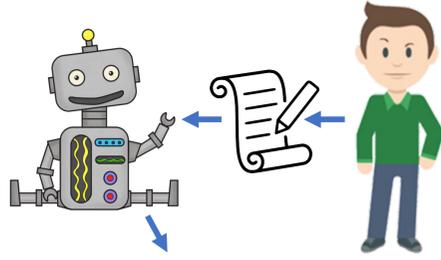# Safe Pareto improvements for delegated game playing

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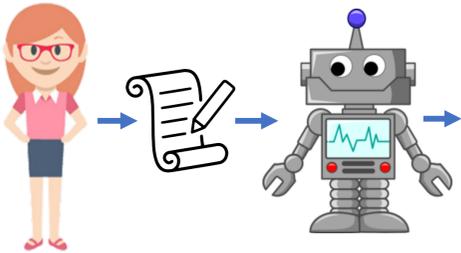{ocaspar,conitzer}@cs.duke.edu
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Delegated game playing

|	DM	RM	DL	RL
DM	-5,-5	2,0	5,-5	5,-5
RM	0,2	1,1	5,-5	5,-5
DL	-5,5	-5,5	1,1	2,0
RL	-5,5	-5,5	0,2	1,1

- Trusted representatives competent in strategic choice
  => Default: aligned delegation
- DL,RL are strictly dominated
  => never played
- **Equilibrium selection problem**
  => Pareto-suboptimal outcome (DM,DM) might occur

An unsafe approach

	RM
RM	1,1
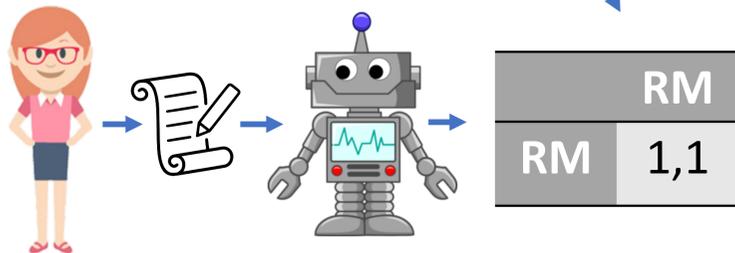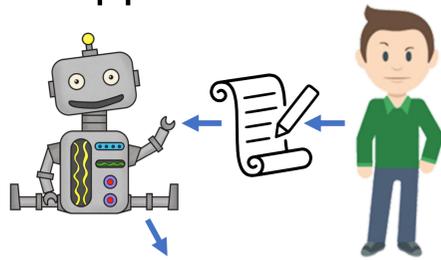
- **Publicly visible contracts** à la program equilibrium (Tennenholtz 2004) or mediated equilibrium (Monderer and Tennenholtz 2009)
- Each player's contract says: "Play RM if the other player adopts an analogous contract."
- Unclear whether this is good for both players.

A safe Pareto improvement

	DL	RL
DL	-5,-5 (1,1)	2,0 (2,0)
RL	0,2 (0,2)	1,1 (1,1)

DM ~ DL
RM ~ RL
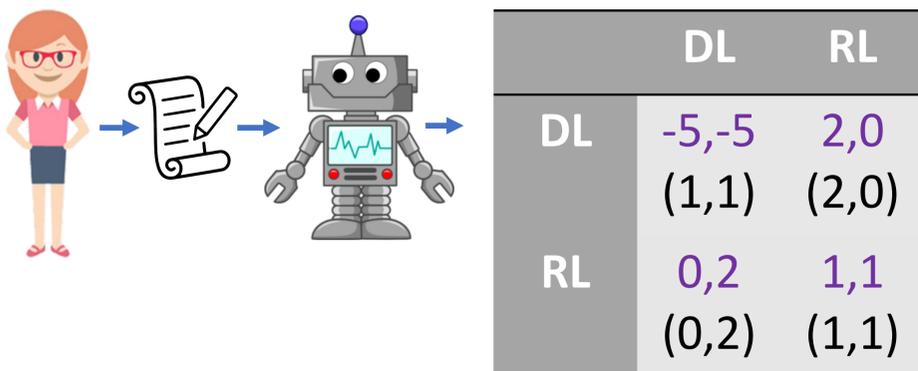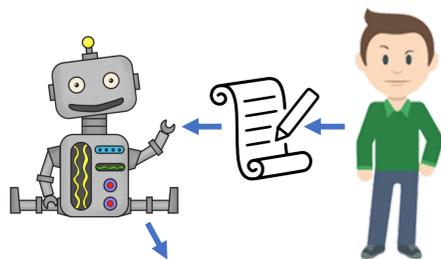
- Each player's contract says: "Assume this alternative payoff matrix if the other player adopts an analogous contract."
- The new game is essentially isomorphic to the original game.
- *Safe Pareto improvement* on the original game: outcome of new game is weakly better for both original players with certainty.

In the paper…
- Formal grounding
- Theorem: All safe Pareto improvements use equivalences between games.
- Theorem: Finding Safe Pareto improvements is NP-complete.