Personal Bests as Reference Points

Ashton Anderson
University of Toronto

Etan Green
Wharton

BEAR Research Retreat 2018
Toronto
Where do reference points come from?
Prior Work

Where do reference points come from?

• Goals provide reference points [Heath, Larrick, Wu, 1999]
• Goals tend to be externally generated (e.g. round numbers [Pope & Simonsohn, 2010]
• Reference points can be internally generated (e.g. expectations [Mellers et al., 1997])
This Work

Personal bests are an internally generated goal
This Work

Personal bests are an internally generated goal

More effort when just short of a personal best
Less motivation after setting a new personal best
Personal Bests

- Athletes and fastest times or best statistics
- Students and test scores
- Teachers and course evaluations
- Real estate agents and commissions
- Salespeople and monthly records
- Traders and portfolio valuations
“There is nothing noble in being superior to your fellow man; true nobility is being superior to your former self.”

— Ernest Hemingway
Difficulties

Personal bests cannot be randomly assigned
Difficulties

Personal bests are necessarily rare
Online Chess

We study behaviour around 133 million chess games played by 70,000 players over a 15-year period.

Chess ratings measure a player’s ability.

Examine motivation near personal best ratings.
One Player
# Player Profile

<table>
<thead>
<tr>
<th></th>
<th>rating</th>
<th>RD</th>
<th>win</th>
<th>loss</th>
<th>draw</th>
<th>total</th>
<th>best</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blitz</td>
<td>1464</td>
<td>41.3</td>
<td>5638</td>
<td>7092</td>
<td>747</td>
<td>13477</td>
<td>1573 (12-Nov-2016)</td>
</tr>
<tr>
<td>Standard</td>
<td>1723</td>
<td>193.8</td>
<td>142</td>
<td>116</td>
<td>19</td>
<td>277</td>
<td>1740 (16-Aug-2012)</td>
</tr>
<tr>
<td>Lightning</td>
<td>1469</td>
<td>77.1</td>
<td>17</td>
<td>66</td>
<td>4</td>
<td>87</td>
<td>1484 (07-Dec-2016)</td>
</tr>
</tbody>
</table>
Player Profile

At any one time, your current rating is a certain distance away from your personal best

<table>
<thead>
<tr>
<th></th>
<th>rating</th>
<th>RD</th>
<th>win</th>
<th>loss</th>
<th>draw</th>
<th>total</th>
<th>best</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blitz</td>
<td>1464</td>
<td>41.3</td>
<td>5638</td>
<td>7092</td>
<td>747</td>
<td>13477</td>
<td>1573 (12-Nov-2016)</td>
</tr>
<tr>
<td>Standard</td>
<td>1723</td>
<td>193.8</td>
<td>142</td>
<td>116</td>
<td>19</td>
<td>277</td>
<td>1740 (16-Aug-2012)</td>
</tr>
<tr>
<td>Lightning</td>
<td>1469</td>
<td>77.1</td>
<td>17</td>
<td>66</td>
<td>4</td>
<td>87</td>
<td>1484 (07-Dec-2016)</td>
</tr>
</tbody>
</table>

\[1464 - 1573 = -91\]
Distribution of Ratings

Number of observations

Rating after game – Personal best
Distribution of Ratings

- 1 in 750 observations are new personal bests.
- Still 285K of them in our data.
Predictions

What should we expect if players treat their personal best as a reference point?
Predictions

Our simple prospect theory utility model predicts:

1. Less motivation after personal best: discontinuous jump in leaving after setting a personal best

2. More effort before personal best: in-game effort increases as players approach a personal best
Effort ↑  Motivation ↓  Rating

Personal Best
1. Quitting
1. Quitting

discontinuous jump after setting a personal best
1. Quitting

Personal bests motivate as powerfully as round numbers.

Fig. 3. Probability of quitting for at least 1 h around personal bests (A) and round numbers (B), with 95% confidence intervals.
2. Effort (Performance relative to expectations)
2. Effort (Performance relative to expectations)

In-game effort increases as players approach a personal best.
2. Effort (Performance relative to expectations)

![Graph A](image1.png)
![Graph B](image2.png)

Fig. 4. Performance short of personal bests (A) and round numbers (B), with 95% confidence intervals.

Personal bests motivate much more than round numbers.
Personal Bests

Measurement of performance is proliferating:

- Step counters, calorie tracking, weight loss
- Test scores, course reviews
- Finances, monthly spending

These advances may motivate people to try to be their best selves
In seminal work [Locke & Latham], specific and difficult goals motivate more than vaguely saying “do your best”

Here we find that your personal best is a specific and individually calibrated goal

...and it motivates as a reference point
People exert more effort to achieve personal bests and quit while they’re ahead.

http://www.pnas.org/content/115/8/1772

ashton@cs.toronto.edu