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Project Proposal

How a Robot Kitten Changed Chess Forever
A study in ELO, how chess players understand it intrinsically, and how new bots keep pushing its limits.

The History of the ELO Formula
     The ELO rating formula is a player rating formula that can be traced back to the 1960s. Arpad Elo, a Hungarian American physics professor and avid chess player, developed a rating system to replace then current system, the Harkness system.
   In the 1978 publication of *The Rating of Chessplayers Past & Present* Elo defines the rating system, the formulas, and the mathematics used to create the performance of players and to properly rate them. The system is built on relative inference basted on other player's scores.

Providing a breakdown of the inputs considered
     The class subdivision into 200 points and choice of 2000 points as reference was preserved when Elo created his calculations.

Rating Scale Categories

Rating	Category	Class
	WORLD CHAMPIONSHIP CONTENDERS	
2600		
	MOST GRANDMASTERS	
	MOST INTERNATIONAL MASTERS	
2400		
	MOST NATIONAL MASTERS	
2200		
	CANDIDATE MASTERS, EXPERTS	
2000		
	AMATEURS	Class A Category 1
1800		
	AMATEURS	Class B Category 2
1600		
	AMATEURS	Class C Category 3
1400		
	AMATEURS	Class D Category 4
1200		
	NOVICES	

     Since we have an established point system, we can consider the variability in player performance. With the number of players contributing to the system there is a normal distribution curve that can explain the range of expected scores. The statistical probability theory, however, needs to be combined with the competition, Elo suggested. So enters the normal probability function.

THE NORMAL PROBABILITY FUNCTION
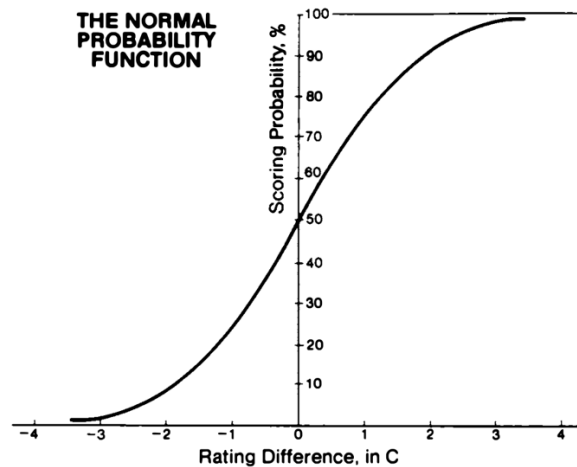
The rating system is defined as a logistic function that maps the probability of winning a game between two players to their relative ratings. The formula for his function involves logarithms and summation.

The Elo Rating System can be broken down to the following two equations

$$E_A = \frac{1}{1 + 10^{(R_B - R_A)/400}} \qquad E_B = \frac{1}{1 + 10^{(R_A - R_B)/400}}$$

These equations calculate the expected score for player A and player B.

- E is the expected result of the game
- RA1 and RB are the ratings of player 1 and player 2, respectively.

The formula for his function involves logarithms and summation. We can see that in the **Current Rating Formula – Continuous Measurement** [1.61] which is recognized as

$$\Delta R = K \cdot (S - E)$$

- ΔR is the change in ratings
- K is the constant, set at $K = 16$ for masters and $K = 32$ for weaker players
- S is the actual result of the game (1 for a win, 0 for a loss, 0.5 for a draw)

In this formula, the base-10 logarithm represents the odds of one player winning, given the difference in their ratings. The expected result E is then used to calculate the change in ratings ΔR using that same logistic function.

Explore how Its Calculation Has Changed Over Time

In its first publication Elo remarked that ratings were subject to the current population. Change in population causes the equations to fluctuate. Hence inevitable change over time.

The change in K-factor for different level of players. The USCF "uses a three-level K-factor for players below 2100, between 2100–2400 and above 2400 of 32, 24 and 16, respectively. FIDE uses similar factors (40, 20 and 10) albeit with somewhat different rules."