April 2021 (repeat from 2019 CAS Annual Meeting, 2020 Spring SWAF, and 2020 CNA internal conference)

Using Chess to Assess Human Error in Insurance Decisions

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

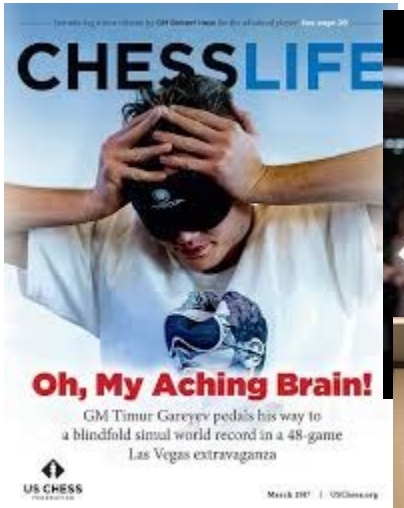
~~Timur Gareyev~~
~~International Grandmaster (GM)~~
~~Professional Chess Player~~

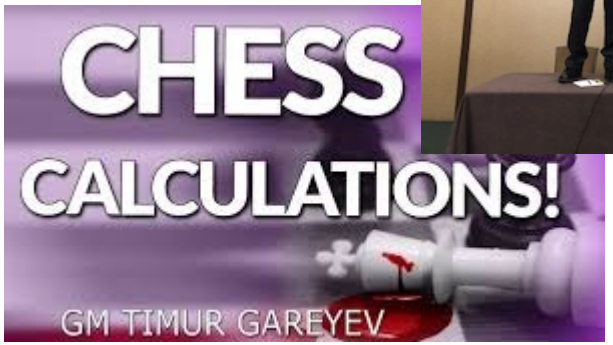
Story: trying to concentrate

Outline

- Chess Grandmaster Introduction
- Errors in Chess Decisions
- Errors in Insurance Decisions
- Questions and Answers

Chess Grandmaster Introduction (not here today)





GM Timur Gareyev

Elo Model for Skill

$$E(score\ of\ stonger\ player) = \frac{1}{1 + 10^{-|d|}},$$

where $d = Elo\ rating\ difference$.

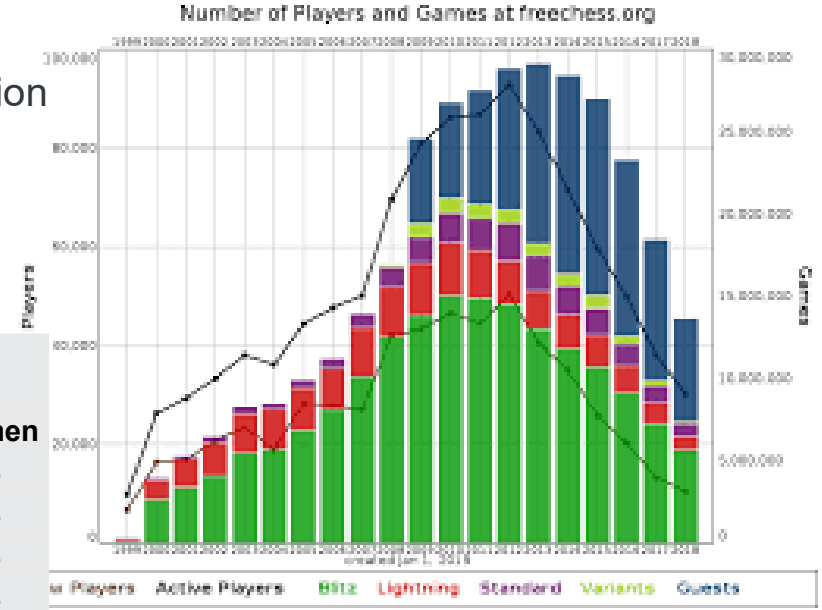
Data: human error in chess endgames

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



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

200 million games

Free Internet Chess Server (ficsgames.org)

ChessBase (chessbase.org)

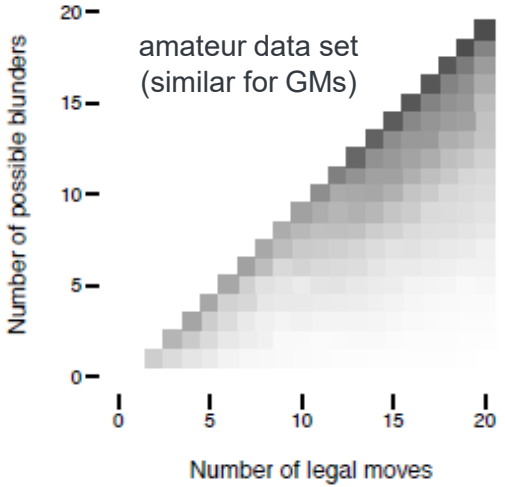
Simplification: key predictor variables for human error

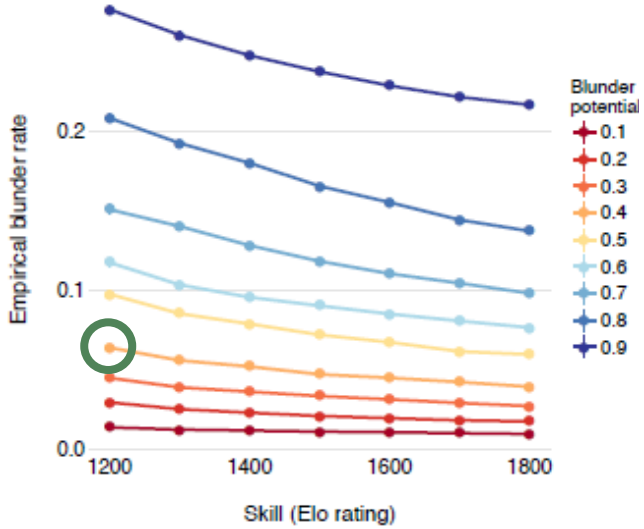
Skill

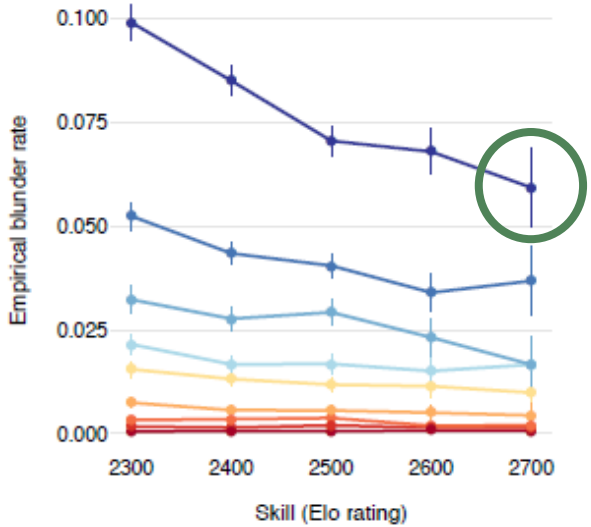
Time

Difficulty

Measurement: empirical results across key variables



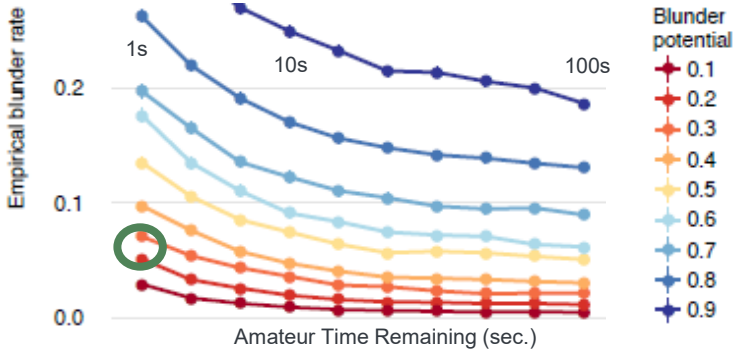




Blunder Potential

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

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



Modeling: equations for predicting human error

P: chess Position

β: parameter for Difficulty

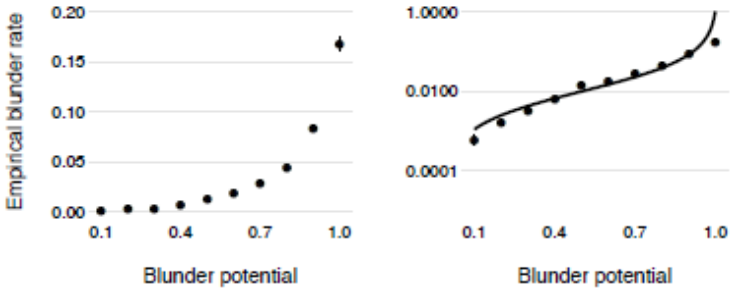
$$\beta(P) = \frac{b(P)}{n(P)} = blunder\ potential.$$

c: parameter for Skill

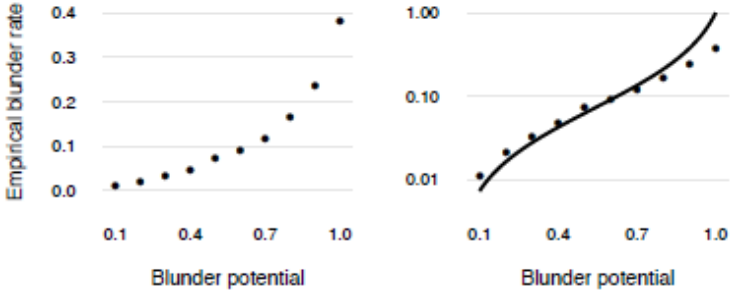
c times more probability weight for non-blunder than blunder
c ≈ 15 for FICS data (amateurs, 1200-1800 Elo).
c ≈ 100 for grandmaster data (professionals, 2300-2700 Elo).

Blunder Model for Difficulty and Skill

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



(a) GM data



(b) FICS data

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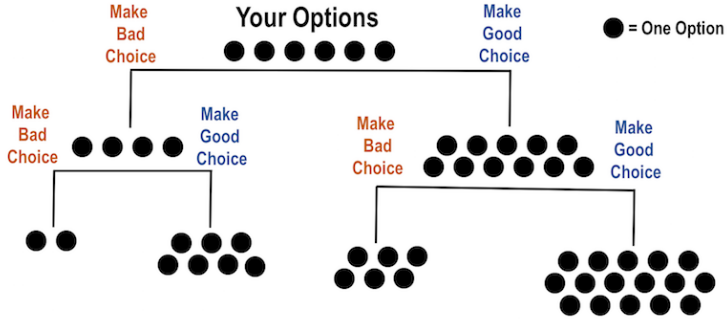
- Questions and Answers

Story: creating options for decision makers

patrickmulick.com/stop-telling-students-autism-make-good-choices/

jesusgilhernandez.com/2018/02/10/too-many-options-hicks-law/

dealerwebb.com/how-too-many-options-can-lead-to-fewer-conversions

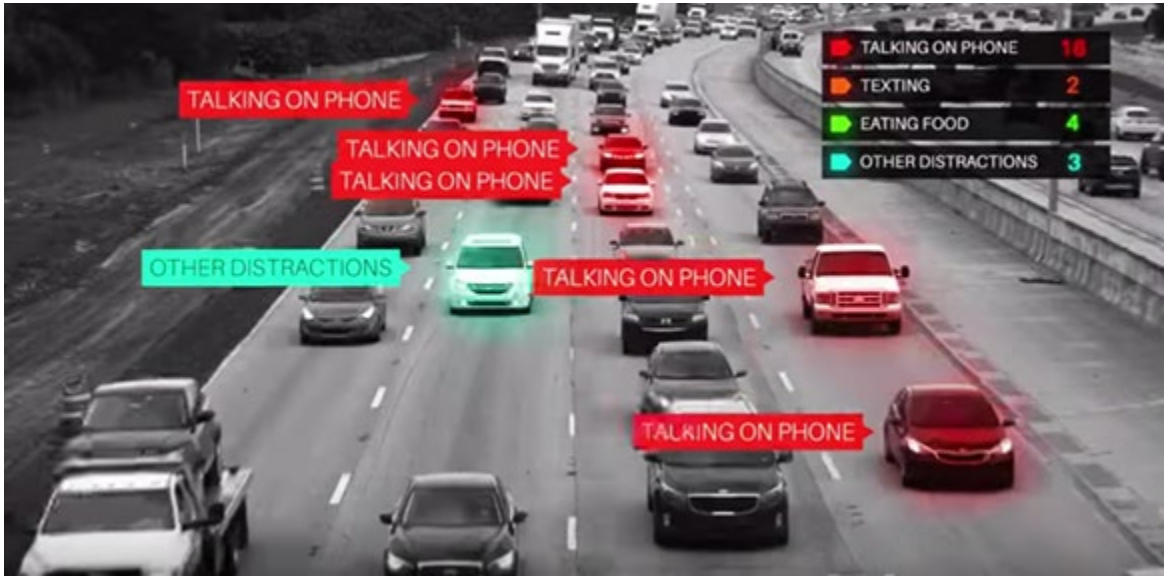


amieemueller.com/how-good-are-you-at-making-the-right-choice-for-you/

Story: simplifying GLM for newbies

www.r-bloggers.com/painting-a-picture-of-statistical-packages/

Story: alerting distracted drivers



www.youtube.com/watch?v=BqBBVHzHV0c&feature=youtu.be

www.thegazette.com/sponsored/iowa-april-signs-distracted-driving-awareness-month-ufg-04242019

www.greylaw.com/los-angeles-distracted-driver-accident-attorney/

Application on the Job

- **Identify insurance scenarios with high difficulty**
  - Customer accidents
  - Modeling problems
  - Business decisions
  - Other scenarios
- **Brainstorm ways to reduce blunder potential**

Questions and Answers

Q&A

USAA®

Outline

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

Small Group Application