

A scenic view of several traditional Dutch windmills with red roofs and white blades, set against a clear blue sky. The mills are located behind some buildings with orange roofs.

EUROPE

# DISCOVERY SUMMIT

EXPLORING DATA • INSPIRING INNOVATION

# Case Studies on Designing and Analysing Discrete Choice Experiments using JMP®

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# Outline

- Packaging choice study
- Choice study on healthcare systems
- Aggregate multinomial logit model
- Individual-level multinomial logit model



# Packaging study

- To help define the brand packaging strategy for P&G laundry liquids in Latin America
  - By identifying the key liquid packaging attributes that drive trial
- The experiment was virtual and executed in Mexico



# Respondent selection

- Two respondent groups:
  - Leg 1: Women Seeking Perfection (WSP)
  - Leg 2: Practical & Experiential (P&E)
- We designed for 150 respondents per leg, but eventually we had 160 respondents per leg
  - We assigned one of the generated surveys to the 10 additional respondents
- We used the same design for WSP and P&E, but different brands were shown to them (cfr. next slide)



# Attributes and attribute levels

| Attributes        | Levels          |                   |                     |                 |                 |            |
|-------------------|-----------------|-------------------|---------------------|-----------------|-----------------|------------|
| Material          | Transparent     | Semi transparent  | Opaque              |                 |                 |            |
| Shape             | Mas color<br>   | Pure<br>          | Isis<br>            | Goldie<br>      | Pure shrink<br> | Cooper<br> |
| Cap functionality | Roller ball<br> | Dosing ball<br>   | Double wall cap<br> | Spout + cap<br> |                 |            |
| Brand             | Mas Color<br>   | Ariel – Leg 1<br> | Ariel – Leg 2<br>   |                 |                 |            |

There are  $3 \times 6 \times 4 \times 2 = 144$  different bottles



# Design setup

- Design set up for 150 respondents in leg 1 and replicated for another 150 respondents in leg 2
- The design consists of 5 different surveys randomly assigned to 5 groups of 30 respondents each
- Each survey consists of 12 choice sets of 3 profiles



# Sample choice set

A1-1

Todos estos detergentes líquidos están disponibles a **29 pesos**. ¿Cuál de ellos estaría más interesada en comprar?

| 1  | 2  | 3  |
|--|--|--|
|  |  |  |



## Design problem

- In total, there are 144 different bottles
- The number of possible choice sets of size 3 is

$$\binom{144}{3} = \frac{144!}{3!141!} = 487,344$$

- JMP will select the choice sets that provide most information, i.e. result in estimates that are precise



# Bayesian approach: prior mean

*“Opaque Cooper bottle with Spout+Cap could be the winner...”*

Conversion into prior mean parameter or part-worth values:

| Attribute | Level         | Prior mean |             |
|-----------|---------------|------------|-------------|
| Material  | FullTrans     | -0.5       | $\sum = -1$ |
|           | SemiTrans     | -0.5       |             |
| Shape     | MasColor      | -0.2       | $\sum = -1$ |
|           | Pure          | -0.2       |             |
|           | ISIS          | -0.2       |             |
|           | Goldie        | -0.2       |             |
|           | PureShrink    | -0.2       |             |
| CapFunct  | RollerBall    | -0.34      | $\sum = -1$ |
|           | CurrentDosing | -0.33      |             |
|           | DoubleCap     | -0.33      |             |
| Brand     | MasColor      | 0          | No guess    |



# Bayesian approach: prior variance

- We allow for a great deal of *uncertainty* around the prior mean part-worths by specifying prior variances of 1
- For an attribute with more than 2 levels, say  $L$  levels, we also specify negative covariances between the (first  $L - 1$ ) part-worths of that attribute using a correlation coefficient of  $-1/(L - 1)$
- This ensures equal prior variances for all ( $L$ ) part-worths of the attribute



## Statistical remarks

- We start from the estimation of the 11 part-worths  
→ Then we need 11 df
- 1 choice set of 3 profiles accounts for  $3 - 1 = 2$  df
- 1 survey of 12 choice sets accounts for  $12 \times 2 = 24$  df
- $24 \text{ df} > 11 \text{ df}$  so that it is possible to estimate part-worths for each individual



# JMP Choice Design Platform

The screenshot shows the JMP Choice Design Platform interface. On the left, the 'DOE - Choice Design - JMP' window is open, displaying the 'Attributes' section. It includes a table for defining attributes, with columns for Name, Role, and Attribute Levels. A button labeled 'Add Factor' is visible. Below the table, a 'Specify Attributes' box contains instructions: 'Add an attribute by clicking the Add Factor button.' and 'Double-click an attribute name or level to edit it.' A 'Continue' button is at the bottom of this box. The top menu bar includes File, Edit, Tables, Rows, Cols, DOE, Analyze, Graph, Tools, Add-Ins, View, Window, and Help. On the right, a 'Journal: BottleExample - J...' window is open, showing the 'Bottle Choice Experiment' section with links to various design files: AttributesBottles, DesignBottles12CS, DesignBottles12CSWithResponsesWSP, and DesignBottles12CSWithResponsesPE. The bottom status bar indicates 'evaluations done'.



# Attributes

The screenshot shows the JMP software interface with the title bar "DOE - Choice Design - JMP". The menu bar includes File, Edit, Tables, Rows, Cols, DOE, Analyze, Graph, Tools, Add-Ins, View, Window, Help. The left sidebar shows a tree view with "Choice Design" expanded, and "Attributes" selected. Below the tree view are buttons for "Add Factor", "Remove", "Add N Factors" (set to 1), and a dropdown menu. The main area displays a table titled "Attribute Levels" with four columns: "Name", "Role", "FullTrans", and "SemiTrans". The "Name" column lists "Material", "Shape", "CapFunct", and "Brand" under the "Categorical" role. The "FullTrans" column contains "MasColor", "Pure", "RollerBall", and "MasColor". The "SemiTrans" column contains "ISIS", "Goldie", "CurrentDosing", and an empty cell. The last column, "Opaque", contains "Cooper", "SpoutCap", and "Ariel". A red arrow points from the text "The most likely preferred attribute levels appear last" to the "Opaque" column.

| Name     | Role        | Attribute Levels      |                   |
|----------|-------------|-----------------------|-------------------|
| Material | Categorical | FullTrans<br>MasColor | SemiTrans<br>ISIS |
| Shape    | Categorical | Pure                  | Goldie            |
| CapFunct | Categorical | RollerBall            | DoubleCap         |
| Brand    | Categorical | MasColor              | Ariel             |

The most likely preferred attribute levels appear last



# Main-effects model

The screenshot shows the JMP software interface with the title bar "DOE - Choice Design - JMP". The menu bar includes File, Edit, Tables, Rows, Cols, DOE, Analyze, Graph, Tools, Add-Ins, View, Window, and Help. The left sidebar has a tree view with "Choice Design" expanded, showing "Attributes" and "Model". "Model" is expanded to show "DOE Model Controls" with three buttons: "Main Effects", "Interactions", and "Remove Term". Below these controls is a table with a red border. The table has one column labeled "Name" and five rows: "Material", "Shape", "CapFunct", "Brand", and "optional item". An arrow points from the bottom of this table to the explanatory text below.

Main-effects model of  $(3-1)+(6-1)+(4-1)+(2-1)$   
= 11 part-worths



# Prior mean

DOE - Choice Design - JMP

File Edit Tables Rows Cols DOE Analyze Graph Tools Add-Ins View Window Help

Choice Design

Model

Prior Specification

Ignore prior specifications. Generate the Utility Neutral design.

Prior Mean

| Effect     | Prior Mean |
|------------|------------|
| Material 1 | -0.50      |
| Material 2 | -0.50      |
| Shape 1    | -0.20      |
| Shape 2    | -0.20      |
| Shape 3    | -0.20      |
| Shape 4    | -0.20      |
| Shape 5    | -0.20      |
| CapFunct 1 | -0.34      |
| CapFunct 2 | -0.33      |
| CapFunct 3 | -0.33      |
| Brand      | 0.000      |



# Prior variance matrix

DOE - Choice Design - JMP

File Edit Tables Rows Cols DOE Analyze Graph Tools Add-Ins View Window Help

Choice Design

Model

Prior Specification

Ignore prior variance. Generate the local design for the prior mean.

Prior Variance Matrix

| Effect     | Material 1 | Material 2 | Shape 1 | Shape 2 | Shape 3 | Shape 4 | Shape 5 | CapFunct 1 | CapFunct 2 | CapFunct 3 | Brand |
|------------|------------|------------|---------|---------|---------|---------|---------|------------|------------|------------|-------|
| Material 1 | 1.000      | -0.50      | 0.000   | 0.000   | 0.000   | 0.000   | 0.000   | 0.000      | 0.000      | 0.000      | 0.000 |
| Material 2 |            | 1.000      | 0.000   | 0.000   | 0.000   | 0.000   | 0.000   | 0.000      | 0.000      | 0.000      | 0.000 |
| Shape 1    |            |            | 1.000   | -0.20   | -0.20   | -0.20   | -0.20   | 0.000      | 0.000      | 0.000      | 0.000 |
| Shape 2    |            |            |         | 1.000   | -0.20   | -0.20   | -0.20   | 0.000      | 0.000      | 0.000      | 0.000 |
| Shape 3    |            |            |         |         | 1.000   | -0.20   | -0.20   | 0.000      | 0.000      | 0.000      | 0.000 |
| Shape 4    |            |            |         |         |         | 1.000   | -0.20   | 0.000      | 0.000      | 0.000      | 0.000 |
| Shape 5    |            |            |         |         |         |         | 1.000   | 0.000      | 0.000      | 0.000      | 0.000 |
| CapFunct 1 |            |            |         |         |         |         |         | 1.000      | -0.33      | -0.33      | 0.000 |
| CapFunct 2 |            |            |         |         |         |         |         |            | 1.000      | -0.33      | 0.000 |
| CapFunct 3 |            |            |         |         |         |         |         |            |            | 1.000      | 0.000 |
| Brand      |            |            |         |         |         |         |         |            |            |            | 1.000 |



# Design generation

DOE - Choice Design - JMP

File Edit Tables Rows Cols DOE Analyze Graph Tools Add-Ins View Window Help

Choice Design

Attributes

Model

Design Generation

- 4 Number of attributes that can change within a choice set
- 3 Number of profiles per choice set
- 12 Number of choice sets per survey
- 5 Number of surveys
- 30 Expected number of respondents per survey

Make Design

Back

Also, don't forget to increase the number of random starts!



# Design

DesignBottles12CS - JMP

File Edit Tables Rows Cols DOE Analyze Graph Tools Add-Ins View Window Help

Design Bottles12CS  
Design Discrete Choice  
Choice  
Columns (8/0)  
Respondent  
Survey  
Choice Set  
Response Indicator  
Material  
Shape  
CapFunct  
Brand

150 x 36

All rows 5,400  
Selected 0

|    | Respondent | Survey | Choice Set | Response Indicator | Material   | Shape         | CapFunct | Brand |
|----|------------|--------|------------|--------------------|------------|---------------|----------|-------|
| 1  | 1          | 1      | 1          | • FullTrans        | Pure       | SpoutCap      | Ariel    |       |
| 2  | 1          | 1      | 1          | • FullTrans        | Goldie     | RollerBall    | MasColor |       |
| 3  | 1          | 1      | 1          | • SemiTrans        | ISIS       | CurrentDosing | Ariel    |       |
| 4  | 1          | 1      | 2          | • SemiTrans        | MasColor   | DoubleCap     | MasColor |       |
| 5  | 1          | 1      | 2          | • FullTrans        | ISIS       | RollerBall    | Ariel    |       |
| 6  | 1          | 1      | 2          | • FullTrans        | Pure       | CurrentDosing | Ariel    |       |
| 7  | 1          | 1      | 3          | • FullTrans        | Pure       | SpoutCap      | Ariel    |       |
| 8  | 1          | 1      | 3          | • SemiTrans        | ISIS       | CurrentDosing | MasColor |       |
| 9  | 1          | 1      | 3          | • Opaque           | PureShrink | DoubleCap     | Ariel    |       |
| 10 | 1          | 1      | 4          | • SemiTrans        | ISIS       | SpoutCap      | Ariel    |       |
| 11 | 1          | 1      | 4          | • FullTrans        | MasColor   | CurrentDosing | Ariel    |       |
| 12 | 1          | 1      | 4          | • Opaque           | Pure       | DoubleCap     | Ariel    |       |
| 13 | 1          | 1      | 5          | • Opaque           | Pure       | DoubleCap     | MasColor |       |
| 14 | 1          | 1      | 5          | • SemiTrans        | MasColor   | RollerBall    | MasColor |       |
| 15 | 1          | 1      | 5          | • FullTrans        | Goldie     | SpoutCap      | MasColor |       |
| 16 | 1          | 1      | 6          | • Opaque           | Goldie     | DoubleCap     | Ariel    |       |



- Based on the random utility model

$$U_{js} = \mathbf{x}'_{js} \boldsymbol{\beta} + \varepsilon_{js}$$

- $U_{js}$  is the utility that a respondent attaches to alternative  $j$  in choice set  $s$
- $\mathbf{x}_{js}$  is a  $k \times 1$  vector containing the attribute levels of alternative  $j$  in choice set  $s$
- $\boldsymbol{\beta}$  is a  $k \times 1$  vector of parameter values (or *part-worths* in case of main effects only)
- $\varepsilon_{js}$  is the IID Gumbel error term



# Multinomial logit model

- Multinomial / conditional logit probability that a respondent chooses alternative  $j$  in choice set  $s$ :

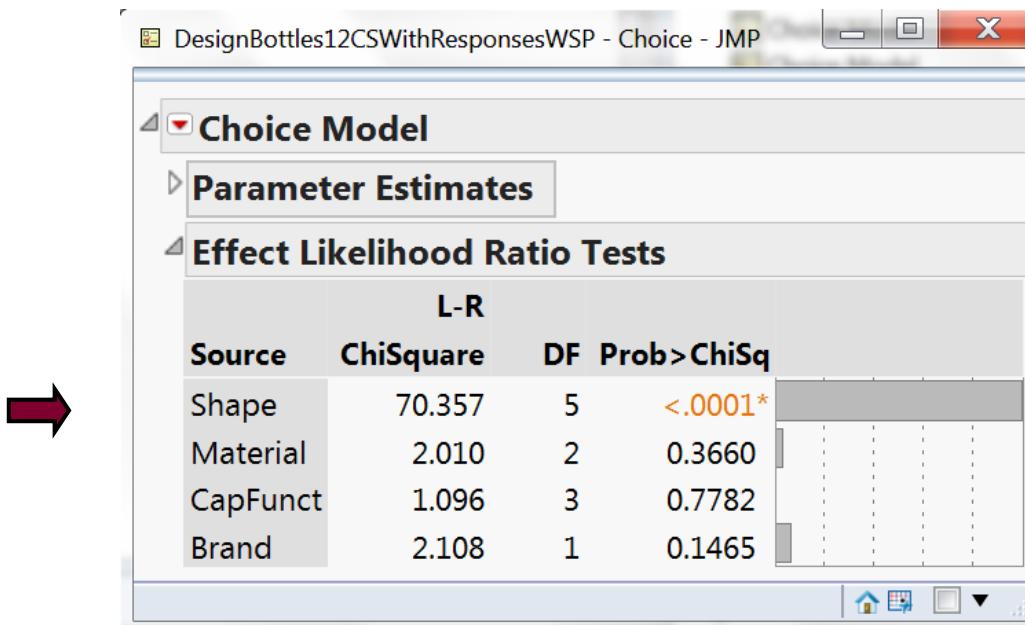
$$p_{js} \left( \begin{array}{l} \text{option } j \text{ chosen} \\ \text{in choice set } s \end{array} \right) = \frac{e^{x'_{js}\beta}}{\sum_{t=1}^J e^{x'_{ts}\beta}}$$



# Analysis of the WSP data



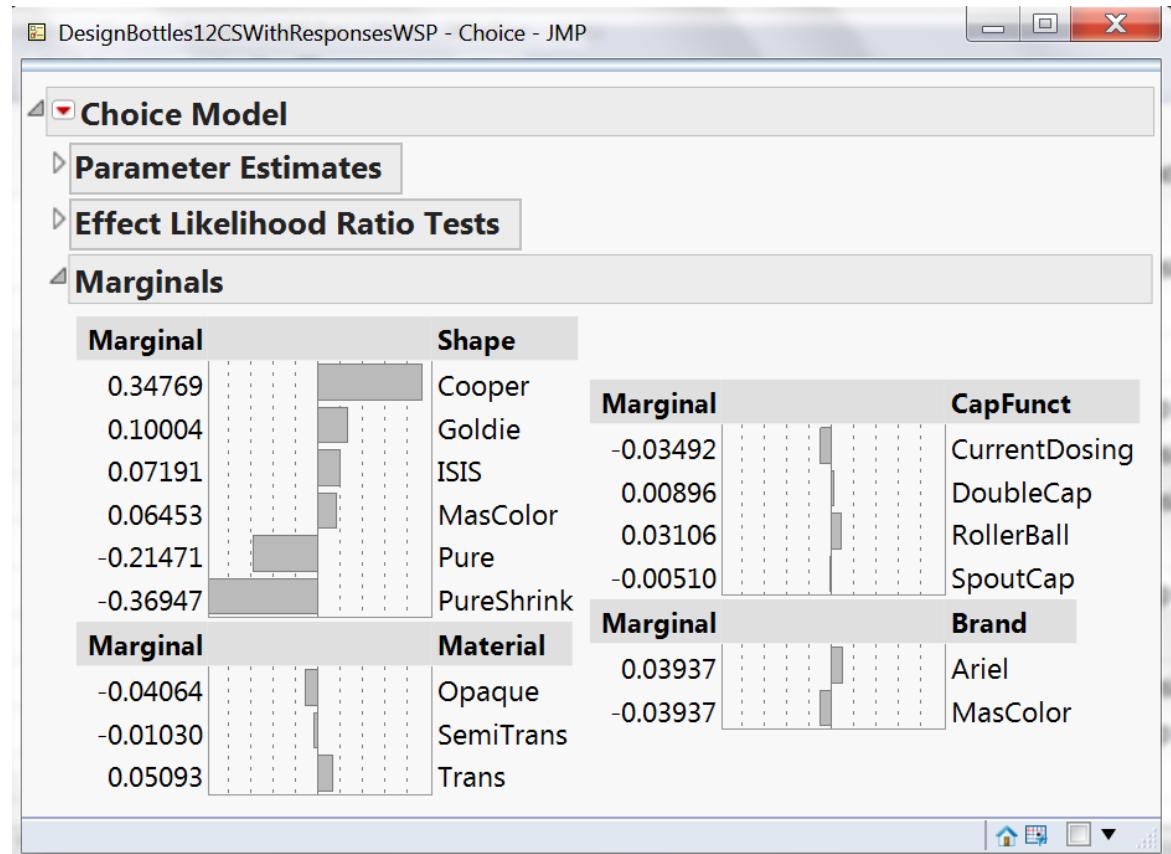
- Only “Shape Design” has a significant impact on bottle choice





# Part-worth estimates

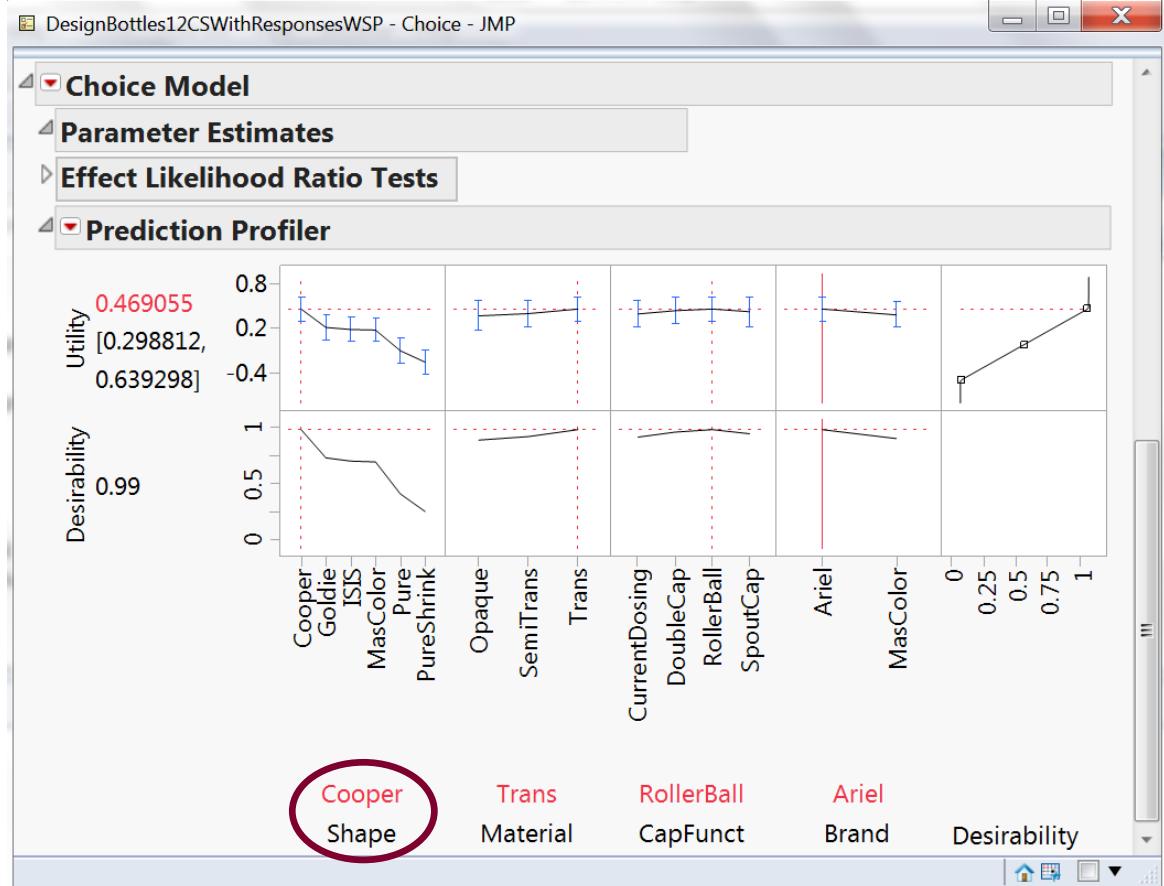
Cooper design is the key driver of bottle choice





# Prediction profiler

Optimal settings  
for Ariel bottle:  
**Cooper**





# Bottle rankings

- Preference ranking of the 144 bottle profiles



|    | Shape  | Material  | CapFunct      | Brand    | Utility      | Desirability |
|----|--------|-----------|---------------|----------|--------------|--------------|
| 1  | Cooper | Trans     | RollerBall    | Ariel    | 0.4690546367 | 0.9899996266 |
| 2  | Cooper | Trans     | DoubleCap     | Ariel    | 0.4469530659 | 0.9672826048 |
| 3  | Cooper | Trans     | SpoutCap      | Ariel    | 0.432889118  | 0.9528270204 |
| 4  | Cooper | SemiTrans | RollerBall    | Ariel    | 0.4078261102 | 0.9270660787 |
| 5  | Cooper | Trans     | CurrentDosing | Ariel    | 0.4030671924 | 0.9221746375 |
| 6  | Cooper | Trans     | RollerBall    | MasColor | 0.3903162183 | 0.9090685806 |
| 7  | Cooper | SemiTrans | DoubleCap     | Ariel    | 0.3857245393 | 0.9043490343 |
| 8  | Cooper | Opaque    | RollerBall    | Ariel    | 0.377483784  | 0.8958787931 |
| 9  | Cooper | SemiTrans | SpoutCap      | Ariel    | 0.3716605915 | 0.8898934378 |
| 10 | Cooper | Trans     | DoubleCap     | MasColor | 0.3682146475 | 0.8863515319 |
| 11 | Cooper | Opaque    | DoubleCap     | Ariel    | 0.3553822131 | 0.8731617419 |
| 12 | Cooper | Trans     | SpoutCap      | MasColor | 0.3541506996 | 0.8718959333 |
| 13 | Cooper | SemiTrans | CurrentDosing | Ariel    | 0.3418386659 | 0.8592410348 |
| 14 | Cooper | Opaque    | SpoutCap      | Ariel    | 0.3413182653 | 0.8587061421 |
| 15 | Cooper | SemiTrans | RollerBall    | MasColor | 0.3290876918 | 0.8461349717 |



# Bottle rankings





# Analysis of the P&E data



- “Shape Design”, “Material” and “Brand” have a significant impact on bottle choice
- “Shape Design” is about 7 times more important than “Material” and “Brand”

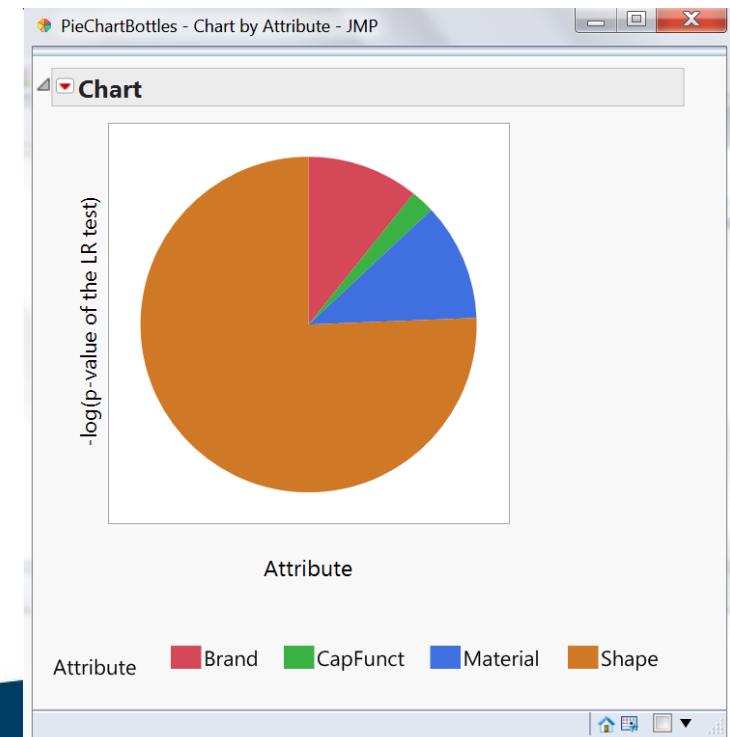
DesignBottles12CSWithResponsesPE - Choice - JMP

Choice Model

Parameter Estimates

Effect Likelihood Ratio Tests

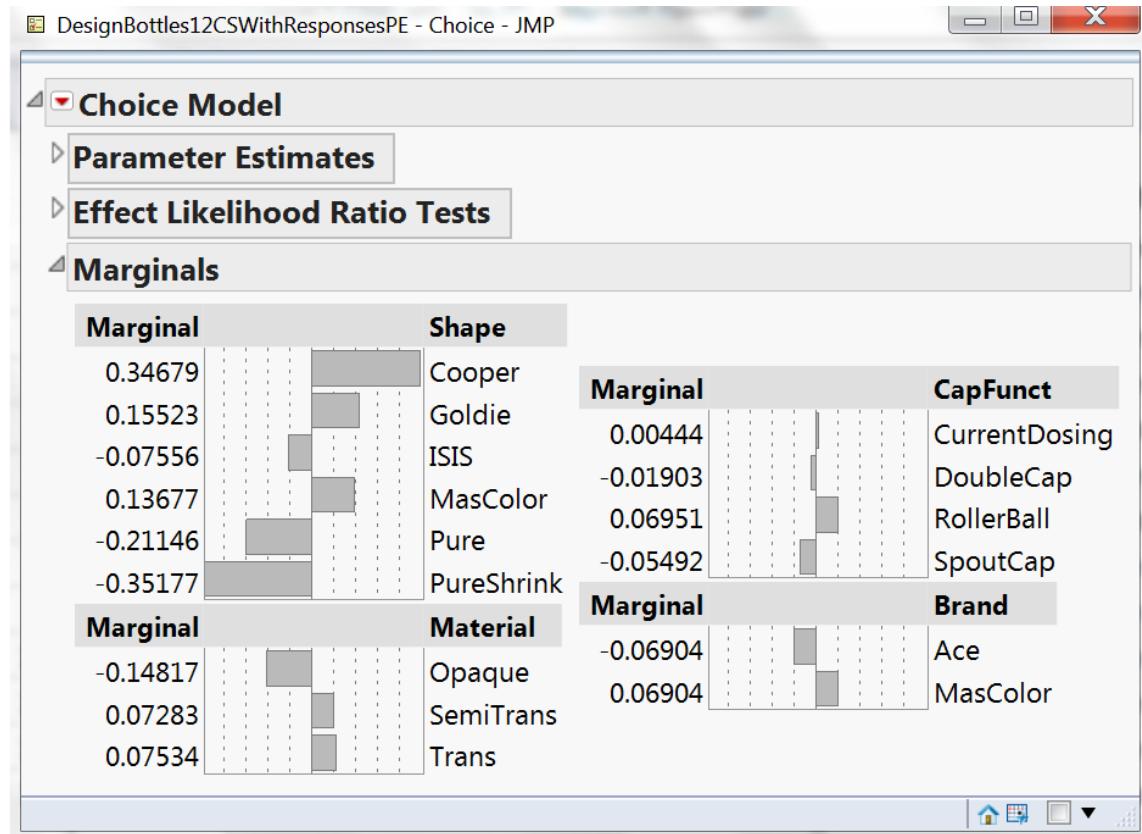
| L-R      |           |    |            |
|----------|-----------|----|------------|
| Source   | ChiSquare | DF | Prob>ChiSq |
| Shape    | 74.255    | 5  | <.0001*    |
| Material | 9.568     | 2  | 0.0084*    |
| Brand    | 6.520     | 1  | 0.0107*    |
| CapFunct | 3.075     | 3  | 0.3803     |





# Part-worth estimates

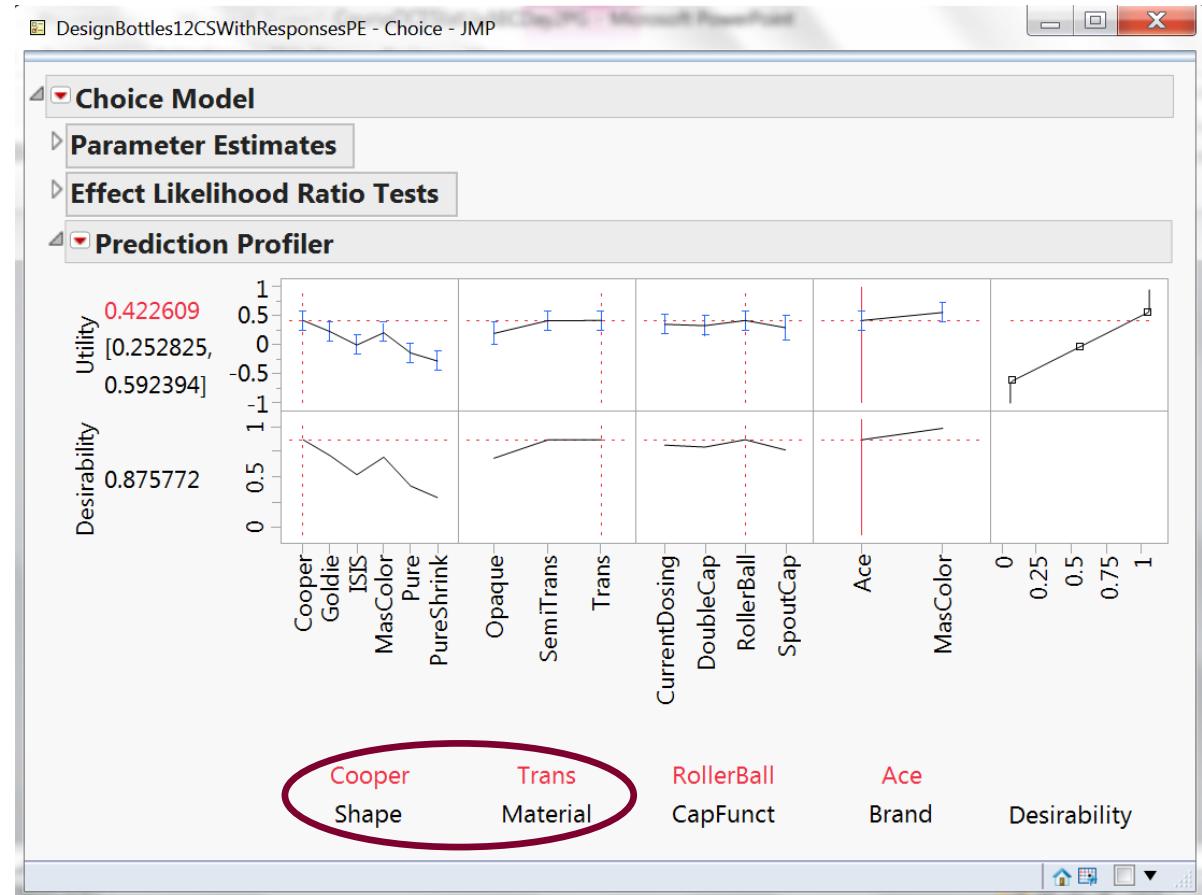
Cooper design,  
transparency  
and MAS Color  
brand are the  
key bottle  
drivers





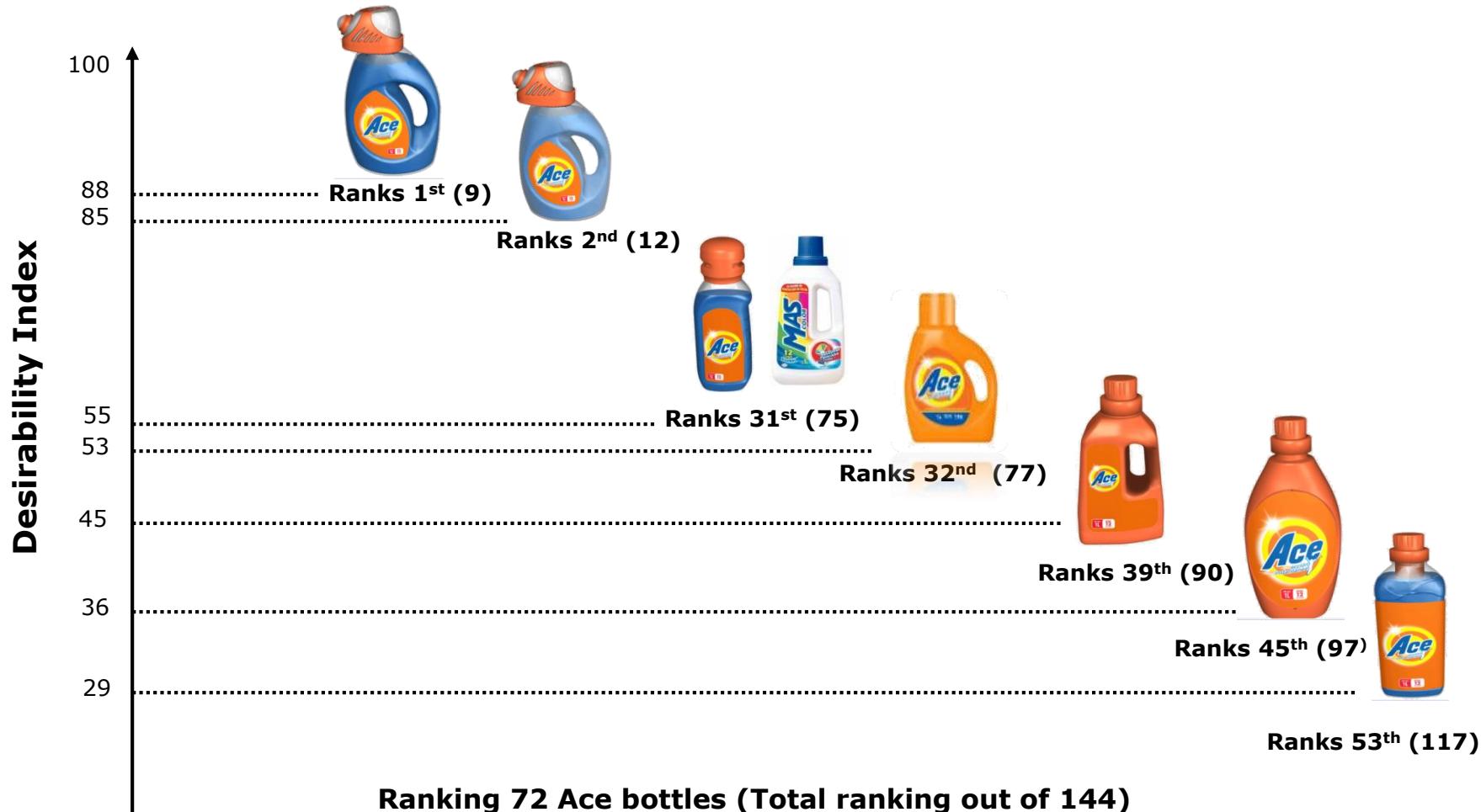
# Prediction profiler

Optimal settings  
for Ace bottle:  
**Cooper –  
Transparent**





# Bottle rankings





# Individual-level preference estimates

- Make sure the option “Firth Bias-adjusted Estimates” is checked
- Use a JSL script to speed up the individual-level analysis
- Look at the distributions of the individual-level estimates in the Distribution Platform
- Firth individual-level estimates prove useful for market segmentation in the Clustering Platform



# Healthcare system preference study

- To measure people's preferences for changes in the healthcare system due to care payment system effects
- Four types of respondents:
  1. Individual care providers
  2. Provider organizations' executives
  3. Policy makers
  4. Healthcare experts
- In Europe, US, Canada, Australia and New Zealand
- Led by the Center for Health Services and Nursing Research of the Catholic University of Leuven



# 11 healthcare system performance domains

1. Clinical effectiveness and patient safety
2. Best practice of service use
3. Care equity
4. Care coordination, teamwork and continuity
5. Patient centeredness
6. Timeliness
7. ST cost containment and budget safety
8. LT cost containment and budget safety
9. Provider wellness
10. Innovation
11. Gaming the system



# Choice set with partial profiles

| Change to your current healthcare system performance due to payment system effects           |   |
|--|---|
| Situation A  | Situation B   |
| Improved level of care equity<br>(avoiding care variation between patients with equal needs) | Current level of care equity<br>(avoiding care variation between patients with equal needs) |
| Current level of care coordination, teamwork and continuity                                  | Deteriorated level of care coordination, teamwork and continuity                            |
| Improved level of timeliness<br>(avoiding waiting and delays)                                | Deteriorated level of timeliness<br>(avoiding waiting and delays)                           |
| Deteriorated level of patient centeredness (respecting preferences and values)               | Improved level of patient centeredness (respecting preferences and values)                  |
| Deteriorated level of short term cost containment and budget safety                          | Current level of short term cost containment and budget safety                              |



# Partial profiles

- The levels of some attributes remain constant in every choice set
- This reduces the cognitive burden on the respondents when “many” attributes are used
- It may also avoid the use of lexicographic choice behavior, i.e., when respondents make choices based on only one attribute or a small subset of the attributes, which violates the assumption of non-compensatory decision-making



# Partial profiles in JMP

The screenshot shows the JMP software interface with the title bar "DOE - Choice Design - JMP Pro". The menu bar includes File, Edit, Tables, Rows, Cols, DOE, Analyze, Graph, Tools, View, Window, and Help. A navigation pane on the left lists "Choice Design", "Attributes", "Model", and "Design Generation". The "Design Generation" section is expanded, showing the following parameters:

- 5 Number of attributes that can change within a choice set
- 2 Number of profiles per choice set
- 18 Number of choice sets per survey
- 3 Number of surveys
- 200 Expected number of respondents per survey

Below these parameters are two buttons: "Make Design" and "Back".



# Prior beliefs about attributes

| RANK | PERFORMANCE DOMAIN   |
|------|--|
| 1    | Clinical effectiveness and patient safety  |
| 2    | Best practice of service use<br>LT cost containment and budget safety  |
| 3    | Gaming the system<br>Care equity<br>Care coordination, teamwork and continuity                                 |
| 4    | Timeliness<br>Patient centeredness<br>Innovation<br>Provider wellness<br>ST cost containment and budget safety |



# Prior beliefs about attribute levels

| RANK | OUTCOME IN A PERFORMANCE DOMAIN |
|------|---------------------------------|
| 1    | Positive                        |
|      | ∨                               |
| 2    | No change or neutral            |
|      | ∨                               |
|      | ∨                               |
| 3    | Negative                        |

People are loss averse!



# Reflection on the prior mean

| RANK | PERFORMANCE DOMAIN                         | -     |
|------|--|-------|
| 1    | Clinical effectiveness and patient safety  | -0.6  |
| 2    | Best practice of service use               | -0.4  |
|      | LT cost containment and budget safety      | -0.4  |
| 3    | Gaming the system                          | -0.35 |
|      | Care equity                                | -0.35 |
|      | Care coordination, teamwork and continuity | -0.35 |
| 4    | Timeliness                                 | -0.3  |
|      | Patient centeredness                       | -0.3  |
|      | Innovation                                 | -0.3  |
|      | Provider wellness                          | -0.3  |
|      | ST cost containment and budget safety      | -0.3  |



# Reflection on the prior mean

| RANK | PERFORMANCE DOMAIN                         | -     | N    | +    |
|------|--|-------|------|------|
| 1    | Clinical effectiveness and patient safety  | -0.6  | 0.1  | 0.5  |
| 2    | Best practice of service use               | -0.4  | 0.05 | 0.35 |
|      | LT cost containment and budget safety      | -0.4  | 0.05 | 0.35 |
| 3    | Gaming the system                          | -0.35 | 0.05 | 0.3  |
|      | Care equity                                | -0.35 | 0.05 | 0.3  |
|      | Care coordination, teamwork and continuity | -0.35 | 0.05 | 0.3  |
| 4    | Timeliness                                 | -0.3  | 0.05 | 0.25 |
|      | Patient centeredness                       | -0.3  | 0.05 | 0.25 |
|      | Innovation                                 | -0.3  | 0.05 | 0.25 |
|      | Provider wellness                          | -0.3  | 0.05 | 0.25 |
|      | ST cost containment and budget safety      | -0.3  | 0.05 | 0.25 |



## Prior mean

$$\beta_0 = [-0.6, 0.1, -0.4, 0.05, -0.4, 0.05, -0.35, 0.05, -0.35, 0.05, -0.35, 0.05, \\ -0.3, 0.05, -0.3, 0.05, -0.3, 0.05, -0.3, 0.05, -0.3, 0.05]'$$

The diagram illustrates the prior mean vector  $\beta_0$  as a sequence of 12 elements. Double-headed arrows above the vector indicate the range of each element. The first five elements are bounded by green arrows, the next three by yellow arrows, and the last four by orange arrows.



# Reflection on the prior variance

| RANK | PERFORMANCE DOMAIN                         | N    | +    |
|------|--|------|------|
| 1    | Clinical effectiveness and patient safety  | 0.1  | 0.5  |
| 2    | Best practice of service use               | 0.05 | 0.35 |
|      | LT cost containment and budget safety      | 0.05 | 0.35 |
| 3    | Gaming the system                          | 0.05 | 0.3  |
|      | Care equity                                | 0.05 | 0.3  |
|      | Care coordination, teamwork and continuity | 0.05 | 0.3  |
| 4    | Timeliness                                 | 0.05 | 0.25 |
|      | Patient centeredness                       | 0.05 | 0.25 |
|      | Innovation                                 | 0.05 | 0.25 |
|      | Provider wellness                          | 0.05 | 0.25 |
|      | ST cost containment and budget safety      | 0.05 | 0.25 |



# Reflection on the prior variance

| RANK | PERFORMANCE DOMAIN                         | N    | +    | Std. |
|------|--|------|------|------|
| 1    | Clinical effectiveness and patient safety  | 0.1  | 0.5  | 0.3  |
| 2    | Best practice of service use               | 0.05 | 0.35 | 0.25 |
|      | LT cost containment and budget safety      | 0.05 | 0.35 | 0.25 |
| 3    | Gaming the system                          | 0.05 | 0.3  | 0.2  |
|      | Care equity                                | 0.05 | 0.3  | 0.2  |
|      | Care coordination, teamwork and continuity | 0.05 | 0.3  | 0.2  |
| 4    | Timeliness                                 | 0.05 | 0.25 | 0.15 |
|      | Patient centeredness                       | 0.05 | 0.25 | 0.15 |
|      | Innovation                                 | 0.05 | 0.25 | 0.15 |
|      | Provider wellness                          | 0.05 | 0.25 | 0.15 |
|      | ST cost containment and budget safety      | 0.05 | 0.25 | 0.15 |



# Prior variance

**Table 4 Survey 1 of the Bayesian D-optimal partial profile design**

| Choice set | Attributes |   |   |   |   |   |   |   |   |   |   |
|------------|------------|---|---|---|---|---|---|---|---|---|---|
| 1          | *          | * | * | * | + | N | + | - | * | * | - |
| 1          | *          | * | * | * | N | - | - | + | * | * | N |
| 2          | *          | * | - | * | * | - | * | + | - | N | * |
| 2          | *          | * | + | * | * | N | * | N | N | - | * |
| 3          | *          | * | - | * | * | + | N | + | N | * | * |
| 3          | *          | * | + | * | * | N | + | - | - | * | * |
| 4          | *          | * | N | + | * | - | * | - | * | + | * |
| 4          | *          | * | - | N | * | + | * | N | * | - | * |
| 5          | *          | - | * | * | S | S | * | * | * | N | + |
| 5          | *          | N | * | * | S | S | * | * | * | + | - |
| 6          | *          | N | * | S | - | * | N | + | * | * | * |
| 6          | *          | - | * | S | N | * | - | - | * | * | * |
| 7          | *          | - | * | * | N | + | * | * | * | - | - |
| 7          | *          | N | * | * | - | N | * | * | * | N | + |
| 8          | *          | N | S | - | - | * | * | * | N | * | * |
| 8          | *          | - | S | N | N | * | * | * | - | * | * |
| 9          | *          | + | N | * | + | * | N | * | * | + | * |
| 9          | *          | N | + | * | N | * | - | * | * | - | * |
| 10         | N          | * | * | S | * | * | + | + | S | * | * |
| 10         | -          | * | * | S | * | * | - | N | S | * | * |
| 11         | N          | * | * | * | * | + | - | - | - | * | * |
| 11         | +          | * | * | * | * | - | + | N | + | * | * |
| 12         | +          | * | * | * | N | * | * | N | N | * | - |
| 12         | -          | * | * | * | + | * | * | - | + | * | N |
| 13         | N          | * | * | * | + | - | * | * | * | N | - |
| 13         | +          | * | * | * | N | N | * | * | * | + | N |
| 14         | +          | * | * | N | * | + | * | * | - | * | N |
| 14         | -          | * | * | - | * | N | * | * | + | * | + |
| 15         | +          | * | * | - | * | * | N | - | * | + | * |
| 15         | -          | * | * | + | * | * | - | + | * | - | * |
| 16         | -          | * | - | * | N | * | + | * | * | * | N |
| 16         | +          | * | + | * | - | * | - | * | * | * | + |
| 17         | -          | + | - | * | * | * | - | * | * | * | + |
| 17         | +          | N | + | * | * | * | N | * | * | * | N |
| 18         | N          | - | + | N | * | * | N | * | * | * | * |
| 18         | -          | N | N | - | * | * | + | * | * | * | * |

**Table 5 Survey 2 of the Bayesian D-optimal partial profile design**

| Choice set | Attributes |   |   |   |   |   |   |   |   |   |   |
|------------|------------|---|---|---|---|---|---|---|---|---|---|
| 1          | *          | * | * | * | + | S | - | * | - | * | N |
| 19         | *          | * | * | * | + | S | - | * | - | * | N |
| 19         | *          | * | * | * | N | S | N | * | N | * | - |
| 20         | *          | * | * | * | - | N | S | N | S | * | * |
| 20         | *          | * | * | * | N | - | S | + | S | * | * |
| 21         | *          | * | * | + | - | S | * | * | + | * | - |
| 21         | *          | * | * | - | N | S | * | * | N | * | + |
| 22         | *          | * | * | N | N | * | * | N | * | N | N |
| 22         | *          | * | * | + | + | * | * | + | * | - | - |
| 23         | *          | * | - | N | * | * | * | * | N | + | - |
| 23         | *          | * | + | - | * | * | * | * | + | - | N |
| 24         | *          | * | + | + | * | * | N | * | * | - | N |
| 24         | *          | * | N | N | * | * | - | * | * | + | - |
| 25         | *          | N | * | * | + | * | * | N | + | - | * |
| 25         | *          | - | * | * | - | * | * | + | - | N | * |
| 26         | *          | - | * | * | - | + | + | * | * | * | N |
| 26         | *          | + | * | * | N | - | N | * | * | * | - |
| 27         | *          | - | * | + | * | * | * | - | N | * | + |
| 27         | *          | + | * | - | * | * | * | + | + | * | - |
| 28         | *          | N | S | + | S | * | - | * | * | * | * |
| 28         | *          | - | S | - | S | * | + | * | * | * | * |
| 29         | *          | N | N | * | * | + | * | * | * | - | + |
| 29         | *          | - | - | * | * | N | * | * | * | + | - |
| 30         | *          | - | N | * | * | N | * | + | * | * | + |
| 30         | *          | + | - | * | * | - | * | - | * | * | N |
| 31         | +          | * | S | S | * | * | - | * | * | N | * |
| 31         | N          | * | S | S | * | * | + | * | * | + | * |
| 32         | N          | * | * | * | N | N | - | N | * | * | * |
| 32         | +          | * | * | * | - | + | - | * | * | * | * |
| 33         | N          | N | * | * | * | * | N | * | - | + | * |
| 33         | +          | - | * | * | * | * | + | * | + | N | * |
| 34         | -          | + | * | N | * | * | * | * | - | * | * |
| 34         | N          | N | * | - | * | * | * | * | + | N | * |
| 35         | N          | + | - | S | * | N | * | * | * | * | * |
| 35         | +          | N | N | S | * | + | * | * | * | * | * |
| 36         | +          | - | - | * | - | * | * | * | * | + | * |
| 36         | -          | + | + | * | N | * | * | * | * | - | * |

**Table 6 Survey 3 of the Bayesian D-optimal partial profile design**

| Choice set | Attributes |   |   |   |   |   |   |   |   |   |   |
|------------|------------|---|---|---|---|---|---|---|---|---|---|
| 1          | *          | * | + | * | * | S | + | S | * | S | * |
| 37         | *          | * | N | * | * | S | - | S | * | S | * |
| 37         | *          | * | + | * | * | * | * | - | N | - | + |
| 38         | *          | * | N | * | * | * | * | + | - | N | - |
| 38         | *          | * | + | * | * | * | * | + | - | N | - |
| 39         | *          | * | + | S | * | * | + | * | * | S | + |
| 39         | *          | * | - | S | * | * | - | * | * | S | N |
| 40         | *          | * | - | * | N | * | + | * | N | * | + |
| 40         | *          | * | + | * | + | * | N | * | - | * | - |
| 41         | *          | - | * | * | * | N | + | * | N | - | * |
| 41         | *          | N | * | * | * | + | N | * | - | + | * |
| 42         | *          | + | * | + | * | + | * | N | * | * | - |
| 42         | *          | - | * | N | * | - | * | + | * | * | N |
| 43         | *          | N | * | - | - | * | + | N | * | * | * |
| 43         | *          | - | * | + | N | * | N | + | * | * | * |
| 44         | *          | N | N | * | N | * | * | + | - | * | * |
| 44         | *          | + | + | * | + | * | * | N | N | * | * |
| 45         | -          | * | * | * | * | * | * | * | + | N | N |
| 45         | +          | * | * | * | * | * | * | * | N | + | - |
| 46         | -          | * | * | S | * | * | - | + | * | * | * |
| 46         | +          | * | * | S | * | * | + | - | * | * | N |
| 47         | -          | * | S | N | N | * | * | * | N | * | * |
| 47         | +          | * | S | + | + | * | * | * | + | * | * |
| 48         | -          | * | * | N | + | * | * | N | * | N | * |
| 48         | +          | * | * | - | N | * | * | + | * | + | * |
| 49         | +          | * | * | + | - | N | * | * | * | - | * |
| 49         | N          | * | * | N | N | - | * | * | * | + | * |
| 50         | -          | * | + | - | * | + | * | * | * | * | + |
| 50         | +          | * | N | + | * | - | * | * | * | * | N |
| 51         | +          | - | * | * | * | * | * | * | N | * | - |
| 51         | N          | + | * | * | * | * | * | * | - | * | + |
| 52         | N          | - | * | + | * | + | * | * | N | * | * |
| 52         | -          | N | * | N | * | N | * | * | + | * | * |
| 53         | -          | + | + | * | * | * | * | * | N | * | * |
| 53         | N          | - | N | * | * | * | * | * | - | * | * |
| 54         | -          | - | N | * | + | * | * | * | N | * | * |
| 54         | N          | + | + | N | * | * | * | * | - | * | * |



# Experiment Yourself!

Experiment!

Make it your motto day and night.

Experiment!

And it will lead you to the light.

The apple on top of the tree

Is never too high to achieve,

So take an example from Eve ...

Experiment!

Be curious,

Though interfering friends may frown.

Get furious

At each attempt to hold you down.

If this advice you only employ,

The future can offer you infinite joy

And merriment ...

Experiment!

And you'll see!

-- Cole Porter, in "Nymph Errant" (1933)



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