

FaceMash



2000's

Data

people (friends)



2000's

Data

people (friends)

Problem

Searching
People



1997

Data

Problem

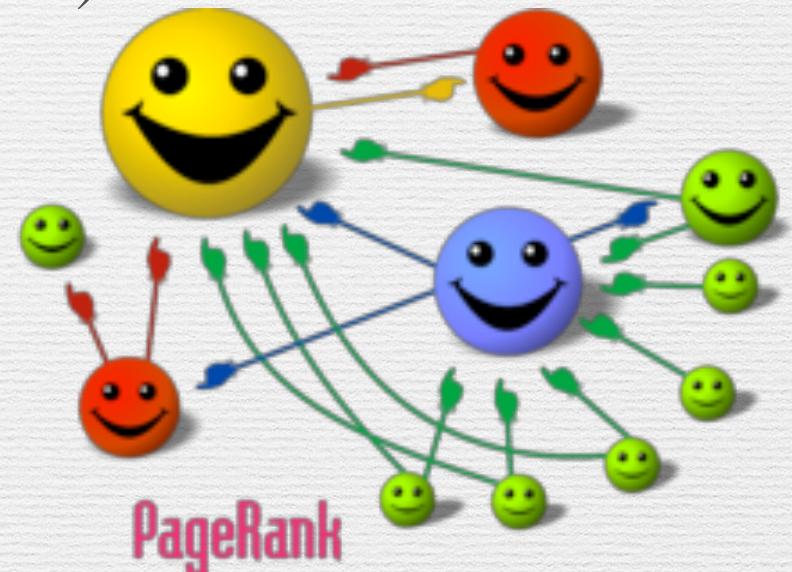
Idea: Algorithm



Webpages (URLs)

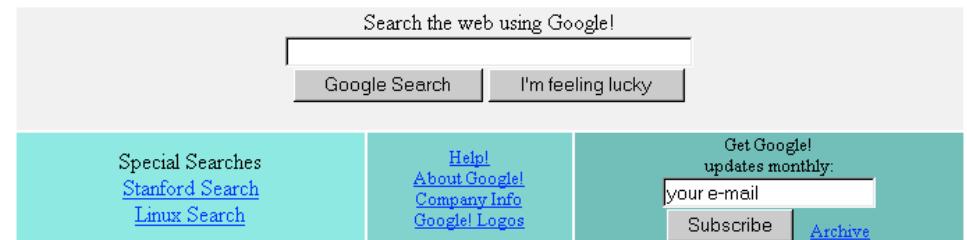
Find URLs

PageRank



Google!

BETA



Larry Page and Sergey Brin

Problem



2003

Data

People

Problem

Find People

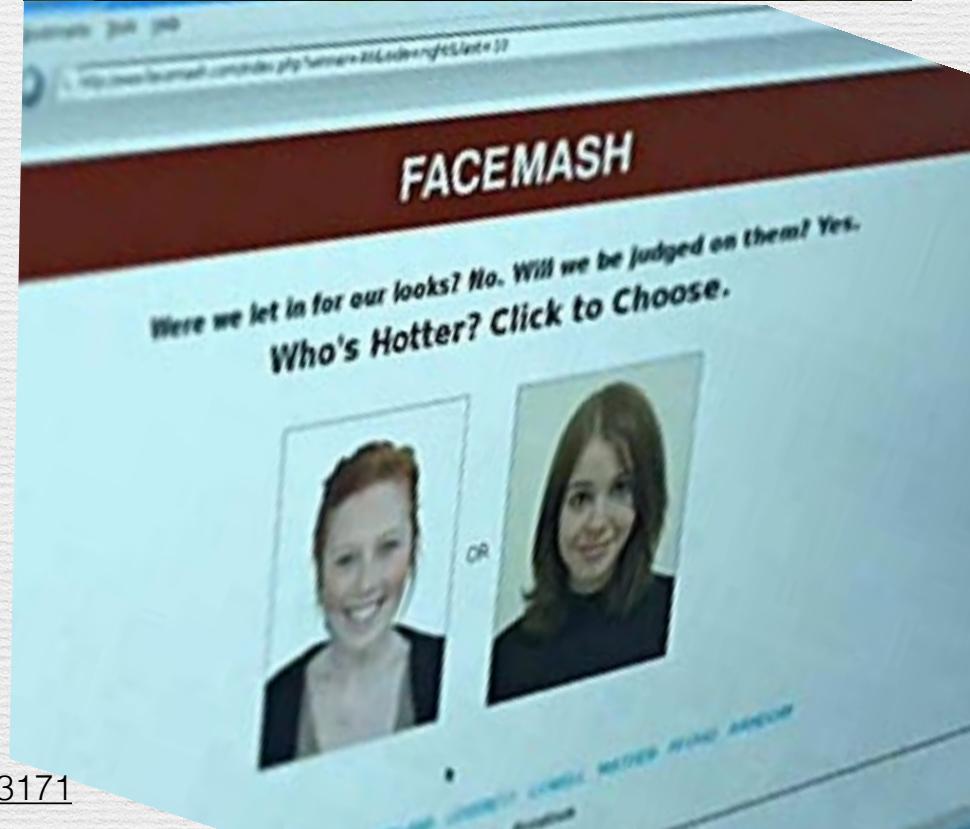
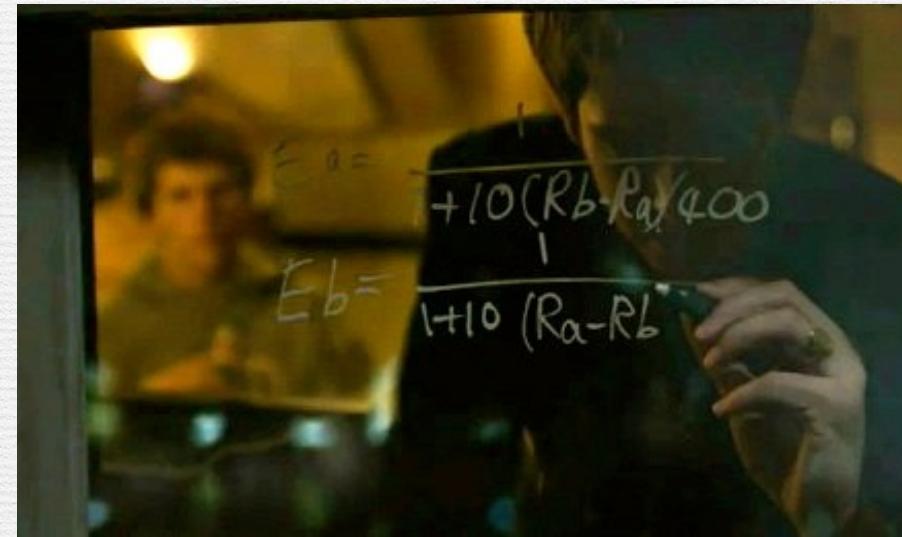
Solution

FaceMash



Mark Zuckerberg

<https://vimeo.com/24543171>



FACEMASH

Hello, ●. Logout

We are let in for our looks? No. Will we be judged on them? Yes.

Who's Hotter? Click to Choose.



OR

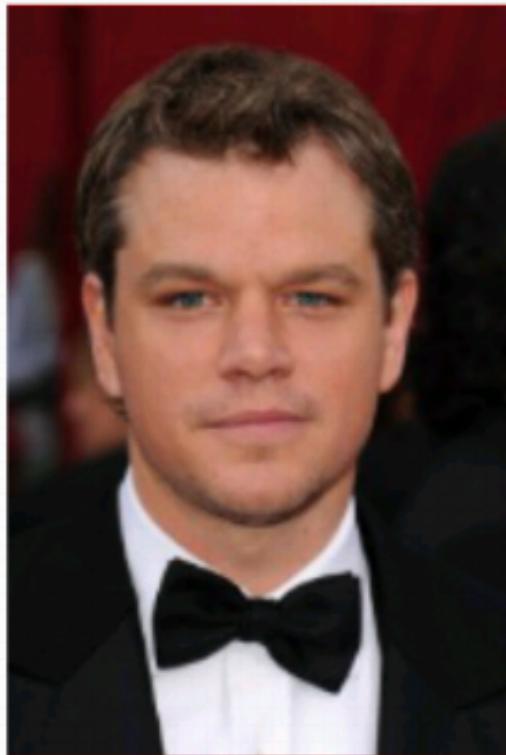


Left or right?

Facemash

TOP 100

Who's Hotter? Click to Choose.



OR



Left or right?

Facemash

TOP 100

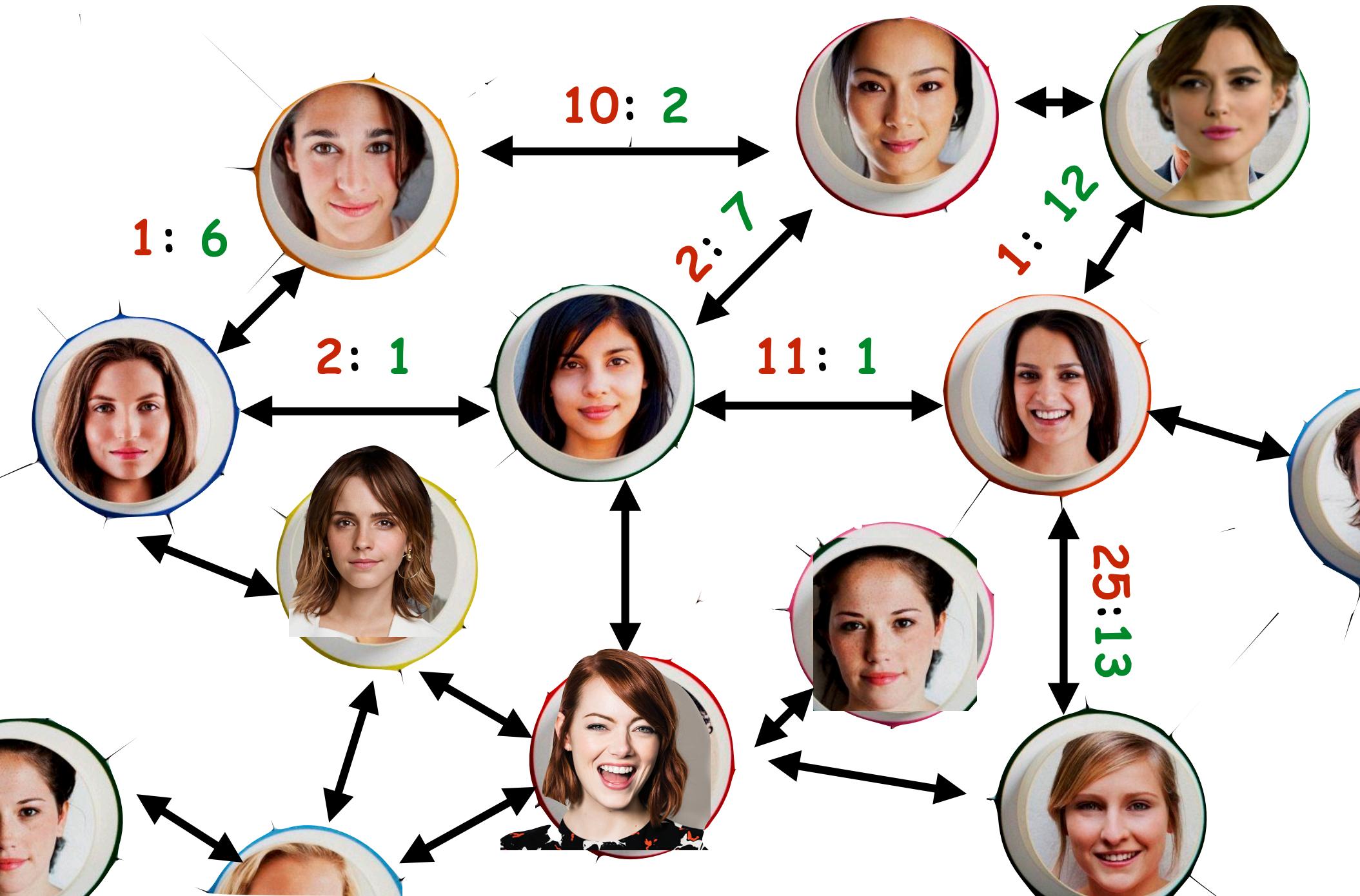
Who's Hotter? Click to Choose.



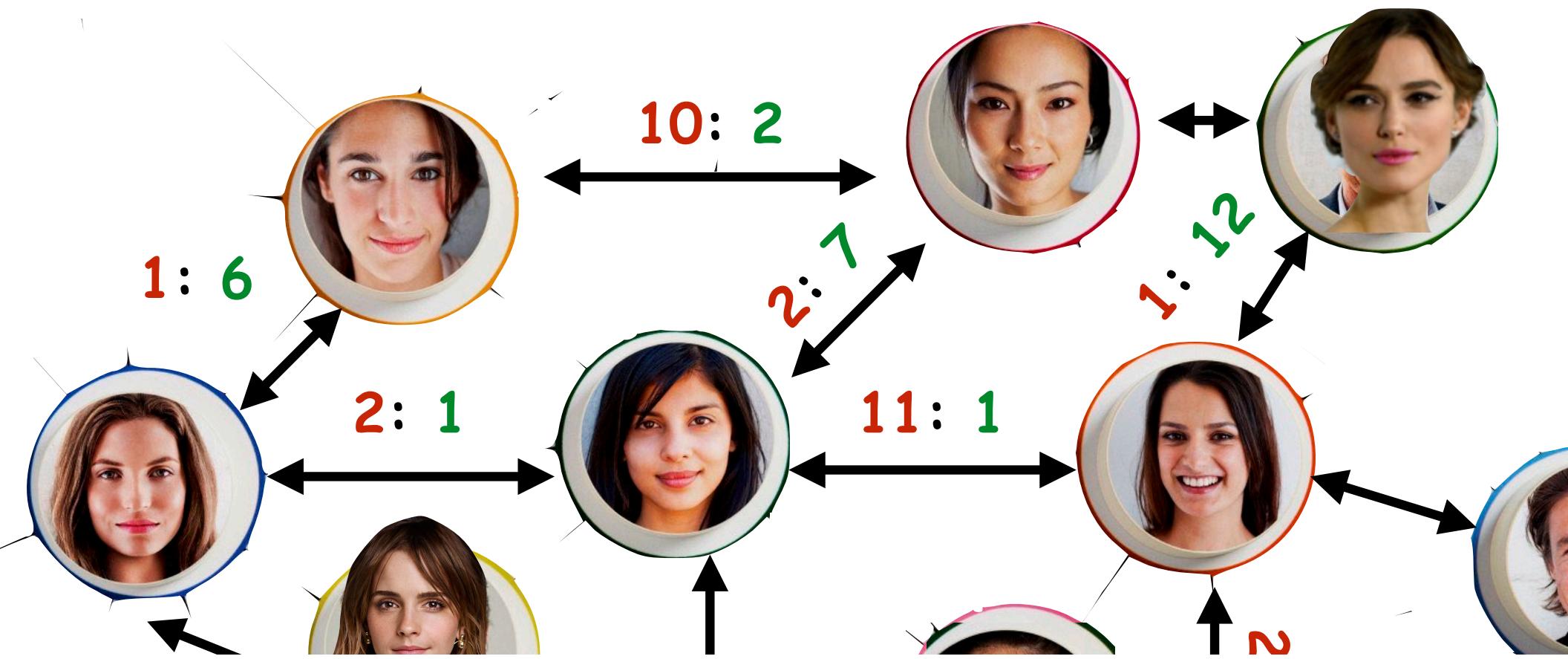
OR



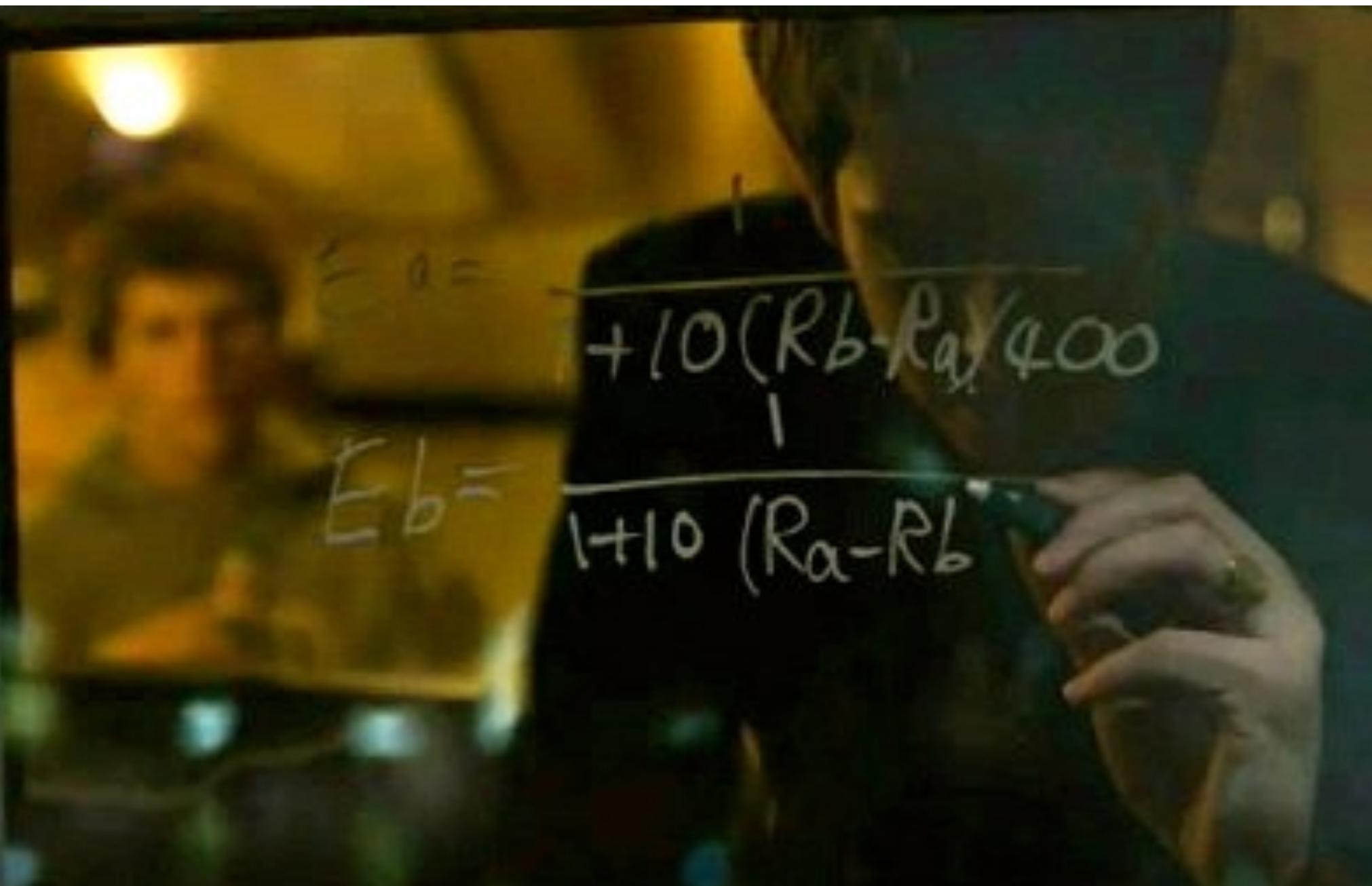
Win/loss data



Data Mining Problem



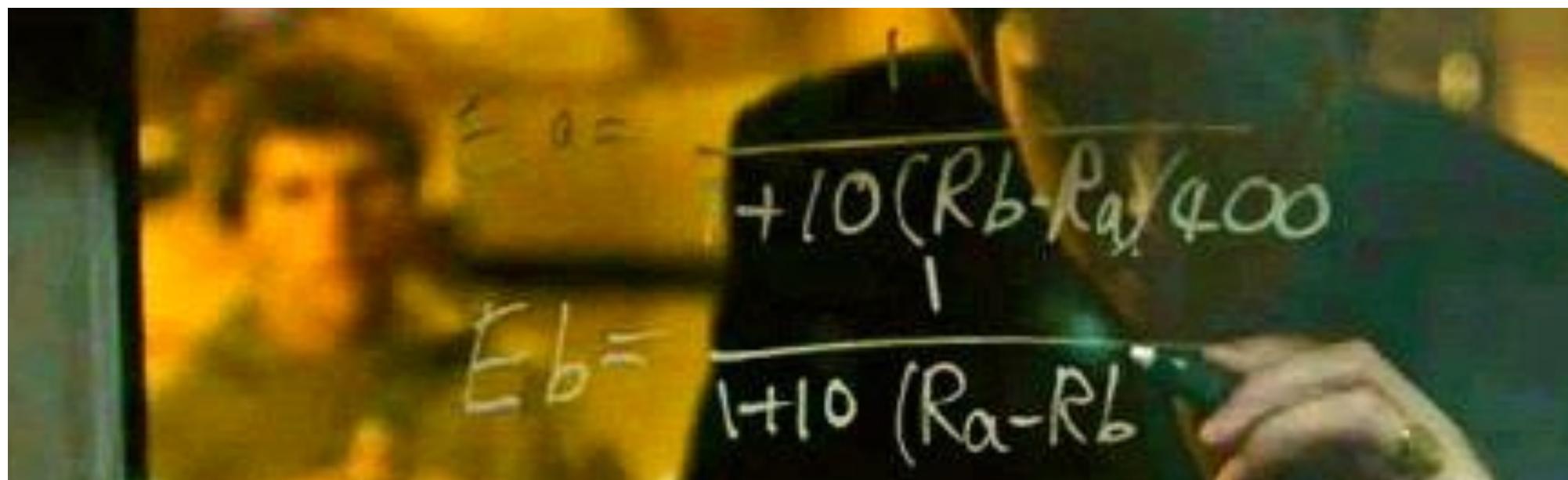
"The Algorithm"



"The Algorithm"

$$E_a = \frac{1}{1 + 10^{(R_b - R_a)/400}}$$

$$E_b = \frac{1}{1 + 10^{(R_a - R_b)/400}}$$



Elo Rating System



https://en.wikipedia.org/wiki/Elo_rating_system#Theory



Elo Ratings

Sept. 30, 2014

TEAM	RATING
1 Seattle	1671
2 Denver	1624
3 San Francisco	1612
4 San Diego	1608
5 Cincinnati	1607
6 Arizona	1596
7 New England	1581
8 Baltimore	1567
9 Dallas	1558
10 Indianapolis	1548
11 Philadelphia	1544
12 Kansas City	1533
13 Pittsburgh	1532
14 Carolina	1528
15 New Orleans	1527
16 Green Bay	1521
17 Detroit	1521
18 N.Y. Giants	1495
19 Chicago	1489
20 Minnesota	1489
21 Miami	1484
22 Atlanta	1459
23 St. Louis	1459
24 Buffalo	1454
25 Houston	1430
26 Tennessee	1430
27 N.Y. Jets	1412
28 Tampa Bay	1405
29 Cleveland	1386
30 Washington	1358
31 Oakland	1302
32 Jacksonville	1293

NBA

RANK	SEASON	TEAM	PEAK	MEAN	END	COMPOSITE ELO
1	'95-96	Chicago Bulls	1853	1770	1823	1815
2	'96-97	Chicago Bulls	1811	1792	1802	1802
3	'85-86	Boston Celtics	1816	1735	1801	1784
4	'14-15	Golden State Warriors	1791	1737	1791	1773
5	'08-09	Los Angeles Lakers	1790	1726	1790	1769
6	'91-92	Chicago Bulls	1782	1759	1762	1768
7	'97-98	Chicago Bulls	1788	1719	1785	1764
8	'90-91	Chicago Bulls	1785	1693	1785	1755
9	'88-89	Detroit Pistons	1788	1675	1788	1750
10	'82-83	Philadelphia 76ers	1777	1731	1739	1749

FACEMASH-ALIKE SCRIPT

[download](#)

Were we let in for our looks? No. Will we be judged on them? Yes.

Who's hotter? Click to choose.



Won: 113, Lost: 132
Score: 1198
Expected: 0.3275

player A

Won: 115, Lost: 154
Score: 1323
Expected: 0.6725

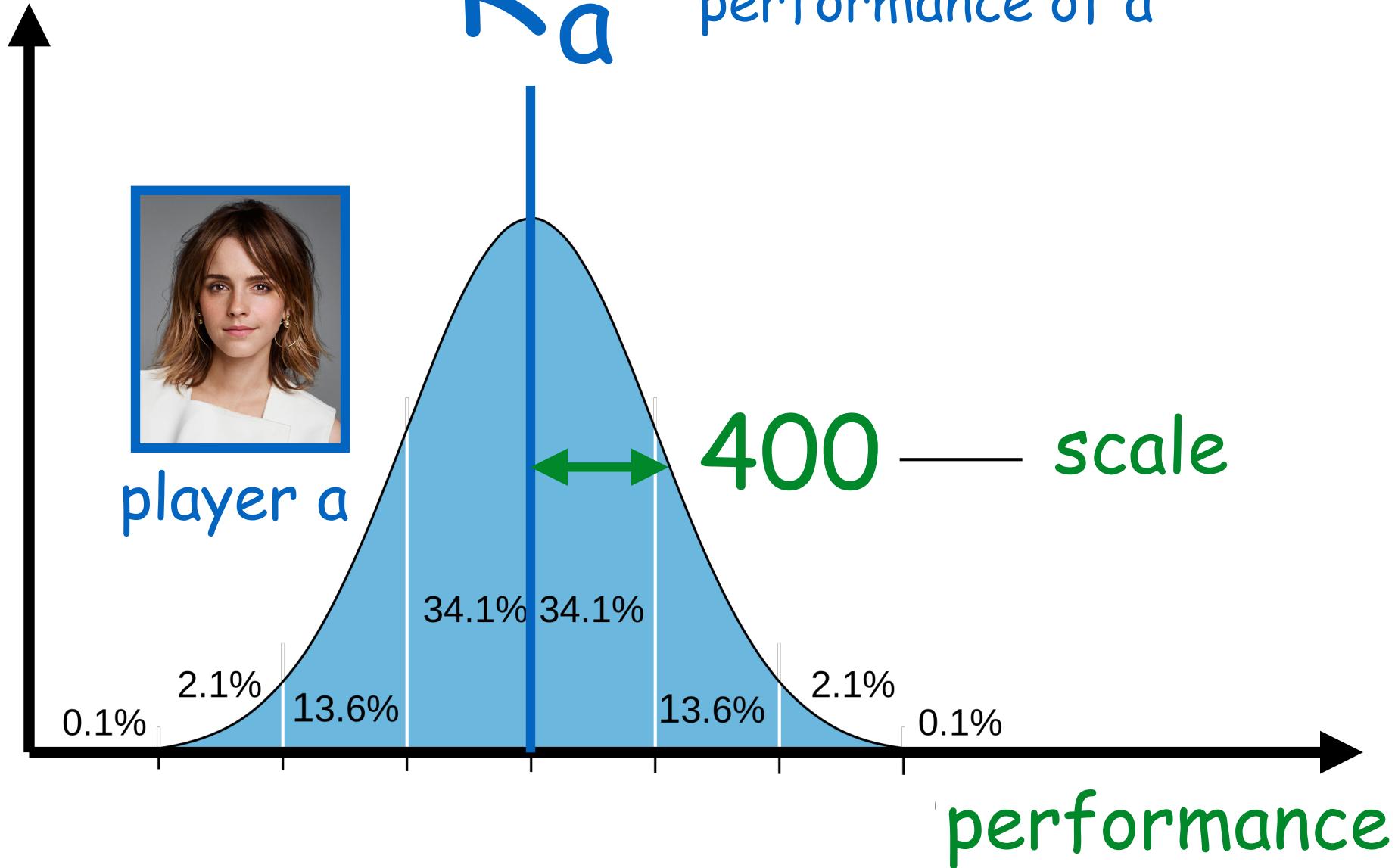
player B

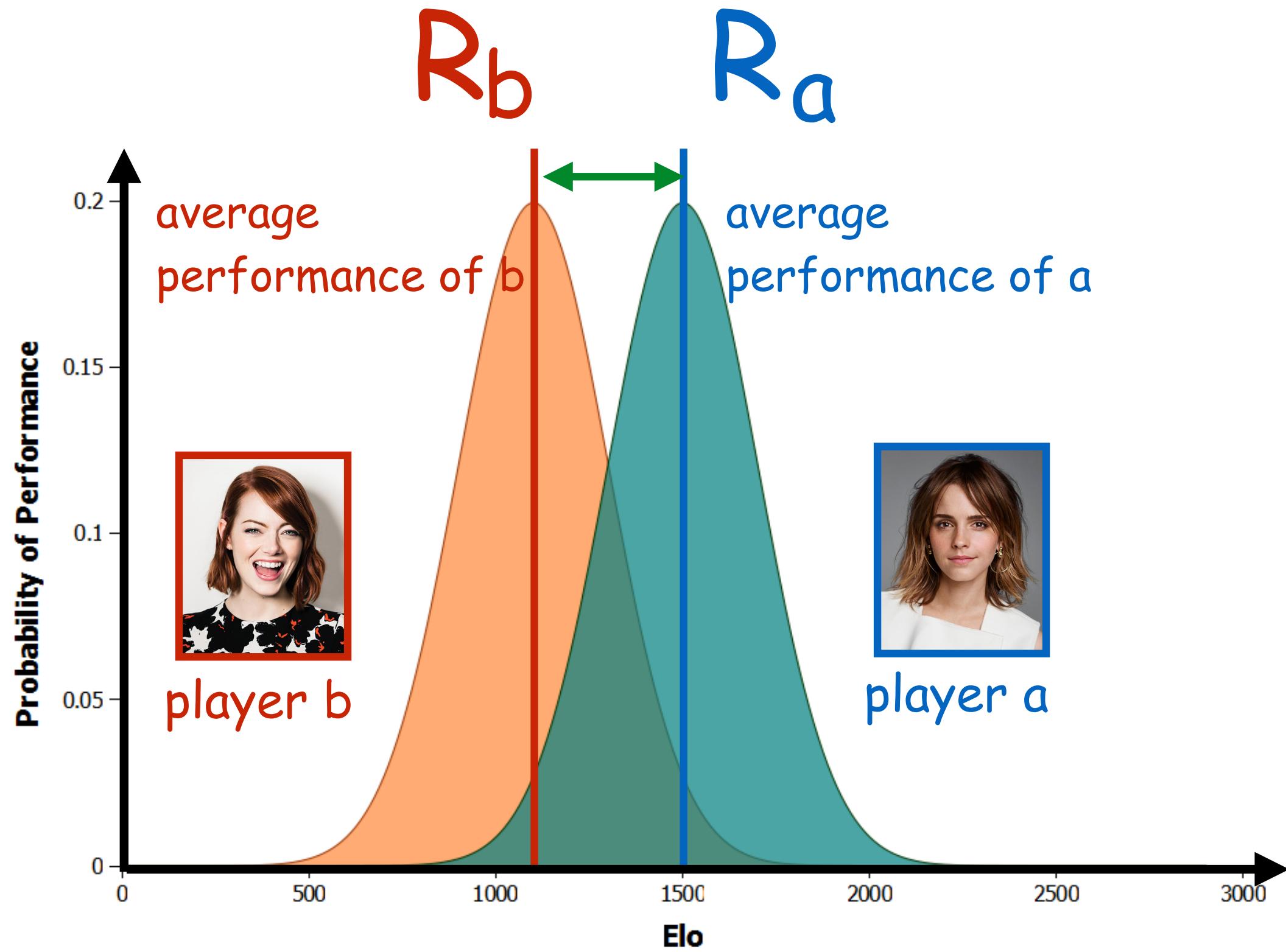
Logistic Distribution

probability

R_a

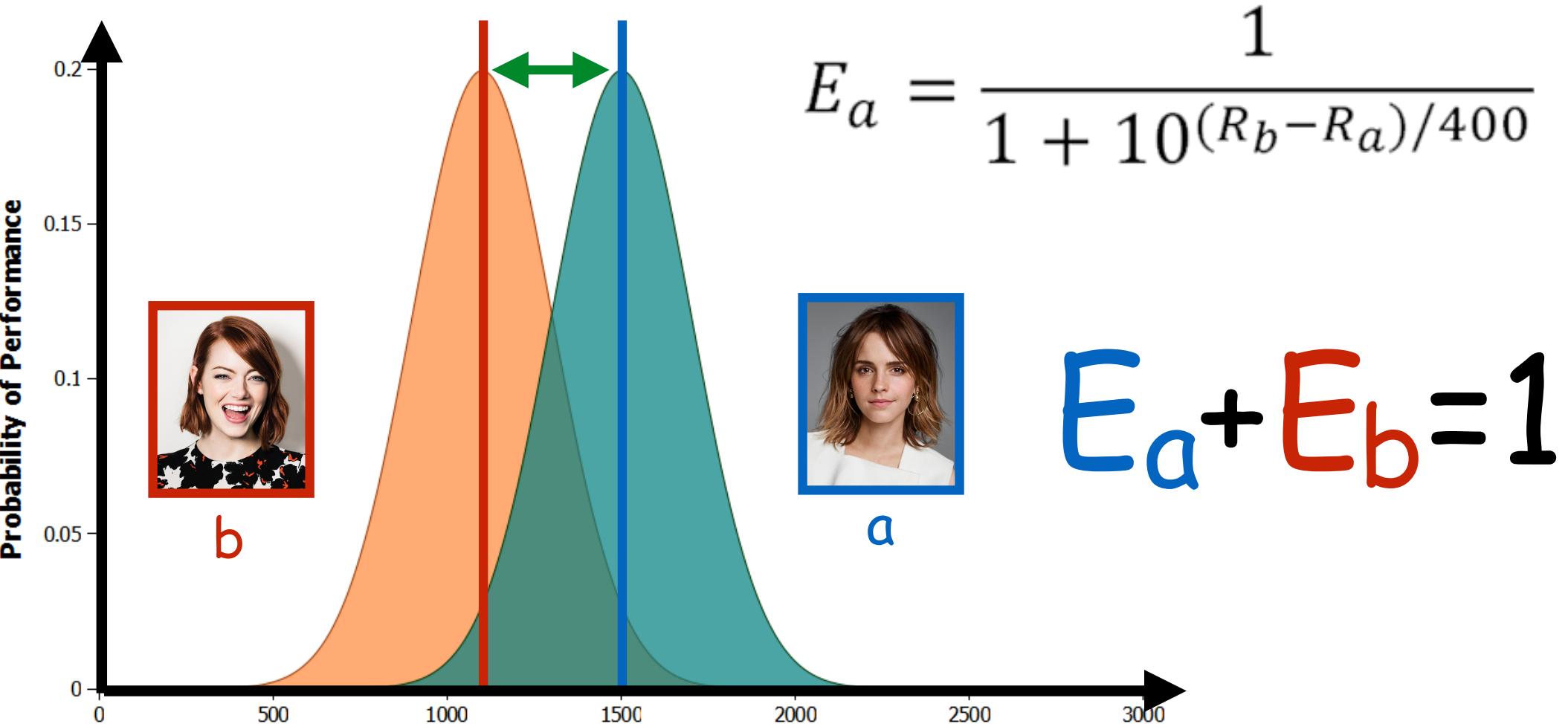
average
performance of a



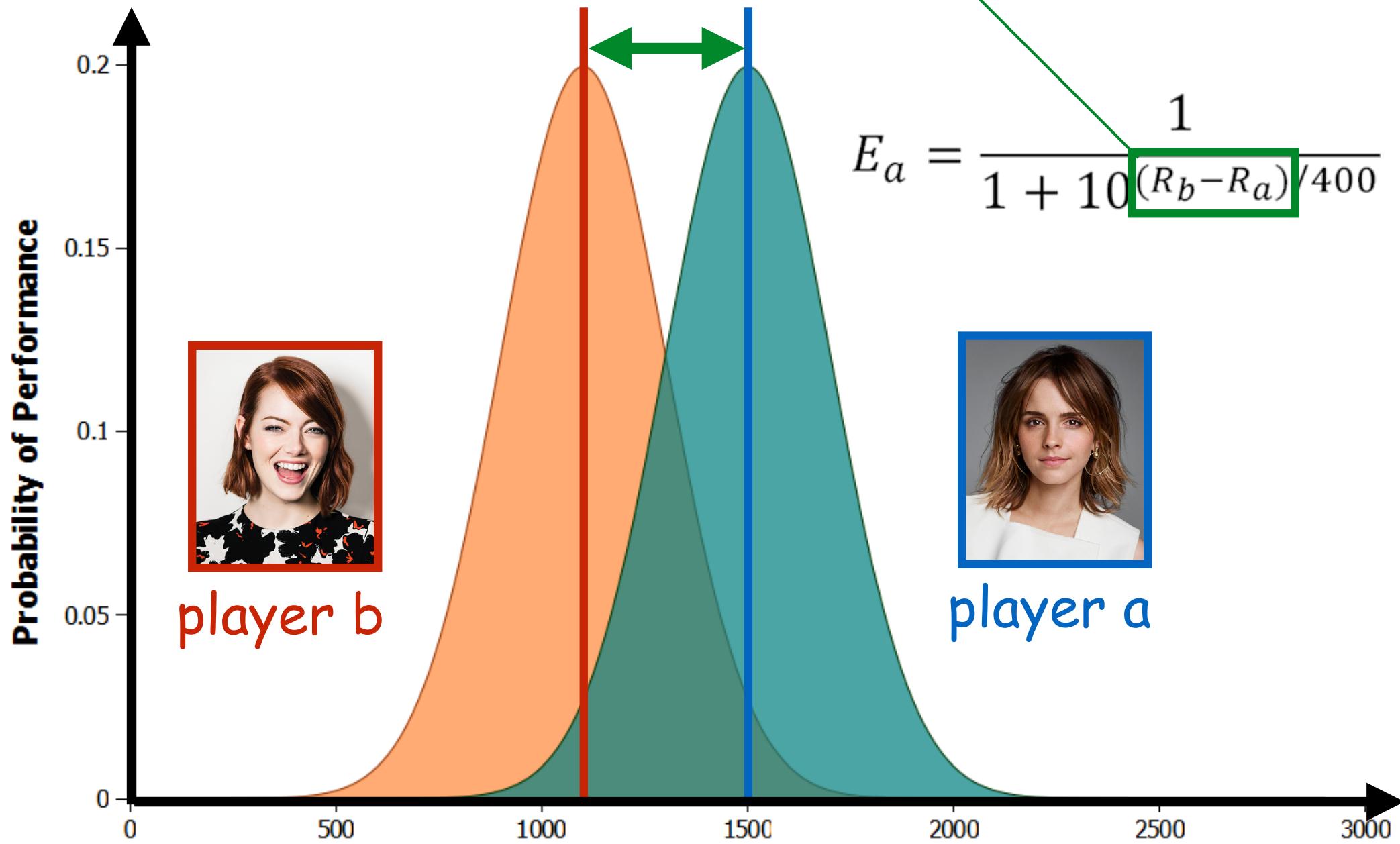


E_a Expected Prob. of Player a winning

E_b Expected Prob. of Player b winning



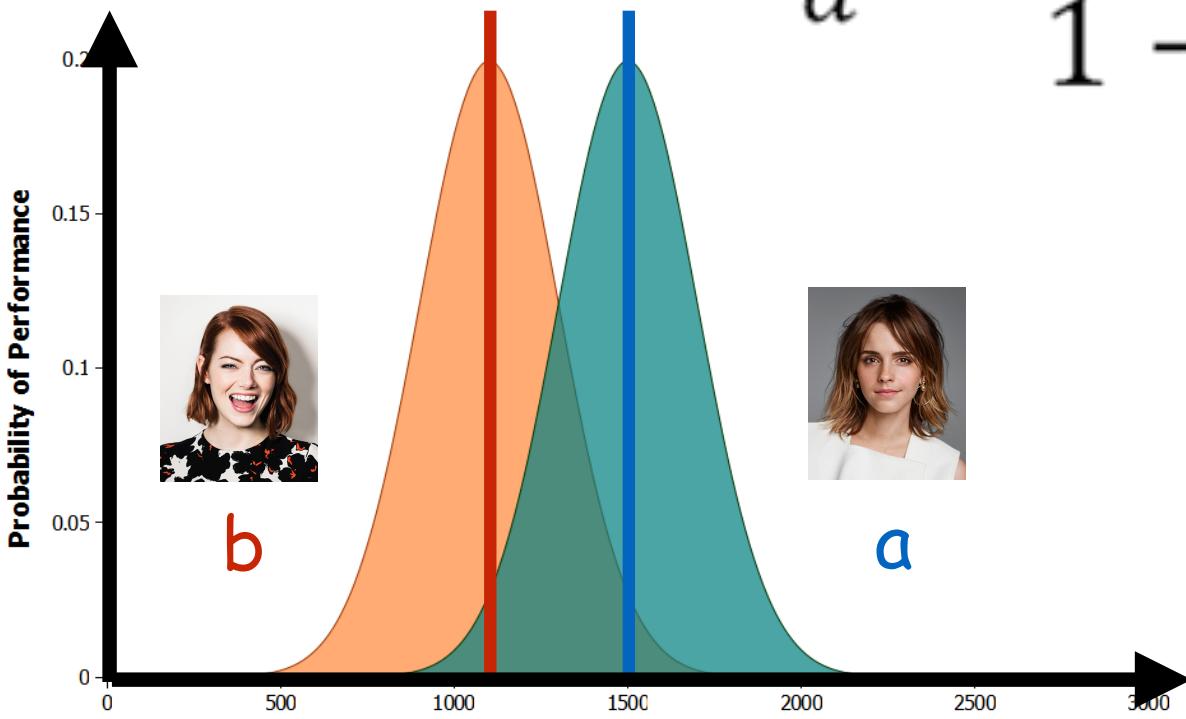
$$R_b - R_a = -400$$



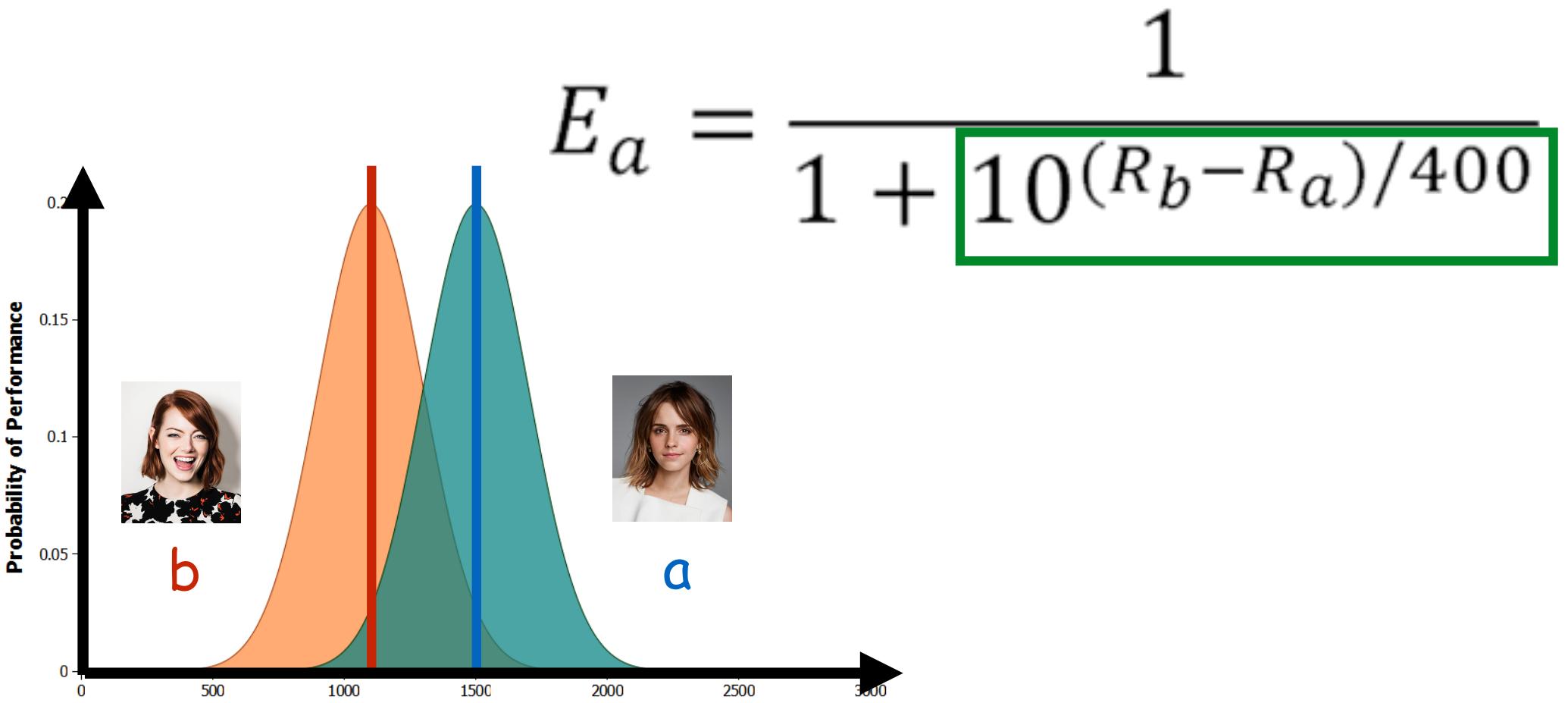
$$(R_b - R_a)/400$$

$$= -400/400 = -1$$

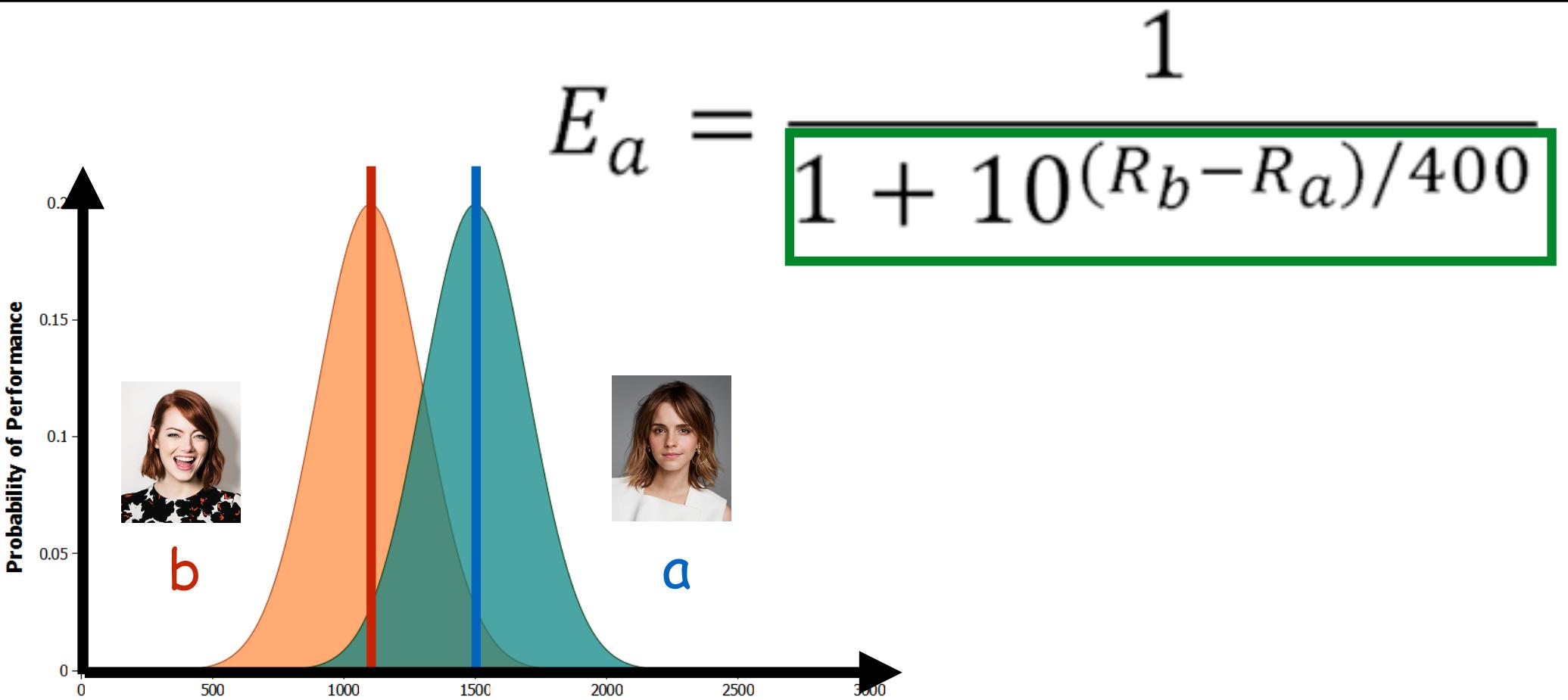
$$E_a = \frac{1}{1 + 10^{(R_b - R_a)/400}}$$



$$10^{(R_b - R_a)/400} = 10^{-1}$$

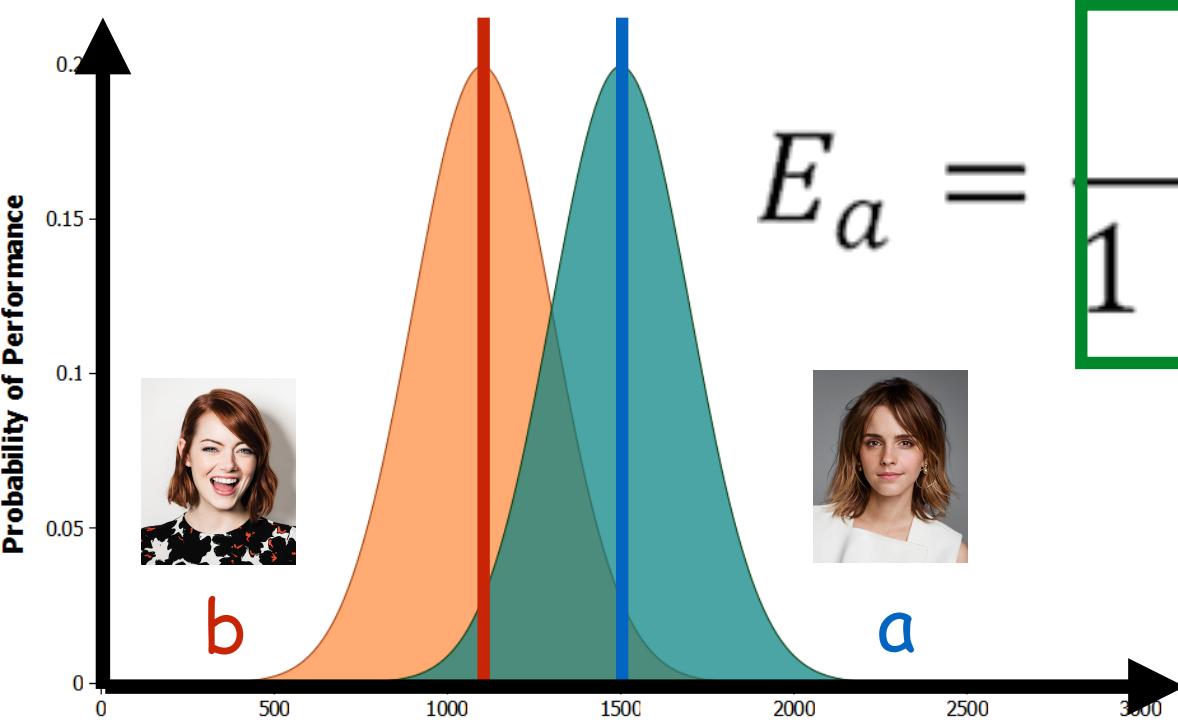


$$1 + 10^{(R_b - R_a)/400} = 1 + 10^{-1}$$
$$= 1.1$$

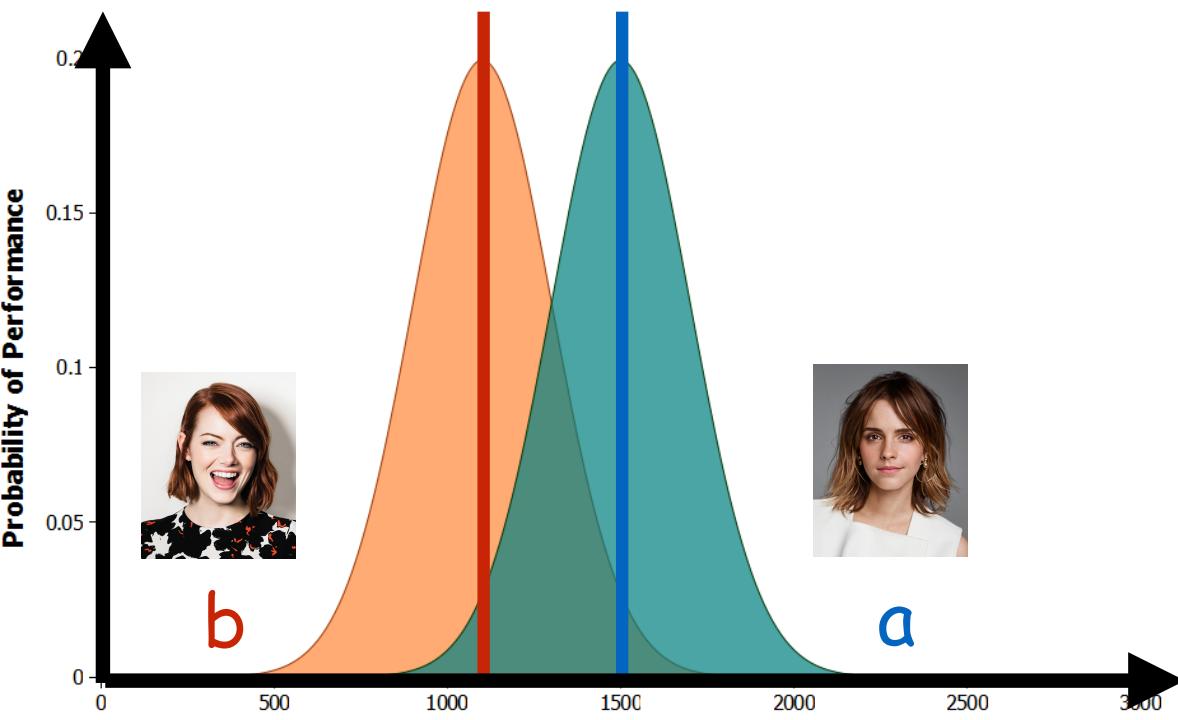
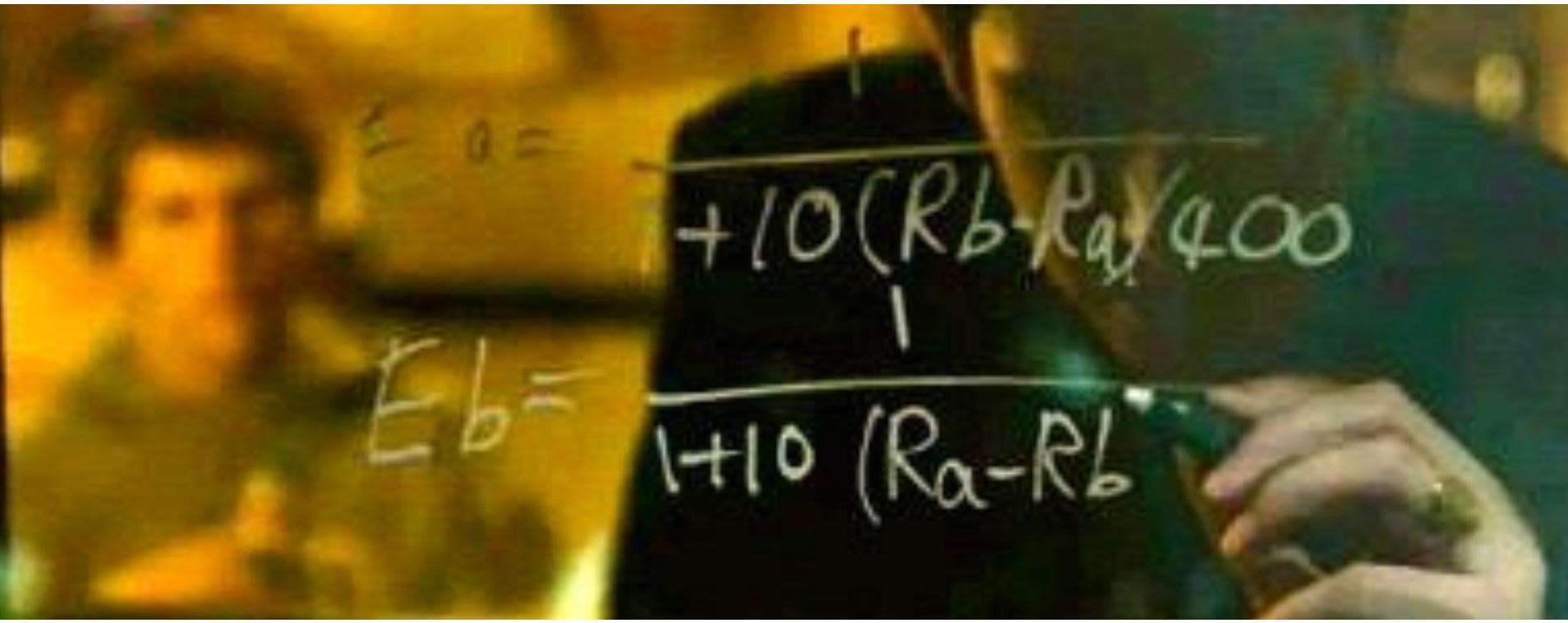


$$\frac{1}{1 + 10^{(R_b - R_a)/400}} = \frac{1}{1.1}$$

$$E_a = 0.9$$



$$E_a = \frac{1}{1 + 10^{(R_b - R_a)/400}}$$

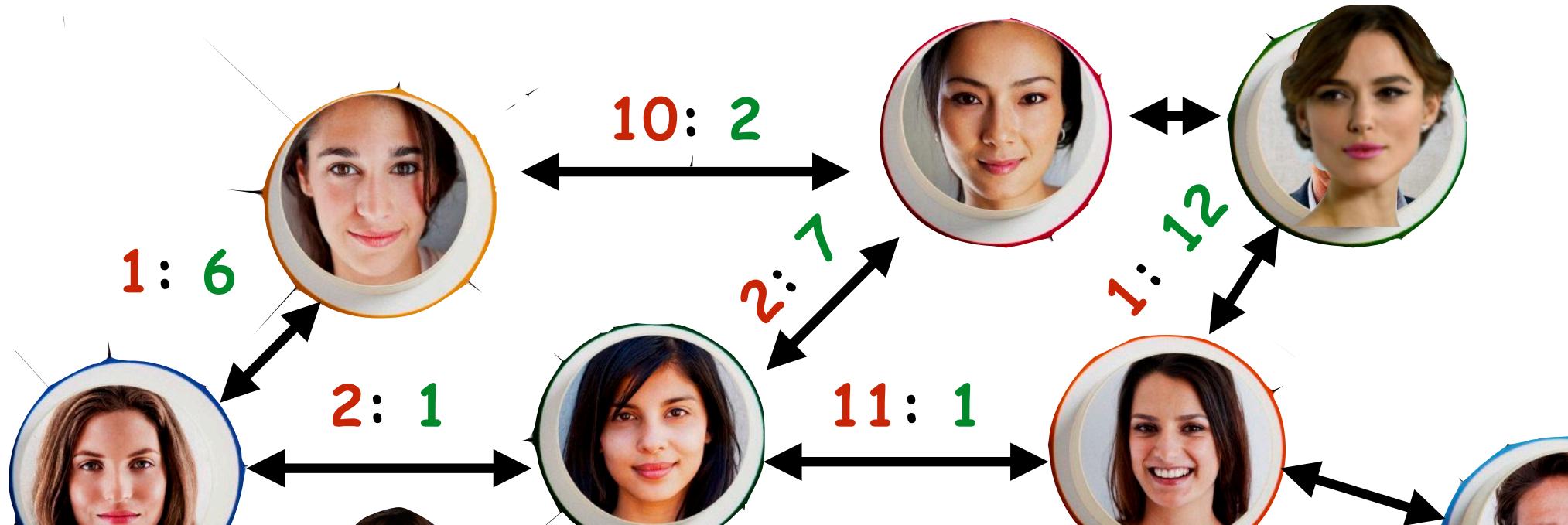


$$E_a = 0.9$$

$$E_b = ?$$

Elo Rating

- A **high-rating player** should be **more likely to win** in a game with **a low-rating player**
- **Chicken and Egg**



Data

game

a

b

winner

1



a

2



b

3



a

...

...

...

Result

$$S_a = \begin{cases} 1 & \text{if a win} \\ 0 & \text{if a loss} \end{cases}$$

game a b winner

1



a

Update rating

$$R'_a = R_a + K (S_a - E_a)$$

new	old	game	expected
rating	rating	result	win prob.

K – k factor (how fast to change)

game

a

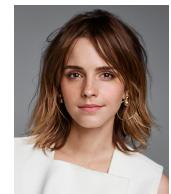
b winner

1



a

Update rating of a



$$R'_a \leftarrow R_a + K (S_a - E_a)$$

$$42 \leftarrow 40 + 16 \times (1 - 0.9)$$

$$54 \leftarrow 40 + 16 \times (1 - 0.1)$$

game

a

b

winner

1



a

Update rating of b



$$R'_b \leftarrow R_b + K (S_b - E_b)$$

$$18 \leftarrow 20 + 16 \times (0 - 0.1)$$

$$8 \leftarrow 20 + 16 \times (0 - 0.9)$$

game

a

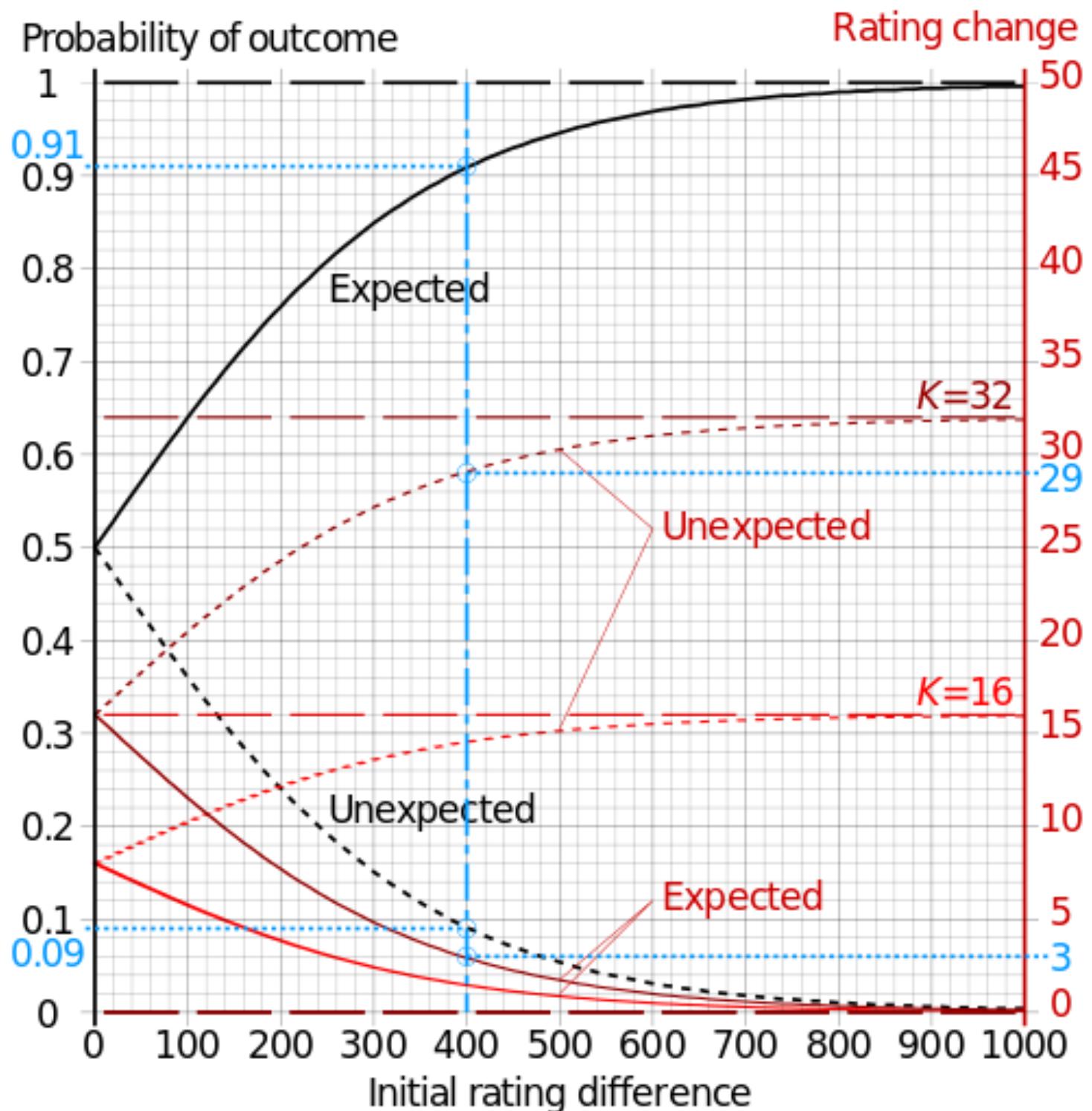
b

winner

1



a



Elo Rating System

Probability of player A to win:

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

Similarly the expected score for Player B is

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

$$R'_A = R_A + K(S_A - E_A).$$



https://en.wikipedia.org/wiki/Elo_rating_system#Theory

Why this solution works

- Santa Approach

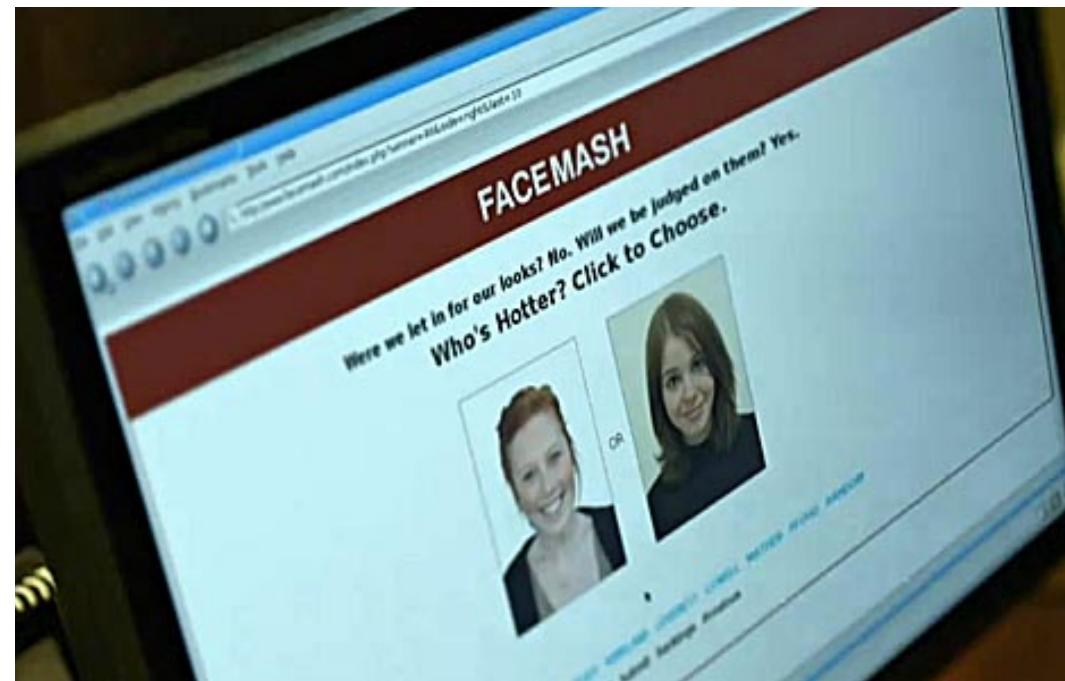
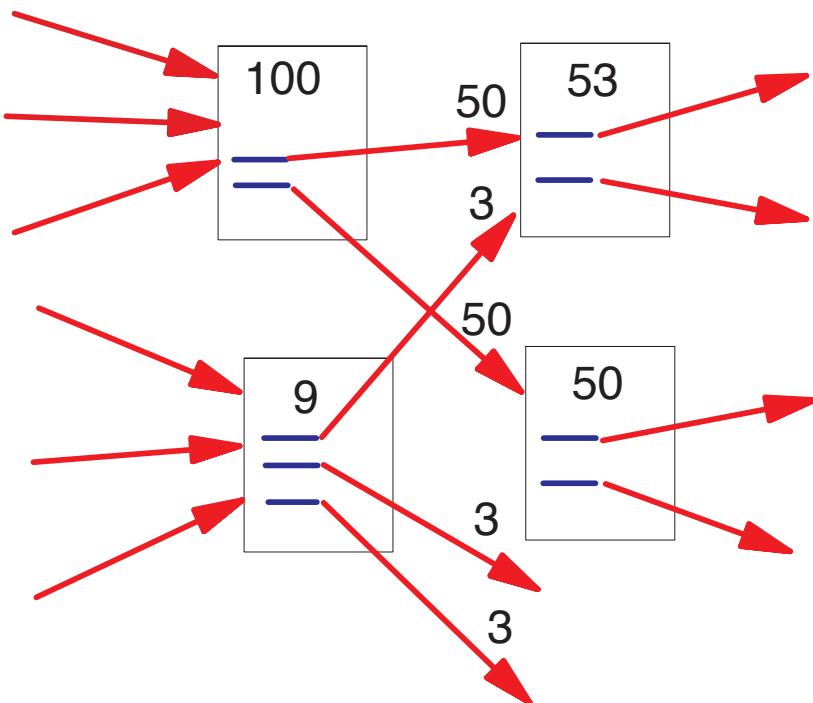


Figure 2: Simplified PageRank Calculation

PageRank



1998

Data: Webpages

FaceMash



2003

Data: students

Similar: “chicken and egg problem”

Elo Rating System

If you win a strong player, your rating increase faster

If you win a weak player, your rating may not increase much

PageRank

If an important page link to your page, your page has a higher rating

If an unimportant page link to your page, your page's rating may not increase much.

Another Solution

people

Data

Problem

Searching People

