Game Theory for the Maritime Professional

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Game Theory

- Theory to apply to games; Chess, Football
- Negotiations
- Engineering optimizations
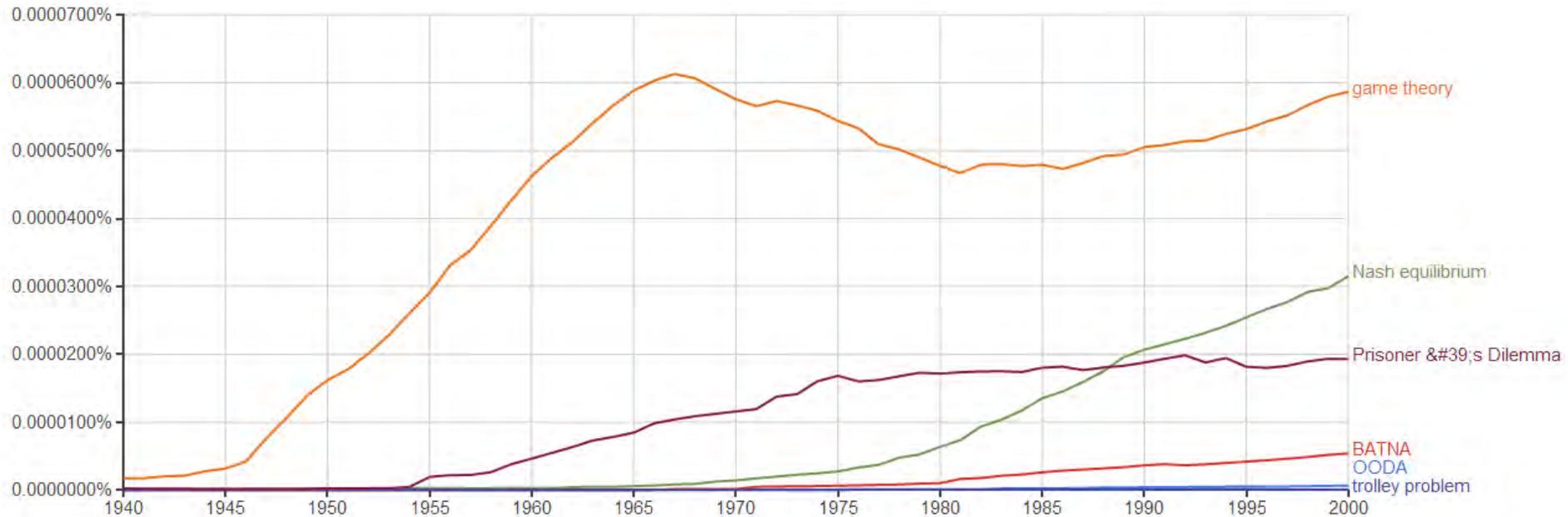- Races (NASCAR)
- Combat
- Commerce
- Decision Making

Terminology and Concepts

- Prisoner's Dilemma
- Tit for Tat
- BATNA
- Negotiation v. Politics
- Nash Equilibrium
- Pareta Optimality
- OODA
- Data
- Women and Children first
- Beer in Training
- How to Outrun a Bear

Terminology and Concepts

Google books Ngram Viewer

www.martinottaway.com

Prisoner's Dilemma

Two members of a criminal gang are arrested and imprisoned. Each prisoner is in solitary confinement with no means of speaking to or exchanging messages with the other. The police admit they don't have enough evidence to convict the pair on the principal charge. They plan to sentence both to a year in prison on a lesser charge. Simultaneously, the police offer each prisoner a [Faustian bargain](). Each prisoner is given the opportunity either to betray the other, by testifying that the other committed the crime, or to cooperate with the other by remaining silent.

Here's how it goes:

- If A and B both betray the other, each of them serves 2 years in prison

- If A betrays B but B remains silent, A will be set free and B will serve 3 years in prison (and vice versa)

- If A and B both remain silent, both of them will only serve 1 year in prison (on the lesser charge)

Hold or Bolt?

- It depends
- How much do you trust your partner in crime?
- If you do not know him at all, you would bolt
- If you trust him, you would hold
- How do you trust him?
- You trust him based on prior experience (data)
- It also depends on the rewards and penalties

Iterative Prisoners Dilemma

- Play multiple sessions with the same "partner in crime"

- Develop a strategy that would provide maximum returns with a "stranger in crime"

- Always bolt with a "stranger in crime"

- What about random "strangers in crime" with random strategies?

- Introduces a time element in decision making

Tit for Tat

- Axelrod Tournament

- Rapoport's Tit for Tat strategy:

- Cooperate; If no cooperation: defect; If cooperation: cooperate

- Watch out for death spiral

- Basis for cooperation in nature and commerce

Ignoranuses

- Tit for Tat is the way to go but ……
- A few defecting players will continue to take advantage of the initial cooperation (ignoranuses)
- How do you reduce ignoranuses?
- Communication
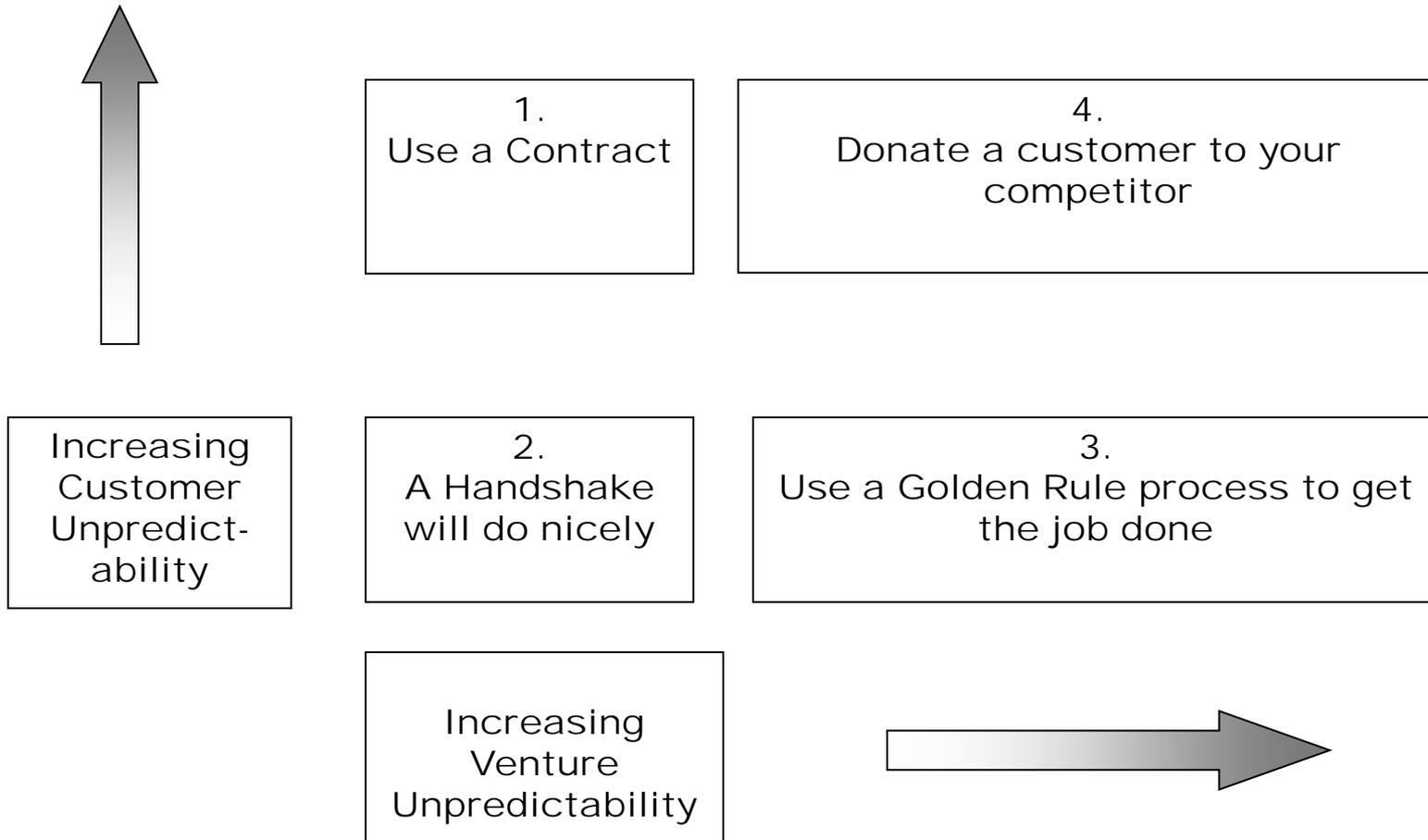- Build well informed (stable) communities with hope for the future

How to build cooperation

- A handshake is the first step towards cooperation. It is like a dog sniffing another dog's butt

- Take small steps and take many steps

- Make sure there is always an opportunity for more opportunities to cooperate

- Cooperation is the basis of everything we see around us. There are no exceptions.

What does this tell us?

↑ Increasing (arrow pointing up)

Increasing Customer Unpredict-ability

1. **Use a Contract**	**4.** **Donate a customer to your competitor**
2. **A Handshake will do nicely**	**3.** **Use a Golden Rule process to get the job done**

Increasing Venture Unpredictability

→ (arrow pointing right)

BATNA

- Best Alternative To No Agreement

- Or in other words, it is easier to deal if you don't have to make a deal

- But if you have to make a deal you'd better know what the other guys' BATNA is.

- Or maybe you can change the other guys' BATNA?

- Try fear, provide a sweetener, be creative

Negotiation v. Politics

- Prisoners' dilemma and tit for tat strategy is between two parties
- BATNA between more than two parties becomes quite complicated
- Multi party negotiations are called politics
- To get control of multiparty negotiations (to achieve a deal) it is often best to somehow reduce the negotiation to two parties
- Divide and conquer is true, but it is related to conquest not trade

Nash Equilibrium

- Bar with women of varying attractions invaded by single men

- Which woman to approach?

- The most attractive or the least attractive?

- Or one in the middle?

- That is some pretty tough math, but the optimal choice may be somewhere in the middle and requires knowledge about the other single men.

- The Nash equilibrium only deals with the simplest case.

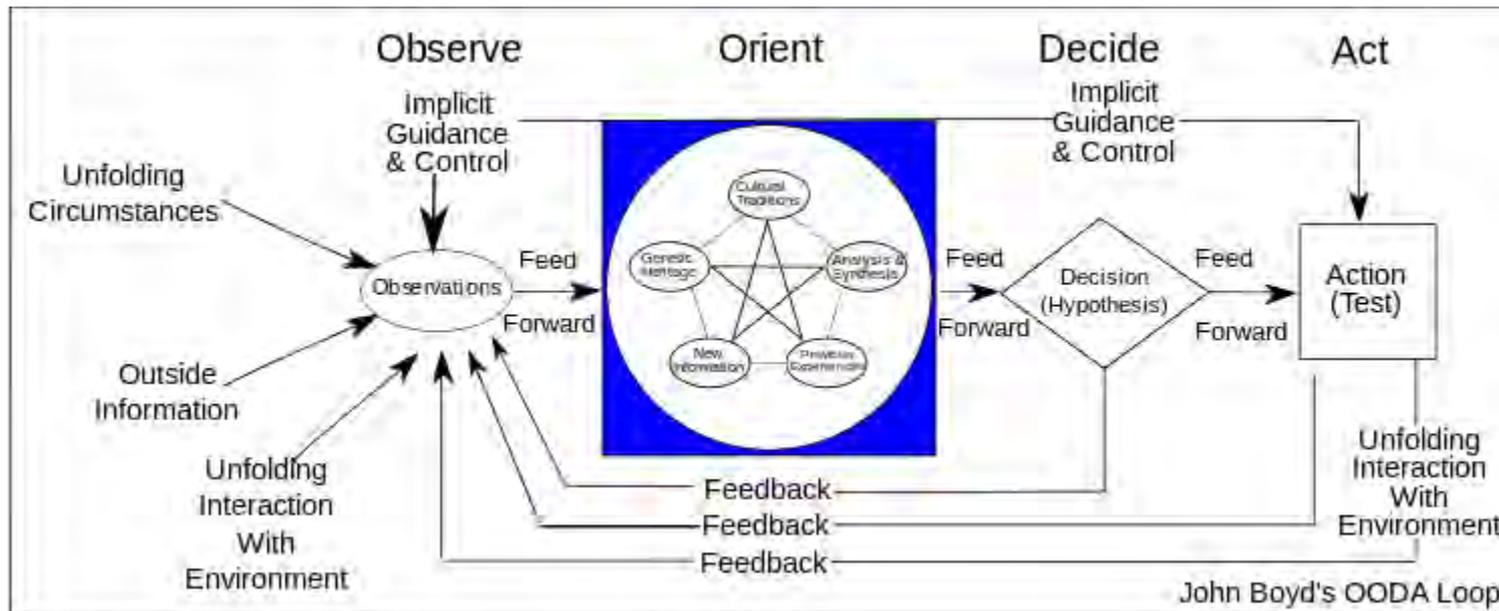- Note how Nash equilibrium involves decision making

Pareta Optimality

- In making decisions and when negotiating there are resource apportionments where each party gets increasingly more resources of their choice without denying resources of other party's choice.

- The point where resources can increase without decreases to other parties is called the Pareta Optimality. This is where win/win ends.

OODA

- Developed by 40 second Boyd
- Observe Orientate Decide Act
- Dynamic game theory (speed)
- http://www.martinottaway.com/blog/rik-van-hemmen/disaster-do-ooda-loop
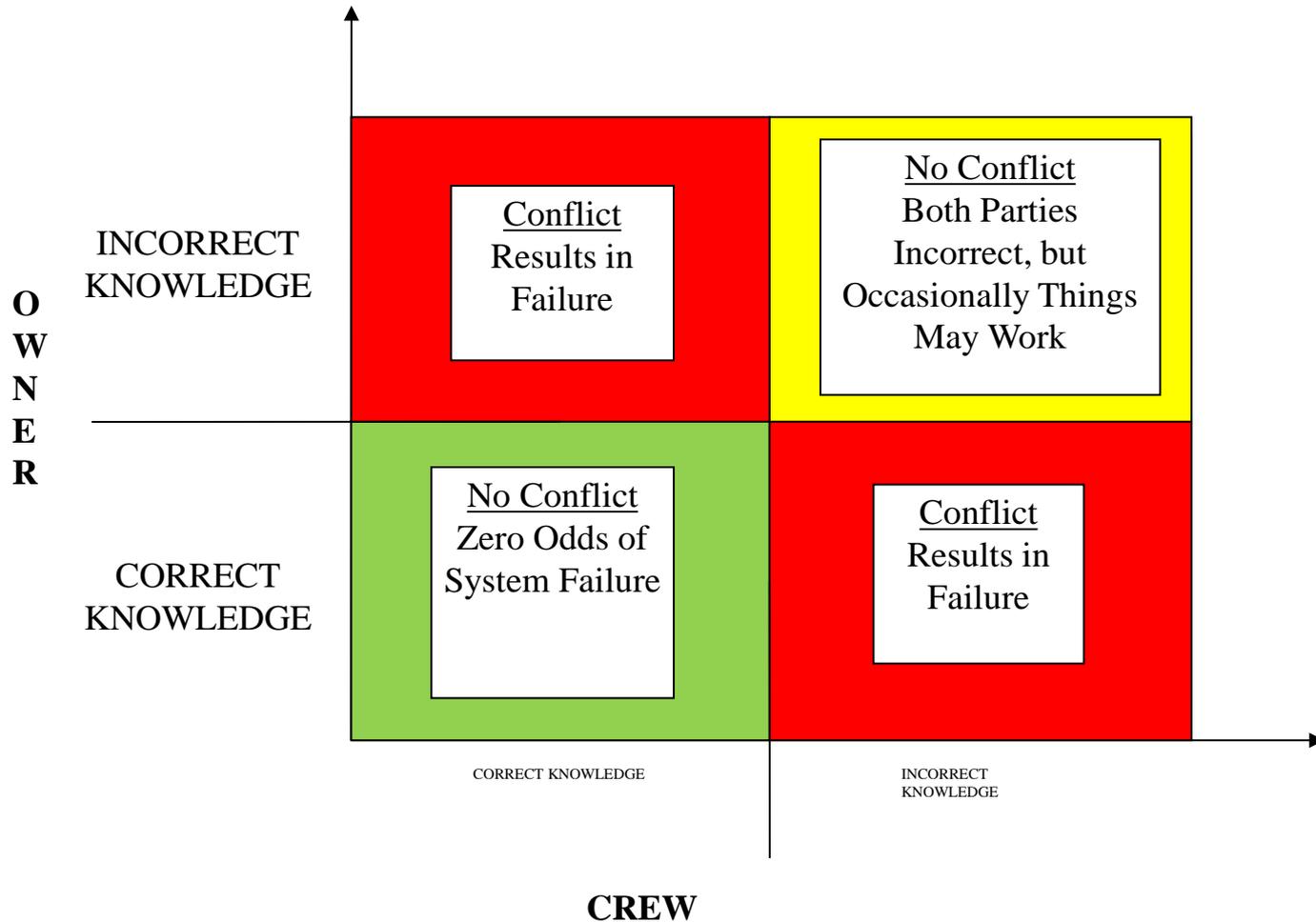

John Boyd's OODA Loop

Data

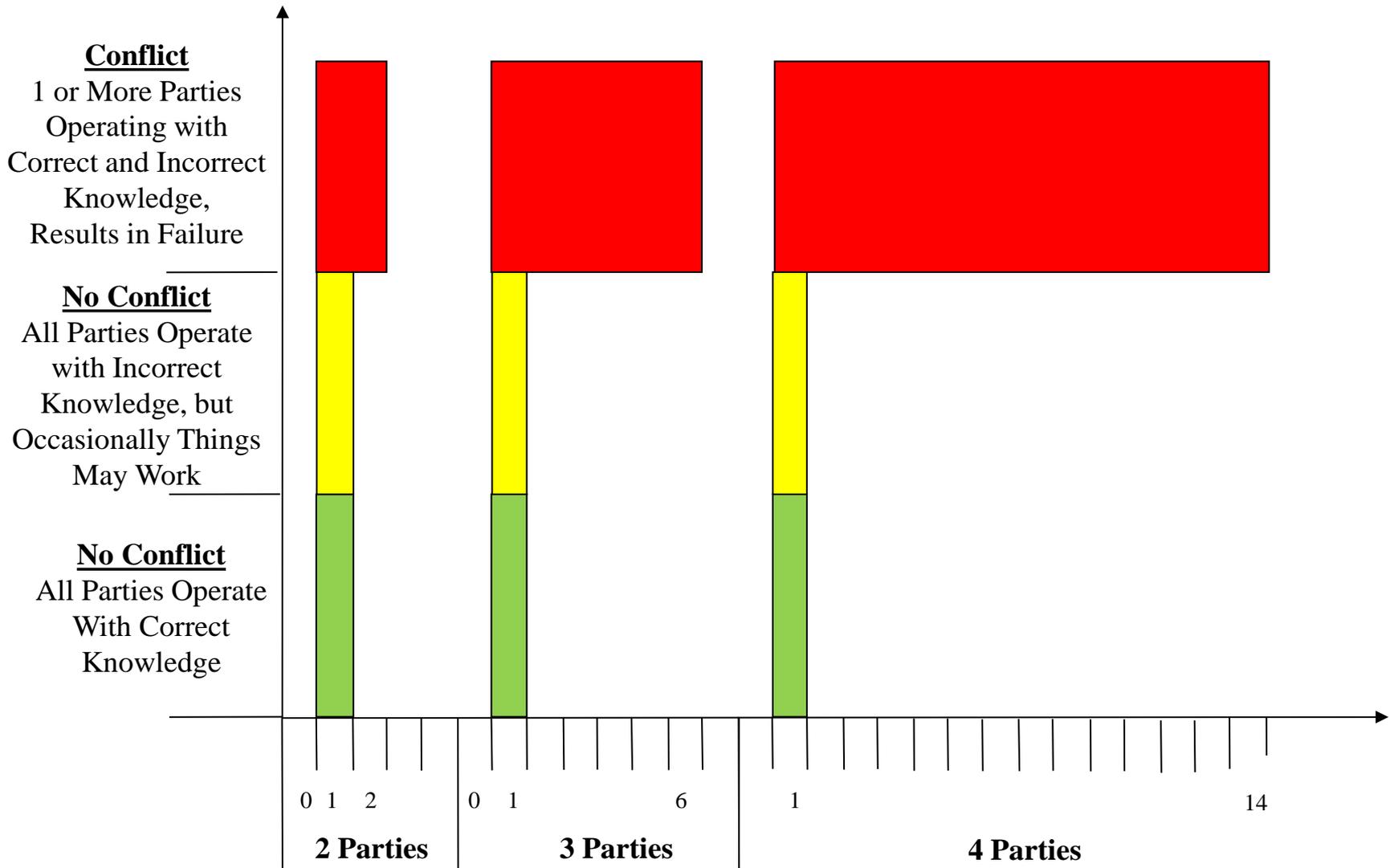- All these game components require data
- There is too much bad data out there
- Getting good data takes very hard work
- See http://www.martinottaway.com/blog/rik-van-hemmen/short-course-flawed-analysis-or-norden-bombsight-insight
- Don't even bother to think in terms of game theory with bad data.

Data in Communications

O W N E R (vertical axis label)

INCORRECT KNOWLEDGE

CORRECT KNOWLEDGE

Top-left (red): __Conflict__ Results in Failure

Top-right (yellow): __No Conflict__ Both Parties Incorrect, but Occasionally Things May Work

Bottom-left (green): __No Conflict__ Zero Odds of System Failure

Bottom-right (red): __Conflict__ Results in Failure

CORRECT KNOWLEDGE

INCORRECT KNOWLEDGE

CREW

Increasing parties

Conflict
1 or More Parties Operating with Correct and Incorrect Knowledge, Results in Failure

No Conflict
All Parties Operate with Incorrect Knowledge, but Occasionally Things May Work

No Conflict
All Parties Operate With Correct Knowledge

0 1 2

0 1   6

1   14

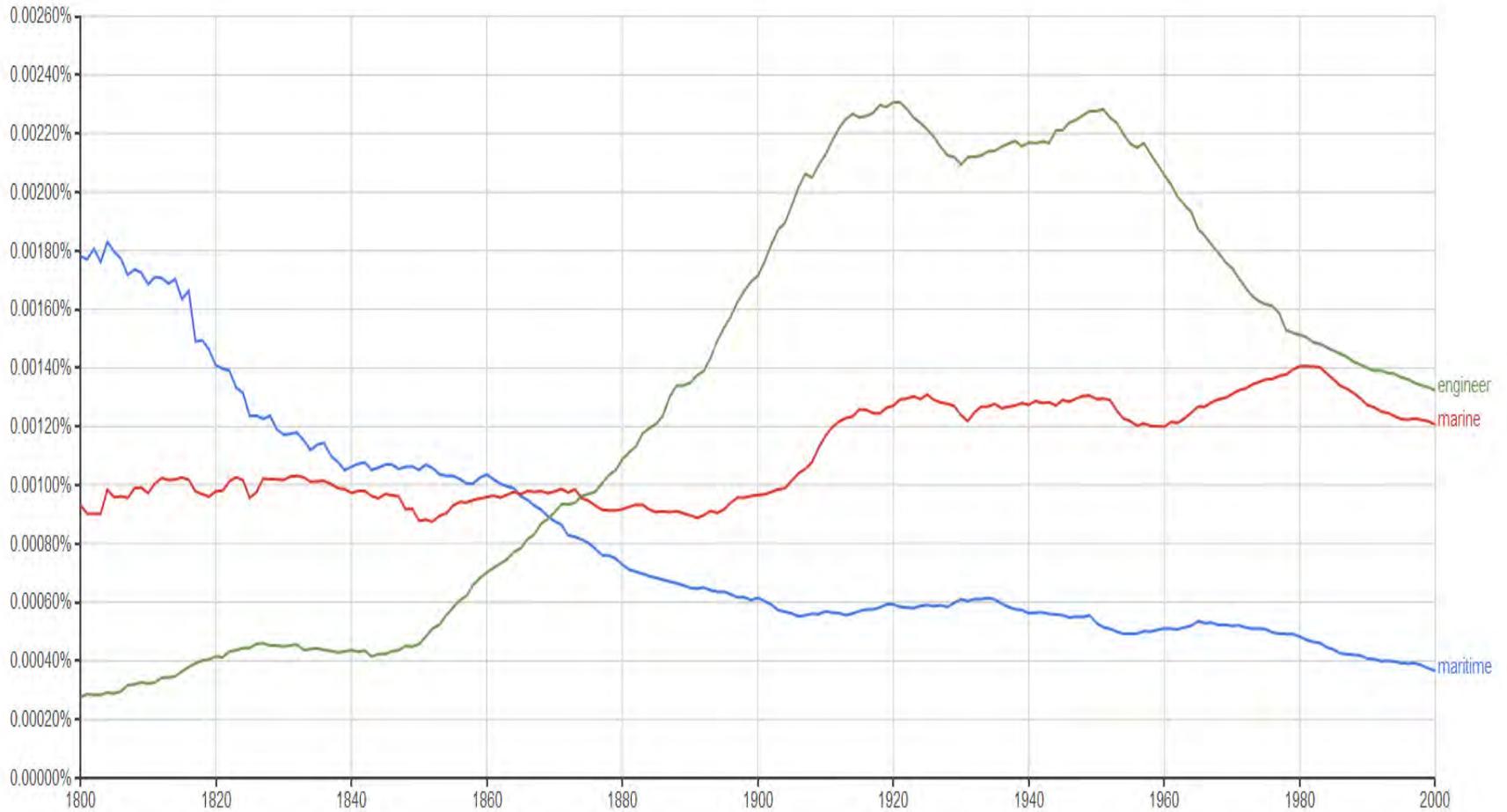**2 Parties**   **3 Parties**   **4 Parties**

Data Issues

Women and Children First

- There was a study that women and children did not get to go first in disasters

- http://www.martinottaway.com/blog/rhemmen/woman-and-children-first

- Actually what the study indicated is that when panic develops the prisoners stop cooperating

Beer in Training

- "Sources of Power" by Klein
- There is no intuition in decision making
- There is only skill and great skill feels like intuition
- 10,000 hrs at anything will make you intuitive
- But story telling is very helpful
- And the best time to tell stories is with a pint of beer, and this impacts maritime

How to Outrun a Bear?

- You can't

- But if two of you are running all you have to do is outrun the other guy, and only by an inch

- That means just a little more speed is a win

- In game theory, that speed, is generally expressed in a little more knowledge.

- Knowledge is not a guess. Knowledge needs a rational basis and data and proper analysis

Using Game Theory

- An oil spill
- An opponent (let's say USCG)
- Prisoner's dilemma? (cooperator or not?)
- Multiple iterations
- Tit for Tat?
- BATNA?
- The DOJ shows up
- Three parties
- Find a Nash Equilibrium
- Is their a Pareta Optimality?
- More oil is spilling
- Get good data
- Run the OODA loops

Outrun the Bear!

Mary McDonald / naturepl.com1

A metaphysical summary

- Human decision making used to be rule based; Thou shall ………

- Jesus came around said: Do onto others ….

- That requires data and evaluation and requires more flexible analysis

- Slowly the world has started to discover further analytical methods in decision making and is shifting towards a different decision making process

- Decision making actually has become an engineering problem solving process

Such as:

- Things are always changing (change is constant)
- First do no irreversible harm
- Consider the cost of action through the entire chain
- Look for efficiencies
- Moderation
- Communicate
- Fairness from both points of view
- Cooperate
- Allow individual freedoms to an extreme if they do not harm others
- One is personally responsible for actions on public knowledge

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