Trade-off primer
Basics of discrete choice, conjoint, MaxDiff and Q-Sort

Basic principles and overview

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The trade-offs: Broad communalities but different applications

- All trade-offs strive to uncover what is truly important
- Beyond this, complexity and goals vary widely
- Approaches in order of increasing difficulty and complexity—
  - Q-Sort
  - MaxDiff
  - Conjoint
  - Discrete Choice

- More complex methods more closely match complete, real-world product/service decisions
- Each method has applications in which it works best

DCM for marketplaces, conjoint single products, MaxDiff and Q-Sort more limited uses

- Discrete choice (DCM): For understanding how products or services will compete in a competitive environment, as features and prices vary
- Conjoint: For making the best configuration of a single product or service or service package—where competitive behavior is not important
- MaxDiff and Q-Sort: Sorting items that do not make a whole product/service
  - For instance, corporate claims, general concerns, basic category needs
  - MaxDiff provides importances for every respondent
  - Q-Sort solves only at the group level, but can handle more items

Marketplaces were hard to predict before DCM

Attributes (features) and levels (variations of features)

- To trade variations of features, we need conjoint or discrete choice
  - For instance, we would use conjoint or DCM to trade off several prices for a product like $60 vs. $100 vs. $140
  - Also, e.g., “stable on the shelf for 3 months” vs. “stable on the shelf for 6 months” would be levels
- MaxDiff sorts and definitely works only with features or lists of concerns where each item relates to one idea
  - Lowest price could be a single idea tradable in MaxDiff, but not (e.g.) three prices as above
- The exercise becomes long with 25+ items
- Q-Sort is looser, and handles up to ~100 items, but still try not to stack on multiple levels of one attribute

Have you seen a MaxDiff trade-off like this?

- This is a sample of one trade-off

When considering buying one of these products, which one is the <u>most</u> important and which is the <u>least</u> important?

Most Important		Least Important
○	Highest quality	○
●	Best comfort/grip	○
○	Best safety features	●

Next

- Respondents typically do 3 trade-offs per 4 items (so, e.g., 20 items would take 16 trade-offs)
- These responses lead to importances for the various attributes
- These are much clearer than anything we can get from scaled ratings
- Importances are **ratio scaled**, so, e.g., 100 has **four times** the importance of 25

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Sample MaxDiff screen (with pictures)

- This trades off designs with pictures. MaxDiff, like other trade-offs, can extend in many directions

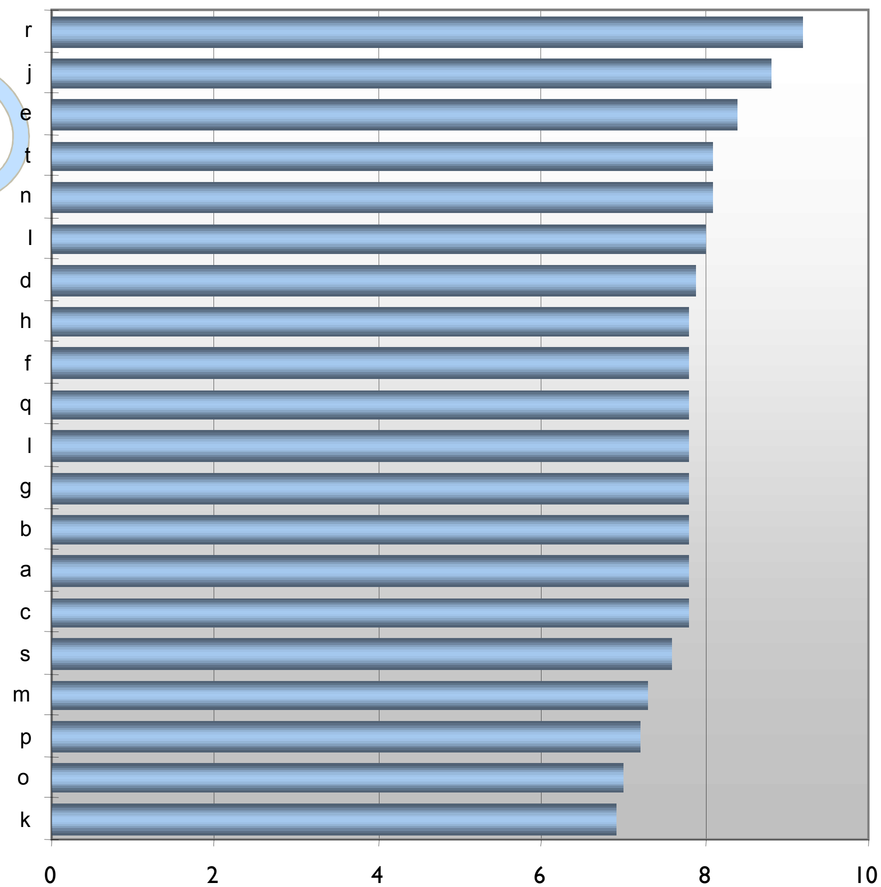
Looking at these three configurations, which ONE do you like the most and which ONE do you like the least?

Like the most		Like the least
		
		
		

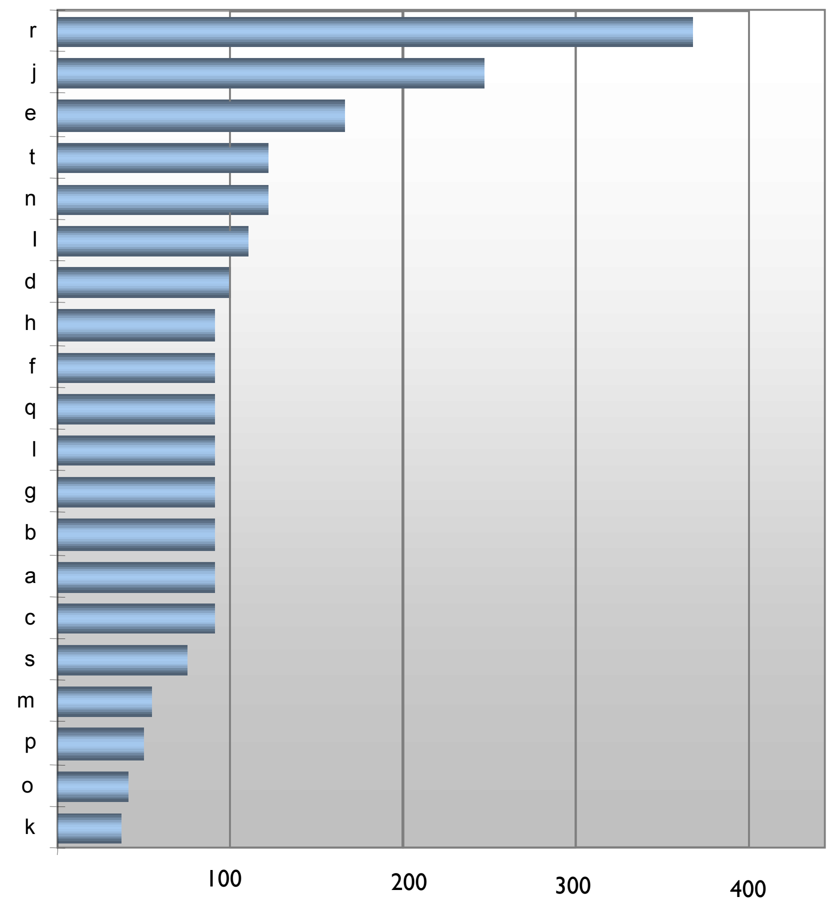
Next

MaxDiff reveals importances much more clearly than ratings

Same attributes tested two ways: the MaxDiff shows differences much more clearly



0 to 10 rating scale



MaxDiff forced trade-off
(Overall average set to 100)

More about Q-Sort: A guided partial ranking for many items

- Doing Q-Sort, we use only the first part of a longer routine—
  - Guided partial ranking
    - Respondents do not sort all items—
      - Typically break list into top half/bottom half
      - Then top 5 (or top 10)
      - Then top 1, 2, 3 in order
      - Next do bottom 5 (or bottom 10)
      - Last choose worst, next worst, third worst
  - The last part of Q-Sort, which we do not use, groups respondents and can sound a little mystical

There is no way to get an interesting illustration about sorting into piles, so here is something by Tintoretto

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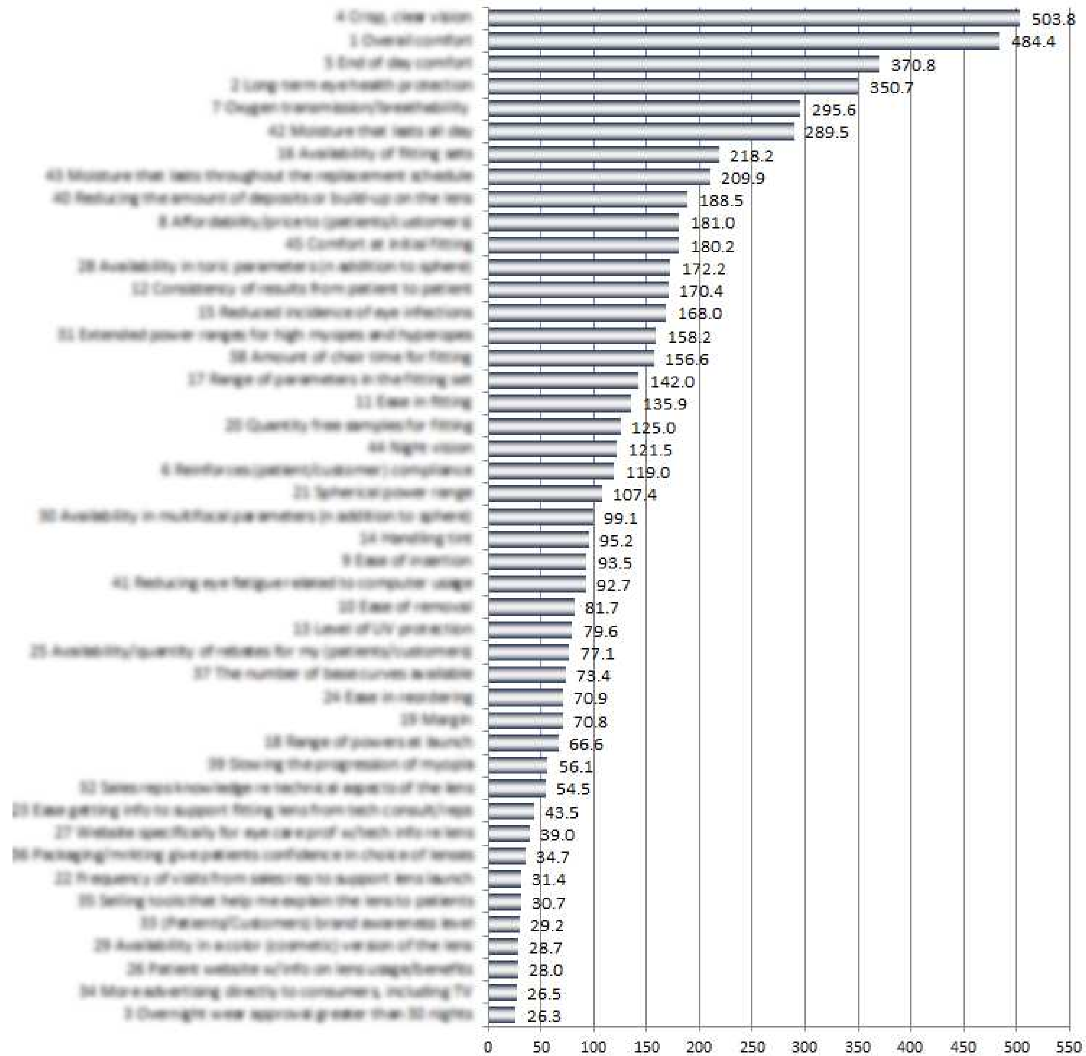
Analyzing the sort: Thurstone's Case 5

- We analyze with a well-established method called "Thurstone's Case 5"—in use since 1930
  - This converts rankings into scaled ratings that can be compared at the ordinal level
  - Thurstone was influential in psychometrics for many years
- Published reports show this working with **100 attributes**
  - We have successfully tried 80
- Results look very much like MaxDiff, only no individual level importances

The Thurstones (front center) and friends having a good time

Q-sort: large numbers of items prioritized

- A disguised list of about 55 items disguised from a recent study
- List is indexed so average importance = 100
  - Two clear winners are about 5.0 and 4.8 times as important as the average
    - Index values 503 and 484 respectively
- Lowest items index at 26.3 and 26.5
- The top item is about 20 times as important as the least



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Have you seen these? Conjoint cards

- Sample full-profile conjoint card
  - This one is for service delivery
  - Respondents typically see 8 to 18 of these cards
    - Online they give them ratings
    - In person, they also could sort and rank (this is now rare)

Feature	For this service:
Frequency of account reviews	6 months
Contract length and trial period	3 month trial period
Time on hold to reach tech support	Call back option within 5 minutes
Frequency of status updates for critical issues	Daily
Wait time for mission critical repair	Within 24 hours
Repair appointment window	AM/PM (8-12 or 12-5)
Wait time for non-mission-critical repairs	Within 4 hours
Frequency of status updates for non-critical issues	Hourly
E-mail response time	8 hours
Frequency of Status Updates	Weekly
Wait time for local telephone service	2 weeks
Wait time for high-speed internet	1 week

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Have you seen this? Choice task screen with instructions

- Respondents typically evaluate 8 to 21 of these. In each they choose the one they want, or none—or allocate across, e.g., 10 uses

Here's the first "purchase scenario" we want you to evaluate. Take a look at the different options being offered and review the characteristics of each. We realize that the features we've included may or may not be important to you. Focus on the aspects that do matter to you.

Then tell us which product, if any, you would buy.

Brand M Device	Brand G Device	Brand R Device	
Max # of users: 15	Max # of users: 75	Max # of users: 10	
Sharing data		Sharing data	
Desktop/server email			
Integrated wireless access			
Remote Access			
Work with customers		Work with customers	
Anti-virus/Anti-spam			
Storage capacity: 400 GB	Storage capacity: 200 GB	Storage capacity: 100 GB	
Storage expansion: Can add an external drive	Storage expansion: Can add an internal drive	Storage expansion: Not possible	I would not buy any of the products shown here.
5 user licenses included. User license additions: $59 per user	5 user licenses included. User license additions: $489 per block of 5 users	5 user licenses included. User license additions: $99 per user	
Price: $499	Price: $1299	Price: $299	

If you hold your mouse pointer over a term, the definition will appear.

Click the button below the option you would pick.

Clicking on this box opens a pop-up window that shows all of the feature definitions.

Definitions

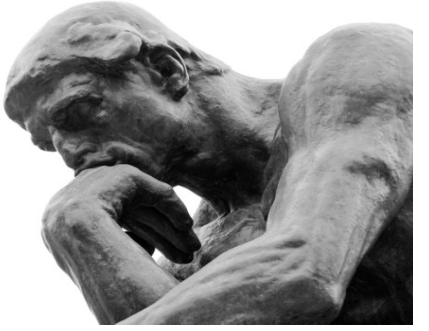
Continue

What are the basics about trade-off methods?

- **All make two basic assumptions**
  - **Products/services can be broken down into distinct sets of features or *attributes***
    - These attributes can be described by sets of distinct variations, or *levels*
    - Where attributes can vary continuously, they are measured only at specified points of interest in the research
      - Example: A course of pharma treatment can be any price between $2,000 and $9,000
        - Several distinct prices are chosen in this range for measurement, e.g.: $2,000; $4,500; $6,800 and $9,000
      - Choosing the right points to measure is very important
  - **Each level of each attribute has a value or utility that can be measured. The levels with the highest utility “win”**
    - This assumes that the basis for decisions is at least consistent
      - People generally are surprisingly consistent in trade-off exercises

Trade-off methods work best with "cognitive" features

- If we consider products as ranging along a continuum—
  - From more "cognitive" (or having more to think about) to
  - More "affective" or "sensory" (or more feeling-based)
- Trade-offs work best where products have more "cognitive" elements.

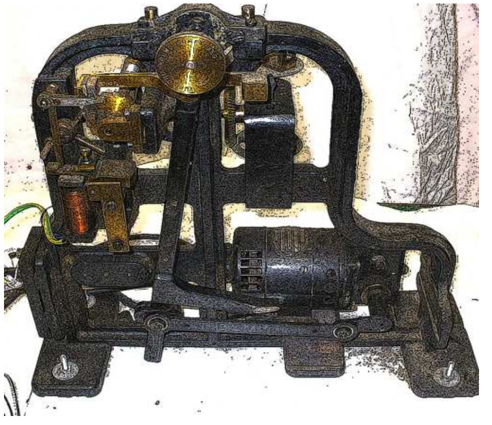


- Sometimes it is very difficult to show how more affective or sensory elements that might be traded
  - For instance, in a trade-off exercise, people cannot trade off "tastes good" against other product attributes
- However, people generally can trade off brand (which can have many affective components) vs. price or other attributes
  - People can value specific attributes differently for different brands
    - For instance, Sony used to command a higher price than many other brands for the same set of features
      - So features were worth more with the Sony name

What can you expect from DCM and conjoint?

- First and foremost a market simulator
  - This typically runs under Excel and allows you to test out all possible combinations (and more if you can interpolate, for instance between tested prices) in real time
  - These typically get run with easy to use controls
- Also, specific simulations
  - These show the results of specific market conditions, or for conjoint and one product, specific product configurations
- Possibly comparisons of each brand in response to changes in price
- These and other types of output are discussed after this, in “Some helpful types of output”

Not guaranteed to produce helpful output



Trade-Off Ground Rules

Attributes and levels

Experimental designs

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Trade-offs consider products as "attributes" and "levels"

- To review—
  - **Attributes** are a product's or service's basic features
    - Traditionally, brand and price were considered attributes
      - Brand does not need to be with discrete choice modeling, as we will see
  - **Levels** are specific variations of features that we wish to measure.
    - e.g., a car's fuel economy can vary from 18 to 32 mpg
      - We choose to measure at
        - 18 mpg
        - 24 mpg and
        - 32 mpg
    - Fuel economy then has **3 levels**
  - When setting levels, the challenge is finding **the right points** to measure **without using too many**
    - There are costs to a study from increasing attributes and levels
      - The Appendix discusses these in more detail

Not our type of levels

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Thinking in attributes and levels: Interesting exercise*

- How can we express this market situation in terms of attributes and levels?
  - Four companies make **Industrial Macerators****
    - Ace (your client);
    - Hyper Size;
    - Leviathan;
    - Truly Big
  - These can cost between $46 and $88 million.
    - Ace, however, considers itself the quality leader, and will not sell anything costing less than $52 million
  - They have some very special features, namely:
    - 2, 4, or 6 macerating paddles
      - Ace has just patented an 8-paddle design, which it wants to introduce.
    - 3 to 17 sparging poles
    - A wide range of colors: black, brown, olive drab, and pink

Something like this only much bigger

** Not a real quiz*
*** Don't worry; this one is not a real product—at least we hope it isn't*

Macerators in attributes and levels: Can you answer?

- First consider the attributes as very well-defined, specific features--things you can point to or show. What would you include?

- Now consider these attributes in terms of benefits or functions useful to the user. How would you describe them?

Macerators in attributes and levels: Sample responses

First consider the attributes as very well-defined, specific features--things you can point to or show. What would you include?

1. Prices from $46 million to $88 million. Make sure you include $52 million. Maybe more if they want to raise prices. So maybe $46, $52, $60, $72, $88 and $94

   Comment: This is a good try. It is a lot of prices. As we will see, prices can be specific to brands

2. Number of macerating paddles. Make sure to include 8 to test the new patented design

   Comment: Good job. This would work!

3. Number of sparging poles, say, 3, 5, 7, 9, 11, 13, and 17

   Comment: This is a lot of choices for poles. We should restrict how many we test based on our in-depth understanding of the pole market, measuring only what is important

4. Brand: The four brands

   Comment: As we will see, brand is really NOT an attribute, but something more

   Comment: And do not forget color as an attribute—the marketing team would be heartbroken

Now consider these attributes in terms of benefits or functions useful to the user. How would you describe them?

Now you have me. You would have to have some idea of how these things actually worked and what they did.

Comment: This is the truth about all trade-off studies. We really need to understand the market before we start doing them

Moral: It pays to know the category first

- As we just saw, you need to know the category to make good decisions about attributes and levels
  - Finding the right values can be tricky even with in-depth understanding
- If your knowledge of the category is scanty, you probably need some qualitative research first
- It is easy to get fixated on product attributes, not benefits
  - Customers typically care about **what the product can do for them**, not how it is put together
  - Our job often includes moving the focus to where it belongs for customers
- We will see later—
  - You also need to be sparing with attributes and levels

"I want the time, not how the watch is made"

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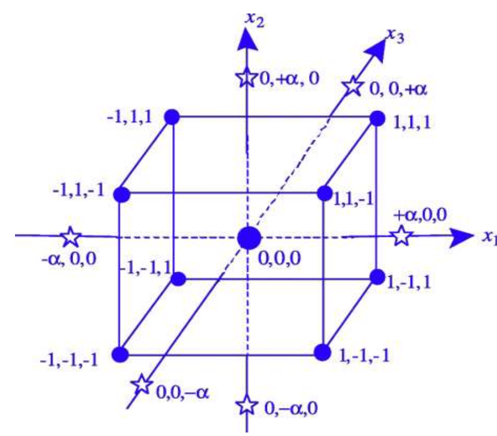
Experimental designs give conjoint and choice great power

- "Experimental design" covers a broad range of approaches
  - However, all designs for trade-offs meet one goal:
    - Accurate estimation of many different situations using relatively few carefully selected situations or comparisons
  - That is, if we use an experimental design and show just a few "stimulus items" (products, marketplaces, or comparisons)
    - Then we can estimate accurately what would happen in hundreds, or even thousands, of different situations
- Let's see how powerful this can be. . .



This should clear up everything!

Examples of the power of experimental designs

- Suppose you had a product with:
  - 6 attributes, each having 3 levels, and
  - one attribute with 6 levels
  - This would mean that you could have 3 x 3 x 3 x 3 x 3 x 3 x 6 or some 4374 possible variations on this product
  - Using an experimental design, we can accurately estimate the value all 4374 possible variations using ***only 18 product descriptions***
- Suppose you have a product with 18 two-level attributes
  - This would give you 2^18 or 262,144 combinations
  - You can measure all these possible ***using only 20 product descriptions***
- More details on how these work can be found in:
  "Inside Experimental Designs"

Hierarchical Bayesian (HB) analysis: a vast improvement

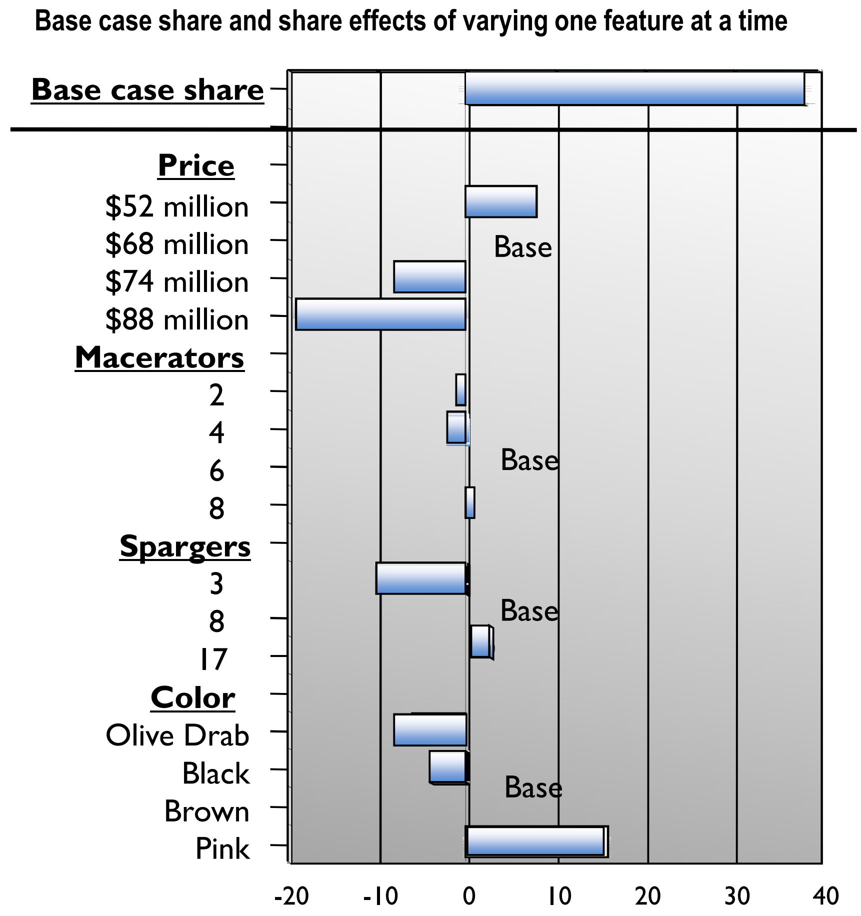
- **Hierarchical Bayesian** (HB) analysis really stretches what we can get from trade-offs, but relies on some fairly mind-boggling concepts
  - It has been proven under fire—since the 1990s
- With HB, we can
  - Get individual level data from a choice model and MaxDiff
    - This was never possible before HB
  - Measure more attributes in both choice models and conjoint
    - For instance, we can run choice tasks requiring 40 to 60 marketplaces without increasing the number of respondents
  - Measure as much as any respondent can evaluate in a study

HB analysis makes other methods seem old and tired

Some helpful DCM output

Some helpful charts: Showing feature changes one at a time

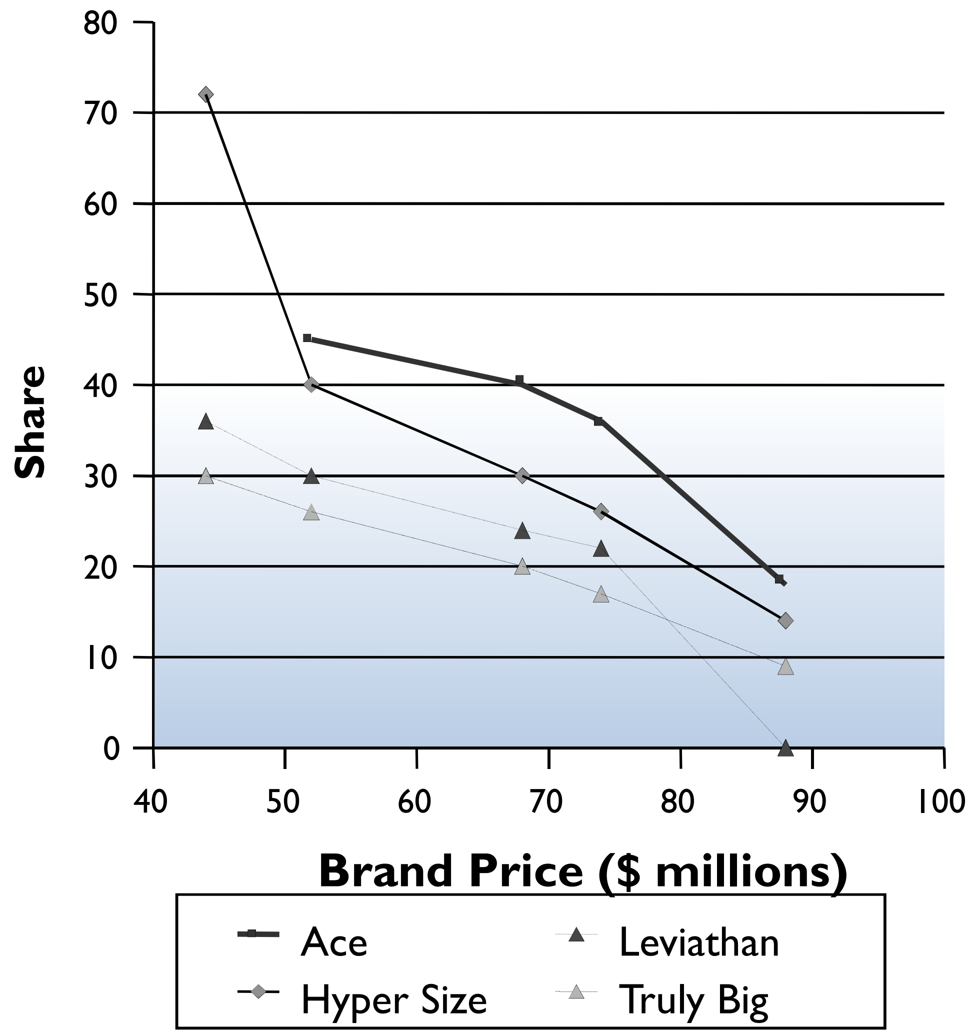
- A quick overview of the relative effects of changing attributes one level at a time for a brand
- Here is a report for the Ace Enterprise Macerator **
- What it shows:
  - When Ace varies all other brands are held at set values (a **base case**)
    - All attributes for Ace are varied one level at a time
    - Results are saved
  - When the next brand (Leviathan) varies, Ace and all others stay at the same set values (their **base cases**)
    - This repeats for all brands
  - This one chart reflects the results of 15 simulator runs
- Note that the set value (or base case) always appears as **zero deviation** in the chart:
  - Price: $68 million
  - Macerators: 6
  - Spargers: 8
  - Color: Brown.



*** Remember them, all the way back in the beginning?*

Some helpful charts: The self-effects chart

- This chart shows what would happen if each brand varied its price while all others remained at their base level
  - e.g., $68 million
  - For Ace, e.g., we see how share would change if all other brands stayed at $68 million and Ace alone changed prices
    - Note that Ace alone does not go below $52 million in price
      - This is below the range Ace's management would consider
  - Superimposing curves for all the brands shows their relative sensitivity to changes in price
    - Note that this one chart summarizes the results of 19 simulation runs, including the base case



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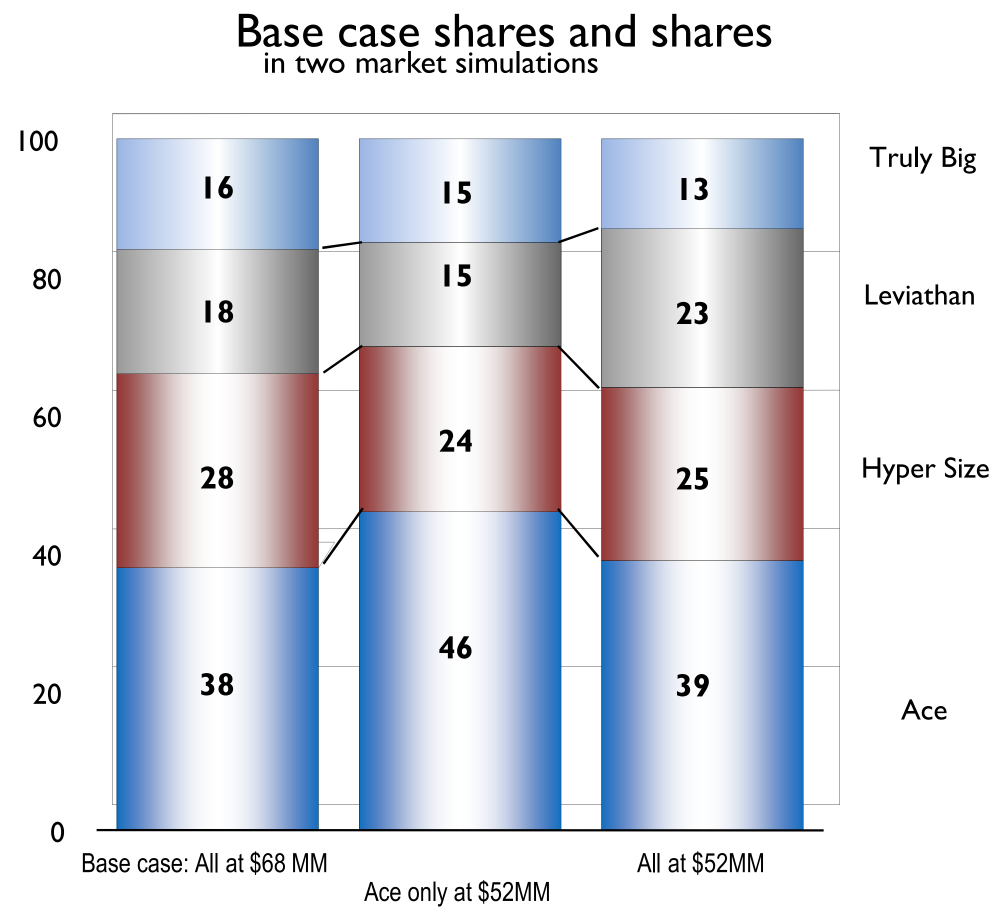
Some helpful charts: Changes in different scenarios

- Here, how all shares change in two different competitive scenarios, compared with the base case.
- A very dramatic way to show answers to a key "what if" question
  - Insights gained from this analysis and display often **make audiences' eyes light up**,[1] and indeed can repay all your hard work
- These are only a few of the types of displays that can flow from a choice-based modeling analysis.
- **Quick quiz**: What is the crucial lesson for Ace from these two simulations?
- **Quick answer**: Do **not** start a price war and hope that nobody else does
  - Leviathan is the only possible winner if this happens: share up 5 points on a base of 18, or 28%, while price per unit decreases 24%



[1] *Or cause calls to lock up the results, so they can't leak out to competitors*

Some helpful output: Market simulator programs

- These easy to use, Excel—based programs give real time answers to hundreds or thousands of “what if” questions about varying prices and features. They also provide both graphical and numeric displays of results and have controls (drop-downs, sliders, etc.) to simplify use. Results stay up front in their most useful form and calculations remain hidden where they belong.

Current Case

		Yes	No
Brand R			
Horsepower	260		
Price	12899		
Features		Yes	No
✓ Cruise control with No-Wake Mode		◉	○
✓ Learning Key		◉	○
✓ MPG Mode for saving fuel		◉	○
✓ Adjustable handlebar with Electric Trim		◉	○
✓ Off-throttle steering control		◉	○
Brand G			
Horsepower	260		
Price	12899		
Features		Yes	No
✓ Cruise control with No-Wake Mode		◉	○
✓ Remote control Learning Key		◉	○
✓ MPG Mode for saving fuel		◉	○
✓ Adjustable handlebar with Manual Trim		◉	○
✓ Brake system		◉	○
Brand N			
Horsepower	260		
Price	12899		
Features		Yes	No
✓ Cruise control with No-Wake Mode		◉	○
✓ Learning Key		◉	○
✓ Fly-by-wire throttle		◉	○
✓ Adjustable handlebar with Electric Trim		◉	○
✓ Brake system		◉	○

Reference Case

		Yes	No
Brand R			
Horsepower	260		
Price	13999		
Features		Yes	No
✓ Cruise control with No-Wake Mode		◉	○
✓ Learning Key		◉	○
✓ MPG Mode for saving fuel		◉	○
✓ Adjustable handlebar with Electric Trim		◉	○
✓ Off-throttle steering control		◉	○
Brand G			
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✓ Learning Key		◉	○
✓ Fly-by-wire throttle		◉	○
✓ Adjustable handlebar with Electric Trim		◉	○
✓ Brake system		◉	○

Hide the Excel Ribbon

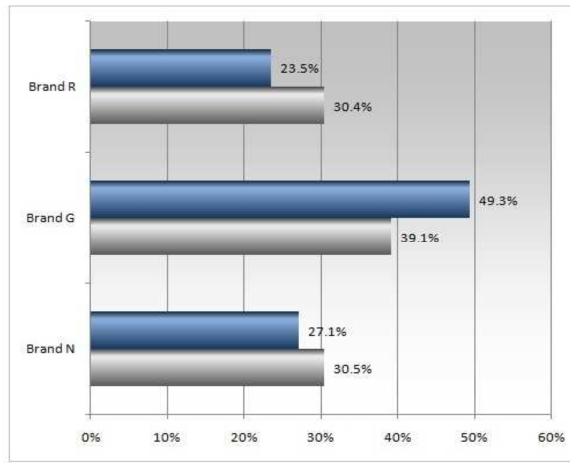
Restore the Excel Ribbon

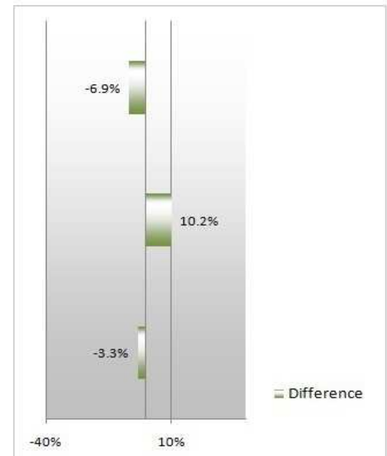
Shares

	Brand R	Brand G	Brand N
Current	23.5%	49.3%	27.1%
Reference	30.4%	39.1%	30.5%
Difference	-6.9%	10.2%	-3.3%

Reset CURRENT case to inital values

Reset reference case to inital values





Gross Revenue per 100 prospects

	Brand R	Brand G	Brand N
Current	$ 303,693	$ 636,341	$ 349,866
Reference	$ 425,723	$ 547,730	$ 426,447
Difference	$ (122,030)	$ 88,611	$ (76,581)
% change	-28.7%	16.2%	-18.0%

A section of a demonstration simulator

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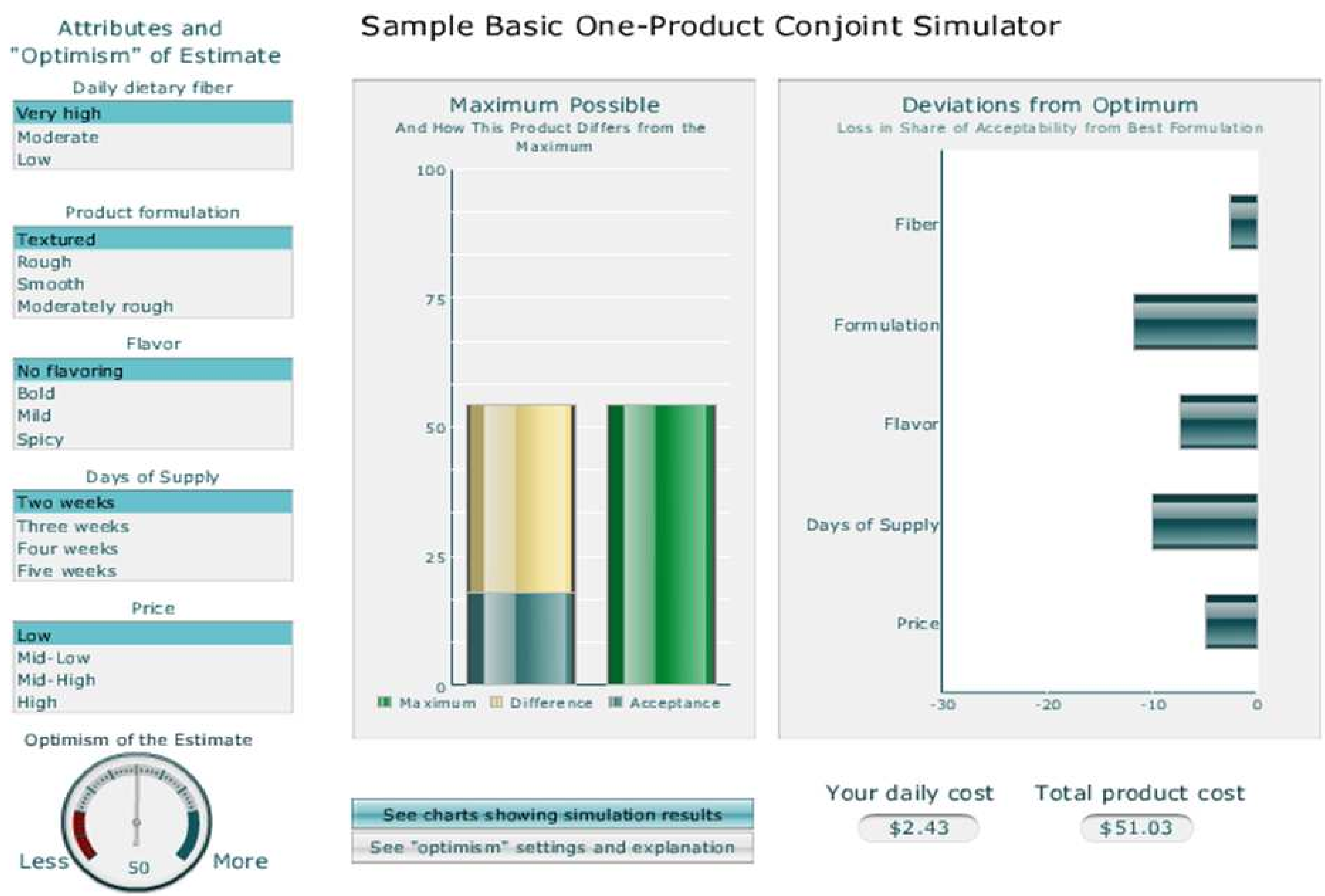
A picture of an interactive simulator that is located on this site. Please look for the link!



The original can run inside PowerPoint as well as on the Web

Questions? Comments? Need more information?

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