

LOGIC, AGENCY, AND GAMES

Day 1 *Dynamic-epistemic logic*

Information flow: questions, observations, inferences. Dynamic, social.

1.1 *Knowledge update*

Three cards. *Modeling*, 'worlds'. Update as model change.

Static epistemic logic. Models and semantics. Complete logic is multi-S5.

No further laws: interaction is connections agents, groups, networks.

Snapshots, now make change explicit. PAL language and semantics.

Recursion laws. Completeness PAL. Application: Moore sentences.

Knowledge stable under true information? Depends. *Substitution core*.

1.2 *Belief revision*

Belief: weaker, or more creative? Revision, learning from errors.

Belief stable under true information? Lying with the truth.

Belief semantics. Recursion law under hard information. Conditional belief.

Repertoire. Other notions: stable belief. Can define conditional belief.

Complete dynamic logic axiomatizable.

Beijing gate. Soft update, plausibility order change.

Complete dynamic logic for safe belief. *General update rules*.

1.3 *Multi-agent settings*

Discuss: Plural actors. Multi-agent (questions, Theory of Mind). Groups sui generis: common or distributed knowledge. Logical systems. *Structured groups, networks*.

Day 2 *Time, preference, and games*

Games, standard example: many notions combined. From kinematics to dynamics,

2.1 *Temporal perspective*

Temporal long term, many update steps. Muddy children, programs, limit behavior.

Protocols, constraints on inquiry, learning theory. Effects on dynamic logic.

Connections dynamic-epistemic logic and temporal logics of agency.

2.2 *Preference*

Information and evaluation. Preference. Commands, deontic logic.

Entanglement with belief. *Combined logics*.

2.3 *Games in static logics*

Modal action logic. Strategies, propositional dynamic logic. Zermelo's theorem, μ -calculus.

Add preference. Logical form rationality. BI analysis, *equilibria in static fixed-point logic*.

2.4 *Games in dynamic logics*

Dynamics before play, deliberation. *Assumptions about agents*.

Rationality characterized dynamically: via hard updates, and via soft updates.

During play. Forward induction and postulating rationality as long as possible.

After play. Rationalization scenarios.

Day 3 Influences from computational logic

Games and computation as agency.

3.1 Zoom levels on games

Game equivalence. Two zoom levels, actions powers. Deontic. Representation.
What are natural game equivalences, what are corresponding logics.

3.2 Logics for players' powers

Modal logics of powers, neighborhood semantics. Dynamic game logic.
Recent perspective: instantial neighborhood logic for games.

3.3 Further perspectives

Infinite games and temporal logic of forcing.
Strategies and automata.
Game algebra. Parallel operations. Proof theory.
The challenge of compositionality.

Day 4 Logic in games

Logic itself has a long history of involvement with games.

4.1 Logic games

Evaluation games. Truth Lemma. Infinite games, recursion.
Ehrenfeucht games. Fine-structure of invariance.

4.2 Game-theoretic features

Zermelo's Theorem, logical laws and powers.

4.3 Designing new games

Sabotage games and logics of model change. Poison games and argumentation.

4.4 Logic of games versus logic as games

How the two directions connect. The L-G carroussel.
Strong Thesis: games as a source of alternative logics.

Day 5 What's brewing today

5.1 More subtle updates: privacy and imperfect information

Updates under privacy. Imperfect information. Knowledge games.

5.2 Finer views of information

Evidence. Finer levels. Tracking between levels.

5.3 Networks and public behavior

Networks. Oscillations. Network games.
Long-term behavior. Logic and dynamical systems.
Boundary of high and low rationality.

5.4 Theory of Play

Logic + game Theory + CS = Theory of Play.
Game or play equivalences.
Bounded agency, agent diversity.

References (see website) J. van Benthem, 2010, *Modal Logic for Open Minds*, CSLI Publications, Stanford University. –, 2011, *Logical Dynamics of Information and Interaction*, Cambridge University Press, Cambridge UK. –, 2014, *Logic in Games*, The MIT Press, Cambridge MA. Follow-up papers.

