Minimal Experiments
Healy, Leo
Will the Braves Win the World Series?
What’s the simplest experiment that learns this info?
Choice-from-Sets Experiments.
Choice-from-Sets Experiments.
Choice-from-Sets Experiments.
Choice-from-Sets Experiments.

1. Determine Menus
2. Subjects Choose
3. Randomize
4. Pay

Simplest- Fewest Sets
$10 if *Braves* Win, $10 if *Astros* Win, $10 with 66%
$10 if **Braves**, $10 if **Astros**, $10 with 75%

$10 if **Braves**, $10 with 50%

0-25% | 25-50% | 50-75% | 75-100%
Everyone likes cookies better than apples and bananas.
Everyone either likes dates best and anyone who doesn’t like dates best likes cookies best and dates worst.
The General Method
Objects.

Can be anything.

- Lotteries
- Consumption Goods
- Time-dated payments
- Strategies in a game
- Multi-person payments
- ...

In general: A, B, C, D, ...
Rankings.

ABC, ACB, BAC, BCA, CAB, CBA
Model (or, “Type Space”).

\{CAB, CBA\}, \{ABC, ACB, BAC, BCA\}

Everyone likes cookies better than apples and bananas.
Option 1: Testing the Theory.

\{CAB, CBA\}, \{ABC, ACB, BAC, BCA\}

Everyone likes cookies better than apples and bananas.
Option 2: Categorize Subjects (& Test).

\{DABC, DACB, DBAC, DBCA, DCAB, DCBA\}, \{CBAD, CABD\}, \{Rest\} 

Everyone likes dates best, or cookies best and dates worst.
Option 3: Categorize, Assume Theory True

\{DABC, DACB, DBAC, DBCA, DCAB, DCBA\}, \{CBAD, CABD\}
Q: What’s the “smallest” experiment that accomplishes your goal?

How many possible experiments are there?
N = 3

127
N=9

6,703,903,964,971,298,549,787,012,499,102,923,063,739,682,910,296,
,196,688,861,780,721,860,882,015,036,773,488,400,937,149,083,451,
713,845,015,929,093,243,025,426,876,941,405,973,284,973,216,824,5
03,042,047
Neighbors.

*Differ by one Inversion.*

ABC, ACB, BAC, BCA, CAB, CBA
Neighbors.

*Differ by one Inversion.*

ABC, ACB, BAC, BCA, CAB, CBA
Permutahedron.
Permutahedron.
Differentiating Vertices.
Theorem.

An experiment tests a model $M$: 

*if and only if*

it includes *at least one set* from each edge between *neighbors* that are *not in the same set* under $M$. 
CAB  CBA
{A, C}
{A, B, C}
ACB
ABC

{A, B, C}
{B, C}

BAC  BCA
Cookies and Dates.

\{A,B,C,D\}, \{A,D\}, \{B,D\}
Test: \{A,B,C,D\}, \{A,D\}, \{B,D\}
Test: \{A,B,C,D\}, \{A,D\}, \{B,D\}

\{A,D\}, \{B,D\}
\{A,B,C,D\},\{A,D\},\{B,D\}
Parametric Utility Example: Risk Prefs
Parametric Utility Example: $R^2$
The App

- https://gregleoe-econ.shinyapps.io/minimalexperiments/