Partition Obvious Preference and Mechanisms Design: Theory and Experiment

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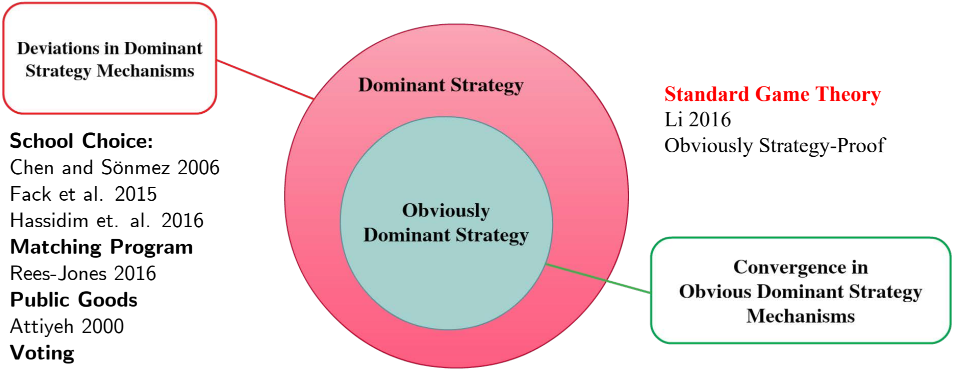
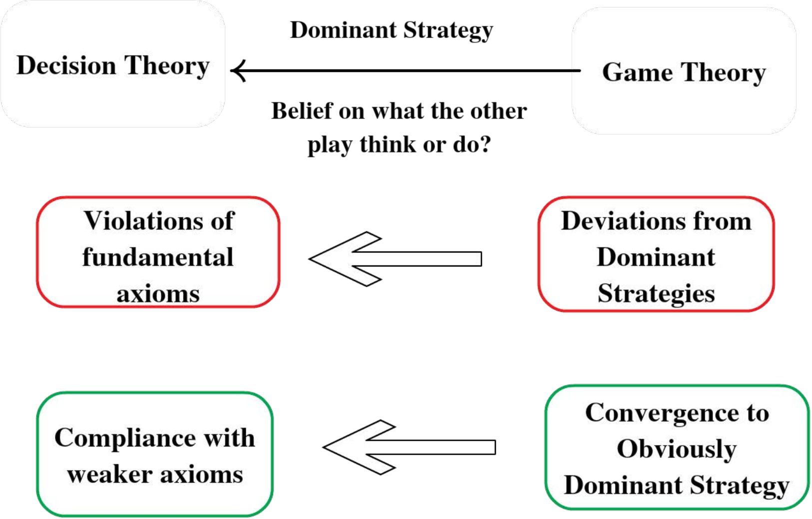
Experimental Evidence & Theoretical Explanations



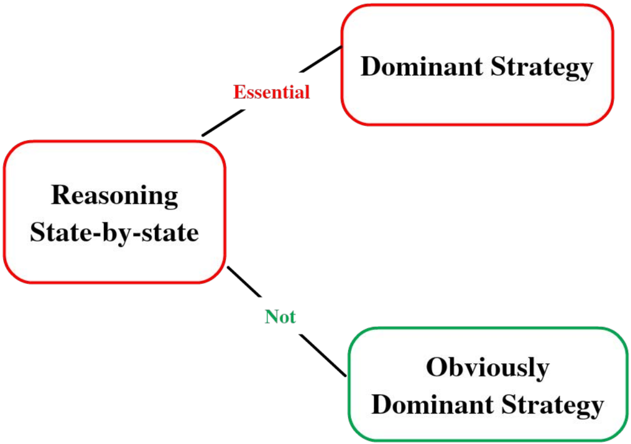
School Choice:
Chen and Sönmez 2006
Fack et al. 2015
Hassidim et. al. 2016
Matching Program
Rees-Jones 2016
Public Goods
Attiyeh 2000
Voting
Esponda and Vespa 2014
Auctions
Kagel et al. 1987
Kagel and Levin 1993
Harstad 2000
Garratt et al. 2011

Standard Game Theory
Li 2016
Obviously Strategy-Proof

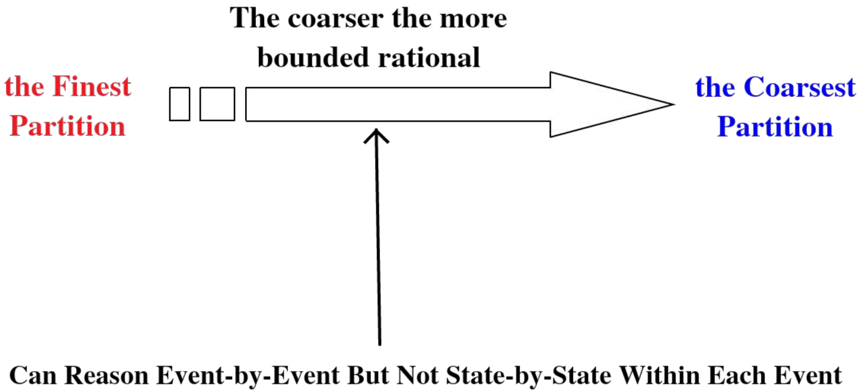
The Implication Is More Fundamental



Alerted by An Critical Fact



Reason by Partitioning the State Space



Why different ways of partitioning matters?

An example with two states

The finest partition:

- **Problem 1**

	State 1	State 2
A	20	8
B	25	13

- **Problem 2**

	State 1	State 2
A	13	8
B	20	15

The Coarsest Partition:

	(State 1, State 2)	
A	20	8
B	25	13

	(State 1, State 2)	
A	13	8
B	20	15

Why different ways of partitioning matters?

An example with four states

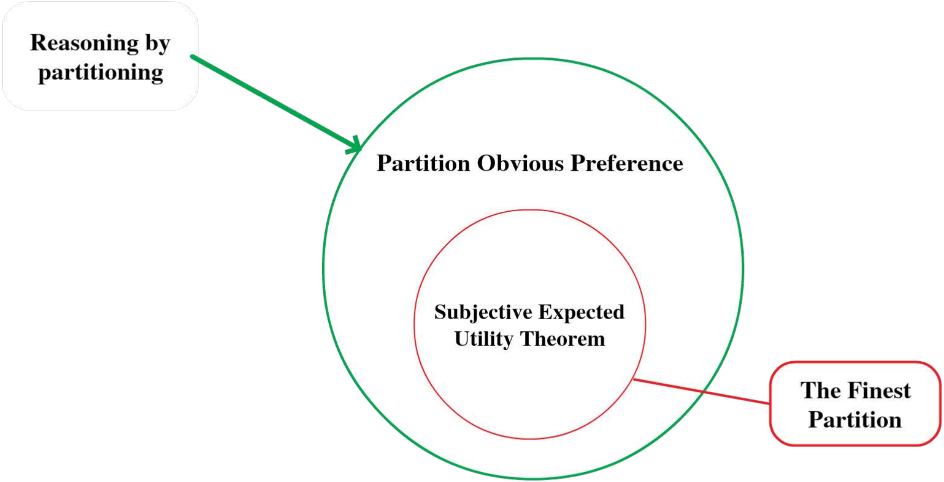
- **Problem 3**

Event	B_1		B_2	
State	s_1	s_2	s_3	s_4
U	20	11	5	8
D	25	22	10	20

- **Problem 4**

Event	B_1		B_2	
State	s_1	s_2	s_3	s_4
U	**21**	13	11	**16**
D	25	**15**	**12**	20

Partition Obvious Preference



The Notation

- X be the set of deterministic outcomes
- Z be the set of distributions over X with finite supports
- Acts:

$$f : \Omega \longrightarrow Z$$

- A finite partition of $\Omega : \Sigma$.
- The range of f given event $B : O^B(f)$

Partition Obvious Monotonicity

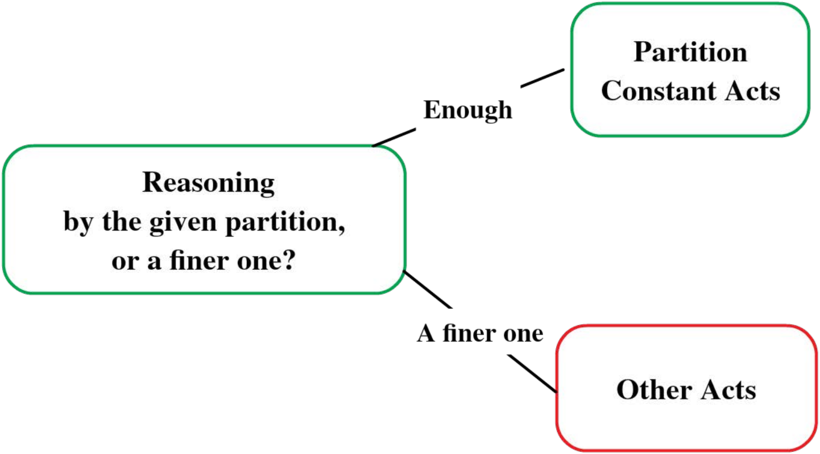
- For any $f, g \in F$, if for any $B \in \Sigma$, we have, for all $p \in O^B(f), q \in C^B(g), p \succsim q$, then $f \succsim g$;

In addition,if for a non-null event $B' \in \Sigma$, it is strictly satisfied then $f \succ g$.

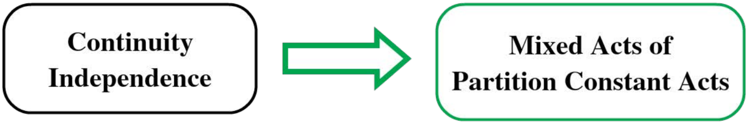
Mixed Acts

- **Mixed Act:** for any $f, h \in F$, $\alpha \in [0,1]$ and $\omega \in \Omega$, $[\alpha f + (1-\alpha)h](\omega) \equiv \alpha f(\omega) + (1-\alpha)h(\omega)$.
- **Partition Constant Act:** $F^c(\Sigma)$, constant act give each event of the partition

Understanding Mixed Acts



Partition Continuity and Independence



- **Partition Independence:** For any three acts $f, g, h \in F^c(\Sigma)$ and any $\alpha \in (0, 1]$, $f \succ g$ implies that $\alpha f + (1-\alpha)h \succ \alpha g + (1-\alpha)h$.
- **Partition Continuity:** For any action $g \in F$ and any two acts $f, h \in F^c(\Sigma)$ such that $f \succ g \succ h$, there are $\alpha, \beta \in (0, 1)$ such that $\alpha f + (1-\alpha)h \succ g \succ \beta f + (1-\beta)h$.

Partition Obvious Preference

- **Subjective Expected Utility**

-weak order
-*monotonicity*
-*Independence*
-*Continuity*
-Nondegeneracy

- **Partition Obvious Preference**

-weak order
- *Partition obvious monotonicity*
- *Partition independence*
- *Partition continuity*
- Nondegeneracy

Equivalent when the partition is the finest

Partition Obvious Preference Representation

- **5 Axioms are satisfied if and only if**

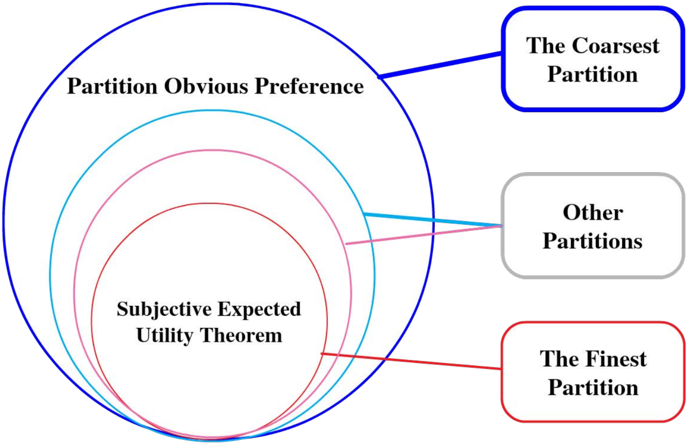
there exists a nonconstant affine function $u : Z \rightarrow R$, *a probability function* $P : \Sigma \longrightarrow [0,1]$ *and a function* $\alpha : F \rightarrow [0,1]$ *such that* $\succsim$ *is represented by the preference functional* $V : F \rightarrow R$ *given by*

$$V(f) = \sum_{k=1}^{n} V(f|B_k)\,P(B_k) \tag{1}$$

where,

$$V(f|B_k) = \alpha(f) \max_{p \in C^{B_k}(f)} u(p) + [1 - \alpha(f)] \min_{q \in C^{B_k}(f)} u(q). \tag{2}$$

Partition Obvious Preference



Extension to Games

It is often argued academically that no science can be more secure than its foundations, and that, if there is controversy about the foundations, there must be even greater controversy about the higher parts of the science.

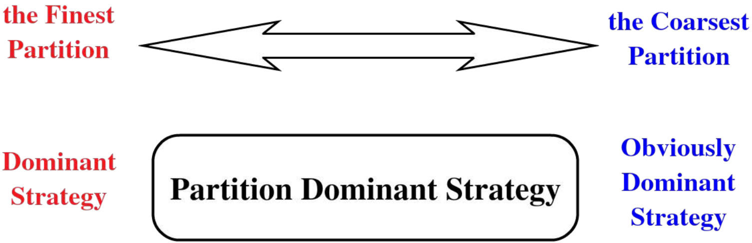
-Savage, The foundation of statistics.

Decision Environment

- **The Domain of uncertainty:**
  The strategy of opponent, S_{-i} **&** moves of nature, Ω_N
- **The subjective state space:**
  $\Omega_i = S_{-i} \times \Omega_N$

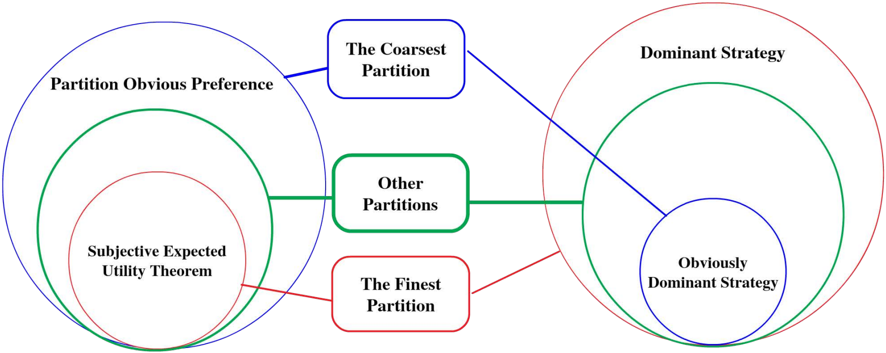
Partition Dominant Strategy

A strategy is partition dominant if it is an obviously dominant strategy in all events of the partition.



Partition Dominant Strategy & Partition Obvious Preference

A Proposition: a strategy is partition dominant if and only if any partition obvious preference prefers it to any deviating strategy at any information set.



Implications for Mechanism Design

- **A second best choice**

Especially when the state space becomes larger

- **Manipulate the Partition**

The Choice of Presentation matters

Not necessarilly framing but bounded rationality

- **Why Dynamic Mechanism**

Help people who reason in coarser partitions

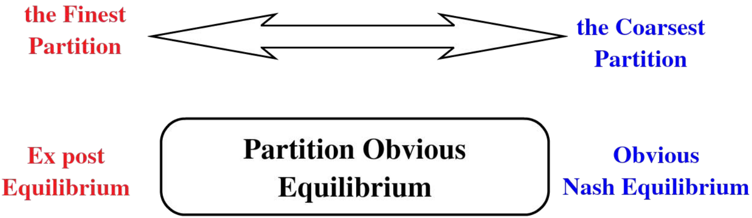
A Laboratory Experiment: In progress

- A pair of games: a variation of Random Serial ictatorship
- A pair of individual decision task

	Dominant Strategy	Obvious DS?	Partition DS?	Error Rate ?
Treatment A	Yes	No	No	High
Treatment B	Yes	No	Yes	Low

Future Research: Theoretical Work

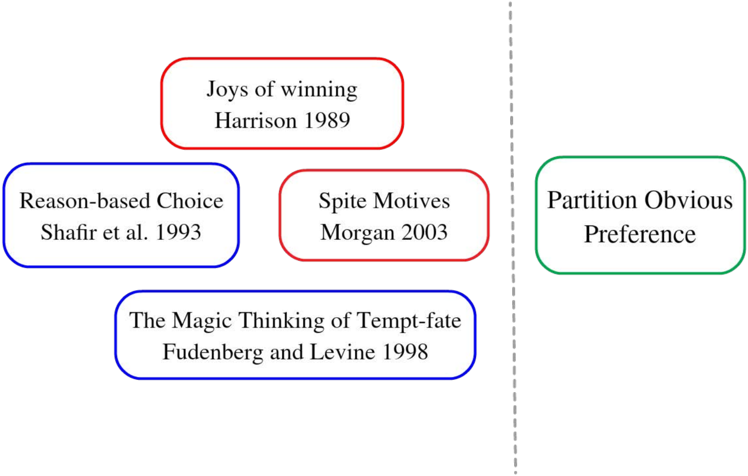
- Necessary & Sufficient Condition for Implementation in Partition Dominant Strategy
- Endogenize Partitions & Learning Dynamics
- An Equilibrium Concept: Partition Obvious Equilibrium



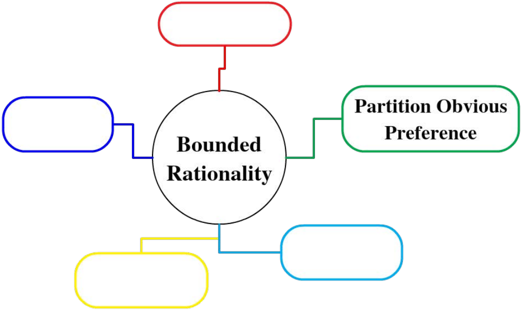
Future Research: Experimental Work

- Manipulations of Partitions: An eye-tracking study (with James Chen)
- Pay for non-instrumental information (solo work)

The Psychological and the Bounded Rational



Thank you !



All rational people are rational in the same way, all irrational people are irrational in different ways.

-Schmeidler

(a variant of Tolstoy s original version)