

Assisted Exploration of Complex State Spaces

Brandon Mechtley

Sustainability

- Behavior change
- Quantitative methods are inaccessible
- Need to model human negotiations

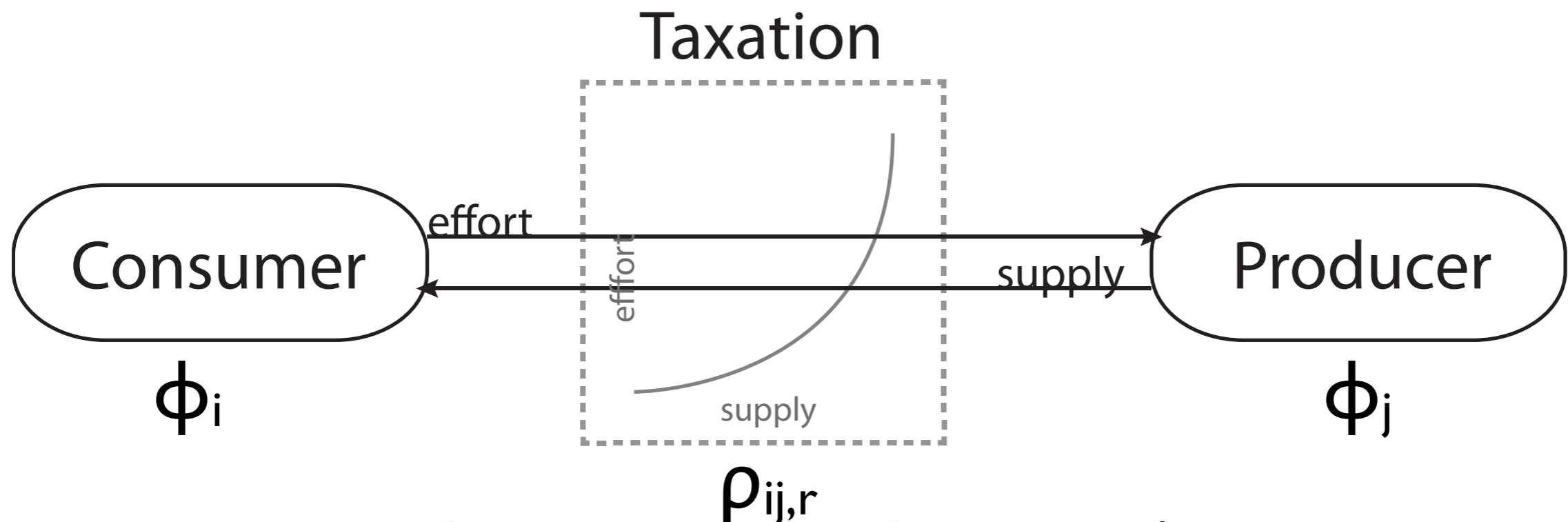
Embodied Interaction

- Gestural interaction
- Sonic, visual feedback
- Multi-user choreography

Effort Costs

- Real world system has multivariate costs: social, material, economic, environmental, etc.
- Map these costs onto:
 - Physical effort
 - Cognitive effort
 - Social effort

Basic Negotiation



- regulated negotiation channels (e.g. graduated tax on cost per supply)
- continuous values for agent states and regulation variables (e.g. tax curvature, base tax, etc.)

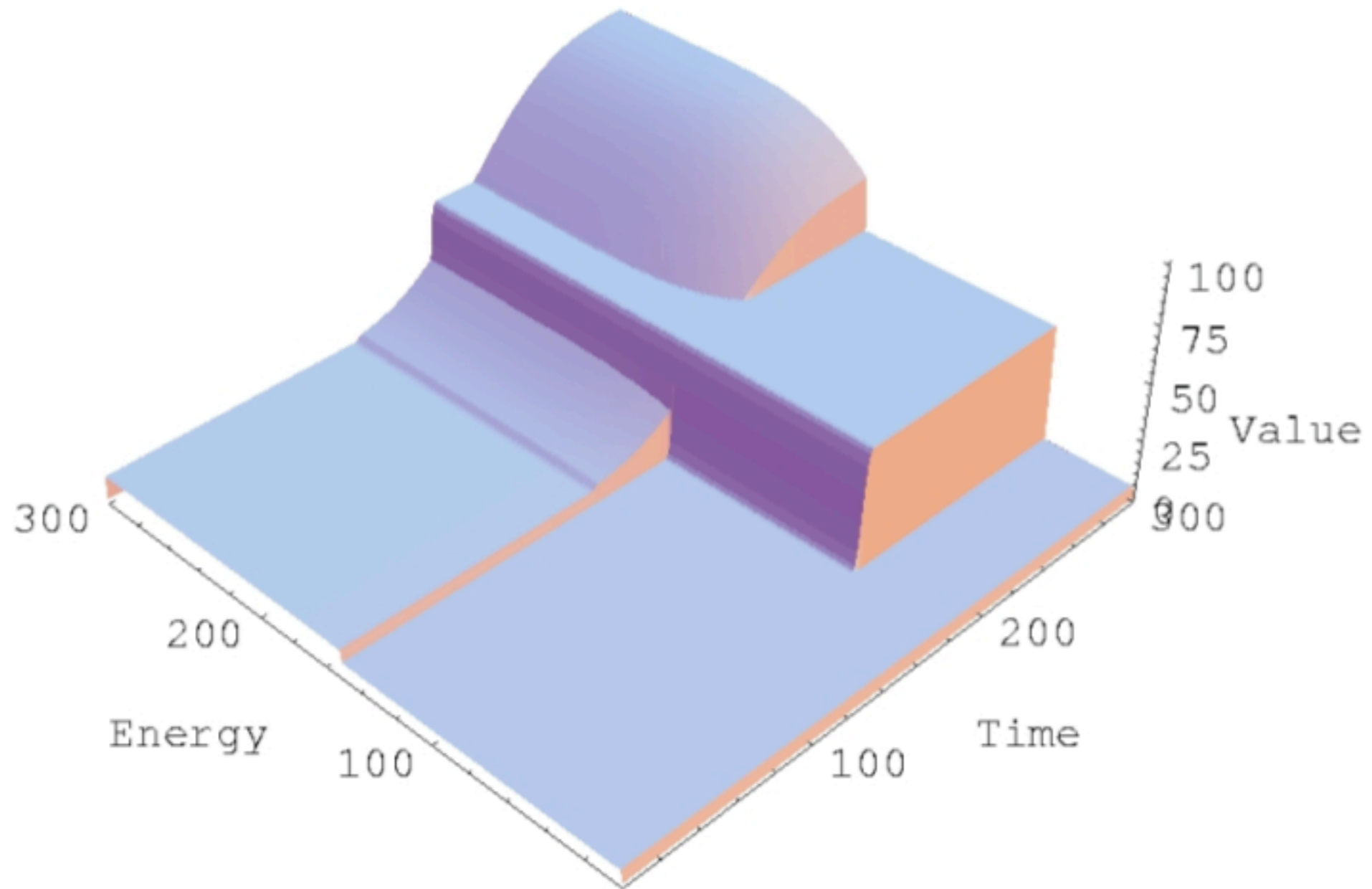
Assistive Planning

- Help users find interesting states (goals).
- Bias toward goals that minimize global effort.
- Make suggestions, but do not perform actions.

Discretization

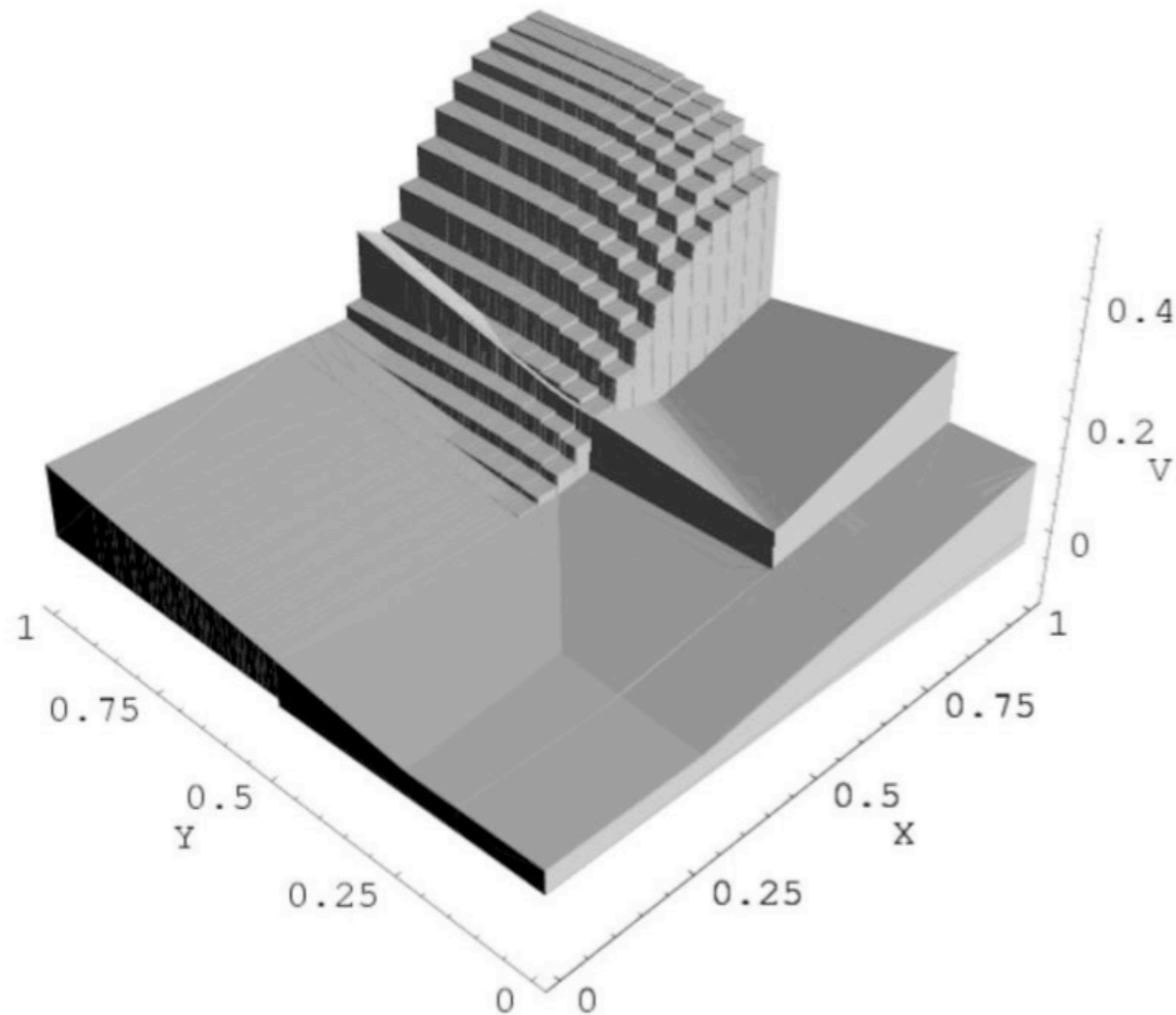
- Consider state variables as independent.
- Quantize according to perceptual characteristics of media or interaction.

Discretization



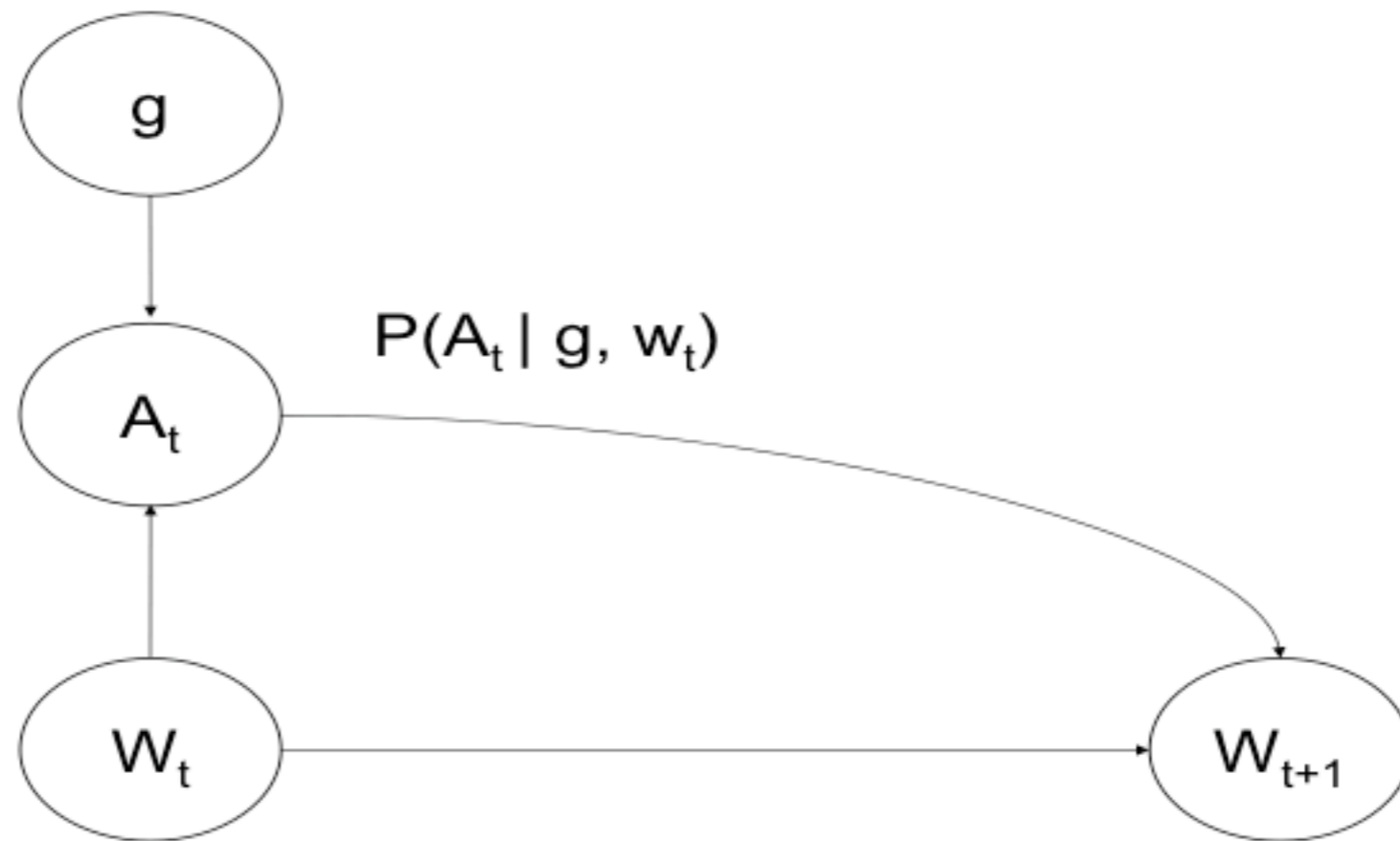
Z. Feng, et al. Dynamic Programming for structured continuous markov decision problems. *Proc. 20th Conference on Uncertainty in AI, 2004.*

Discretization



Z. Feng, et al. Dynamic Programming for structured continuous markov decision problems. *Proc. 20th Conference on Uncertainty in AI*, 2004.

POMDP



Supports multiple goals (unobservable distribution)

A. Fern, et al. A decision-theoretic model of assistance. *Proc. IJCAI*, 2007.

The Really Important Bits

$$P(g|O_t) = (1/Z) \cdot P(g|O_{t-1}) \cdot \pi(a|w, g)$$

Need expected user policy.

$$H(w, a, O_t) = \sum_g Q_g(w, a) \cdot P(g|O_t)$$

Q is expected cost of performing action and following user policy--where effort comes in.