters. Otherwise, eliminate the option with the smallest number of plurality votes, rerank the remaining options, and compute a new plurality score among the remaining options	
Borda	the first ranked option of each voter scores two points, and the second ranked scores one point. Chose the option with the most points	

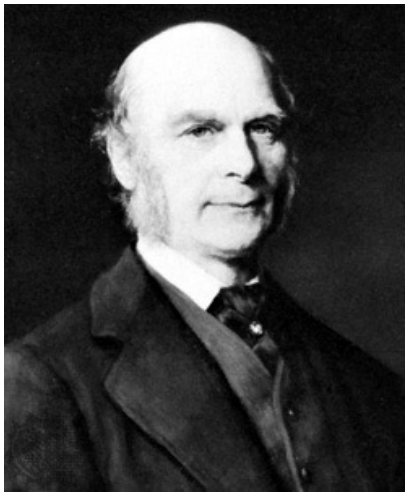
Popov, S. V., Popova, A., & Regenwetter, M. (2014). Consensus in organizations: Hunting for the social choice conundrum in APA elections. ***Decision, 1***(2), 123-146.

Aggregating preferences can lead to social choice conundra - it is important to formalise and agree on decision processes beforehand!!!

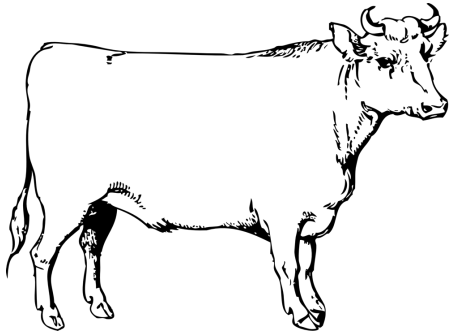
Different voting methods require (or consider) different amounts of information. For example, plurality vote only considers first choice, but STV or Borda consider more information (e.g., it could be important to exclude candidates that are very unpopular).

Fortunately, social choice conundra may not arise often in the real world (cf. Popov et al., 2014)…

When groups work: Wisdom of the crowd!



Francis Galton, 1822-1911



True = 1198 pounds

Distribution of the estimates of the dressed weight of a particular living ox, made by 787 different persons.

Degrees of the length of Array 0°—100°	Estimates in lbs.	Centiles: Observed deviates from 1207 lbs.	Centiles: Normal p.e = 37	Excess of Observed over Normal
5	1074	−133	−90	+43
10	1109	− 98	−70	+28
15	1126	− 81	−57	+24
20	1148	− 59	−46	+13
q_1 25	1162	− 45	−37	+ 8
30	1174	− 33	−29	+ 4
35	1181	− 26	−21	+ 5
40	1188	− 19	−14	+ 5
45	1197	− 10	− 7	+ 3
m 50	1207	0	0	0
55	1214	+ 7	+ 7	0
60	1219	+ 12	+14	− 2
65	1225	+ 18	+21	− 3
70	1230	+ 23	+29	− 6
q_3 75	1236	+ 29	+37	− 8
80	1243	+ 36	+46	−10
85	1254	+ 47	+57	−10
90	1267	+ 52	+70	−18
95	1293	+ 86	+90	− 4

q_1, q_3, the first and third quartiles, stand at 25° and 75° respectively.
m, the median or middlemost value, stands at 50°.
The dressed weight proved to be 1198 lbs.

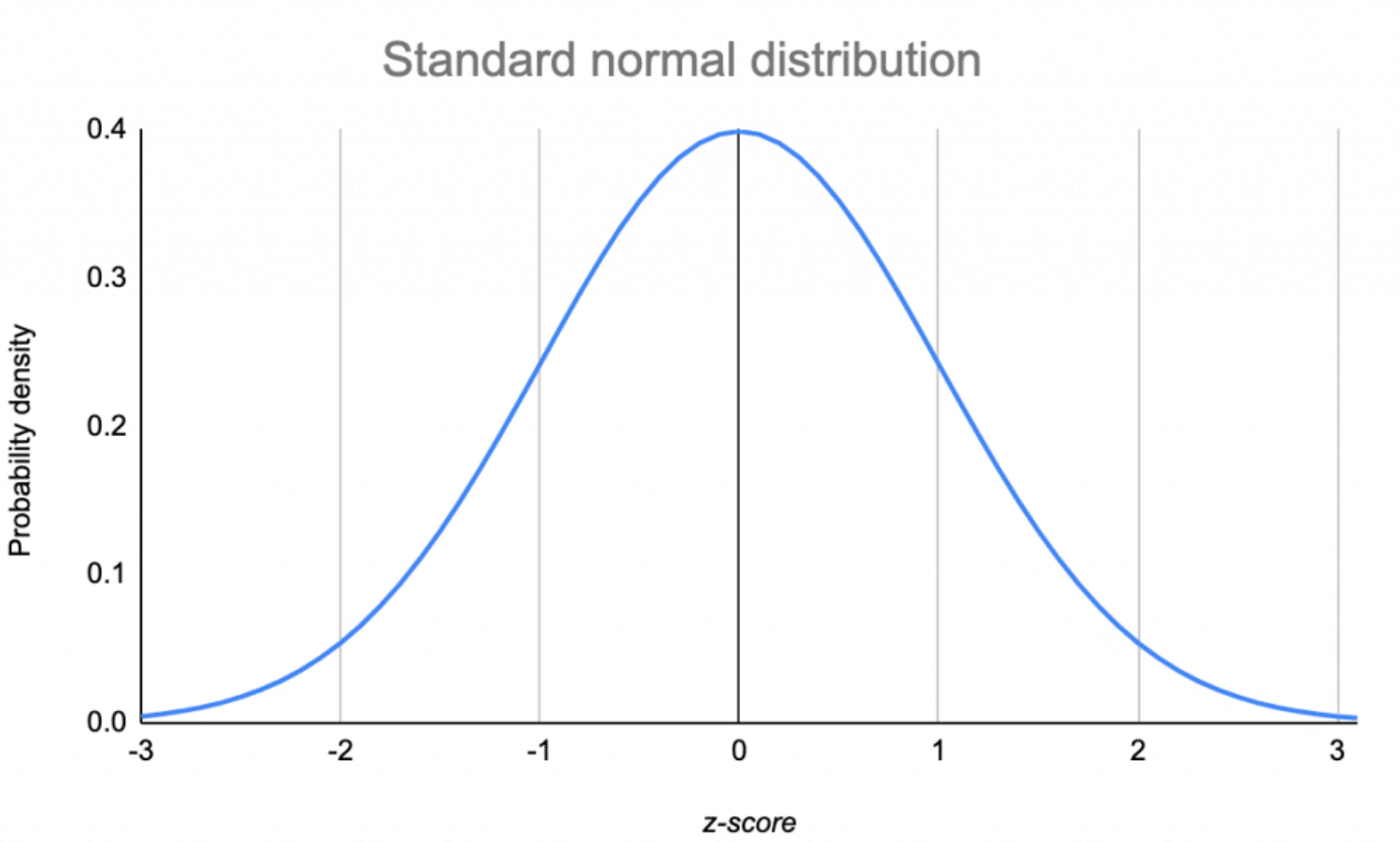
"This result is, I think, more credible to the trustworthiness of a democratic judgment than might have been expected."

Staticized groups can be powerful!

Galton, F. (1907). Vox Populi. ***Nature,*** 75, 450-451.

A BIOLOGIST, A CHEMIST, AND
A STATISTICIAN ARE OUT HUNTING.

Wisdom of the crowd: The role of aggregation



Summary

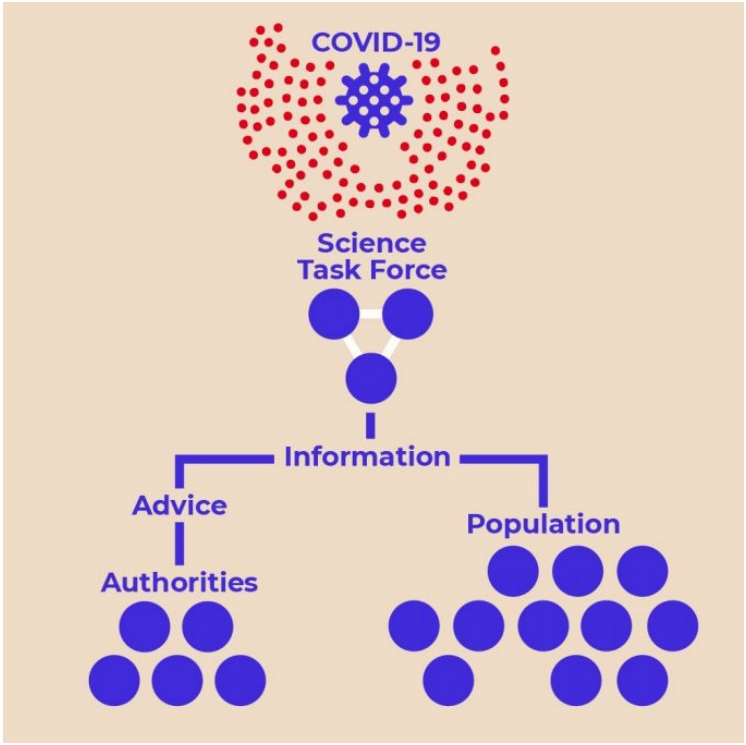
Deliberative groups can fall prey to biases. Formalization of decision process and structured interaction (e.g., nominal group technique, delphi methods) provide an alternative to purely deliberative groups.

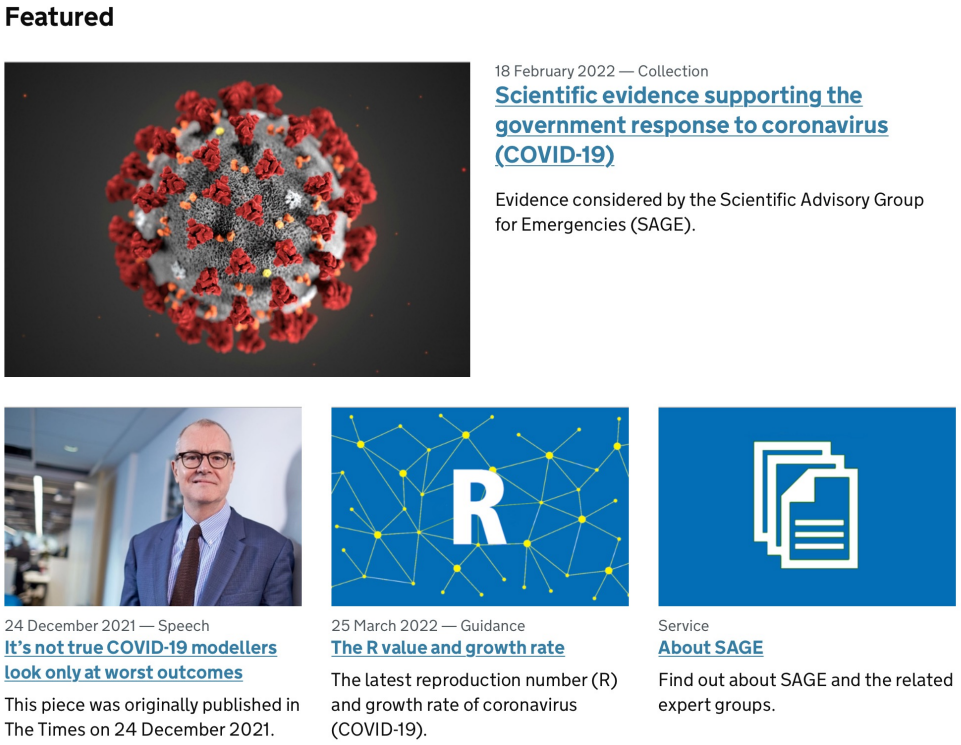
Consensus obtained through voting is possible but this research refers to preferences (not inference); crucially, this literature shows that different voting methods can lead to different conclusions...

Staticized groups may work well for inference problems – wisdom of the crowd. It may help to understand the relative performance of groups as the result of certain statistical processes (i.e., aggregation) – *more on this in the next session*.

Exercise

What kind of groups are scientific task forces? Can one make recommendations about how experts should interact in these settings?





https://sciencetaskforce.ch/en/home/

https://www.youtube.com/watch?v=L7uBwyr0sdg