

AAAI/IJCAI Computer Poker Competition

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University of Alberta



UNIVERSITY OF
ALBERTA

Why Poker?

Industry executives and analysts often mistakenly talk about strategy as if it were some kind of chess match. But in chess, you have just two opponents, each with identical resources, and with luck playing a minimal role. **The real world is much more like a poker game, with multiple players trying to make the best of whatever hand fortune has dealt them.**

David Moschella, *Computerworld*, 1999

Why Poker?

“The real world is much more like a poker game...”

David Moschella in Computerworld, 1999

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- Imperfect information

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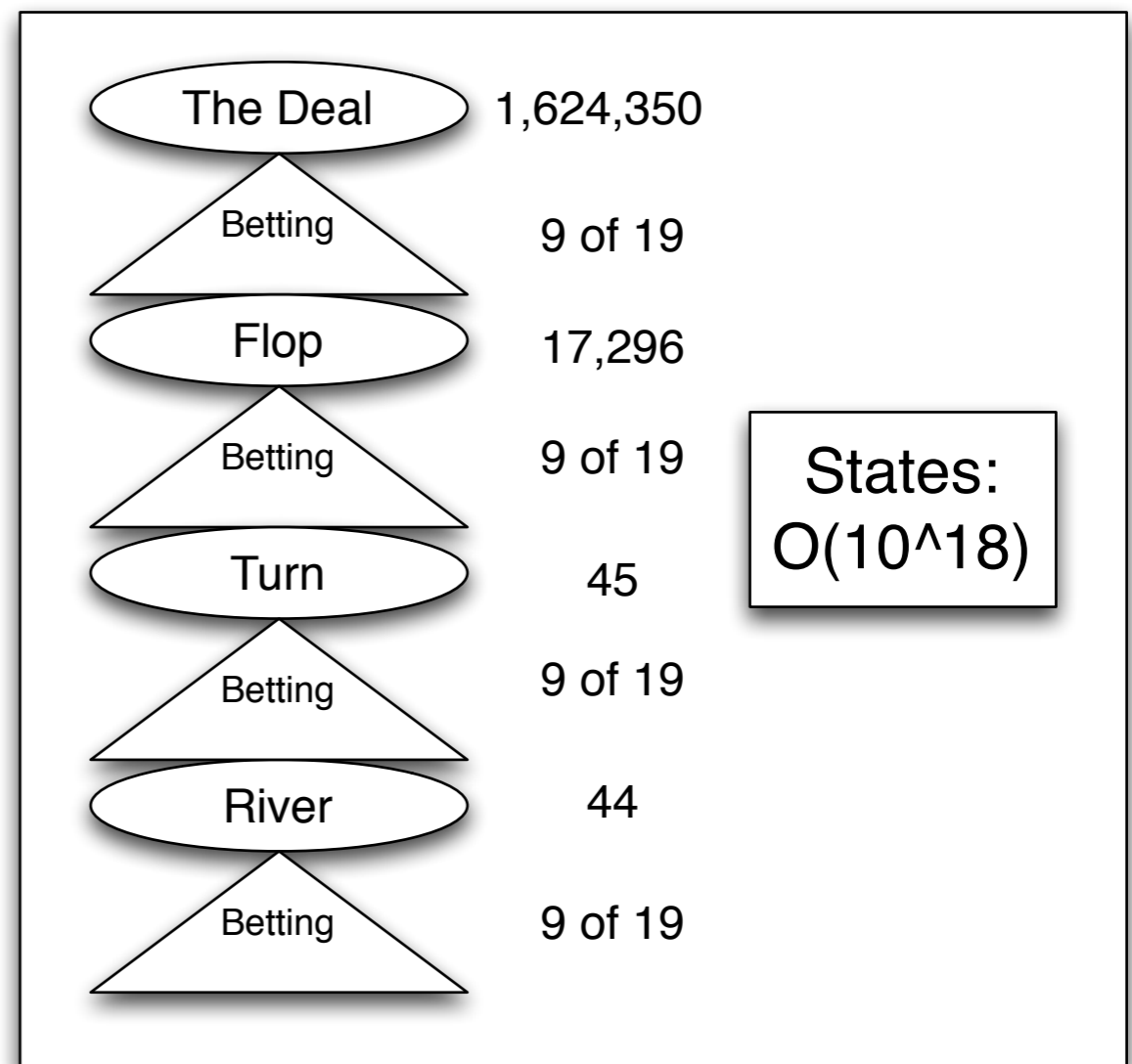
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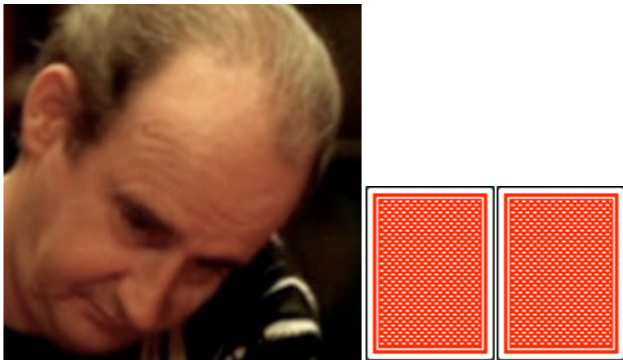
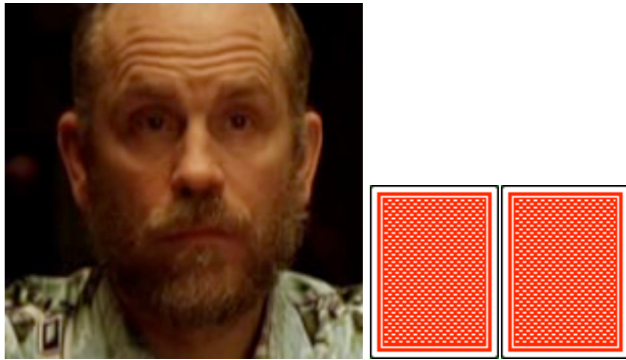
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- Imperfect information
- Large game tree
- Variable number of players (2-10, or more)
- Stochastic element
- Amount of winnings matters

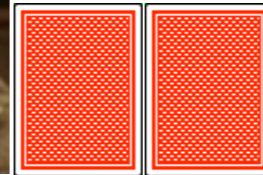
What is Poker?

Example hand from the movie *Rounders*

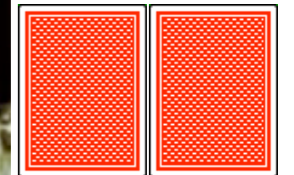
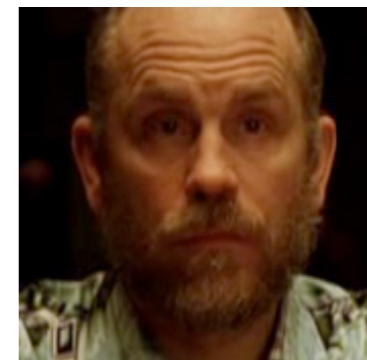
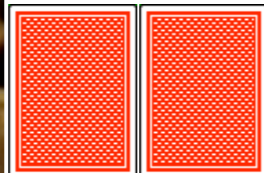


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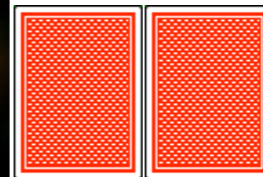
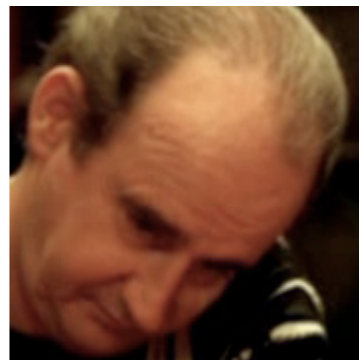
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Small Blind

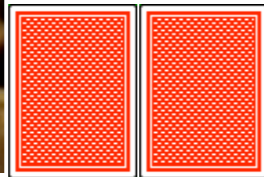


Big Blind

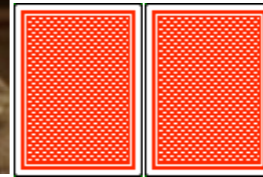


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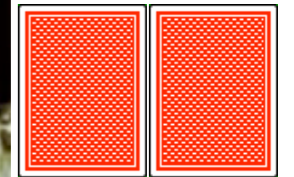
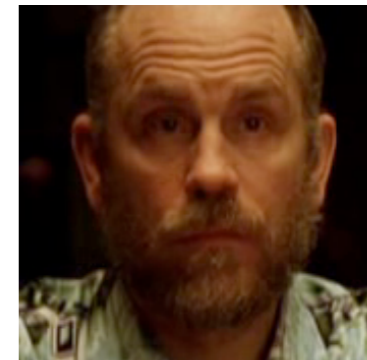
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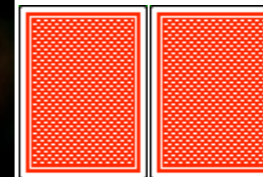
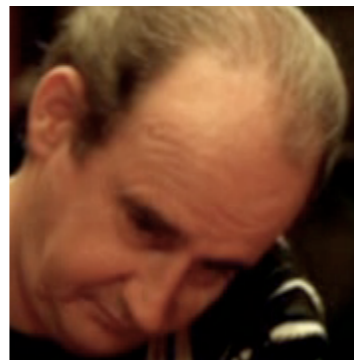
Raise



Small Blind
Fold



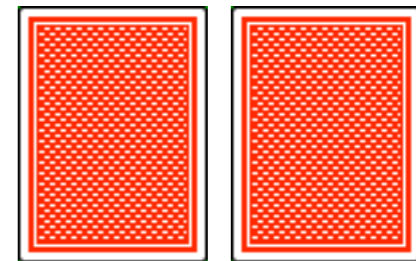
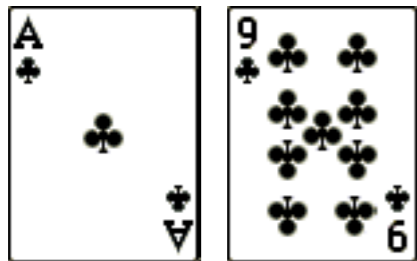
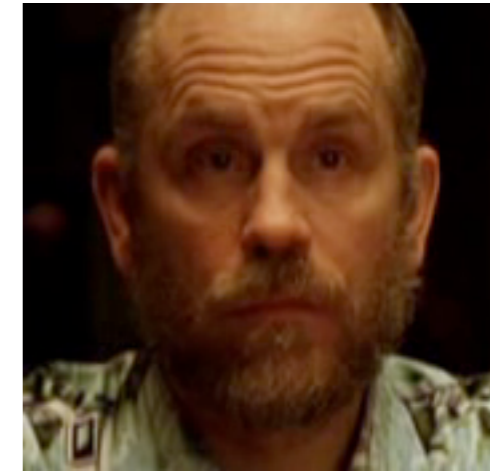
Big Blind
Call



Fold

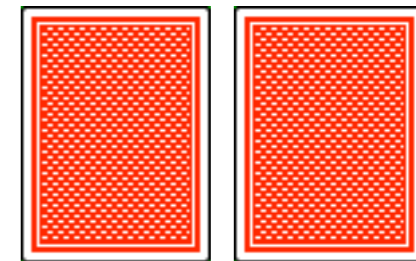
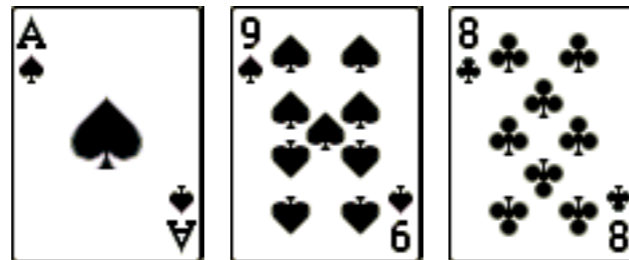
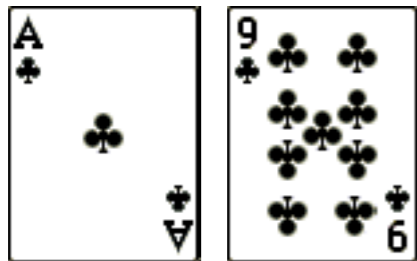
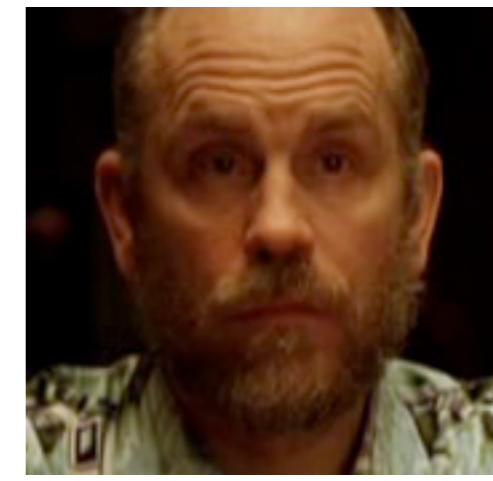
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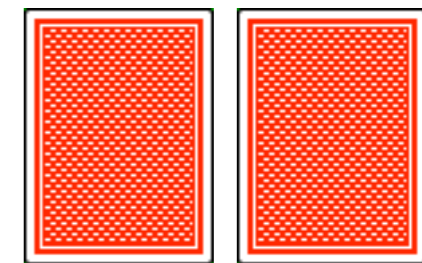
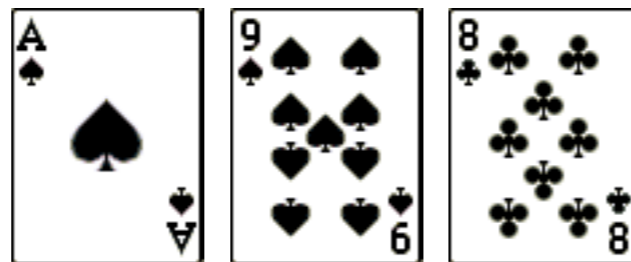
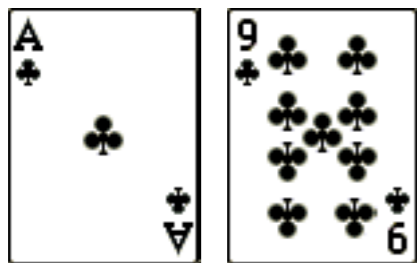
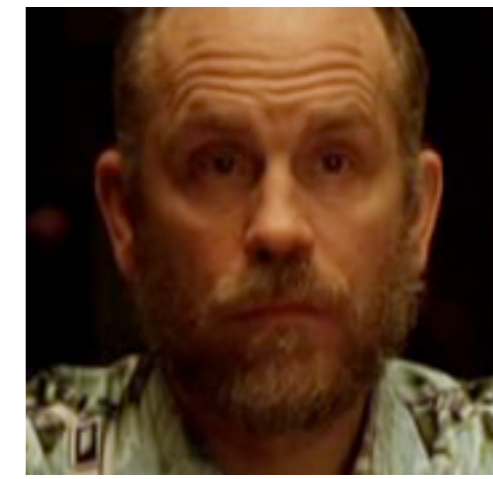
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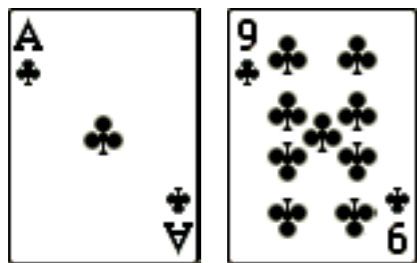
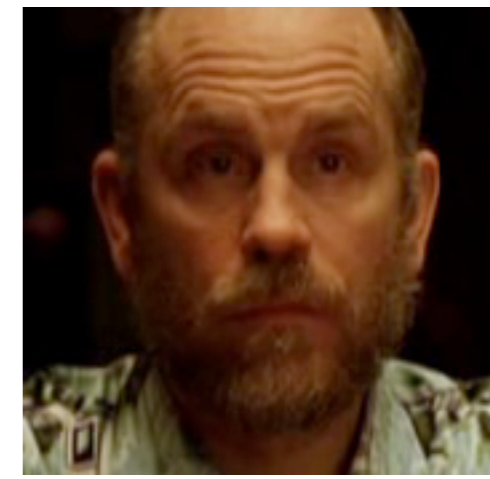
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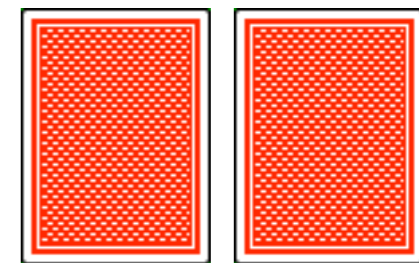
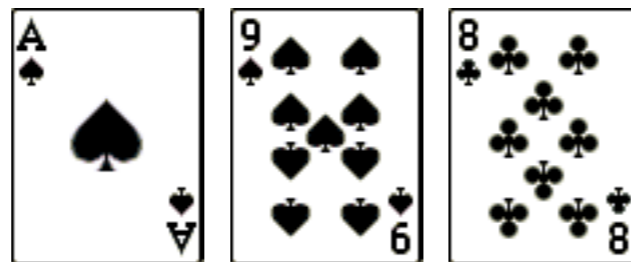
Check

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Raise

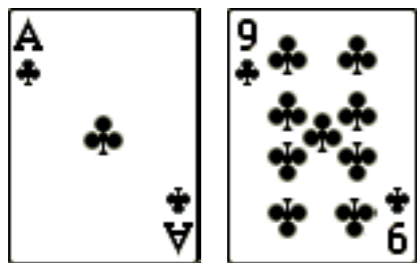
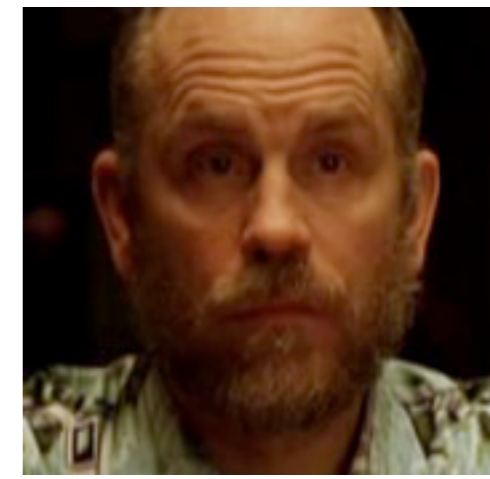


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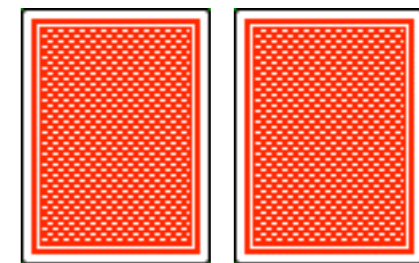
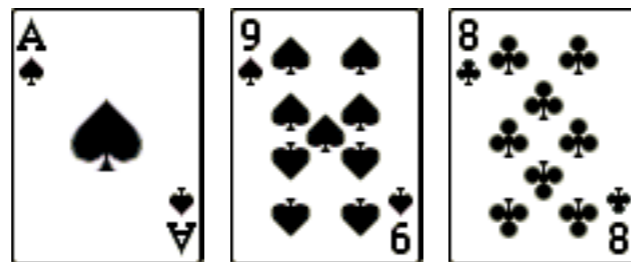
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What is Poker?

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Raise



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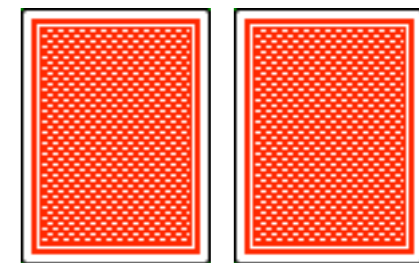
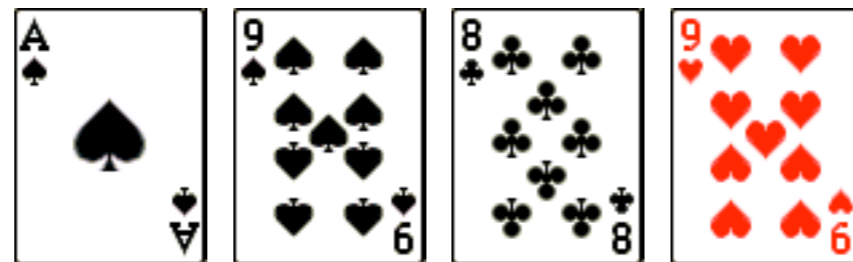
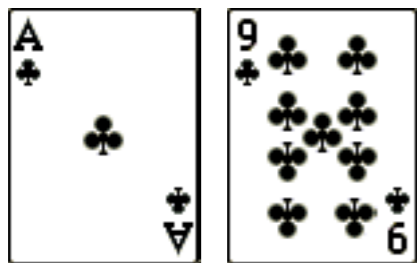
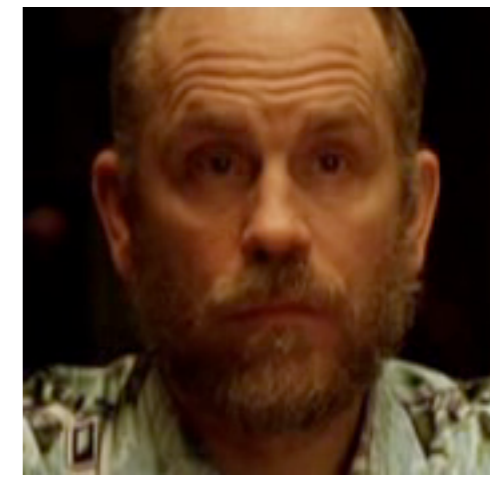
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“Teddy has a flush draw” (imperfect information)

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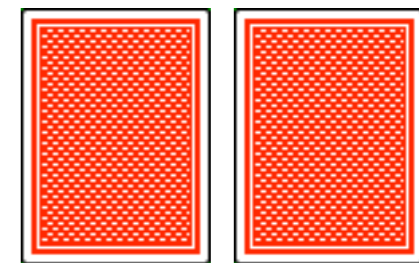
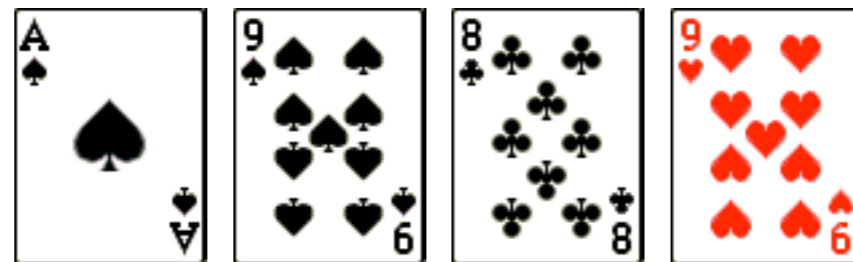
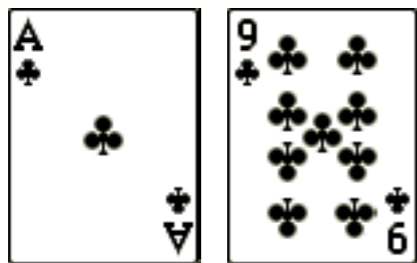
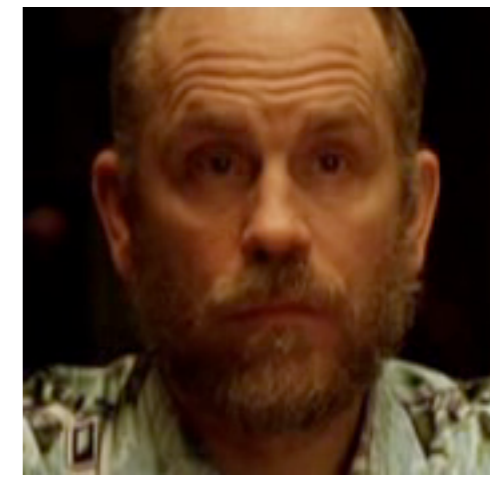


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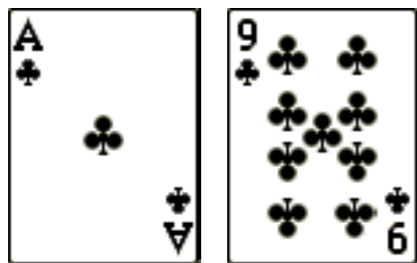
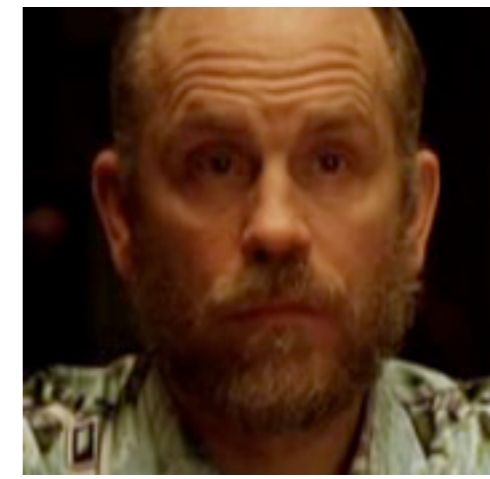
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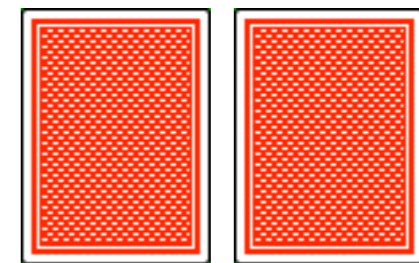
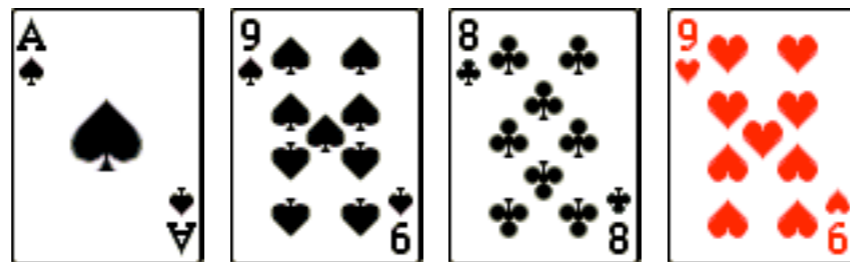
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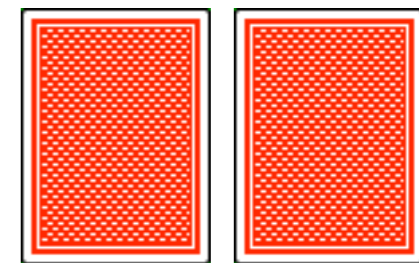
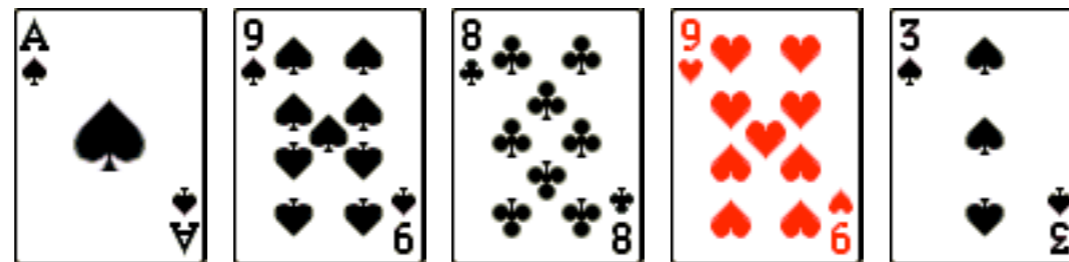
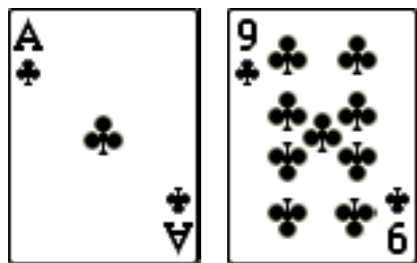
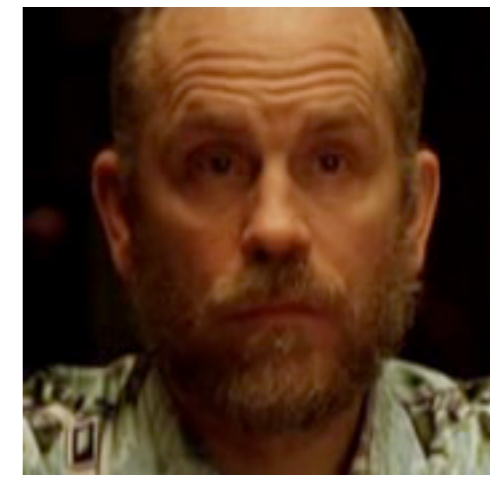
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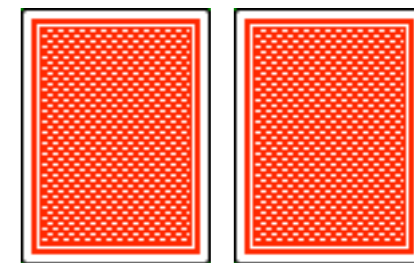
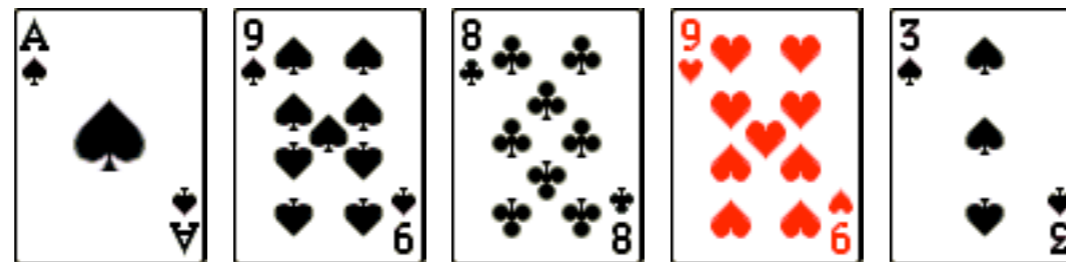
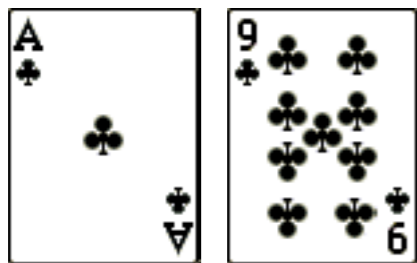
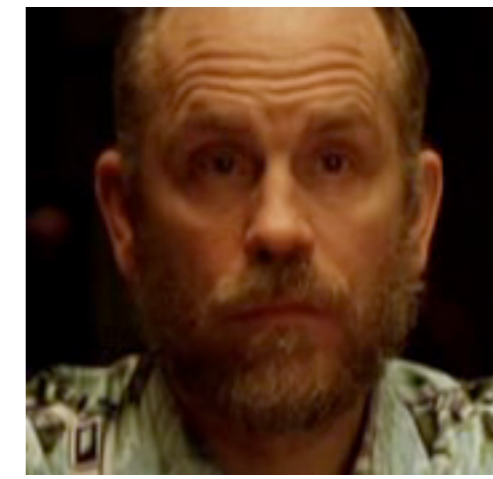


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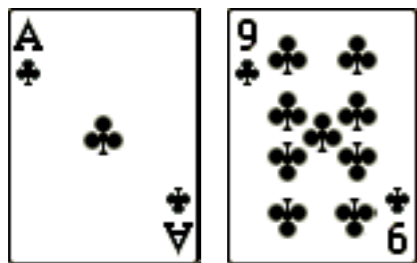
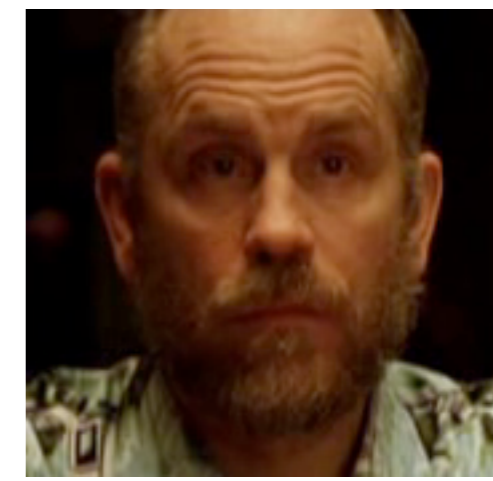
Raise

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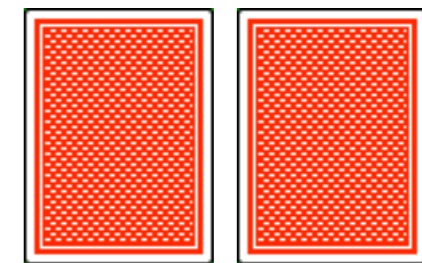
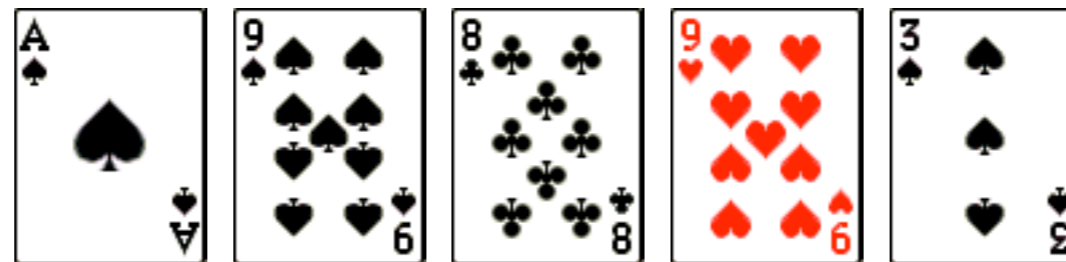
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What is Poker?

Example hand from the movie *Rounders*



All-In



Raise

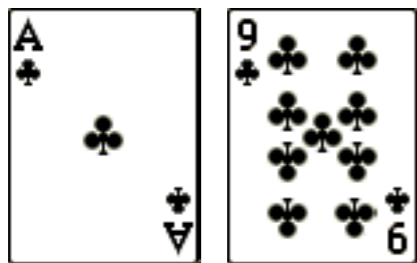
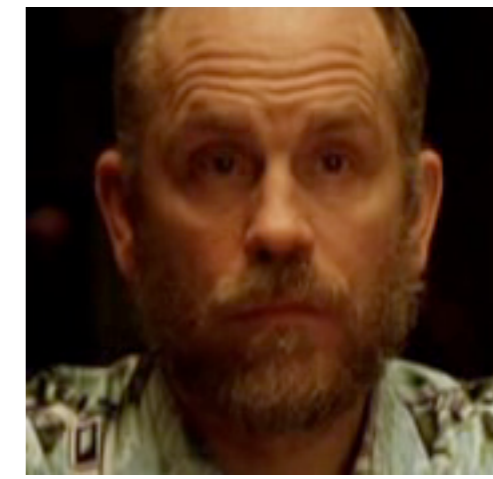
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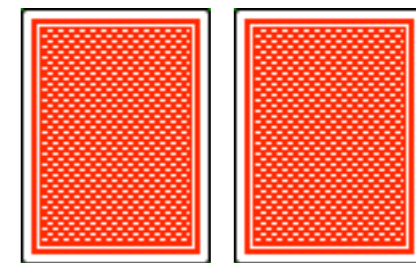
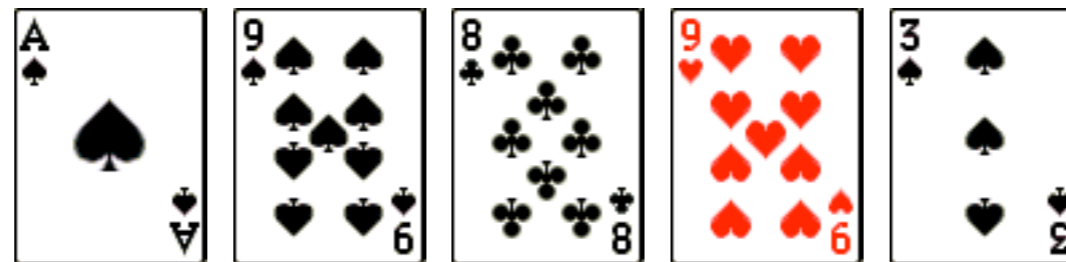
“Got'em... All-In” (opponent modelling)

What is Poker?

Example hand from the movie *Rounders*



All-In



Raise

Call

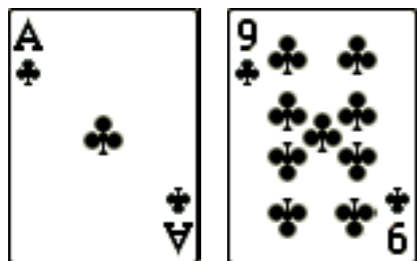
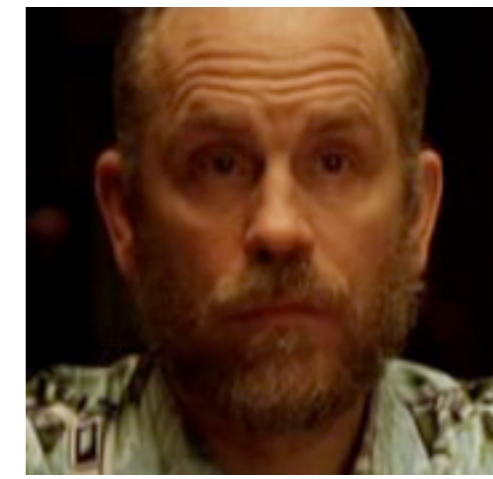
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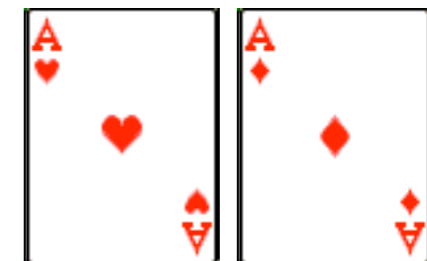
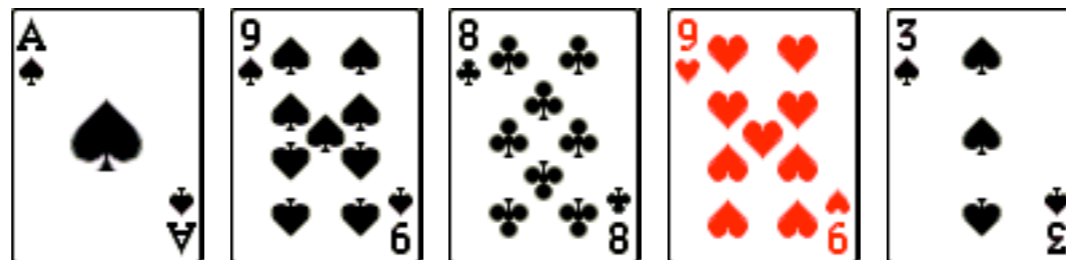
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All-In



Raise

Call

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“Teddy has a flush draw” (imperfect information)

“Got’em... All-In” (opponent modelling)

“Ouch!” (stochastic element)

AAAI/IJCAI Computer Poker Competitions

- Started in 2006
 - Thanks also to J. Schaeffer, T. Sandholm, and M. Zinkevich
 - First competition was only 2-player limit Texas hold'em

- Guiding Principles
 - Drive research on interesting scientific questions
 - Make sure the results are meaningful

Basics of the Competition

- Gather as much data as possible

	10	5	15
-10		30	35
-5	-30		150
-15	-35	-150	

- Who is the winner?

Basics of the Competition

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	10	5	15	30
-10		30	35	55
-5	-30		150	115
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The table above is a 4x7 grid. The top-left cell is shaded gray. The top-right cell contains a yellow star with the number 10 inside. The second row, second column cell is shaded gray. The third row, third column cell is shaded gray. The fourth row, fourth column cell is shaded gray. Two vertical red lines are drawn through the second and third columns. Two horizontal red lines are drawn through the third and fourth rows.

Basics of the Competition

- Winner declared by both “run-off” and “bankroll”
- Results in very different research agendas
 - Maximize expected utility (decision theory)
 - Minimize worst-case utility (game theory)

But... “on any given Sunday”

- We want statistical significance
 - Single hand of 2-player limit has a standard deviation of ~6000mb
 - Top programs separated by under 20mb/h
 - Requires over 300k hands for significance! Yikes!
- Duplicate
 - Programs play both sides of the same cards
 - Cuts standard deviation nearly in half: 3x fewer hands
- More advanced variance reduction techniques

2009 Competition:
Over 150 CPU
months

Evolution of the Competition

- 2006: Two-player limit Texas hold'em
 - 5 bots, 5 institutions, 4 countries
- 2007: Two-player no-limit added
 - 32 bots, 15 institutions, 6 countries
- 2008: Six-player limit added
 - 19 bots, 12 institutions, 5 countries
- 2009: Six-player dropped to Three-player
 - 25 bots, 14 institutions, 7 countries

Evolution of the Science

10^{13}

10^{12}

10^{10}

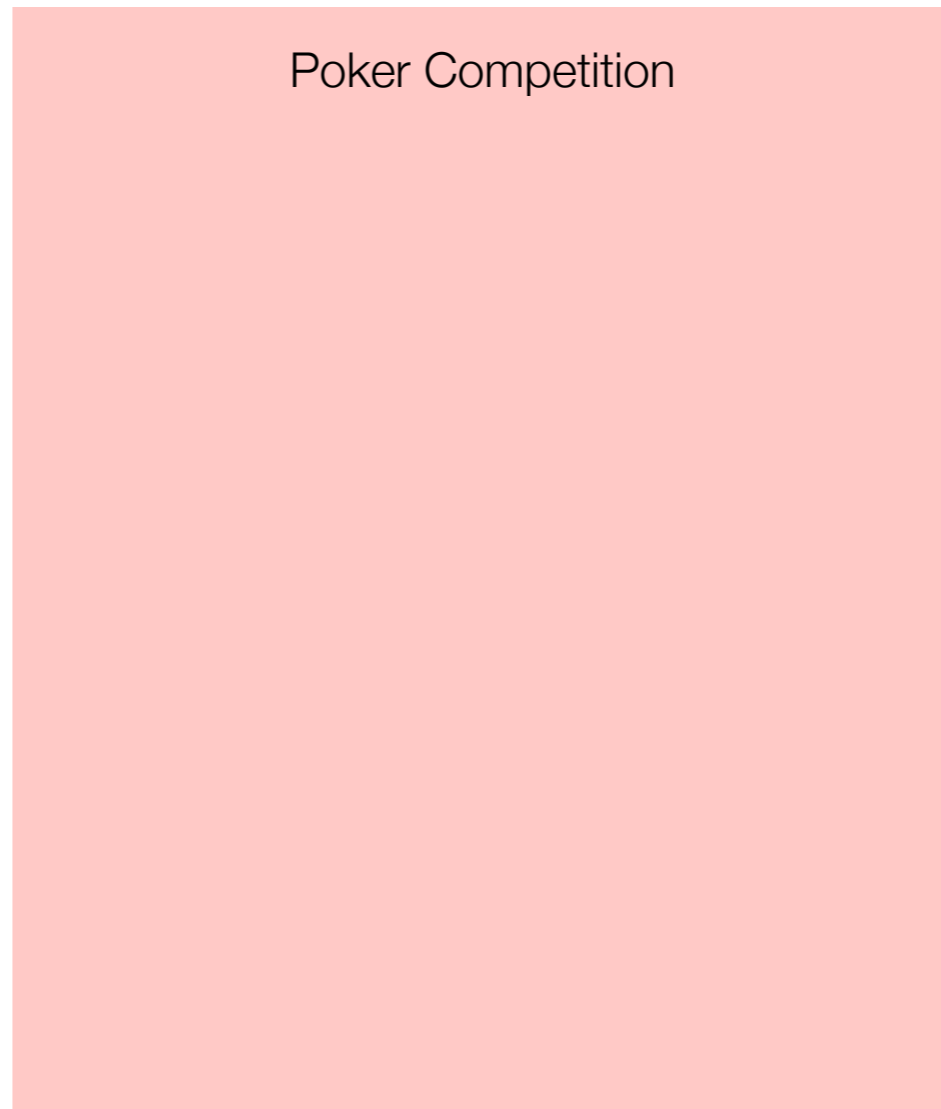
10^8

Poker Competition

Koller et al.

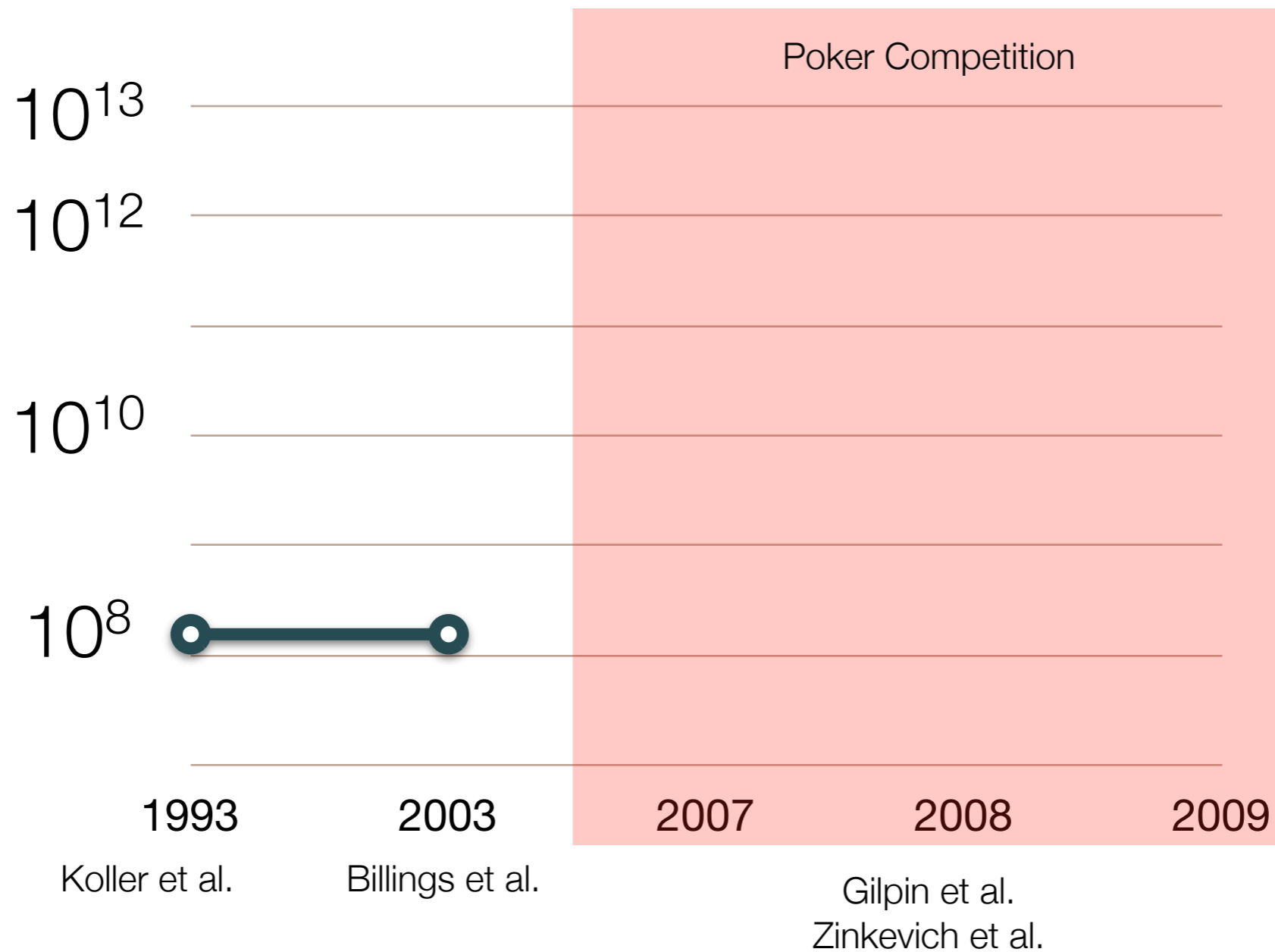
Billings et al.

Gilpin et al.
Zinkevich et al.



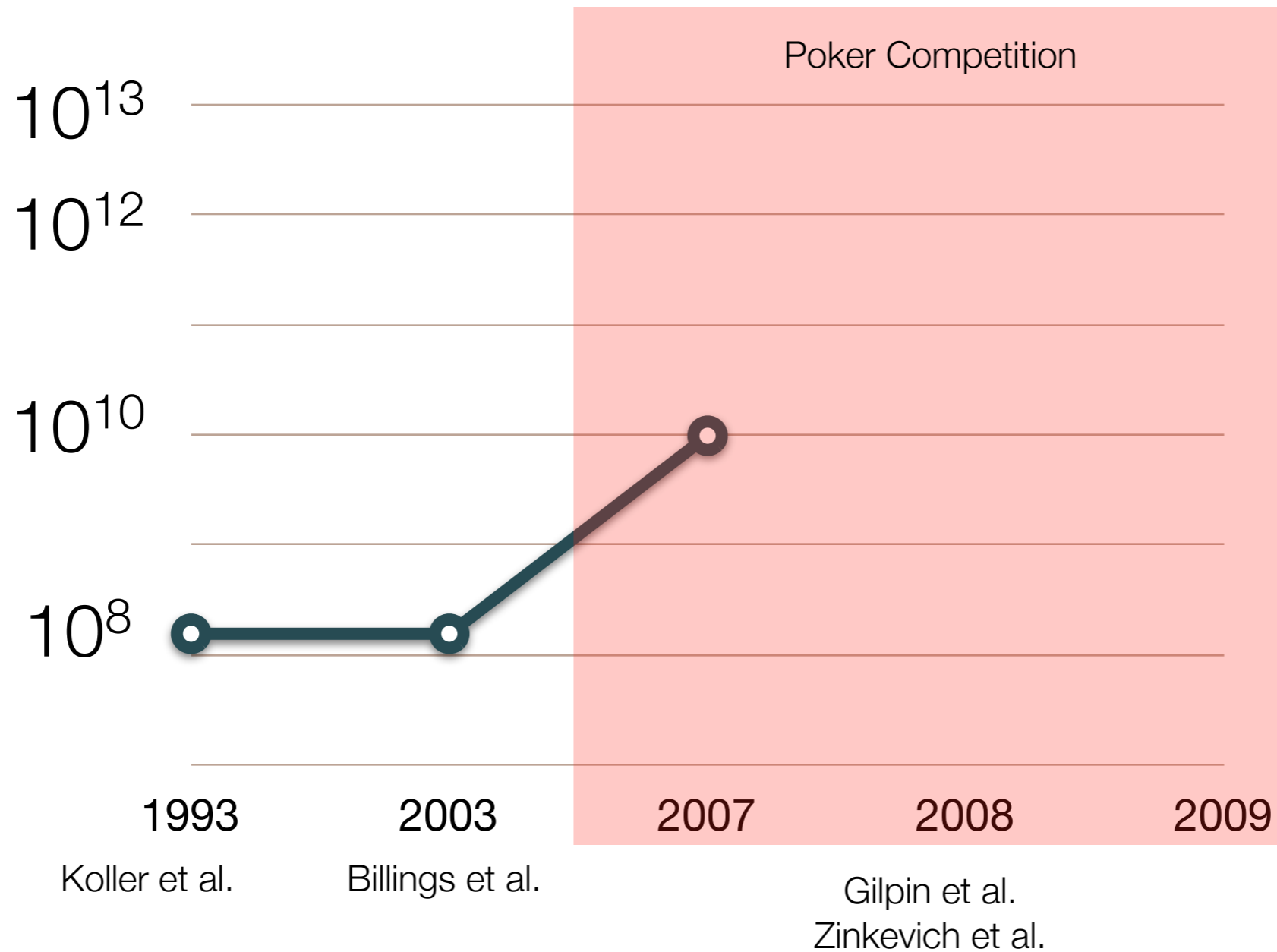
Evolution of the Science

- Solving large 2-player extensive games



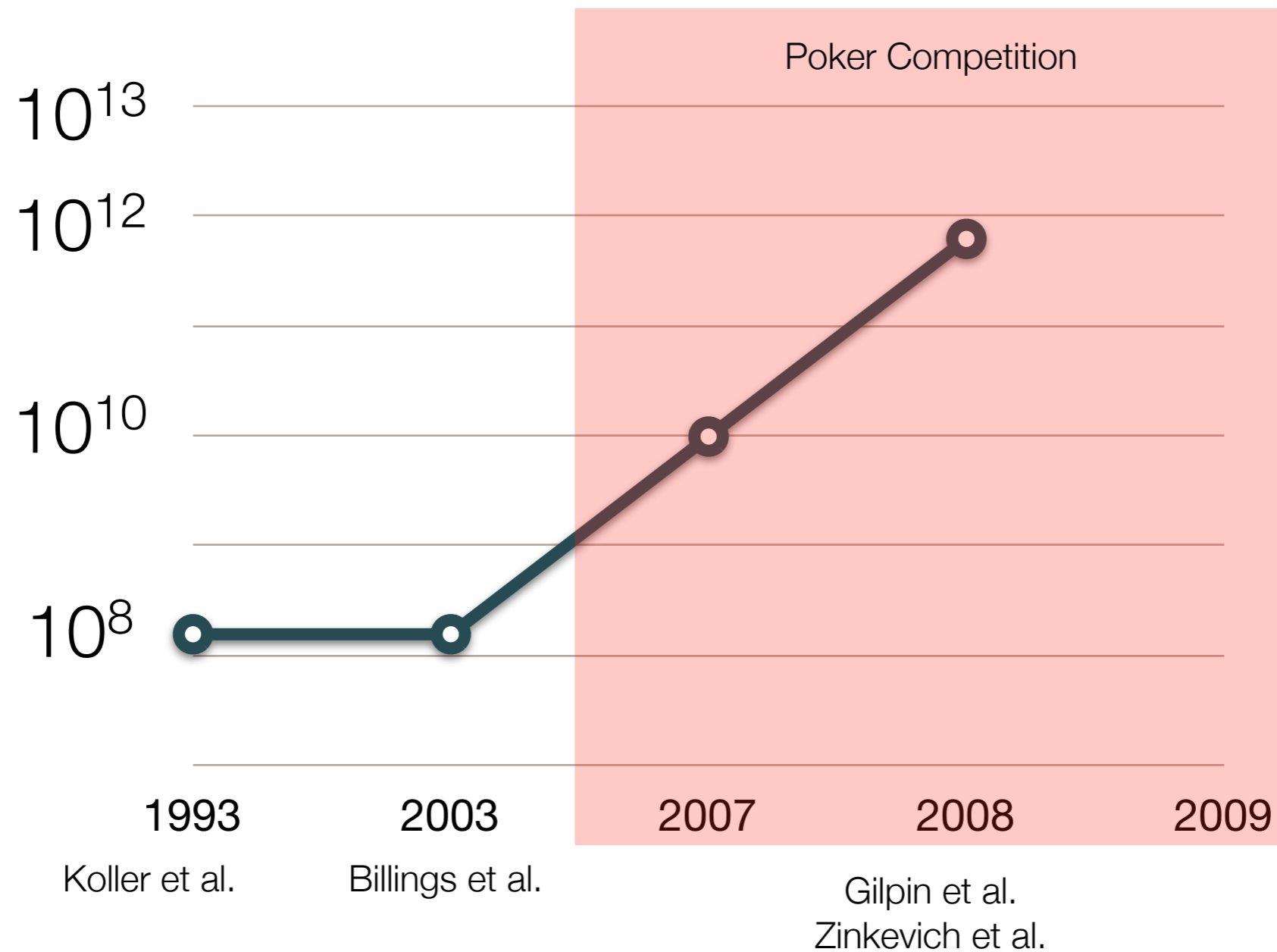
Evolution of the Science

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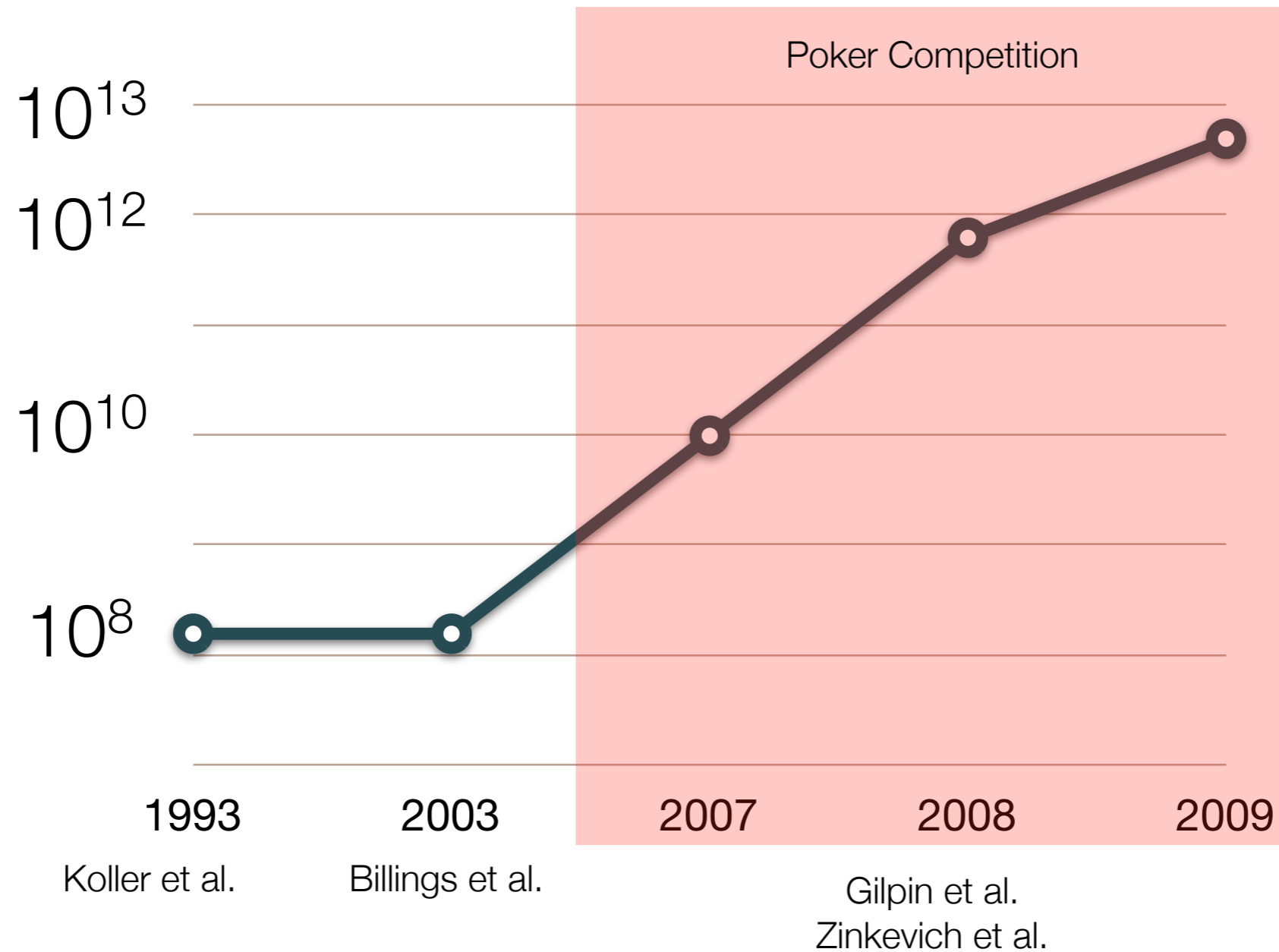
Evolution of the Science

- Solving large 2-player extensive games



Evolution of the Science

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Evolution of the Science

- Solving large 2-player extensive games
- Abstraction in competitive domains
 - Automated abstraction: Gilpin and Sandholm (2006, 2007)
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 - **MIVAT: White et al. (2009)**
- Polaris (U. Alberta) defeated a team of professionals in a man-machine match in Vegas in 2008

The Good & The Bad

- Solid evaluation
 - Statistical significance
 - Tailored evaluation criteria
- Natural progression with increasing complexity
- Science to tweaking ratio extremely high
- Long-term progress meter... the human benchmark
- One dominant team
- Software rewrite needed
- Many entrants are not researchers
- Releasing source/binary has additional implications
 - Benchmarking outside of the competition

Questions?

“Learning a Value Analysis Tool for Agent Evaluation”

Tuesday 11am, Ballroom D