

## A short and nice survey of Lloyd Shapley contributions by Larry Blume

Yesterday Lloyd Shapley passed away at 92. Aumann once called him the greatest game theorist of all time. (Thank you, Barkley). The obituaries recall the Gale-Shapley marriage paper, which brought him the Nobel prize, but he gave us much more. So I am reprising a post I wrote on the occasion of the Prize announcement, to remind us of how much we owe him. Here are some of my favorite Shapley papers, some of which are at least as significant as the marriage paper. I'm sure I've forgotten a few.

Game changers:

**1952** "*Notes on the  $n$ -person game III: Some variants of the von-Neumann-Morgenstern definition of solution*" Here and in Gillies' thesis, the modern core first appears.

**1953** "*A value for  $n$ -person games*" Guess what this is about. "Stochastic games." Do you suppose this is where Bellman first read about the Bellman equation?

**1954** "*A method for evaluating the distribution of power in a committee system*" with Shubik. A lovely application of the value to voting in the UN security council with its then-existing rules.

**1971** "*The assignment game I: The core*" I missed this the first time around but now I teach it.

Two other important papers that I like very much:

**1967** "*Utility comparison and the theory of games*" Why some game theoretic questions are inherently cardinal. Foundational questions like this are as important as they are unpopular.

**1993** "*Potential Games*" with Dov Monderer. I used potential games in my first network game paper, without knowing what I was doing. After I gave the paper in a seminar in Israel, Dov handed me a cup of coffee and told me all about potentials. Suddenly the clouds parted,...

Beautiful, charming, quixotic, simply weird:

**1957** "*On games of survival*" with John Milnor. This did not turn game theory on its head, but it's such a beautiful paper. One of the few papers I actually reread for the aesthetic experience.

**1972** "*Lets block 'block'*" a truly quixotic quest.

**1986** "*On Milnor's classes 'L' and 'D'*" with K. Kikuta. A 21 player counterexample ...

And in the beautiful category, the *Shapley-Folkman Theorem*.

When I was a grad student, for some now incomprehensible reason I became enamored of the nucleolus (this before Aumann and Maschler, but long after the gemara in Masechet Ketubot about the three creditors) and the bargaining set. I posed for Debreu several possible thesis questions. His answer was always the same: "LarRY [emphasis intentional], you must ask Lloyd." Shapley was a frequent visitor to Berkeley in those days, so I would see him regularly and throw my conjectures at him. The answers were all of a type. "Interesting question. I thought about that once. Here is what you'll find..." I finally decided there was no question I could think of that he hadn't already answer. The stock of unpublished results in those legendary file cabinets at RAND vastly exceeded what he put into the public sphere.

Thank you for those conversations, Lloyd, and thank you for these papers.

Larry Blume, March 14, 2016