Search, Satisficing, and Revealed Preference

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1. Introduction
2. Theory
3. Experiment

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  - Center of policy and business agenda
  - Lies outside standard choice theory
- Can search models reconcile incomplete information and revealed preference?

Method

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- Key innovation: Enriching the data set in theory and practices
    - 'Choice process' data: Records how subjects' choices change with consideration time
    - Corresponding experimental design

- Theoretical results

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  - Environment may change behavior within this model class
  - In fact, reservation strategy is optimal under certain assumptions

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    - Subjects behave broadly in line with alternative-based and reservation-based
    - Reservation levels respond to environmental factors

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  - McCall [1970]

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- $\mathcal{Z}$ set of sequences Z
- $\mathcal{Z}_A \subset Z$: set of sequences s.t. $Z_t \subset A \in \mathcal{X}$

Definition

A Choice Process Data Set (X, C) comprises of:

- finite set X
- choice function $C : \mathcal{X} \rightarrow \mathcal{Z}$

such that $C(A) \in \mathcal{Z}_A \; \forall \; A \in \mathcal{X}$

- $C_A(t)$: choice made from set A after contemplation time t

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$$C_A(t) = \arg \max_{x \in S_A(t)} u(x)$$

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Characterizing ABS

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$$\begin{array}{rcl} xPy & \rightarrow & v(x) > v(y) \\ xIy & \rightarrow & y(x) = v(y) \end{array}$$

  - If and only if P and I satisfy **Only Weak Cycles**

$$x_1 PIx_2, ..., x_{n-1} PIx_n PIx_1$$

then there is no k such that $x_k Px_{k+1}$

Theorem

Choice process data admits an ABS representation if and only if $\succ^{ABS}$ and $\sim^{ABS}$ satisfy Only Weak Cycles

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- Equivalent to Simon's [1955] concept of satisficing
- Also optimal stopping rule for fixed search costs and no learning

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- Note: Implies complete search of sets comprising only of below-reservation objects

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- If they are **non-terminal**: Search continues after that object has been chosen

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- Let $X^{IN} = X^I \cup X^N$

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- Let $\succ^{RBS} = \succ^{L} \cup \succ^{ABS}$

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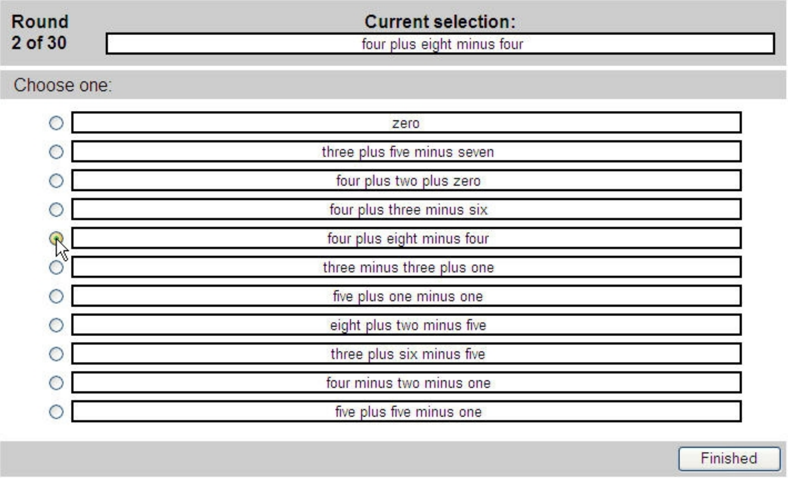
    - 3 x choice set size (10, 20 and 40 options)

Choice and Mistakes



Results

Failure rates (%) (22 subjects, 657 choices)

Set Size	***Complexity*** 3	7
10	7	24
20	22	56
40	29	65

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10	0.41	1.69
20	1.10	4.00
40	2.30	7.12

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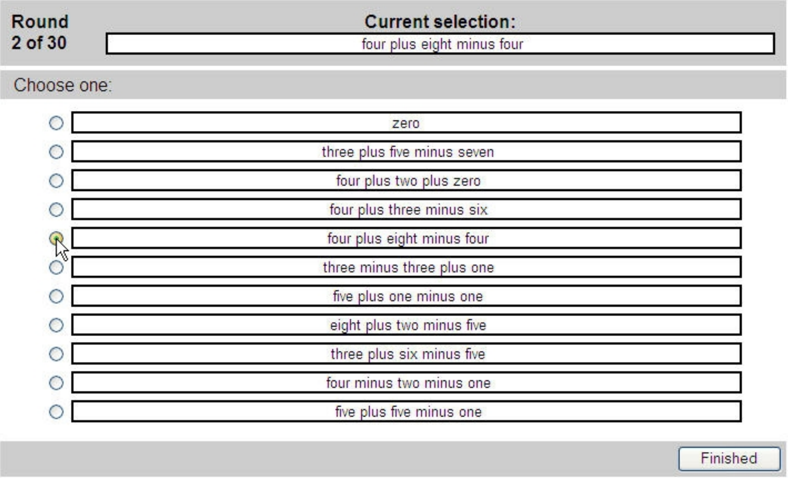
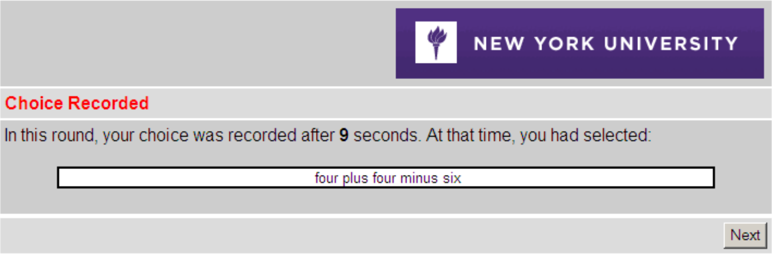
   - After 120 seconds has elapsed
   - When subject presses the ‘finish’ button
   - We discard any rounds in which subjects do not press ‘finish’

Stage 1: Selection

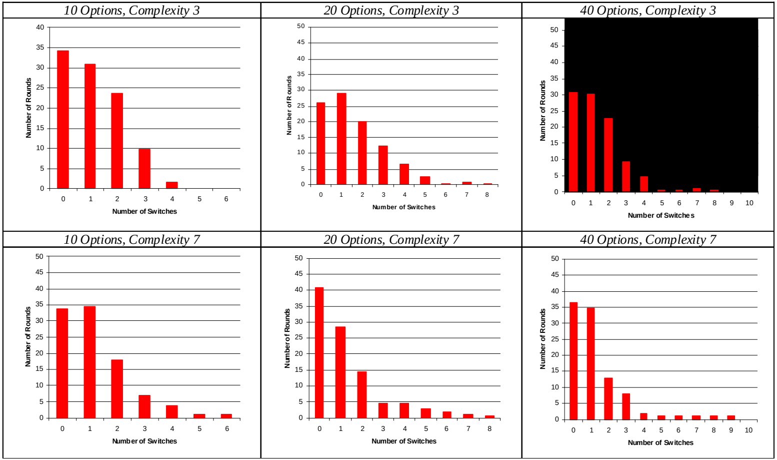


Stage 2: Choice Recorded



Do We Get Richer Data from Choice Process Methodology?

978 Rounds, 76 Subjects



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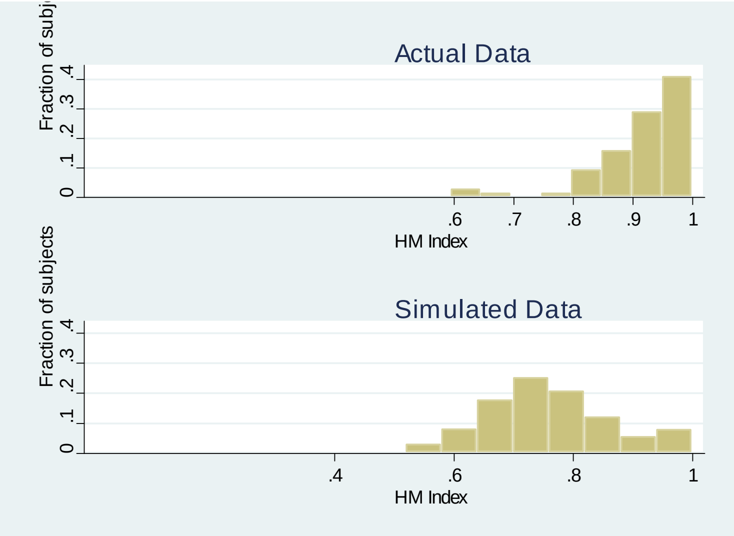
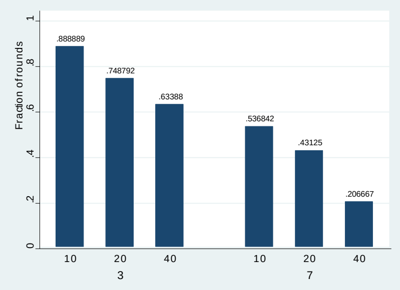
  - Largest subset of choice data that is consistent with condition

Houtman-Maks Measure for ABS

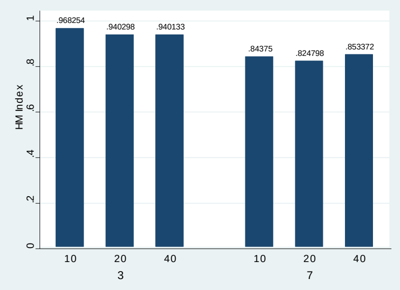


Traditional vs ABS Revealed Preference

Traditional



ABS



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2. Theory
3. Experiment
   - Mistakes
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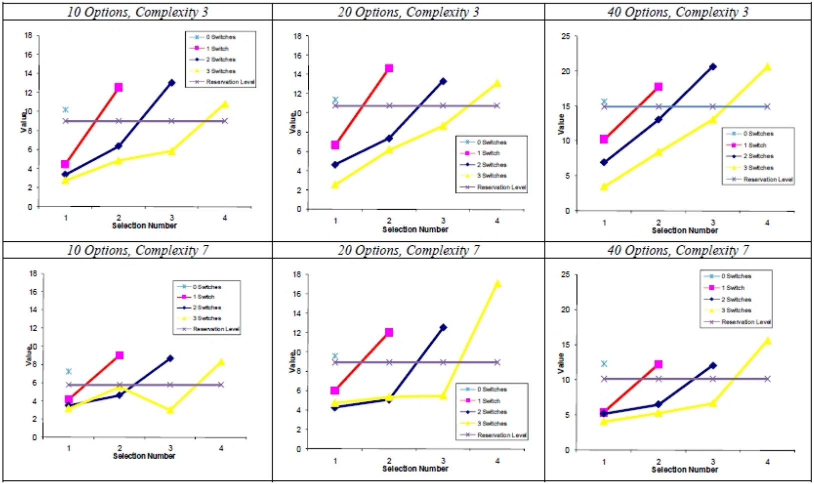
   - Testing Alternative-Based Search
   - Satisficing
   - Search Order

Satisficing Behavior a la Simon [1955]



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Estimating Reservation Levels

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  - Stopping search
  - Continuing to search
- Allows us to
  - Test satisficing model
  - Estimate reservation levels
- Assume that reservation level is observed with some error
- Can estimate reservation levels for each treatment using maximum likelihood

Estimated Reservation Levels

	Complexity	
Set Size	3	7
10	9.54	6.35
20	10.76	8.94
40	14.91	10.16

HM Indices for Estimated Reservation Levels

Set Size	Complexity 3	Complexity 7
10	0.91	0.83
20	0.83	0.77
40	0.84	0.78

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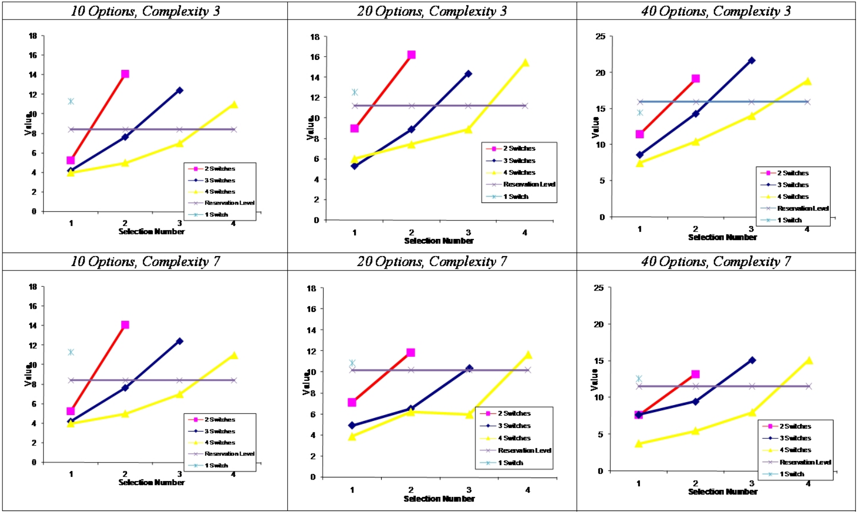
  - Fall with search costs
  - Unchanged with size of choice sets
- Our subjects
  - Respond optimally to increased complexity
  - Search too hard in large choice sets relative to small ones

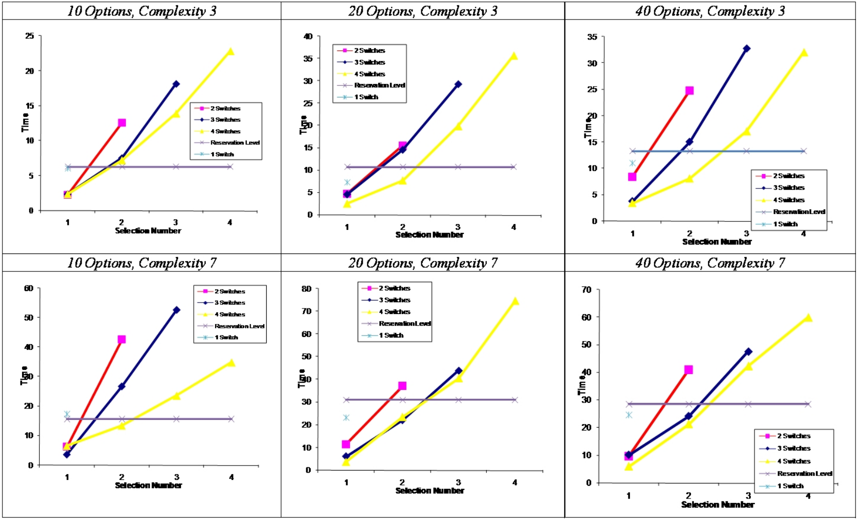
Question 1: Does Choice Process Elicitation Change Behavior?

Failure Rate			
		Complexity	
Set Size		3	7
10	Choice Process	11	47
	Normal Choice	*7*	*24*
20	Choice Process	27	59
	Normal Choice	*22*	*56*
40	Choice Process	38	81
	Normal Choice	*29*	*65*

Question 1: Does Choice Process Elicitation Change Behavior?



Question 2: Can Data be Described by a 'Reservation Stopping Time'?



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- Want to test how search order is affected by
  - Screen position
  - Complexity
- Ran a new treatment in which complexity varies within choice round

Search Order

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  - From the top of the list to the bottom of the list

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  - Simple-Complex (SC) searchers

Search Types			
		TB Search	
		Yes	No
SC Search	Yes	7	4
	No	7	2

Search Types Predict Choice - Example 1

Round
9 of 30

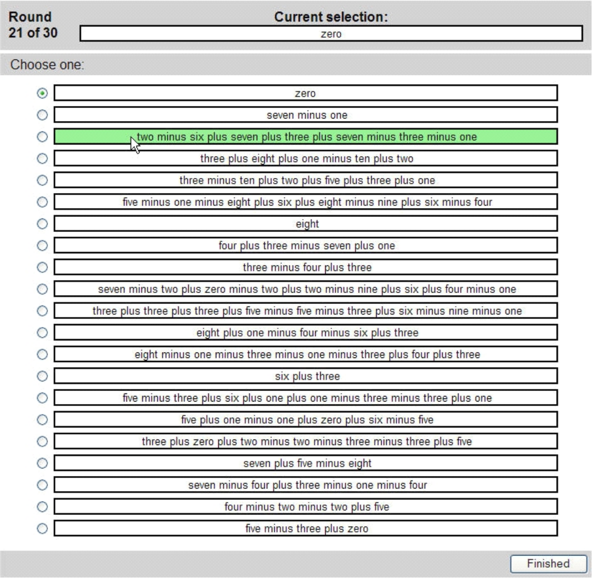
Current selection:
zero

Choose one:

- (selected) zero
- four minus four plus five
- three plus two
- seven plus three plus two
- five plus nine minus four minus four
- three plus two minus eight minus four plus five plus six minus nine plus eight plus seven
- four plus zero plus two plus one minus two
- four minus ten plus zero minus one plus two plus zero plus five plus two
- six minus two minus two minus four plus four
- four minus one
- five plus four minus six plus one
- eight plus four minus three minus two plus one minus three plus three
- five plus six minus seven minus nine plus two plus five plus three minus one
- seven plus zero minus eight minus one plus five plus six minus one minus four minus two
- four plus zero plus three plus two minus two minus nine plus six
- three minus one
- four minus four minus two plus four minus ten plus seven plus three plus three plus one
- five plus zero minus four minus two plus five plus three minus five
- two
- four plus five minus four minus one minus one
- four plus one plus ten

Finished

Search Types Predict Choice - Example 2



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  - 100% vs 66% of the time
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  - 80% vs 66% of the time
- Differences have low significance due to small sample sizes

What Next?

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  - e.g. lotteries

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- Level k reasoning