

November 11, 2019



# Using Chess to Assess Human Error in Insurance Decisions

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➤ **To err is human; to really foul things up requires a computer**

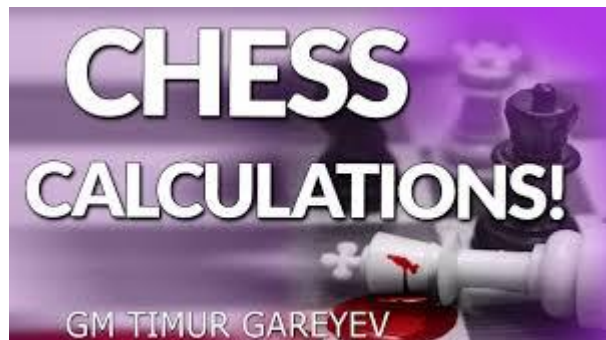
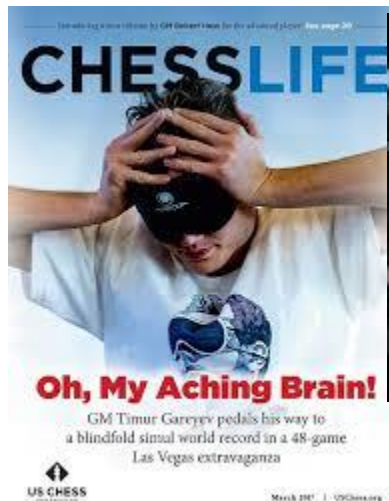
**Ross Johnson, FCAS, PhD, MBA, MAAA**  
Director, Actuary Innovations  
USAA Catastrophe Risk Management

**Timur Gareyev**  
International Grandmaster  
Professional Chess Player



- **Chess Grandmaster Introduction**
- **Errors in Chess Decisions**
- **Errors in Insurance Decisions**
- **Small Group Application**

# Chess Grandmaster Introduction



**GM Timur Gareyev**

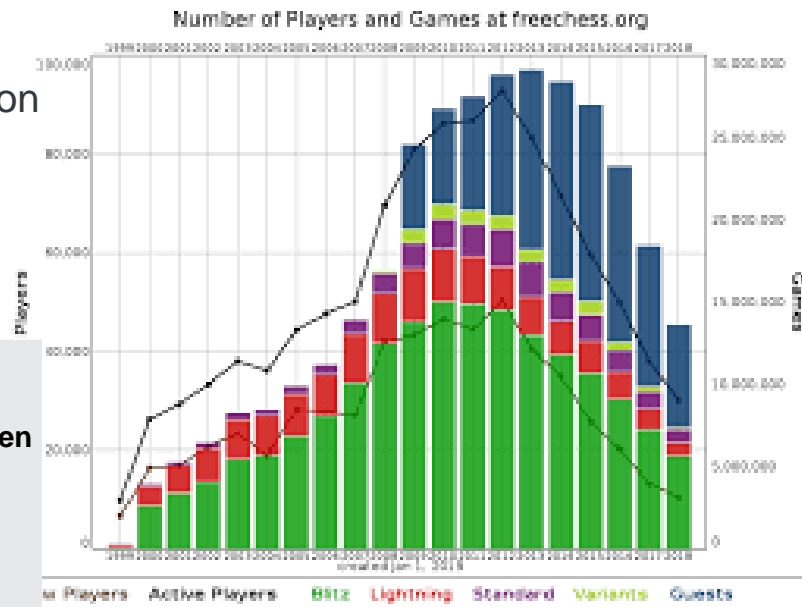
# Data: human error in chess endgames

## Chess Research Paper

Assessing Human Error Against a Benchmark of Perfection

Ashton Anderson, Jon Kleinberg, Sendhil Mullainathan

[www.cs.toronto.edu/~ashton/pubs/tbase.pdf](http://www.cs.toronto.edu/~ashton/pubs/tbase.pdf)



## Databases for Perfect Chess Endgames

Format	Metric	1st published	5 men	6 men	7 men
Thompson	DTC	1991	2.5 GiB (not completed)	-	-
Edwards	DTM	1994	56 GiB (estimated)	-	-
Nalimov	DTM	1998	7.1 GiB	1.2 TiB	-
Scorpio	WDL	2005	214 MiB	48.1 GiB	-
Gaviota	DTM	2008	6.5 GiB	-	-
Lomonosov	DTM	2012	-	-	140 TiB
Syzygy	WDL + DTZ50	2013 / 2018	939 MiB	150.2 GB	17 TB

Source: [www.chessprogramming.org/Endgame\\_Tablebases](http://www.chessprogramming.org/Endgame_Tablebases)

**200 million games**

Free Internet Chess Server  
(ficsgames.org)

ChessBase (chessbase.org)

# Simplification: key predictor variables for human error

## Skill



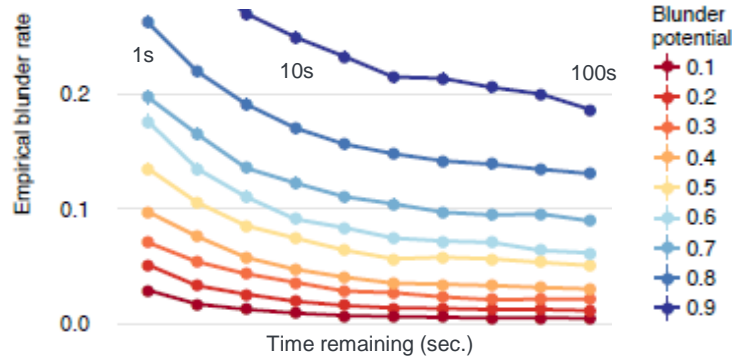
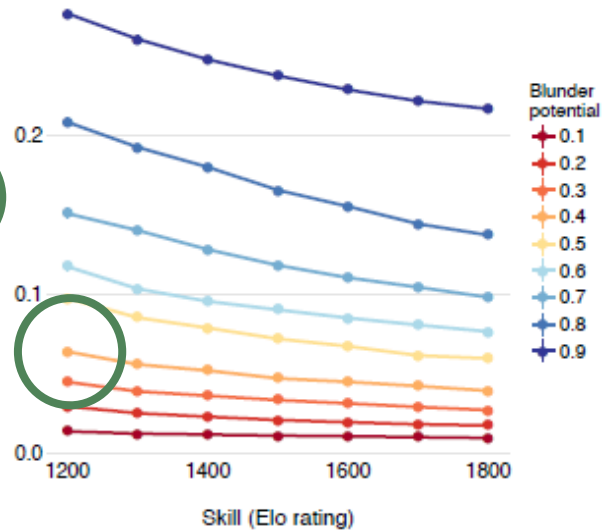
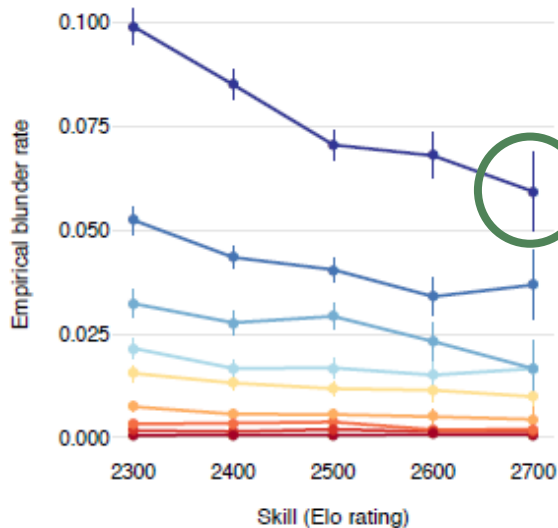
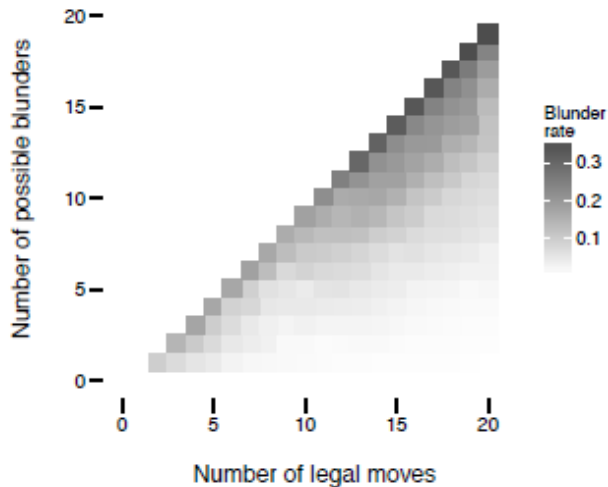
## Time



# Difficulty



# Measurement: empirical results across key variables



## Blunder Potential

$$\beta(n, b) = \frac{b(P)}{n(P)}; P = \text{position};$$

$$b(P) = \#blunders; n(P) = \#moves.$$



# Modeling: equations for predicting human error

P: chess Position

$\beta$ : parameter for Difficulty

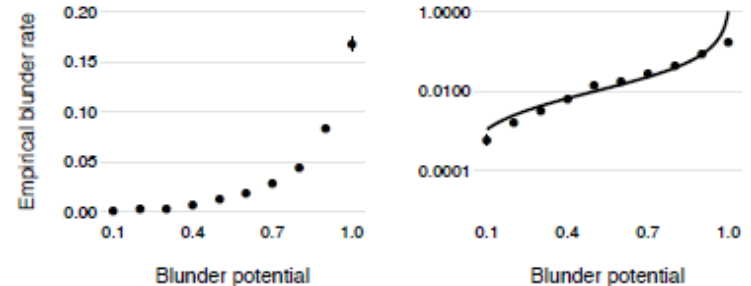
$$\beta(P) = \frac{b(P)}{n(P)} = \text{blunder potential.}$$

c: parameter for Skill

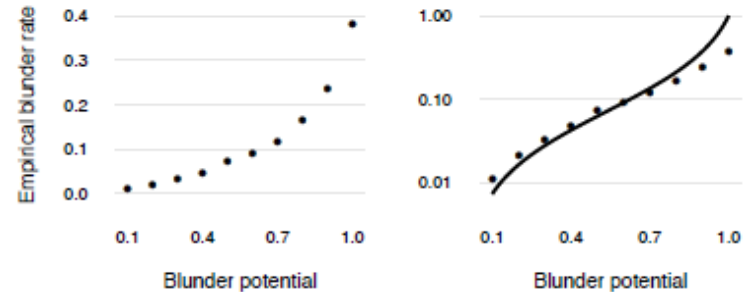
c times more likely to select a non-blunder than a blunder  
c = 100 for grandmaster data (professionals, 2300-2700 Elo).  
c = 15 for FICS data (amateurs, 1200-1800 Elo).

Blunder Model for Difficulty and Skill

$$\gamma_c(P) = \frac{b(P)}{c(n(P) - b(P)) + b(P)} = \frac{\beta(P)}{c - (c - 1)\beta(P)}$$



(a) GM data

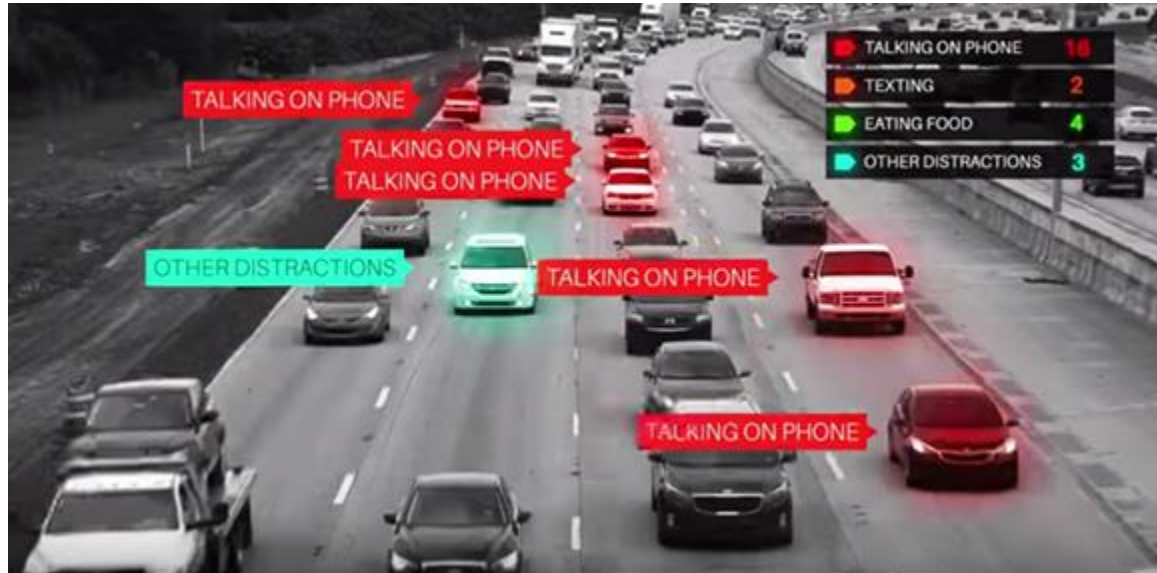


(b) FICS data

- Chess Grandmaster Introduction
- Errors in Chess Decisions
- **Errors in Insurance Decisions**
- Small Group Application



# Story: alerting distracted drivers



[www.youtube.com/watch?v=BqBBVHzHV0c&feature=youtu.be](http://www.youtube.com/watch?v=BqBBVHzHV0c&feature=youtu.be)

**CELL PHONES AND DRIVING:  
A DANGEROUS COMBINATION**

**HOW RISKY IS THE DISTRACTION AND POTENTIAL FOR A CRASH?**

<b>READING</b>	<b>3.4X</b>	<b>TALKING ON A CELL PHONE</b>	<b>4X</b>
<b>REACHING FOR A MOVING OBJECT</b>	<b>8.8X</b>	<b>TEXTING</b>	<b>8X-23X</b>
<b>TURNING AROUND IN YOUR SEAT</b>	<b>8.8X</b>		

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[www.thegazette.com/sponsored/iowa-april-signs-distracted-driving-awareness-month-ufg-04242019](http://www.thegazette.com/sponsored/iowa-april-signs-distracted-driving-awareness-month-ufg-04242019)



[www.greylaw.com/los-angeles-distracted-driver-accident-attorney/](http://www.greylaw.com/los-angeles-distracted-driver-accident-attorney/)



# Story: creating options for decision makers



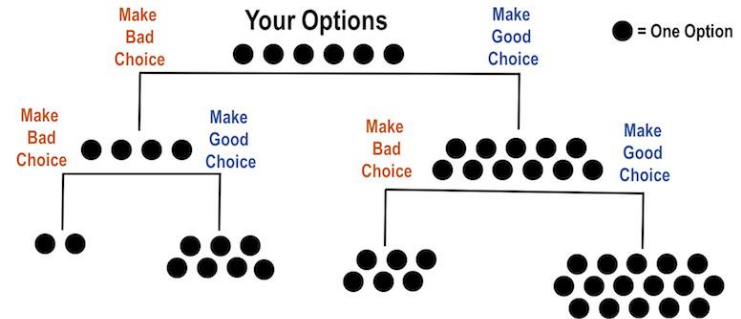
[patrickmulick.com/stop-telling-students-autism-make-good-choices/](http://patrickmulick.com/stop-telling-students-autism-make-good-choices/)



[jesusgilhernandez.com/2018/02/10/too-many-options-hicks-law/](http://jesusgilhernandez.com/2018/02/10/too-many-options-hicks-law/)



[dealerwebb.com/how-too-many-options-can-lead-to-fewer-conversions](http://dealerwebb.com/how-too-many-options-can-lead-to-fewer-conversions)



[amiemueller.com/how-good-are-you-at-making-the-right-choice-for-you/](http://amiemueller.com/how-good-are-you-at-making-the-right-choice-for-you/)

# Small Group Application



- **Break into groups of 3 to 7 people**
- **Identify insurance scenarios with high difficulty**
  - Customer accidents
  - Modeling problems
  - Business decisions
  - Other scenarios
- **Brainstorm ways to reduce blunder potential**



## ➤ Chess Grandmaster Introduction

## ➤ Errors in Chess Decisions

- Data: human error in chess endgames
- Simplification: key predictor variables for human error
- Measurement: empirical results across key variables
- Modeling: equations for predicting human error

## ➤ Errors in Insurance Decisions

- Story: alerting distracted drivers
- Story: simplifying GLM for newbies
- Story: creating options for decision makers

## ➤ Small Group Application