Beliefs inconsistencies

Sergey Alexeev

UTS

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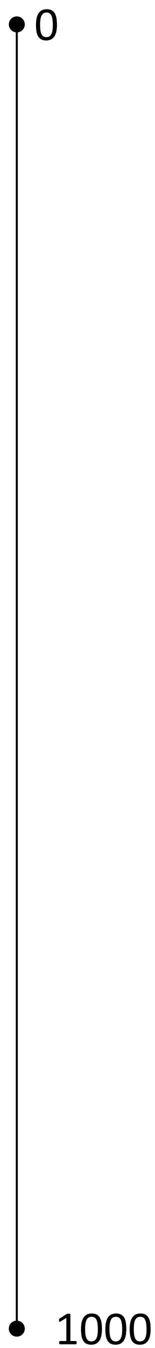
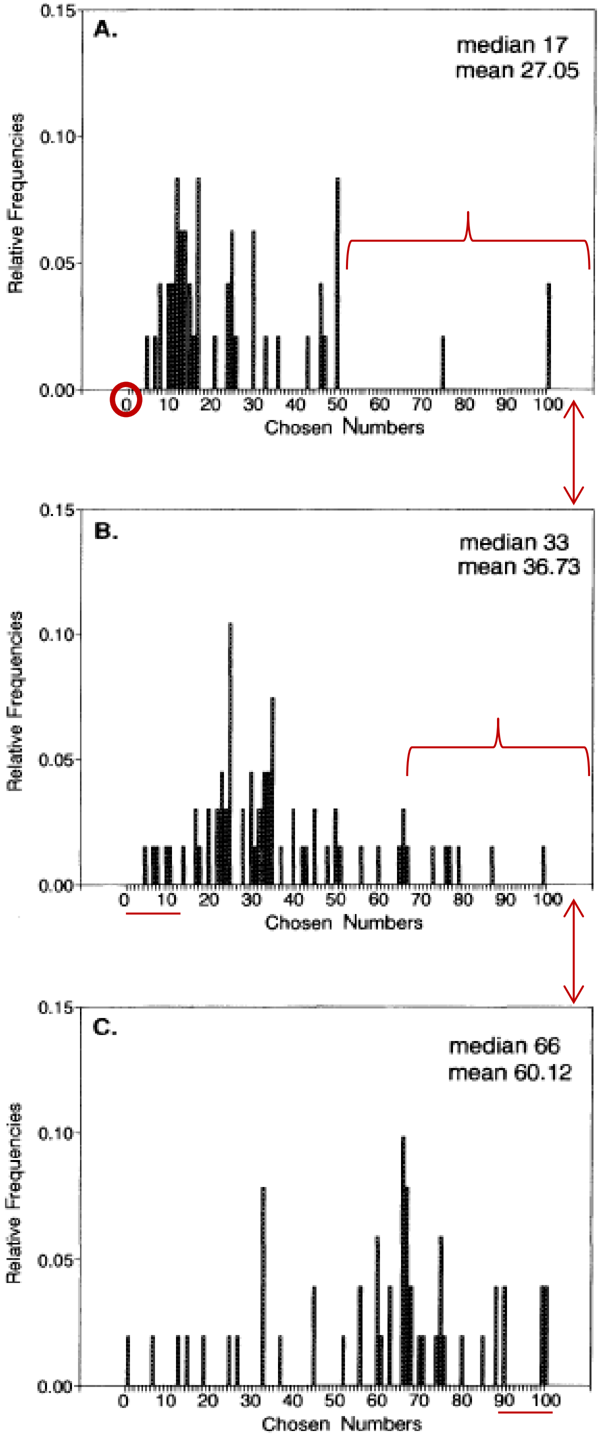
- A 1000 miles long country
  - Lauca National Park (for NE; cf. 11-20)
- n resort developers plan to locate a resort somewhere in the coast
  - After the resorts are constructed the airport is built at the average of the all locations including Lauca National Park
- Suppose most tourists visit all resort equally often, except for lazy tourist who visit only the resorts nearest to the airport
  - The developers who located closest to the airport get a fixed bonus of fixed visitors
- Where should the developers locate to be nearest to the airport?
- Game theoretical prediction is that all developers should locate exactly near Lauca National Park.
  - The answer requires at least 1 attraction
  - Independent from fraction of lazy tourists and number of developers



- Label the coastline starting from the Lauca National Park with miles
  - Park is at 0
  - Developers chose from 0 to 1000
    - $x_1, x_2, x_3, x_4, \ldots, x_n$
  - $A = \frac{x_1+x_2+\cdots+x_n}{n+m} = \frac{n}{(n+m)}\bar{x} = p\bar{x}$, is the average location
    - where $p \leq 1$ since $m \geq 1$
  - The developer closest to $A = p\bar{x}$ wins those lazy tourists
- No matter where the average of other developers' location is, a developer wants to locate between that average and the Park
  - Which is where the airport will be built
  - This desire draws all the developers toward exactly where the Park is
- The solution is reached by iterated application of dominance
  - The largest possible value of A is $1000p$
  - Any choice of x above $1000p$ is dominated by choosing $1000p$
  - If a developer believes that others obey dominance and, thus, choose $x_i < 1000p$, then the largest A is $1000p^2$
  - Any choice larger than that is dominated and so on

- Games assume mutual rationality and mutual consistency
  - What others might do ?-> your beliefs -> your act
- Example above (Ho et al, 1998) belongs to “p-beauty contests” class of games
  - Favourable to study the depths of players’ reasoning
- Other examples
  - Newspaper competition (Keynes, 1936) (p=1)
    - Investors choose the time and the crash is when everyone else sell
    - Investor want to sell closest to the crash, but not too far ahead
  - Guessing game (Moulin, 1986)
- Unravelling happens naturally when timing of transaction matters
  - Contracting medical students from the first year
    - No distinction can be made and unstable matching results



If x is from 0 to 100

- then $50p^n$, where n is a degree of being strategic
- 1 order strategy corresponds to Cournout
- 0 salient or random number

Experiment with n = 15-18

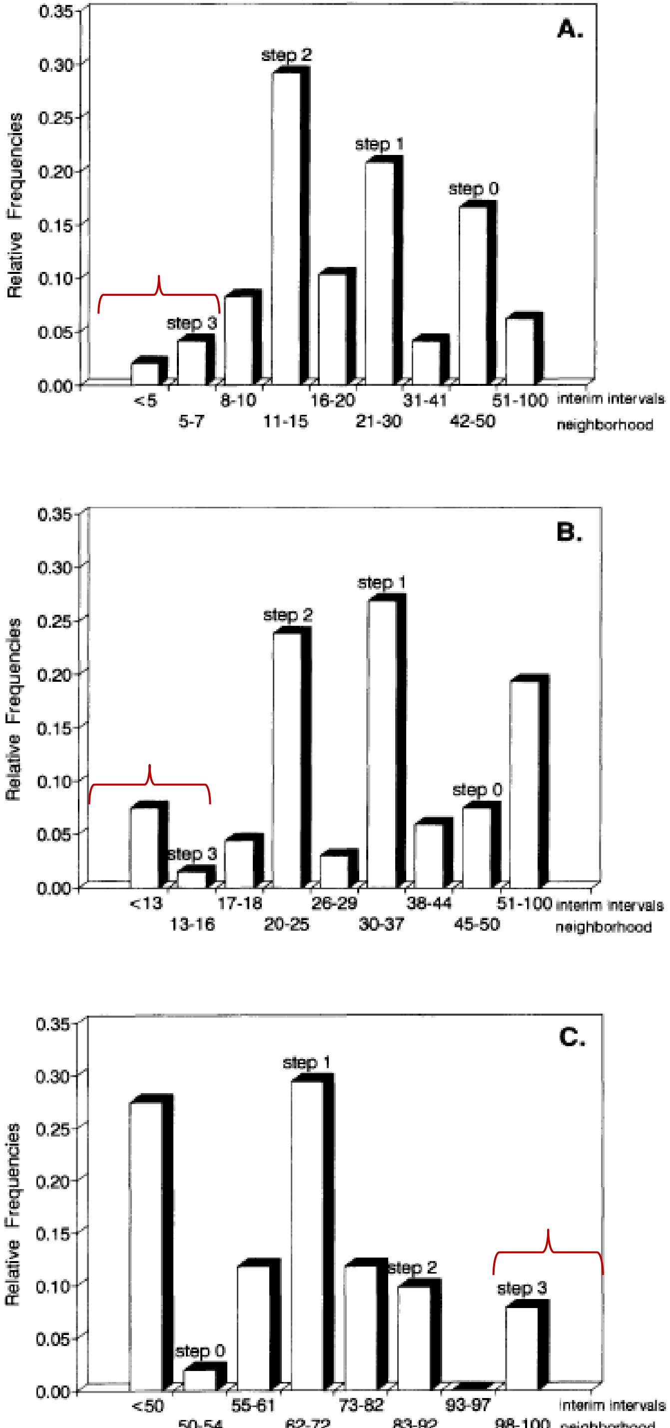
4 session per p with facilitated learning

Choices in the first period:

A) Sessions 1-3 $(p = \frac{1}{2})$

B) Sessions 4-7 $(p = \frac{2}{3})$

C) Sessions 8-10 $(p = \frac{4}{3})$



-50 is a reference
-Neighbourhood intervals of $50p^n$
-$50p^{n+1}$ and $50p^n$ interim intervals
-Geometric mean determines the boundaries
E.g. for $p = \frac{1}{2}$ the NI 50, 25, 12.5, 6.25, 3.25, 1.65

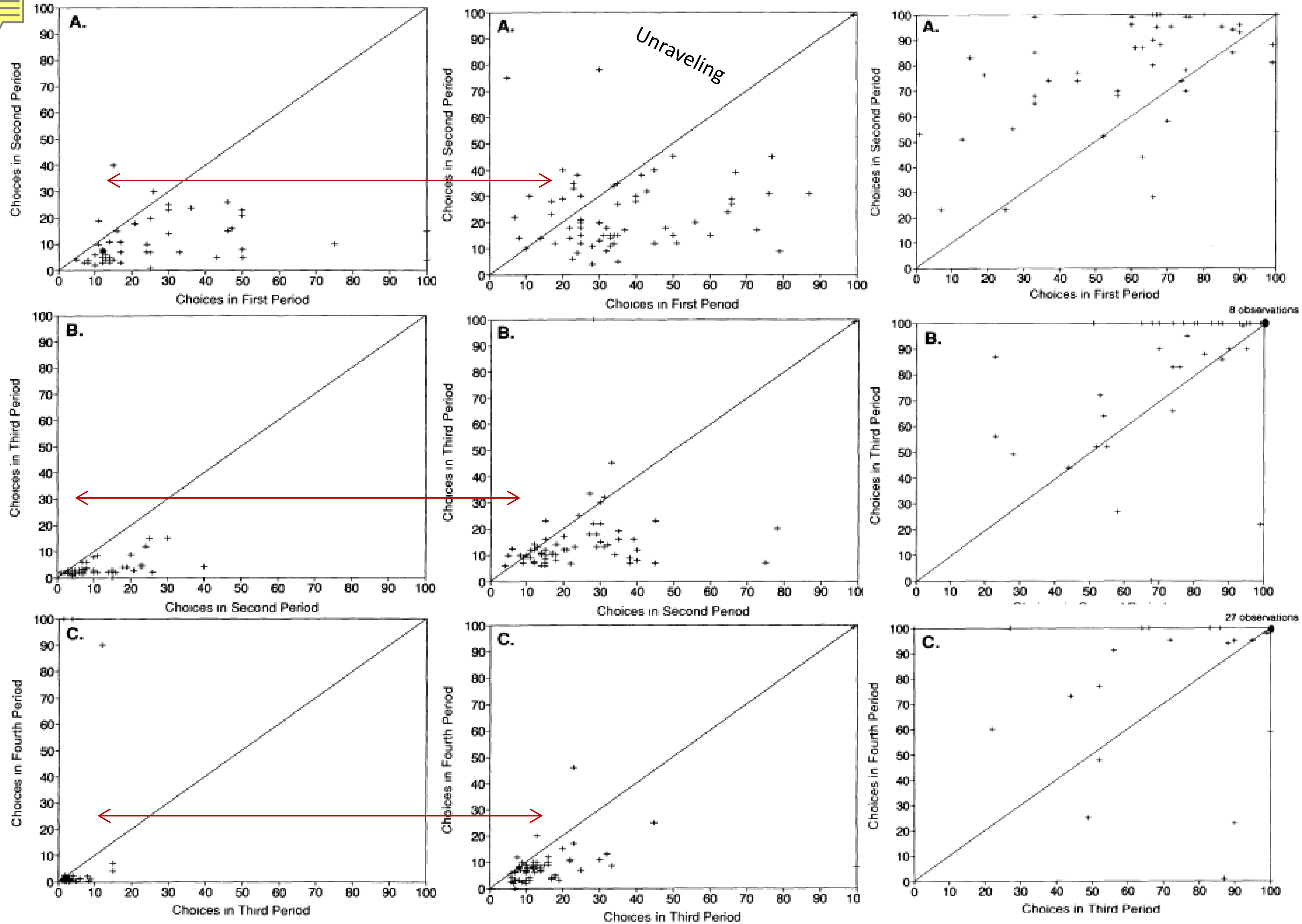
$$\sqrt[6]{50\ 25\ 12.5\ 6.25\ 3.25\ 1.65} \approx 9$$

Relative frequencies of choices in the first period according to the interval classification with reference point 50:

A) Sessions 1-3 $(p = \frac{1}{2})$

B) Sessions 4-7 $(p = \frac{2}{3})$

C) Sessions 8-10 $(p = \frac{4}{3})$



A) Transition from 1 to 2 Period
Left panel: $p = \frac{1}{2}$

B) Transition from 2 to 3 Period
Middle panel: $p = \frac{2}{3}$

C) Transition from 3 to 4 Period
Right panel: $p = \frac{4}{3}$

TABLE 1—MEANS AND MEDIANS OF PERIODS 1–4, AND RATE OF DECREASE FROM PERIOD 1 TO PERIOD 4

A. *Sessions with* $p = {}^1/_2$:

	Session 1		Session 2		Session 3	
Period	Mean	Median	Mean	Median	Mean	Median
1	23.7	17	33.2	30	24.2	14
2	10.9	7	12.1	10	10.2	6
3	5.3	3	3.8	3.3	2.4	2.1
4	8.1	2	13.0	0.57	0.4	0.33
Rate of decrease:[a]	0.66	0.88	0.61	0.98	0.98	0.97

B. *Sessions with* $p = {}^2/_3$:

	Session 4		Session 5		Session 6		Session 7	
Period	Mean	Median	Mean	Median	Mean	Median	Mean	Median
1	39.7	33	37.7	35	32.9	28	36.4	33
2	28.6	29	20.2	17	20.3	18	26.5	20
3	20.2	14	10.0	9	16.7	10	16.7	12.5
4	16.7	10	3.2	3	8.3	8	8.7	8
Rate of decrease:[a]	0.58	0.7	0.92	0.91	0.75	0.71	0.76	0.76

TABLE 2—RELATIVE FREQUENCIES AND AREAS OF PERIODS 2–4 ACCORDING TO THE STEP-MODEL FOR AGGREGATED DATA

Classification	Period 2		Period 3		Period 4	
	Relative frequency	Area	Relative frequency	Area	Relative frequency	Area
A. *Sessions 1–3 ($p = 1/2$):*						
Higher steps	4.2	2.4	4.2	1.0	20.8	0.3
Step 3	25.0	2.4	12.5	1.0	22.9	0.3
Step 2	31.3	4.9	60.4	2.0	29.2	0.7
Step 1	27.0	9.6	12.5	3.9	14.5	1.4
Step 0	2.1	7.9	4.1	3.2	4.2	1.1
Above $mean_{t-1}$	10.4	73.0	6.3	88.9	8.3	96.2
All	100.0	100.0	100.0	100.0	100.0	100.0
B. *Sessions 4–7 ($p = 2/3$):*						
Higher steps	7.5	8.9	1.5	5.8	7.5	3.8
Step 3	11.9	4.4	17.9	2.9	25.3	1.9
Step 2	31.3	6.7	46.2	4.3	47.8	2.9
Step 1	20.9	10.0	16.4	6.5	10.4	4.3
Step 0	14.9	6.7	7.5	4.4	3.0	2.9
Above $mean_{t-1}$	13.4	63.3	10.5	76.1	6.0	84.1
All	100.0	100.0	100.0	100.0	100.0	100.0

Adjustment process

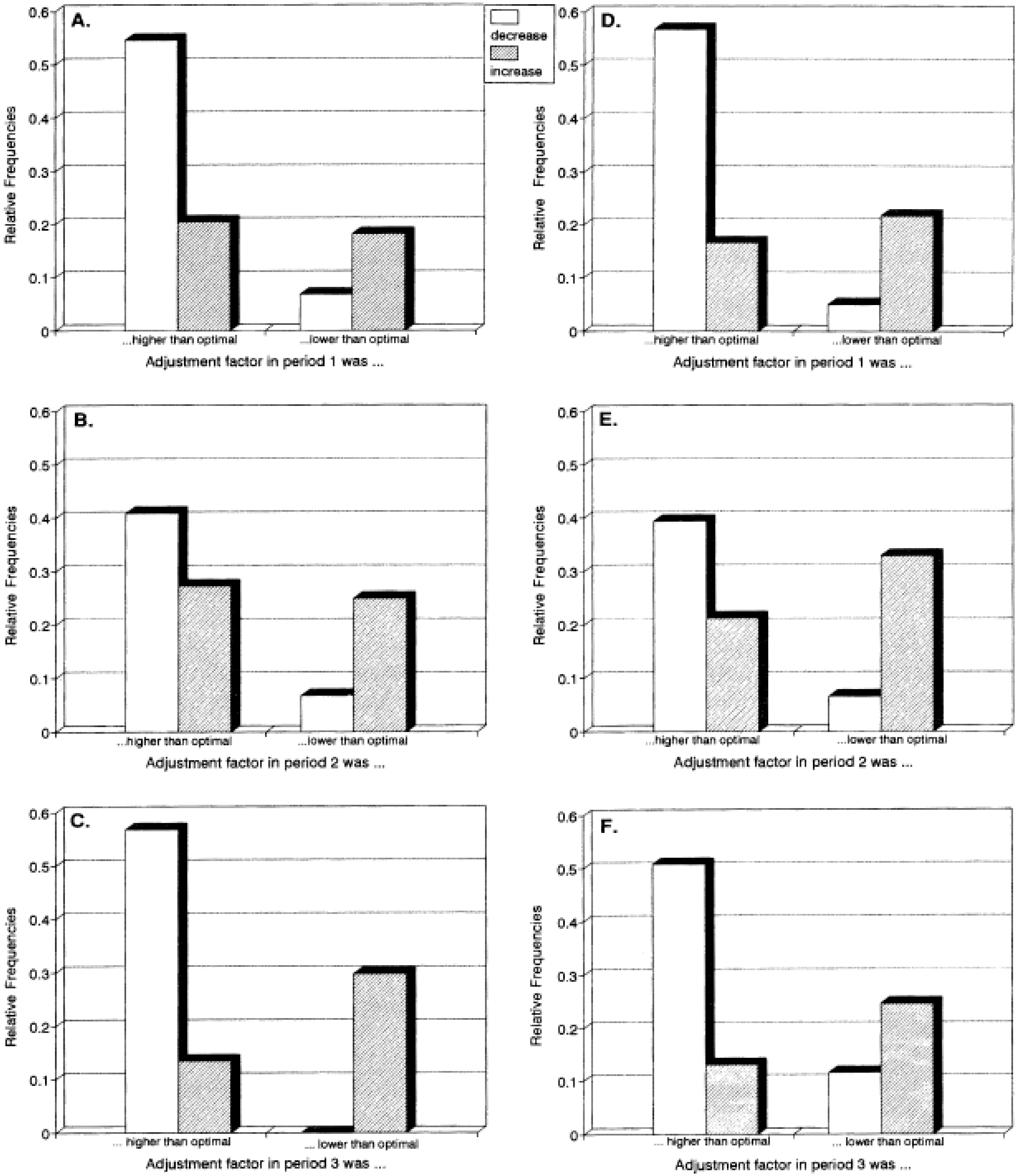
- a – adjustment parameter
  - The relative deviation from the mean (reference point) of the previous period

In words, if he observed that his chosen number was above p-times the mean in the previous period (i.e., his adjustment factor was higher than the optimal adjustment factor), then he should decrease his rate; if his number was below p times the mean (i.e., his adjustment factor was lower than the optimal adjustment factor), he should increase his adjustment factor

$$a_{it} = \begin{cases} \dfrac{x_{it}}{50} & \text{for } t = 1 \\[2ex] \dfrac{x_{it}}{(\text{mean})_{t-1}} & \text{for } t = 2, 3, 4 \end{cases} \quad \Rightarrow \quad a_{\text{opt},t} = \begin{cases} \dfrac{x_{\text{opt},t}}{50} = \dfrac{p \times (\text{mean})_t}{50} \\[1ex] \quad \text{for } t = 1 \\[2ex] \dfrac{x_{\text{opt},t}}{(\text{mean})_{t-1}} = \dfrac{p \times (\text{mean})_t}{(\text{mean})_{t-1}} \\[1ex] \quad \text{for } t = 2, 3, 4. \end{cases}$$

$$\text{if } a_t > a_{\text{opt},t} \Rightarrow a_{t+1} < a_t$$

$$\text{if } a_t < a_{\text{opt},t} \Rightarrow a_{t+1} > a_t.$$



Relative frequencies of changes in adjustment factors due to individual experience in the preceding period:

A. $p = \frac{1}{2}$ transition from 1 to 2 period

B. $p = \frac{1}{2}$ transition from 2 to 3 period

C. $p = \frac{1}{2}$ transition from 3 to 4 period

D. $p = \frac{2}{3}$ transition from 1 to 2 period

E. $p = \frac{2}{3}$ transition from 2 to 3 period

F. $p = \frac{2}{3}$ transition from 3 to 4 period

Some notes

- Inspired QRE
  - McKelvey et al 1995
- And cognitive hierarchy model of games
  - Camerer et al 2004
- And tons of other stuff
  - Nagel was the first to mention Keynes observation