

## Testing Models of Consumer Search Using Web Browsing Data

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## Introduction

- Choice alone cannot be used to test the Satisficing model
- We need other data
- Choice process data is one option
- Another would be to use data directly on search
- Assume we observe exactly what alternatives have been looked at, and in what order

## Satisficing and Search Data

- Satisficing make 2 predictions
1. Object chosen should be last searched (unless they have search all available alternatives)
    - Search stops when an above reservation alternative is found
    - That alternative is then chosen
  2. Value of the best option currently seen should predict probability of continuing to search
    - Higher value alternatives more likely to be above reservation level
    - More likely that search will stop

## An Alternative Model

- Fixed search set size
  - Before starting to search decide how many alternatives to look at
  - Search that number of alternatives regardless of what is seen along the way
  - Note that such behavior is not optimal if one can 'dynamically optimize'
- Fixed search set implies
  - Last object seen not necessarily the one purchased
  - Value of object seen not predictive of whether search will continue

## Data

- Web browsing data allows us to approximate search data
  - We can record what websites a subject has looked at
  - (Note this is not the same thing as a subject understanding what is on the website)
- Dataset: 152,000 users from ComScore
  - Company that records web browsing activity (!)
    - Date
    - Time
    - Duration
    - Purchase description, price and quantity

## Data

- Concentrate on purchase of books

Table 1 - Transactions and Value by Bookstore

Bookstore	Transactions		Value	
	Number	Percentage	Number	Percentage
Amazon	10,197	65.5	210,543	76.3
Barnes and Noble	3,042	19.6	25,758	7.9
Book Club				
christianbook.com	615	3.9	3,968	1.2
christianbookstore.com	408	2.6	4,001	1.2
christianbook.com	61	0.4	3,617	1.1
brarypub.com	322	2.1	3,500	1.1
christianbook.com	197	1.2	2,095	0.6
Other Bookstore				
bookstreet.com	10	0.1	190	0.0
allbookstore.com	5	0.0	199	0.1
allbook.com	27	0.2	490	0.1
ocw.org	114	0.7	1,296	0.4
book.com	68	0.4	1,296	0.4
book.com	16	0.1	219	0.1
book.com	163	1.1	20,663	6.9
book.com	246	1.6	2,290	0.7
Total	15,561	100.0	277,074	100.0

## Data

- Aggregate data into 4 'stores'
  - Amazon
  - Barnes and Noble
  - Book clubs
  - Other Book stores
- Construct search history by looking at web browsing history for 7 days prior to transaction

Table 3 - Descriptive Statistics on Conditional Book Search

	2010			
	Amazon	B&N	Book Clubs	Other Book Stores
Duration of each website visit (in minutes)	4.99	13.03	7.69	12.36
Visits per 7 days of transaction	12,752	15,815	11,022	12,400
Visits within 7 days, including transactions	18,516	19,286	13,774	17,127
Transactions only	29,496	17,649	36,498	17,771
Total duration, including transaction visits	32.47	69.90	39.41	79.10
Total duration, including transaction visits	43.95	63.27	47.43	66.11
Number of stores searched	1.27	0.54	1.39	0.59
Number of books per transaction	2.39	2.00	2.29	1.60
Transaction expenditures (books only)	36.67	60.64	32.23	35.69
Number of books purchased	17,606	17,603	17,603	17,603
Number of transactions completed	7,209	6,962	7,209	6,962
Number of visits within 7 days	18,203	20,259	18,203	20,259
Number of visits per 7 days	94,011	109,127	94,011	109,127

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## Data

- Assume that the product the consumer wants is homogenous
  - They really want a copy of 'Inferno' by Dan Brown
- Search is over prices
  - Price of book in purchased store observed directly
  - Price of books in other store imputed from most recent purchase

## Results

- Consumers do not maximize on price
  - Buy from lowest priced store in 63% of observations
  - Average loss \$2.60 compared to lowest available price
  - BUT this difference is not due entirely to unawareness
    - Average loss relative to lowest of stores searched is \$1.99

## Results

- Some consumers do NOT buy the last searched product

Table 3 - Test of "No Recall" Assumption

Search window	No. of stores visited	Percentage	If 2 or more stores bought from		Percentage who bought from last searched?
			Yes	No	
7 Days	One	76			
	2 or more	24	Last store searched	65	55
8 Days	One	99			
	2 or more	1	Last store searched	64	55
9 Days	One	79			
	2 or more	21	Last store searched	63	55
4 Days	One	80			
	2 or more	20	Last store searched	61	55
3 Days	One	82			
	2 or more	18	Last store searched	61	56
2 Days	One	84			
	2 or more	16	Last store searched	61	56
1 Day	One	86			
	2 or more	14	Last store searched	61	56
Same day	One	90			
	2 or more	10	Last store searched	62	56

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4 Days	One	80			
	2 or more	20	Last store searched	61	55
3 Days	One	82			
	2 or more	18	Last store searched	61	56
2 Days	One	84			
	2 or more	16	Last store searched	61	56
1 Day	One	86			
	2 or more	14	Last store searched	61	56
Same day	One	90			
	2 or more	10	Last store searched	62	56

## Results

### 3. Observed price does NOT affect the decision to continue searching

TABLE 5—PRICE OF THE FIRST STORE BY NUMBER OF SEARCHES

Price of the first store	Once	Twice	Total
Lower or equal	63.55%	61.89%	63.32%
Higher	36.45%	38.11%	36.68%
Number of observations	2,244	349	2,593

## Summary

- We have introduced the 'Satisficing' model of incomplete attention
- Shown that satisficing can be optimal in the face of per-item search costs
- Shown that it is difficult to test satisficing with standard choice data
- Introduced two data sets which can be used to test satisficing
  - Choice process
  - Search data
- In the lab, satisficing seems to do a reasonable job of explaining behavior
- But in web search, behavior seems better described by a 'fixed search' algorithm
  - But data set does not have a lot of power