Novel Quantitative Model of Happiness: Reality Less Expectations

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This paper presents a quantitative model for understanding happiness, hypothesizing that happiness is a function of the difference between reality and expectations. Using two surveys, 84 participants reported their expected and actual IQ percentiles alongside their happiness levels before and after receiving their scores. By comparing the difference between expectations and reality against the change in happiness, we found a positive correlation with p = 0.0017, indicating that higher expectations required higher scores to maintain or increase happiness. This model emphasizes the role of expectations in emotional well-being and suggests practical implications for mental health interventions. Further research is recommended to explore the cognitive mechanisms influencing happiness and to refine the model.

1 Introduction

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Happiness is a universally pursued emotion, yet it re-2 mains challenging to define with precision. Psycholo-3 gists, philosophers, and researchers have developed numer-4 ous models to understand happiness, often associating it 5 with positive emotions like joy, satisfaction, and fulfill-6 ment [2]. Positive psychology, a field that explores what 7 makes life most worth living, emphasizes that happiness is 8 not merely the absence of negative emotions but involves 9 actively cultivating positive states, such as gratitude and 10 meaning [7]. While many might believe that happiness can 11 be achieved by obtaining more-be it money, success, or 12 material goods-research suggests otherwise. Studies ex-13 amining the relationship between money and happiness re-14 veal diminishing returns: beyond a baseline income level, 15 increases in wealth do not significantly boost happiness [5]. 16 This concept aligns with the idea that happiness is more 17 relative than absolute, depending largely on expectations. 18 Norton (2012) explored how spending money on others, 19 rather than on oneself, led to greater happiness, suggesting 20 that how one engages with resources influences emotional 21 well-being more than the quantity of resources themselves. 22 Gratitude has emerged as a key component of happiness. 23

Gratitude has emerged as a key component of happiness. Emmons and McCullough (2003) demonstrated that practicing gratitude can enhance subjective well-being, highlighting how individuals who regularly reflect on things ²⁷ they are thankful for experience more positive emotions.

²⁸ Moreover, gratitude interventions, such as journaling or

²⁹ writing thank-you letters, have been shown to significantly

³⁰ improve long-term happiness [8, 1].

This dynamic interplay between expectations and real-31 ity offers a useful framework for quantifying happiness. 32 When outcomes exceed expectations, individuals tend to 33 feel satisfied and content, while unmet expectations can 34 foster disappointment. Gilbert (2006) discussed the psy-35 chological phenomenon of "impact bias," which explains 36 how people often misjudge how future events will affect 37 their emotional state. This supports the idea that happiness 38 is not only about receiving but is inherently tied to one's 39 anticipations and subsequent realities. This study builds 40 on the idea that happiness can be represented as a function 41 of expectations and reality. I hypothesize that happiness is 42 a result of the difference between an individual's expecta-43 tions and the actual outcome they experience. If we let r44 represent quantifiable reality and e represent expectations, 45 happiness can be modeled as a function f where: 46

$$\% happiness = f(\frac{r-e}{r}) \tag{1}$$

By evaluating how these variables interact, we can better understand how people perceive happiness and predict the conditions under which it flourishes. This model provides an empirical pathway to exploring how both material ⁵¹ and non-material factors influence emotional well-being,

⁵² with practical implications for personal development, men-

tal health, and societal policies.

54 2 Methodology

Two surveys have been designed to collect data for this 55 study, one of them being an IQ survey and the other be-56 ing a Post Test Reflection. The first survey, the IQ survey, 57 contains questions that determine where each participant's 58 IQ lies. However, first, they are asked for their happiness 59 level on a scale from 1-10, and what percentile of IO they 60 believe they fall in. This percentile of IQ will serve as the 61 expectations e value because it is a measure of how they 62 expect to do on the IQ test. After participants finish this 63 first survey, they will be given a score. Using the happiness 64 levels from the first and second survey, we can calculate 65 a difference in happiness, using the function $\frac{f(r-e)}{r}$ being 66 how happy they are with their score, e being how happy 67 they claimed to be in the first survey. Using the values for 68 what they believed their IQ to be in the first survey and their 69 actual percentile based on their score in the second survey, 70 we can calculate the difference of their expectations and 71 reality, using the function $\frac{f(r-e)}{r}$, r being their percentile 72 based on their score and e being what percentile they ex-73 pected themselves to fall in. The function f(r-e) will 74 then be converted into a percentage difference to represent 75 the value of a difference in expectations, by dividing it over 76 the predicted expectations value. 77

$$\%\Delta expectation = \frac{\text{Predicted percentile} - \text{actual percentile}}{\text{Predicted percentile}}$$
(2)
Similarly, we can apply the function $\frac{f(r-e)}{r}$ to find the

Similarly, we can apply the function $\frac{f(r-e)}{r}$ to find the difference in happiness values. The difference in happiness values can be obtained by subtracting the number which represents how happy an individual feels with their score from their happiness first reported. Then, this difference is used to calculate a percent difference by dividing it over the initial happiness reported.

$$\% \Delta happiness = \frac{\text{Initial happiness} - happiness with score}{\text{Initial happiness}}$$
(3)

If there is a positive correlation between the difference happiness and the difference in expectations values, then these results will support our hypothesis that expectations influence happiness. The higher the expectations, the higher a score must be for one to be happier.

An IQ survey seemed the best for our research because its results (an IQ score) would most likely have an influence on a participant's happiness. One's intelligence level is a trait most should take pride in. Additionally, we designed some of the questions on the IQ test so that they had no correct answer. These questions act as sort of a "debuffer" to guarantee lower scores. Lower scores will result
in a greater difference between expectations and reality.
Since we hypothesize that the difference between expectations and reality will also affect happiness, lower scores
will make it easier for us to analyze happiness levels.

The purpose of the IQ survey is not to accurately predict somebody's IQ, it is to measure levels of happiness. Therefore, no validity or reliability typically expected to be found in standardized tests or actual IQ tests are present in this IQ survey. The difficulty of the questions are not adjusted in relation to the average intelligence. They should be more difficult for the same reason there are fake questions.

To further compel people to take surveys, and to further ensure that the results of this survey will indeed affect participants' happiness, four gift cards were offered as prizes. Two are rewarded to the two highest scorers, and the other two are decided by raffle. This way, participants' happiness will fluctuate depending on how high their score is because it affects their chances of receiving money.

3 Results and Discussions

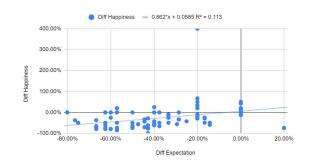


Figure 1: Difference in happiness vs. expectation

The line of best fit shows somewhat of a positive correlation between the difference in expectations and difference in happiness.

Trends and Patterns:

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- Specifically, for every single 1% increase in expectations, you'll expect a 0.862% increase in happiness. Happiness increases at a similar rate as expectations.
- The graph's p-value is 0.001742. A p-value below 0.05 is considered statistically significant. This means that the results were very unlikely to occur by chance, thus hinting at the possibility that the results were caused by a correlation between the two variables.
- There is a significant outlier. One of the data points shows a -20% difference in happiness and a 400% difference in happiness.

¹³¹ • If the difference in expectations is obtained by the ¹³² function f(r - e) and the difference in happiness ¹³³ somewhat correlates with the difference in expecta-¹³⁴ tions, then we can conclude that happiness = f(r - e)¹³⁵ holds some truth.

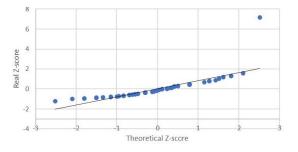


Figure 2: QQ plot

This QQ Plot compares the real z-scores of our happiness 136 values to the theoretical Z-scores of a normal distribution. 137 The actual z-scores from -1 to 1 roughly fall on the line; 138 however, the actual z-scores from -3 to -1 and 1 to 3 do not 139 fit well with the line representing the theoretical Z-scores. 140 The actual z-scores of the left tail are higher than the theo-141 retical and the actual z-scores of the right tail are lower than 142 the theoretical. This shows that the farther from the mean 143 the results are, the less they are representative of a normal 144 distribution. 145

While all the other data points fall near the line of best
fit, there is one significant outlier. There is a 400% increase
in happiness, far more than any of the other differences in
happiness.

Due to the wording of certain questions, a 400% increase 150 in happiness may not accurately represent the correlation 151 between difference in expectations and difference in hap-152 piness. In the first survey, participants were asked, "How 153 happy are you from a scale of 1-10?" which implies that 154 participants are being asked for their general happiness, not 155 their happiness in regards to their IQ. Then, they are asked 156 in the second survey, "From 1-10, how happy are you with 157 your score?" 158

The values used to calculate the difference in happi-159 ness is the percentage of the difference between the initial 160 reported happiness and the happiness with the IQ score. 161 However, this may not really be a difference in happiness, 162 because if a participant reported how happy they felt in gen-163 eral, then their reported happiness with their score was not 164 very related with their initial reported score. The partici-165 pant may have initially reported a 1 on the scale of happi-166 ness overall, but reported a 5 in happiness levels relative to 167 his IQ score, not in general. This results in a major differ-168 ence between the two reported happiness values. 169

This issue may be fixed by rewording the question. Intranstead of asking participants "How happy are you from a scale of 1-10?" they should be asked instead, "How happy
are you in regards to how well you think you'd perform on
an IQ test?" so we can be confident that the reported happiness of their score has definitely changed from their initial
happiness.

Furthermore, there is undercoverage bias in this study. No participant from our data believed they fell in a percentile lower than the 50^{th} . People who fall equal or above the 50^{th} percentile's happiness may be influenced by expectations, as our data has clearly shown, but we cannot determine this for people who believe they fall under the 50^{th} percentile.

This may have occurred because of the difficulty of the questions. People who are not confident in their intelligence level may not want to complete an IQ survey they feel they would not do well in. Next time, we should be aware of factors that can lead to this bias and take measures to avoid it, such as by trying to make questions look not as difficult.

Additionally, we should consider using flat values instead of percentages to measure the difference in happiness and expectations. Flat values may not yield such extreme numbers. Data will be more consistent and near the line of best fit.

4 Conclusion and Future Directions

It is evident that the data gathered does support our hypothesis to an extent. Because %happiness = $f(\frac{r-e}{r})$, as proposed in our hypothesis, and the line of best fit shows that there is a positive correlation between the difference in happiness and difference in expectations. We can conclude that it is, to a certain degree, true that happiness = f(r-e).

If the belief is that possessing more or better resources 203 leads to increased happiness, this assumption may need 204 reevaluation. It may not be the condition of resources them-205 selves but rather the standards set for them that influence 206 happiness levels. Given the established impact of expec-207 tations on happiness, the definition of happiness and the 208 methods for attaining it warrant reconsideration. While 209 many individuals attempt to enhance their circumstances 210 to achieve happiness, a potentially more effective approach 211 might be to lower expectations. 212

These findings may also explain why expressing grati-213 tude is associated with elevated happiness levels. Lower-214 ing expectations could result from contentment with less. 215 Gratitude involves appreciating one's current reality with-216 out seeking more. Individuals often seek therapy when ex-217 periencing depression or dissatisfaction, and these thera-218 pies frequently include cognitive and behavioral interven-219 tions. Cognitive therapies aim to alter a patient's thought 220 patterns, potentially influencing their sense of gratitude or 221 expectations. Further research is needed to explore the re-222 lationship between expectations and happiness, as well as 223

the efficacy of therapeutic interventions that target expectations or gratitude.

While significant research has focused on the biochemi-226 cal mechanisms of happiness, such as dopamine and sero-227 tonin, there is insufficient attention to the cognitive fac-228 tors. Greater emphasis should be placed on investigating 229 the cognitive science underlying happiness. If the mind is 230 indeed a powerful tool, it is essential to harness its poten-231 tial by exploring how cognition affects quality of life. The 232 practical application of this research holds promise for sig-233 nificantly improving overall well-being. 234

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5 Appendix I: Data

ш	now nappy are you	what percentile of IQ do	score	Actual	From 1-10, now	Difference in	Difference in
	from a scale of 1-10	you believe you fall in?	out of 80	Percentile	happy are you with your score?	Expectation	Happiness
1	6	70%	48	60.00%	3	-14.29%	-50.00%
2	6	50%	38	50.00%	9	0.00%	50.00%
3	8	60%	38	50.00%	6	-16.67%	-25.00%
4	4	80%	32	40.00%	1	-50.00%	-75.00%
5	2	80%	15	20.00%	1	-75.00%	-50.00%
6	4	70%	25	30.00%	1	-57.14%	-75.00%
7	3	50%	35	50.00%	3	0.00%	0.00%
8	3	80%	35	50.00%	1	-37.50%	-66.67%
9	4	80%	20	30.00%	2	-62.50%	-50.00%
10	5	50%	32	40.00%	6	-20.00%	20.00%
11	5	70%	51	60.00%	2	-14.29%	-60.00%
12	5	50%	9	20.00%	1	-60.00%	-80.00%
13	7	70%	20	30.00%	1	-57.14%	-85.71%
14	10	60%	15	20.00%	3	-66.67%	-70.00%
15	3	60%	9	20.00%	1	-66.67%	-66.67%
16	3	50%	3	10.00%	3	-80.00%	0.00%
17	4	50%	38	50.00%	4	0.00%	0.00%
18	1	70%	20	30.00%	1	-57.14%	0.00%
19	2	50%	30	40.00%	3	-20.00%	50.00%
20	6	70%	25	30.00%	1	-57.14%	-83.33%
21	9	70%	29	40.00%	2	-42.86%	-77.78%
22	8	50%	35	50.00%	9	0.00%	12.50%
23	9	90%	35	50.00%	5	-44.44%	-44.44%
24	3	50%	30	40.00%	5	-20.00%	66.67%
25	4	80%	20	30.00%	1	-62.50%	-75.00%
26	4	60%	23	30.00%	2	-50.00%	-50.00%
27	5	50%	35	50.00%	6	0.00%	20.00%
28	7	50%	25	30.00%	3	-40.00%	-57.14%
29	5	70%	32	40.00%	0	-42.86%	-100.00%
30	6	60%	12	20.00%	2	-66.67%	-66.67%
31	9	50%	20	30.00%	4	-40.00%	-55.56%

Table 1: Data from 84 participants of surveys.

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