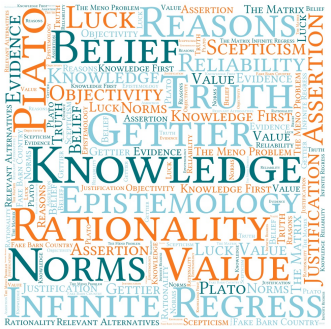

Knowledge, Individuals & Society

Jake Chandler

Judgment Aggregation: Problems

LA TROBE UNIVERSITY

Judgment Aggregation

- Last week: two of *many* ways of aggregating the opinions of a group of people (Majority, Weighted Majority)
- Judgment aggregation is an epistemological question with an obviously *far* broader relevance than just XPhi
- Think:
  - Voters
  - Jurors
  - Scientific experts
  - Sensors
  - Databases

Some terminology

- An agenda is a list of propositions (sentences)

  Example: $\langle P, Q, (P \& Q) \leftrightarrow R, R \rangle$
- A judgment is a list of true (T) / false (F) / undecided (–) verdicts on each proposition of the agenda

  Example: $\langle T, T, F, - \rangle$
- A judgment aggregation procedure is a method that takes a list of individual judgments of the n members of a group and returns, as an output, a group-level judgment

Constraints on individual judgments

- For simplicity, we'll assume:

  Input Consistency: The individual judgments are logically consistent

  Input Decisiveness The individual judgments assign T or F to every proposition

Some aggregation rules

- Quota rules (for all propositions, group judgment is T iff the proportion of T votes exceeds proportion p)
  - Majority ($p = 0.5$)
  - Super-majority ($0.5 < p < 1$)
  - Unanimity ($p = 1$)
- Undemocratic rules (some people get more of a say)
  - Oligarchy (only $1 < m < n$ people get a say)
  - Dictatorship (only 1 person gets a say)
- Topic-dependent rules (different requirements for different propositions)
  - Constant (certain group-level judgments on certain propositions are mandated whatever the votes)

The 'Discursive Dilemma'

- The CJT: Under certain conditions, majority voting on agendas with a single proposition yields very reliable results
- Now the bad news:

  > Majority voting on sets of logically interdependent propositions can lead to inconsistent group judgments

  (Logically interdependent propositions: propositions such that some combinations of truth values are not possible)
- Originally in Kornhauser & Sager (1986) ('Doctrinal Paradox'); appeared in philosophy in Pettit (2001) ('Discursive Dilemma')
- Related to a famous observation of Condorcet's regarding majority voting on preferences

The 'Discursive Dilemma' (ctd)

- Consider a panel giving advice on various claims relating to global warming, with E = Emissions are above some specific threshold and T = Global temperature will increase by some specific number of degrees by a specific date

	E	$E \rightarrow T$	T
Person 1	T	T	T
Person 2	T	F	F
Person 3	F	T	F
Majority	T	T	F

A general result

- As List points out, there are *lots* of conceivable aggregation procedures:

  > For an agenda with only one proposition, there are 2^n combinations of individual judgments, each of which can be mapped to a different output: 2^{2^n} procedures in total!
- Question: Might we able to find one that fares better than majority voting?
- A prima facie worrying result:

  > *Any* procedure that satisfies a number of seemingly compelling conditions is *also* liable to violate:
  >
  > Output Consistency: The aggregation procedure always generates as output *consistent* judgments on the propositions

The seemingly compelling conditions

Output Decisiveness: The aggregation procedure always generates as output *complete* judgments on the propositions

Anonymity: All individuals' attitudes are given equal weight in determining the group attitudes

Systematicity: The collective judgment on each proposition depends only on the individual judgments on it (Independence), and the pattern of dependence is the same across propositions (Neutrality).

The principles vs sample procedures

- Undemocratic rules rules violate Anonymity

	A	B
1 (D)	T	T
2	F	F
Dictator	T	T

	A	B
2	T	T
1 (D)	F	F
Dictator	F	F

(swapping the names on the inputs yields different outputs)

- Constant rule violates Systematicity (Neutrality)

	A	B
1	T	T
2	F	F
Constant	T	F

(A and B are treated differently, despite identical patterns of votes)

The principles vs sample procedures (ctd)

- We've seen that quota rules (except Unanimity) violate Output Consistency
- They also violate Output Decisiveness

	A	$A \rightarrow B$	B
1	T	T	T
2	T	F	F
3	F	T	F
3	F	F	T
Majority	-	-	-
Super-Majority of 0.9	-	-	-
Unanimity	-	-	-

- Note: Majority satisfies Output Decisiveness for the special case in which n is odd

List & Pettit's "impossibility" theorem

- A key theorem from List & Pettit (2002):

  No aggregation procedure satisfies Output Decisiveness, Anonymity, Systematicity, and Output Consistency

- Note that related 'impossibility' results have long been established wrt preference aggregation (e.g. Arrow's Theorem)
- At least one thing has to go!

References

- Kornhauser, L.A., & L.G. Sager 1986: Unpacking the Court. *Yale Law Journal* 96: 82–117.
- List, C. 2005: The probability of inconsistencies in complex collective decisions. *Social Choice and Welfare*, 24(1): 3–32.
- Pettit, P. 2001: Deliberative Democracy and the Discursive Dilemma. *Philosophical Issues* 11: 268–99.