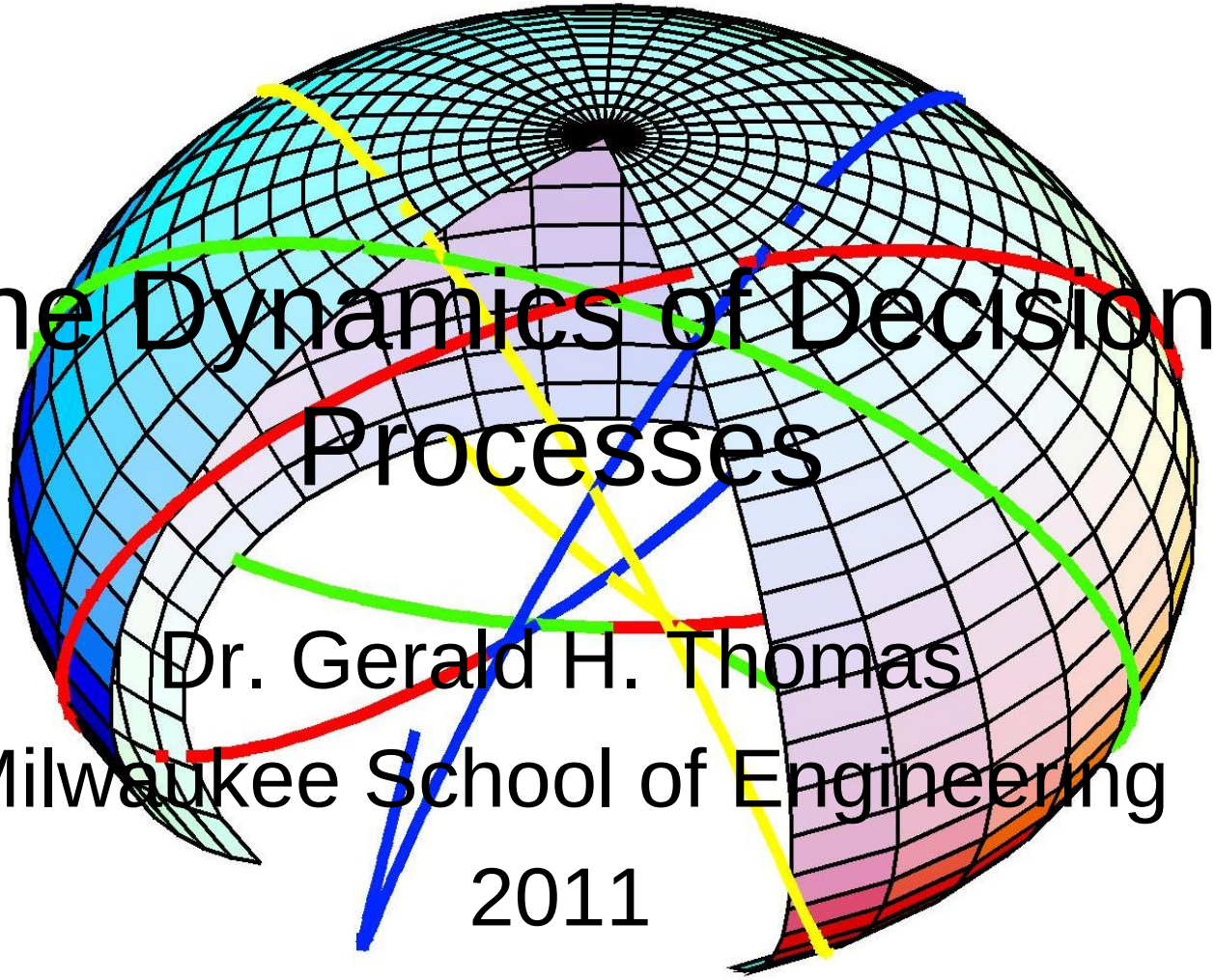

The Dynamics of Decision Processes

Dr. Gerald H. Thomas
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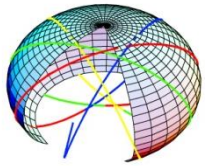
2011



The Dynamics of Decision Processes

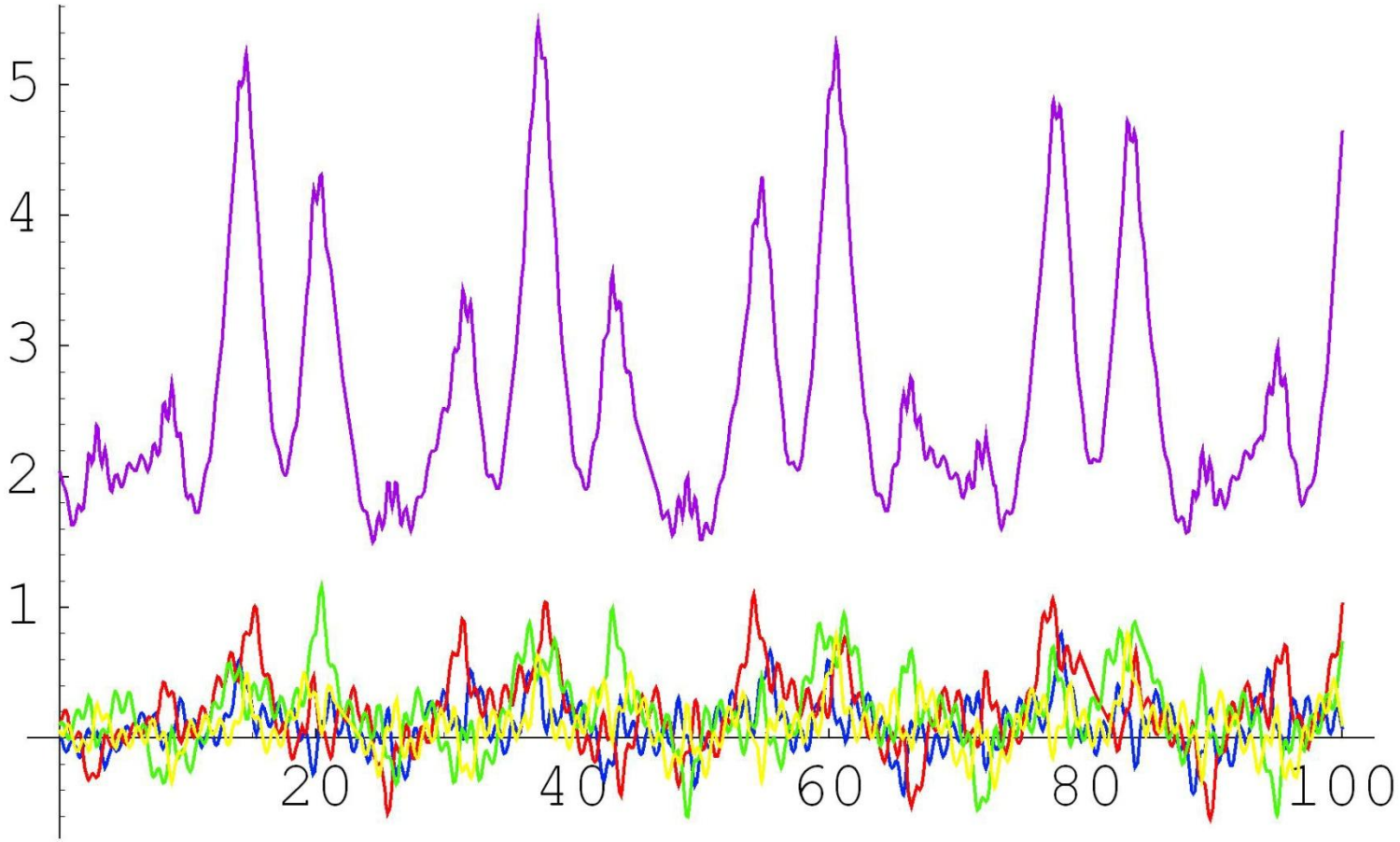
- “I have created a complete, comprehensive and quantitative theory of the time dependence of decision processes. I apply this theory with the differential geometry techniques used in electrical engineering, meteorology and general relativity to gain insights into such diverse issues as the prisoner's dilemma in game theory and ethical issues such as the tragedy of the commons; covered in between includes all of economic behaviors.”

Commercial

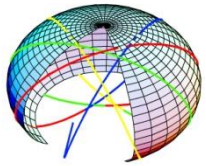
- The approach starts with the Theory of Games, but departs with significant deviations and help from physical and engineering theories.
- These ideas appeared first in Kauffman's knot series: Thomas, G. H. (2006), *Geometry, Language and Strategy*, New Jersey, World Scientific

- Second book : Thomas, G. H. (in preparation), *The Dynamics of Decision Processes*
- *Both* with *Partnership Program Support* from Wolfram Research.

Theory—Elastic Behavior



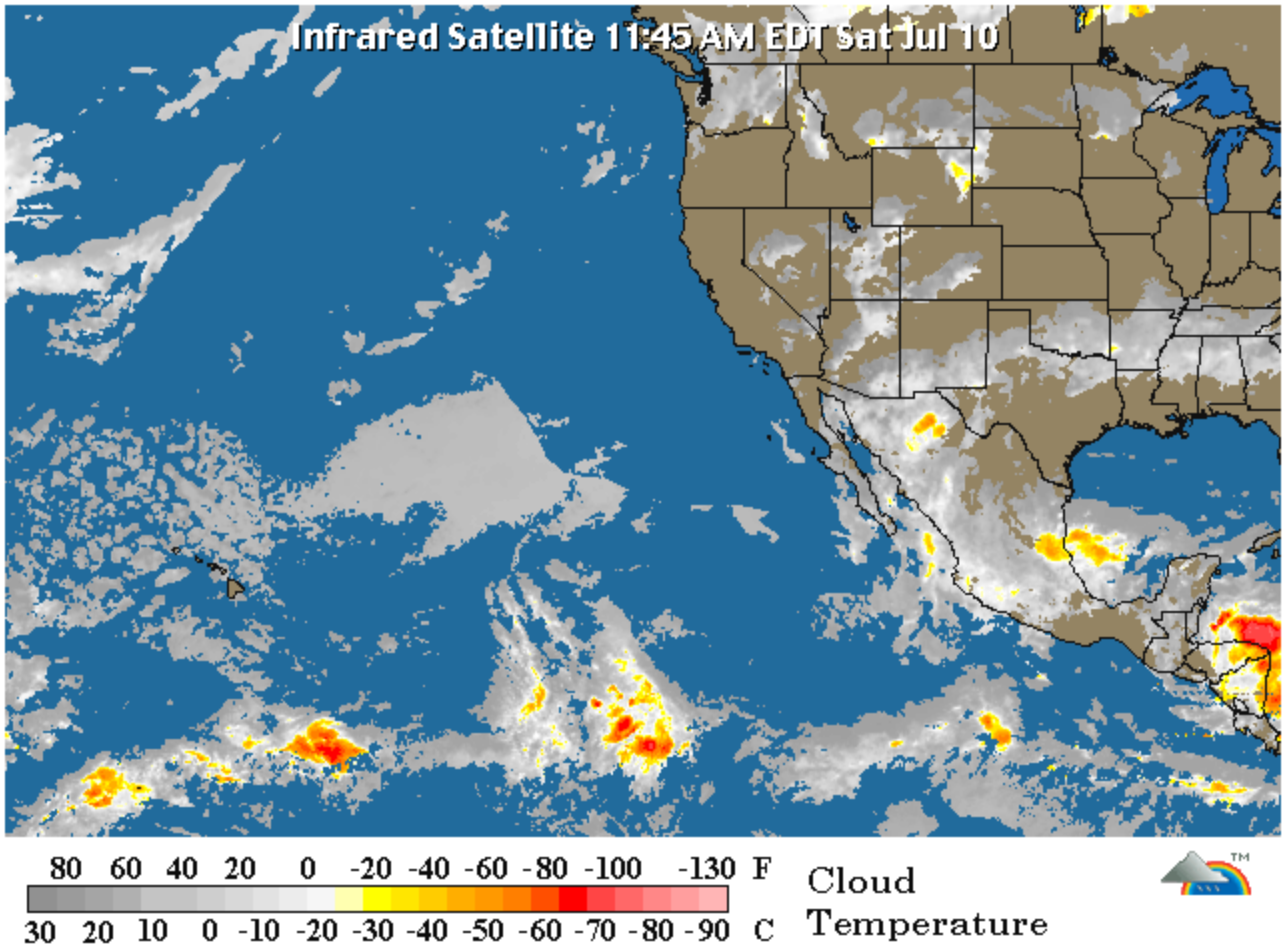
Source: Thomas (2006)

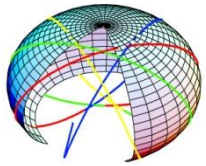


Example--Meteorology

- Forget “Bayesian” Farmer’s Almanac
- Take a snapshot of the wind, pressure and temperatures over the earth
- What will these values be in an hour? A day? A month?
- Use local behaviors from fluid mechanics to provide differential properties
- Integrate these properties over time to produce the result

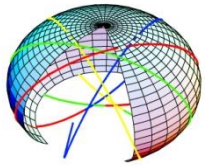
Weather: Elastic Behavior





Take-a-way

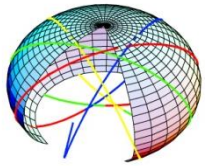
- *Decision Process Theory* can be a generalization to how we describe economic processes such as game theory
- But:
  - It is continuous
  - Predicts not on the basis of Bayesian probability but by the principle of Least Action
  - To be idiosyncratic: It is an example of Einstein's theory in a higher dimension, with a specific isometry for each player (*e.g.* Kaluza-Klein theory)
- Use Mathematica to judge success



Conceptual Basis

- Decisions are physical processes
- Though complicated, certainly an example of Lagrange's principle of least action
- What are the "active" variables, what are the constraints?
- Normal Form pure strategies are the "active" variables
- Need some simple example(s)—a "hydrogen atom" of decision processes

Prisoner's Dilemma



Prisoner's Dilemma

- The scenario is that two prisoners are being held for a crime where it is suspected they have acted in concert.
- Each is given a choice to confess or not confess with penalties that are supposed to induce confession of their guilt.
- However if neither confesses they will get off lightly.
- If both confess they will be penalized but not as severely as the case in which one confesses and implicates the other.
- The dilemma is that the prisoners would be collectively best off by not confessing.
- However the game theory analysis gets it wrong that they ***always*** both confess.

Payoff Matrix

- Game Theory analysis reduces the "intrinsic form" possibilities to two 2X2 matrix of numbers, one for each prisoner:

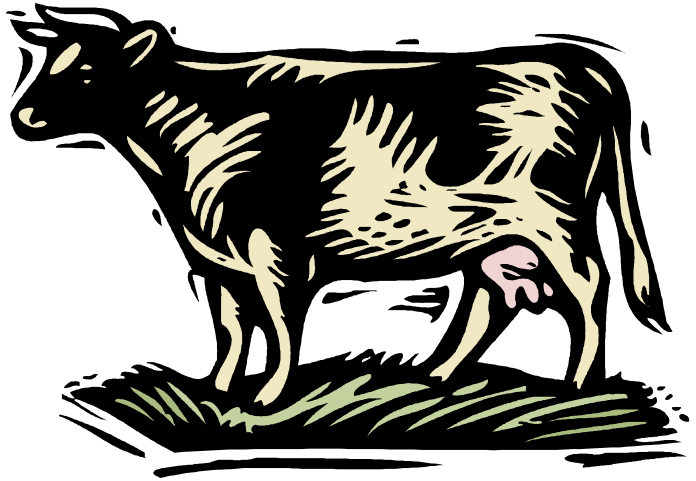
G_{12}^{1}	N_2	C_2
N_1	–0.1	–1
C_1	0	–0.9

and.

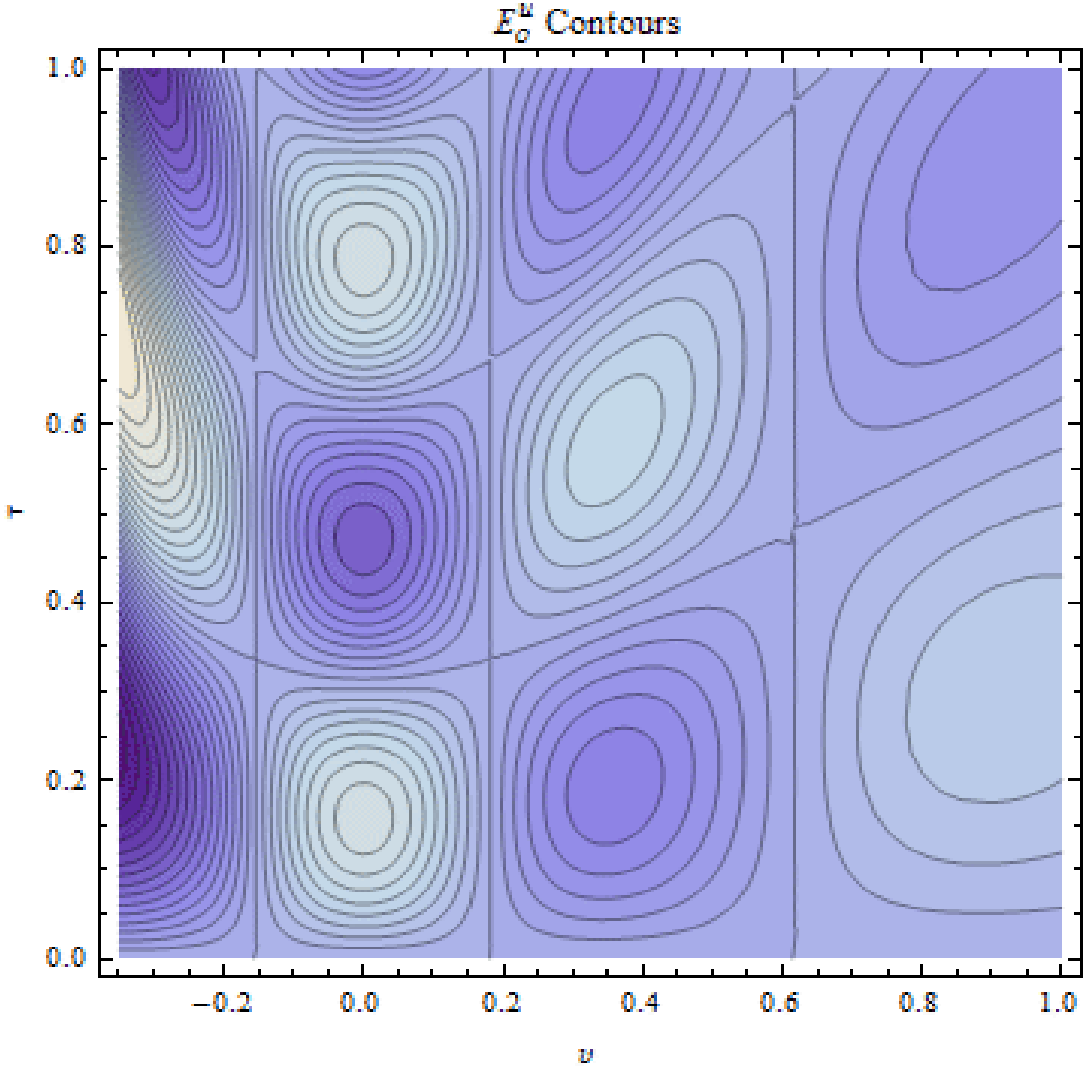
G_{21}^{2}	N_1	C_1
N_2	–0.1	–1
C_2	0	–0.9

Exercise

- Prisoner's Dilemma is a special case of the tragedy of the commons—Code of conduct. Game theory gets it wrong!!
- Code of Conduct essential: Adam Smith

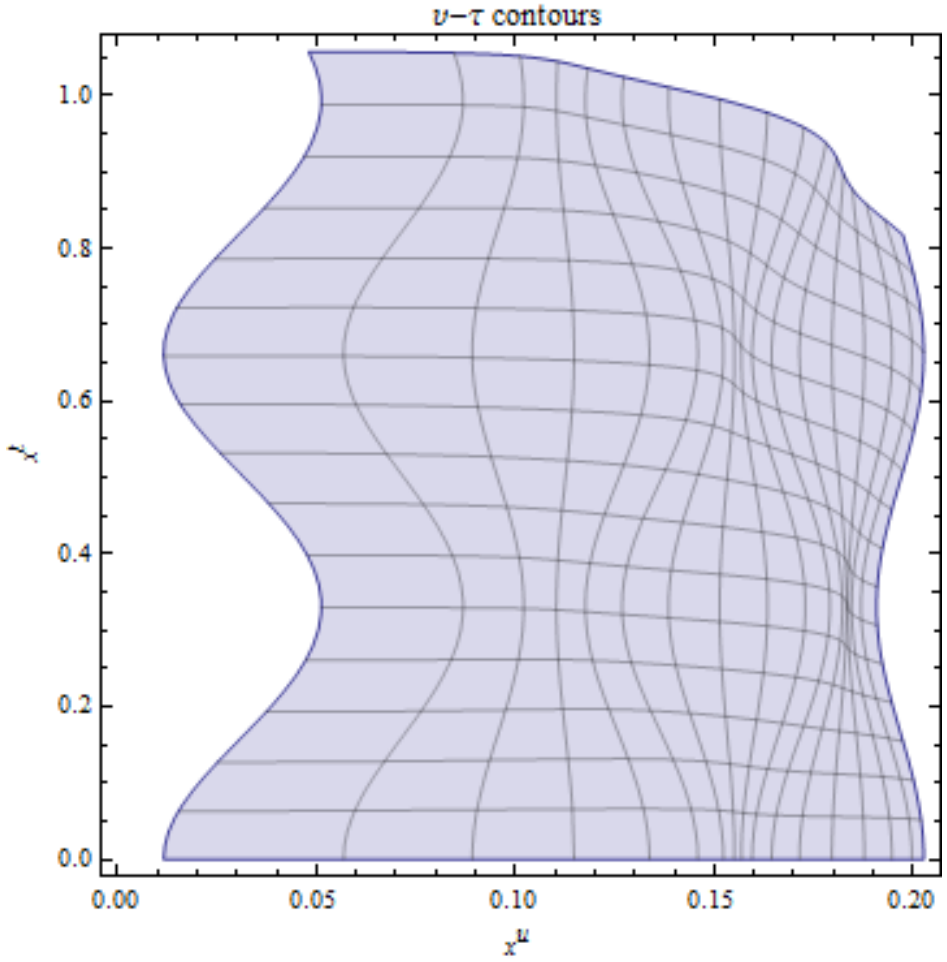


Dynamic flow/balanced forces

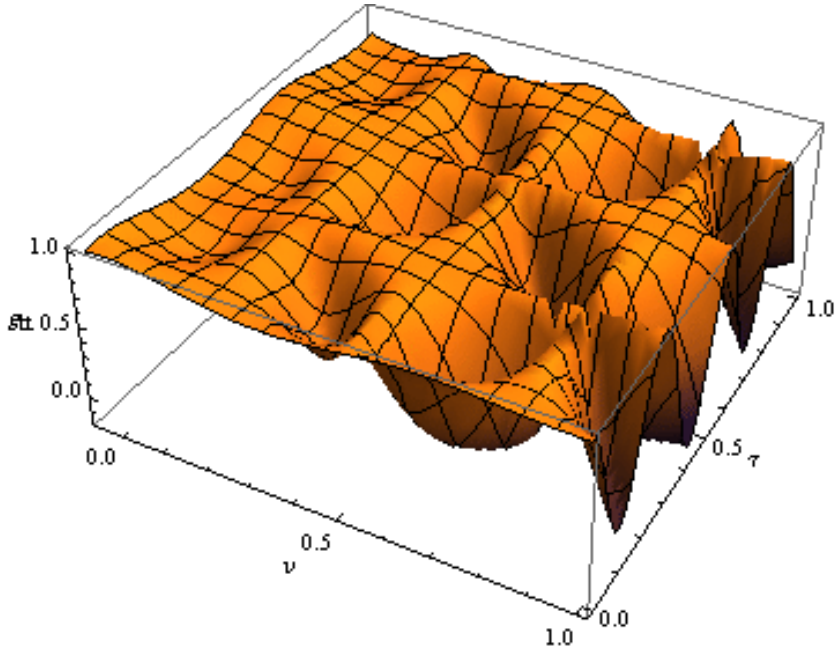


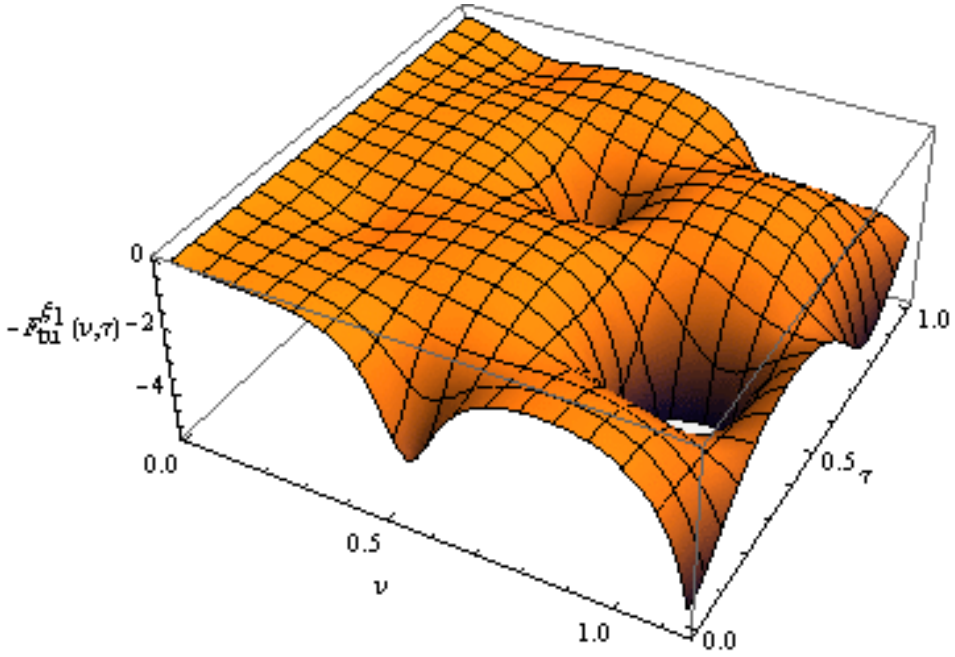
Source: calculations from Thomas, (in preparation)

Differential Geometry: Elastic Behavior

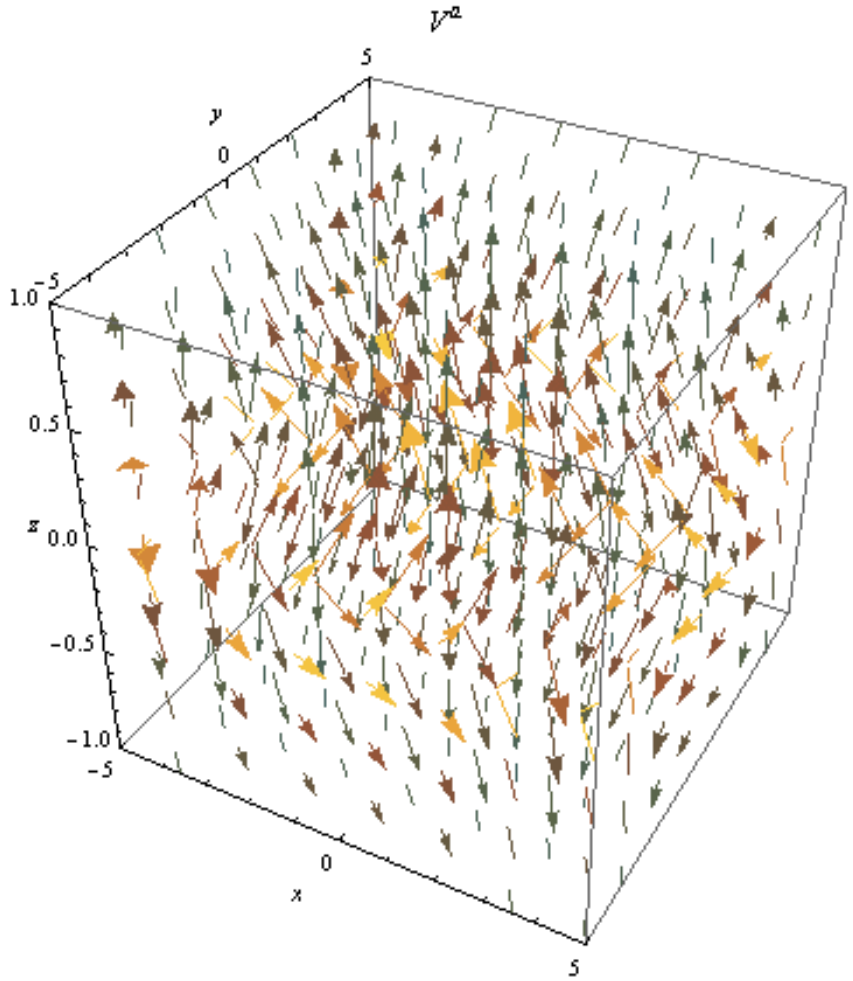


Prisoner's investment may have holes

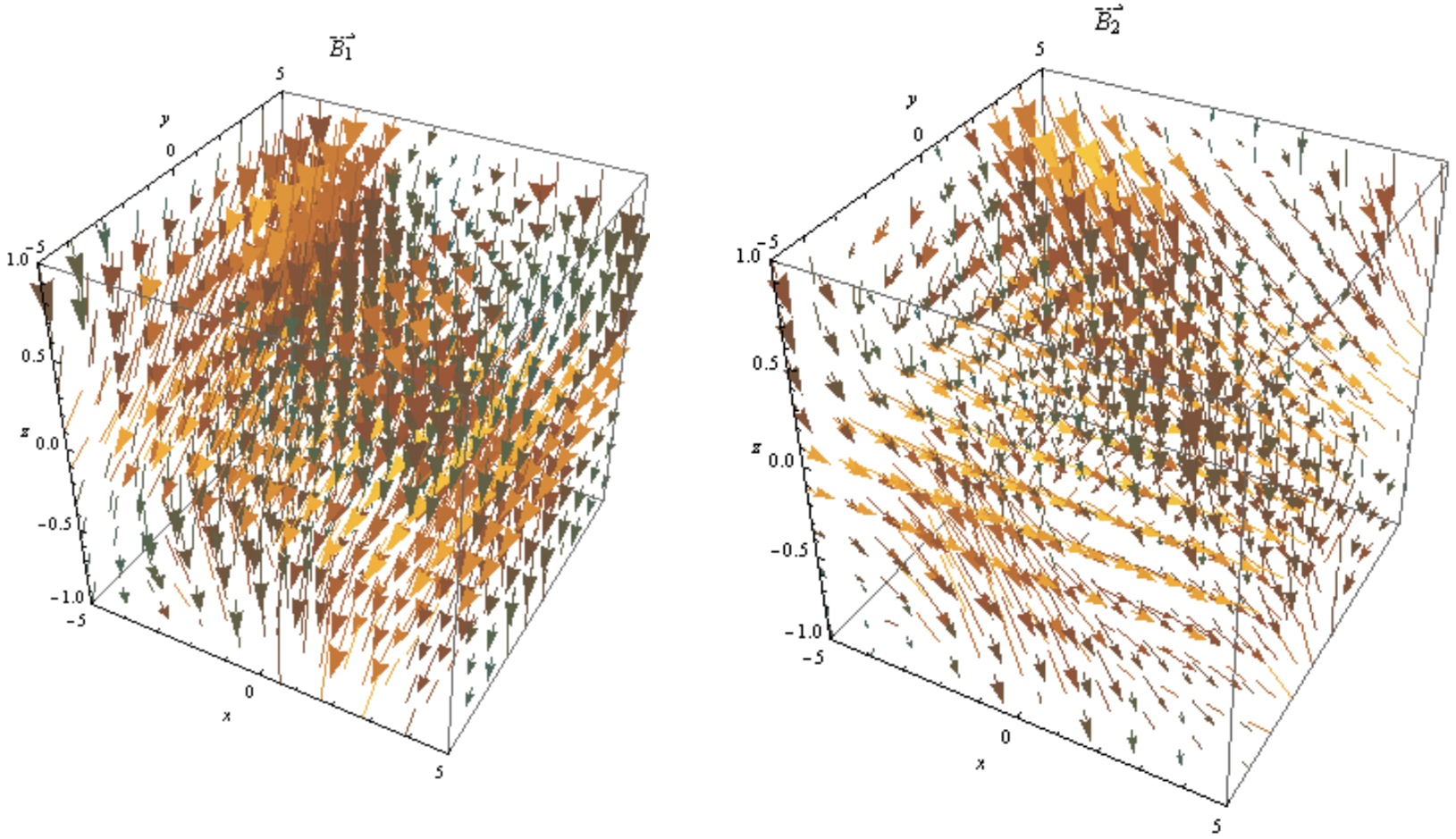




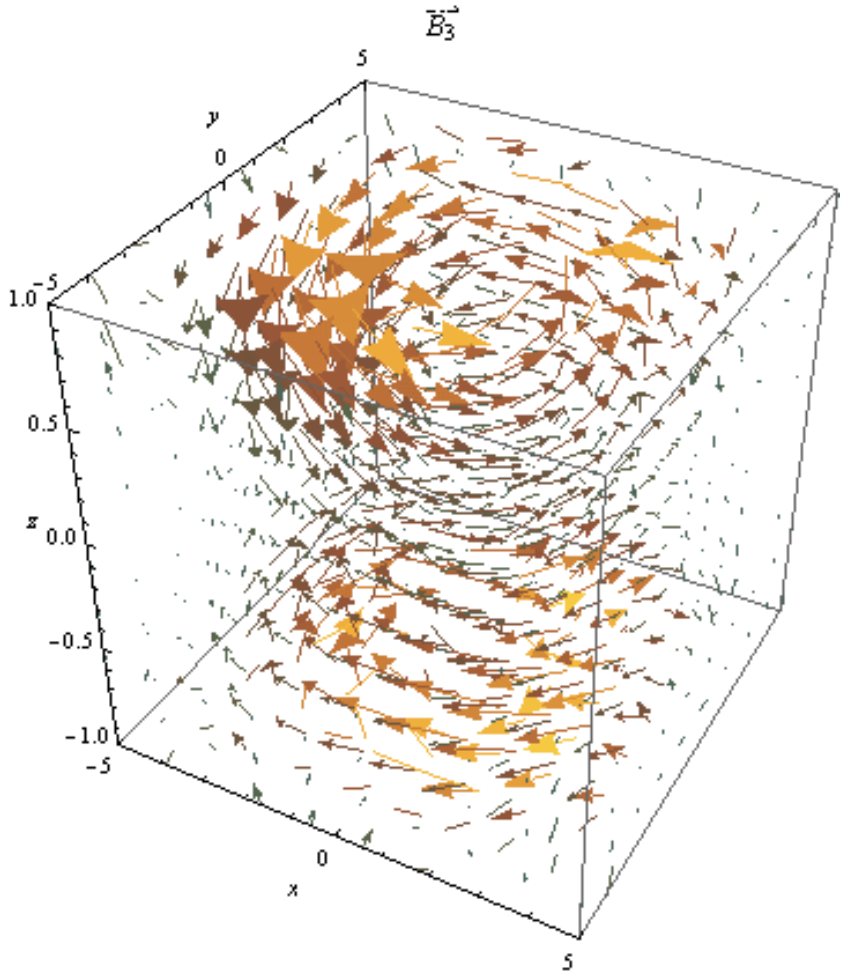
Different example: Blue versus Red Army



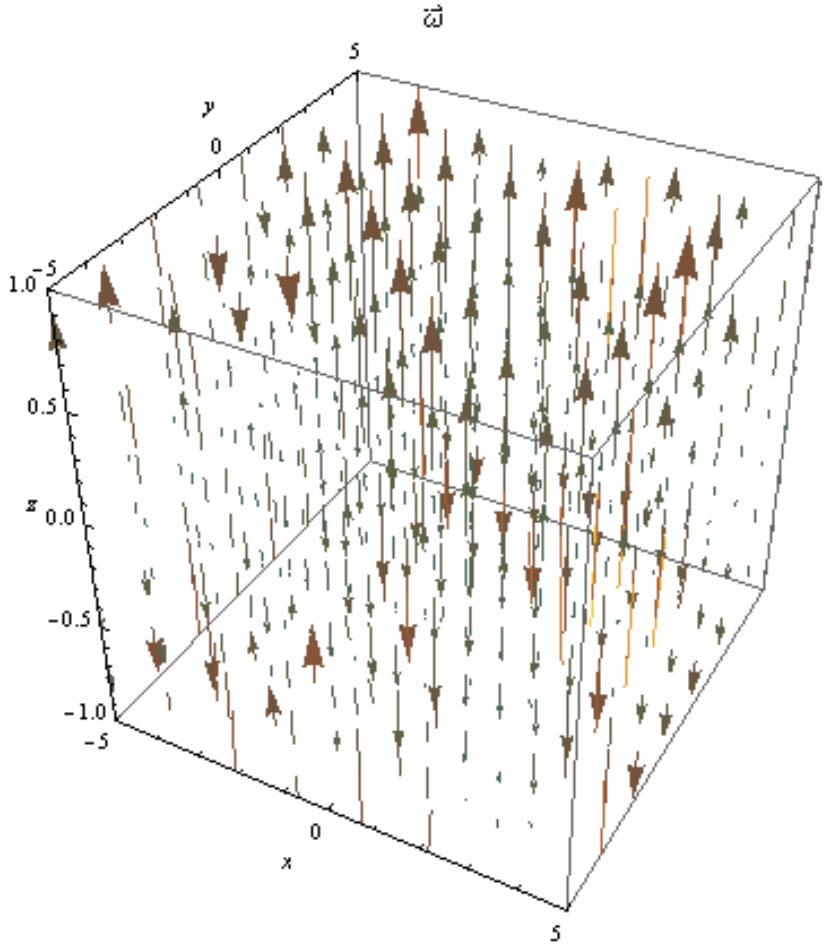
Blue & Red Elastic Behaviors



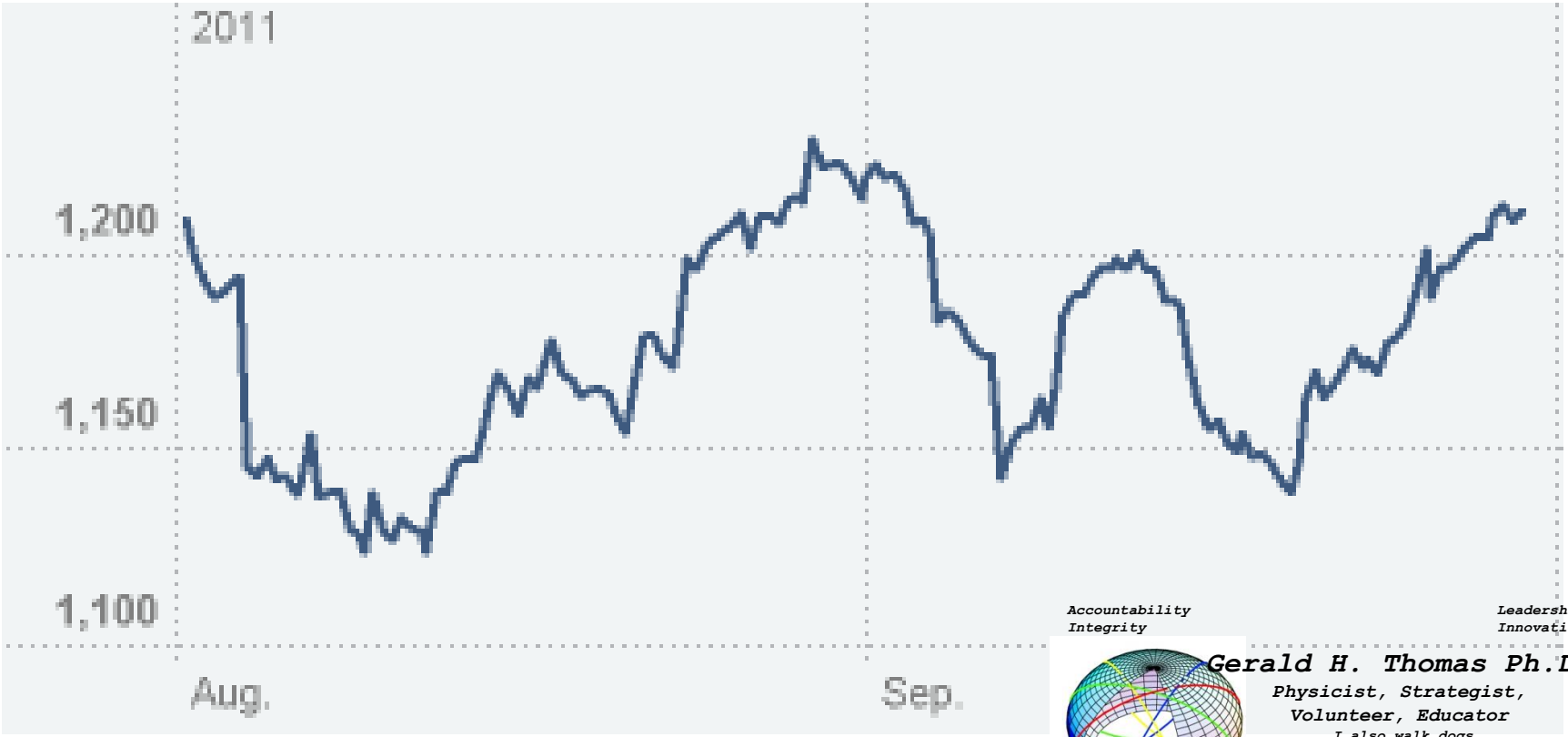
Distinct Code of Conduct Behavior



Combined Elastic Behavior = Entitlement + Engagement



Stock Market—Elastic Behavior?



Accountability
Integrity

Leadership
Innovation

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