

The Truth is in the Eye of the Beholder: or Equilibrium in Beliefs and Rational Learning in Games

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ABSTRACT. Games with incomplete information or randomness in the moves of others typically have many decision-theoretically equivalent formulations of the type space. These different formulations correspond to different ways of encoding the realizations of randomizations in the type of a player. Solution concepts, assumptions or paradoxes in games should be independent of the formulation of the game used. I refer to this axiom as TIGER, for "*Type Independence among Games which are equivalently Re-formulated.*" Results like convergence of beliefs to a Nash equilibrium (e.g., Jordan (1995)), obey TIGER. On the other hand, I show that results on Bayesian Learning and convergence of true play to Nash equilibrium (e.g., Kalai and Lehrer (1993a)) violate TIGER. Similarly many of the paradoxes in the learning literature (e.g., on the possibility of having optimization and prediction at the same time - Nachbar (1997)) disappear when we require TIGER to hold. The message is that in games with incomplete information, (i) the appropriate solution concept is Nash equilibrium of beliefs rather than "true" strategies, and (ii) the type-space formulation is important for other solution concepts. As regards (ii), we note that there is one formulation of the type space under which the Kalai and Lehrer (1993) assumptions always imply that type space is countable.

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