Analyzing Survey Research Data
GSERM, Summer 2019

Adam M. Enders
Department of Political Science
University of Louisville

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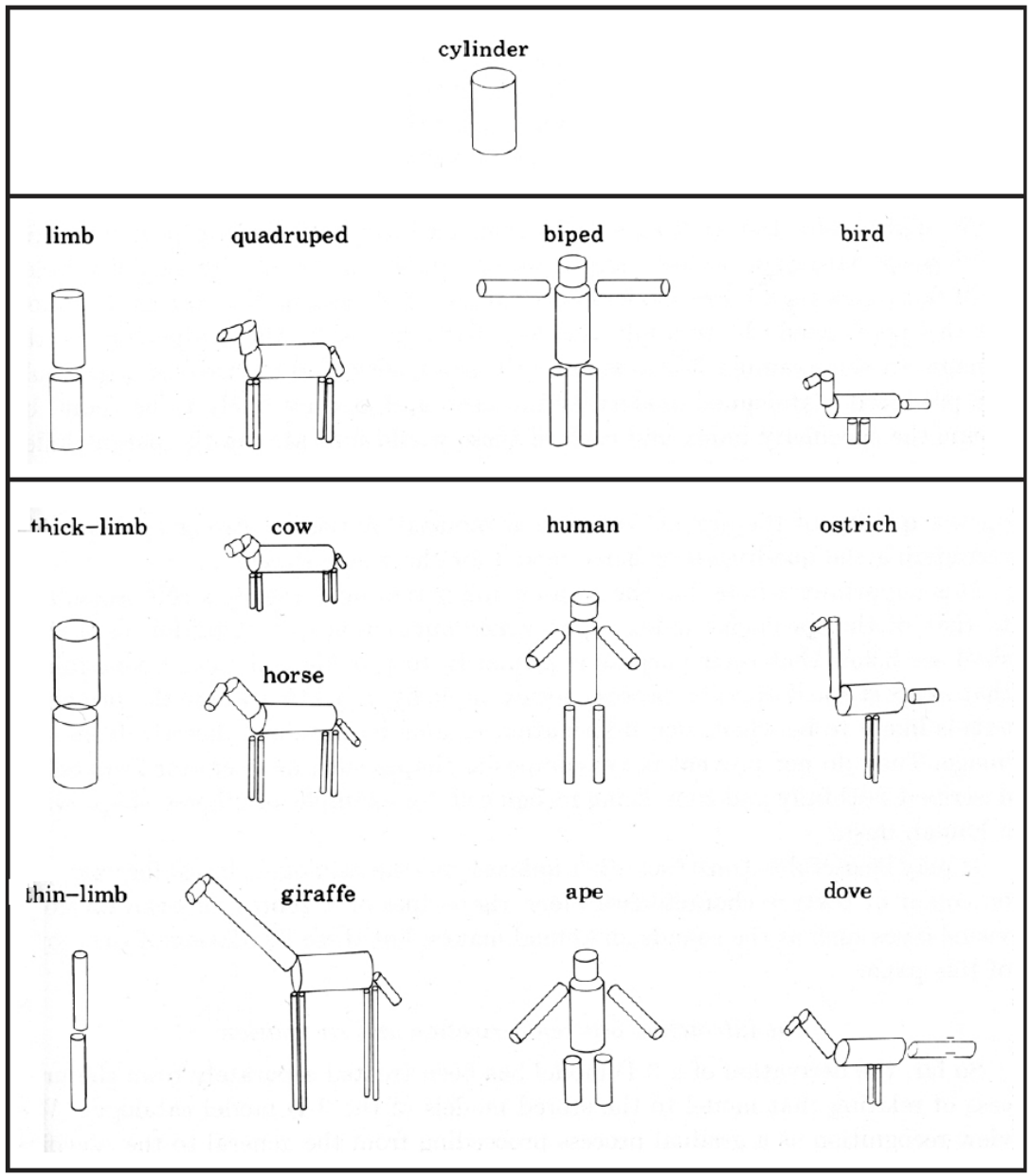
Goal of Course

- **Explore a family of techniques that will help us better measure the things we're interested in**
- Students will (hopefully) walk away with a better sense of:
  1. What it really means to measure something
  2. How to go about measuring social phenomena in a deliberate, theoretical, and empirically rigorous way
  3. How to lend substantive interpretations to measurements and convince others of those interpretations
     - Oftentimes, this will be done with the help of statistical graphics

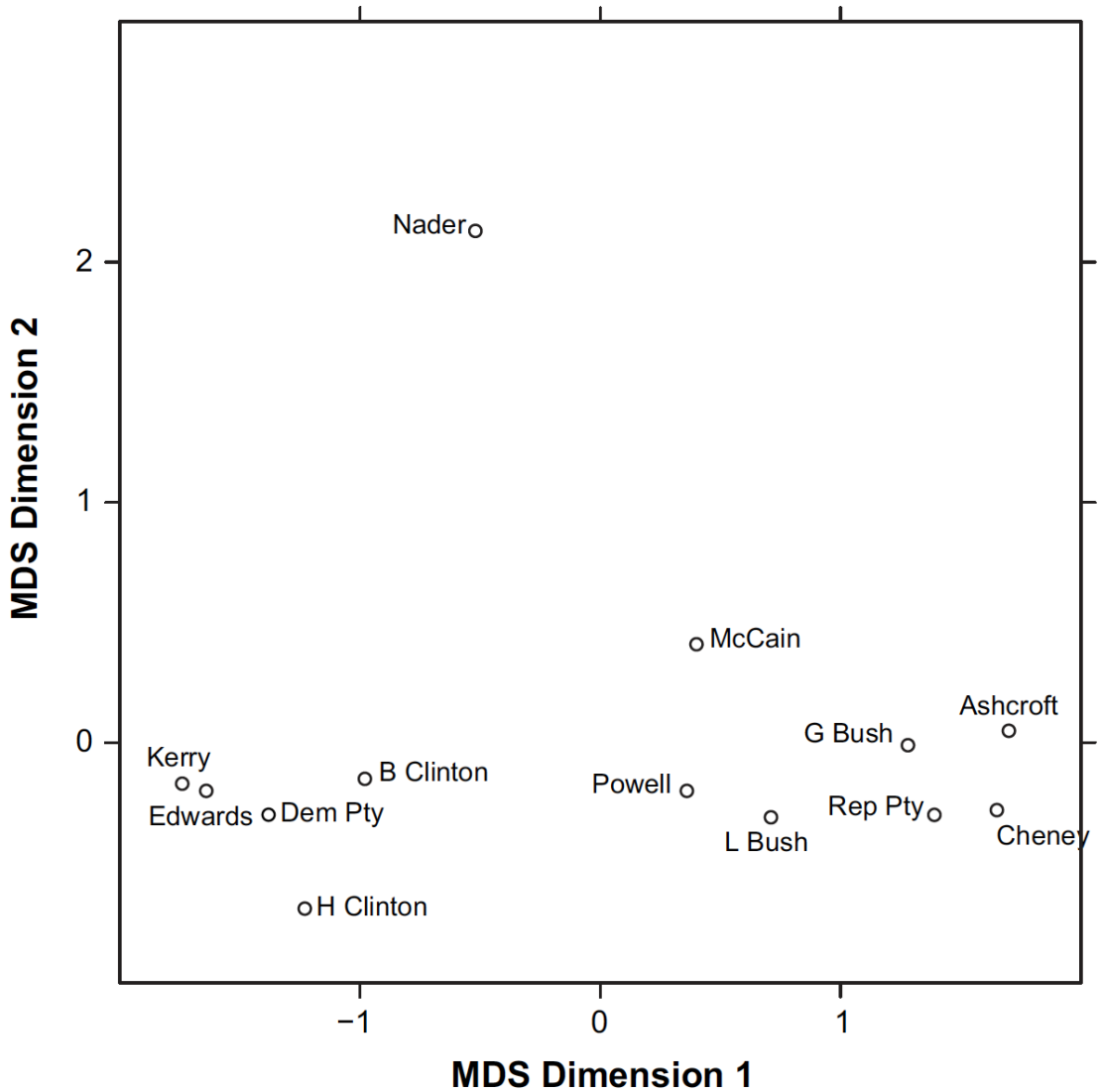
What is Scaling?

- People speak about scaling analysis as if its a single method called "scaling"
- There is a commonality to the methods we label "scaling"
  - They are all geometric representations of data
- The models themselves provide information about the substantive processes that produce the data (DGP in some sense)
- Producing geometric structures lies at the heart of everything we'll be doing
  - Some cognitive scientists even believe that cognition and concept formation is inherently geometric
  - In other words, we make sense out of – and even create – objects (concepts, theories, associations) using geometry
  - The language of shapes, proximity, size, and association is universal

Example: Gärdenfors (2004)



Example: 2004 ANES Feeling Thermometers



Why "Scale" Things?

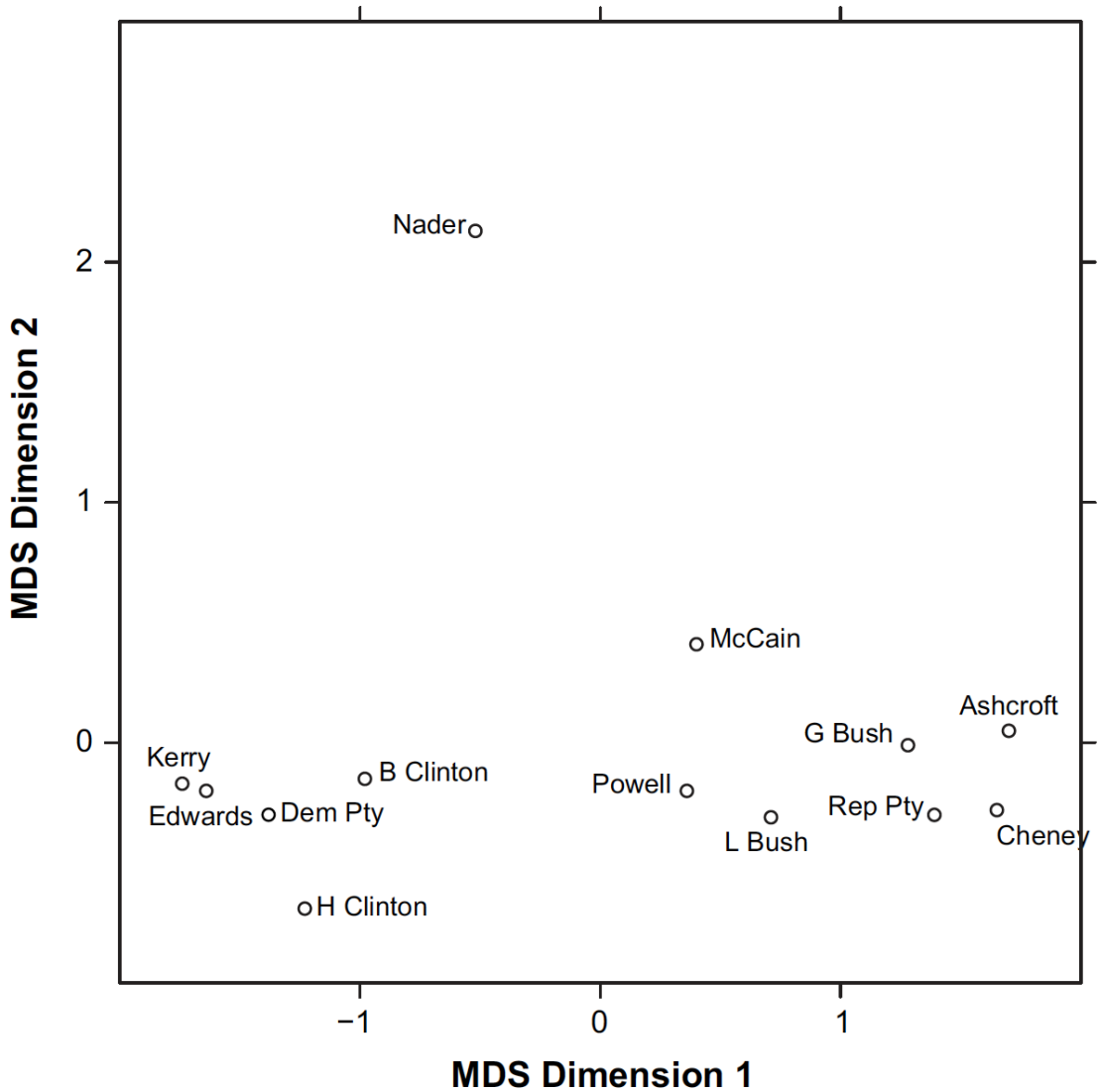
Four main objectives (in no particular order)

1. Data reduction
   - We live in an information age and we're confronted by big data that is hard to examine in raw form
   - 1000s of units on 100s or 1000s of variables
   - Information is useless if we can't comprehend it
   - So, we reduce data down, distill it, from an incomprehensible mass to some digestible that also retains the interesting, important properties of the original data
   - Examples
     - Principal components analysis
     - Factor analysis
     - Likert scales/additive scales
     - ...basically everything we'll talk about!

Example: 2004 ANES Feeling Thermometers

wbush	obama	mccain	biden	palin	hclinton	bclinton	rice	limbaugh
85	25	60	15	90	20	20	95	52
60	0	70	50	70	30	0	50	40
85	30	60	50	70	40	40	100	50
70	30	70	50	85	40	30	70	70
70	0	85	50	60	0	0	70	40
85	15	70	50	70	0	0	100	50
70	30	70	15	100	40	30	100	60
0	100	50	60	15	50	70	50	0
60	30	85	15	100	60	40	50	40
85	0	85	50	85	0	0	70	50
100	0	70	50	85	0	0	100	70
70	15	85	15	85	15	50	85	70
70	85	85	100	70	85	70	100	0
30	40	85	100	70	85	85	70	0
85	0	70	0	85	0	0	100	70
40	40	70	50	85	85	70	70	50
30	60	60	85	60	70	85	30	40
30	100	0	70	0	50	85	70	0
0	70	30	70	15	70	70	30	0
40	70	60	70	50	70	85	60	50
60	15	85	30	70	60	40	70	60
100	40	100	40	100	60	50	100	100
60	40	85	50	60	20	30	60	50
0	100	15	60	0	60	40	60	0
30	70	60	50	30	60	60	30	15
70	70	50	50	50	50	50	50	50
25	85	50	50	40	85	100	60	50
1	70	80	80	40	90	100	50	10
25	85	35	90	30	60	75	15	10
0	70	15	60	30	70	15	0	0

Example: 2004 ANES Feeling Thermometers



Why "Scale" Things?

2. Assess the dimensionality of the information we're analyzing
   - We try to understand the number and nature of the distinct sources of variability in a set of data
   - Think about market researchers trying to figure out what aspects of breakfast cereal people pay attention to when buying cereal
     - Cost, the box, sugar content, organic, where its produced?
     - These are all potential sources of variability in people's behavior when it comes to purchasing cereal
     - Assessing dimensionality is a way of figuring out which of those distinct sources of variability is actually present in people's minds

Why "Scale" Things?

- We use dimensionality analysis to separate the interesting and important sources of variability from the other potential sources of variability (error) that don't matter/aren't interesting/important
  - Error isn't mistakes, just information that isn't useful or interesting
- Deal with the "curse of dimensionality"
  - The useful thing about making geometric representations is that they can be represented visually very nicely
  - The problem: we can't see into more than 3-4 dimensions very easily
  - Analytically we aren't limited by the curse of dimensionality. We can engage $n - 1$ dimensions. But we can't produce graphical representations beyond 3-4.

Why "Scale" Things?

3. Measurement
   - Extremely powerful measurement tools
   - Can extract information from incomprehensible data measured at ordinal and nominal levels and produce comprehensible interval level information
   - Example: Likert scales
     - Likert scales take ordinal information and produces an interval level scale
   - Measurement is, itself, a theory and theories are meant to be tested
   - Scaling methods are ways of testing those theories about our measures

Why "Scale" Things?

4. Statistical graphics
   - All methods we use are amenable to being represented in pictorial form
   - A picture is worth 1000 words – worth 1000 numbers too
   - Visualizing data is extremely useful in communicating our findings to reviewers, editors, colleagues, the public, etc.
     - A lot more powerful that tables of estimates or equations
   - Science is an inherently social enterprise – visualizing data via statistical graphics makes the socializing, the communication more efficient and easier

Caveats

- This course is usually taught over the span of a month
  - A shorter version of "Measurement, Scaling, and Dimensional Analysis" at the ICPSR Summer Program at the University of Michigan
  - Never taught the course in one week
- Conundrum: breadth or depth?
  - Will shoot for breadth, but go in depth on fundamental concepts
  - Slightly more applied than theoretical, so that participants can execute analyses and interpret results in their own work
  - Still need to be careful about having enough knowledge to be dangerous...
- I'm a political scientist, so lots of examples will be from public opinion polling
  - Will also incorporate datasets from psychology and marketing
  - The beauty of the methodologies is that the substantive nature of the data doesn't matter!

Who Am I?

- Adam Enders
- Political science professor
- University of Louisville, Kentucky, USA
- Public opinion and political behavior research in American context
- Substantive research interests:
  - Conspiratorial thinking
  - Polarization
  - Partisanship and ideology
- Methodology interests:
  - Latent variable modeling of all sorts (particularly IRT and MDS)
  - In addition to class: SEM, differential item functioning, optimal scaling

Who Are You?

1. Name
2. Affiliation (university, department, employer...whatever makes sense)
3. Field of study/work
4. Why are you interested in the course?
   - What methodologies are you most interested in?
   - What does your work look like, what problems are you trying to solve?
   - Is there anything relevant to class that isn't on the syllabus?

Course Details

- Course webpage: `www.adamenders.com/surveydata-gserm`
  - Password: "GSERM2019"
- Will post slides, data, code, and homework assignments
- *Please do not share course materials with non-participants*
- Contact information
  - Email: amende01@louisville.edu
- Requirements:
  - Must be present for 80% of class time to receive credit (per GSERM rules)
  - Final assignment where you apply at least two methodologies discussed in class to a dataset of your choosing
  - Will spend much of Friday afternoon on one-on-one consultations about student projects

Other Odds and Ends

- Class meeting time
  - Formally: 1) begin at 9:15, end at 15:15, 2) hour for lunch, 12:00–13:00, 3) 15 min break in morning and afternoon
  - Could shave 15 min off lunch and end at 15:00?
- Assume some R knowledge
  - Should brush up on R, if relevant
  - If not an R user, talk to me after class today (it's OK if this is the case)
- Feel free to interrupt me and ask questions
- Don't worry about doing all readings...I'll assume no prior knowledge every day

See course syllabus for more information