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

Happiness is a universally pursued emotion, yet it remains challenging to define with precision. Psychologists, philosophers, and researchers have developed numerous models to understand happiness, often associating it with positive emotions like joy, satisfaction, and fulfillment [2]. Positive psychology, a field that explores what makes life most worth living, emphasizes that happiness is not merely the absence of negative emotions but involves actively cultivating positive states, such as gratitude and meaning [7]. While many might believe that happiness can be achieved by obtaining more—be it money, success, or material goods—research suggests otherwise. Studies examining the relationship between money and happiness reveal diminishing returns: beyond a baseline income level, increases in wealth do not significantly boost happiness [5]. This concept aligns with the idea that happiness is more relative than absolute, depending largely on expectations. Norton (2012) explored how spending money on others, rather than on oneself, led to greater happiness, suggesting that how one engages with resources influences emotional well-being more than the quantity of resources themselves.

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 they are thankful for experience more positive emotions. Moreover, gratitude interventions, such as journaling or writing thank-you letters, have been shown to significantly improve long-term happiness [8, 1].

This dynamic interplay between expectations and reality offers a useful framework for quantifying happiness. When outcomes exceed expectations, individuals tend to feel satisfied and content, while unmet expectations can foster disappointment. Gilbert (2006) discussed the psychological phenomenon of ”impact bias,” which explains how people often misjudge how future events will affect their emotional state. This supports the idea that happiness is not only about receiving but is inherently tied to one’s anticipations and subsequent realities. This study builds on the idea that happiness can be represented as a function of expectations and reality. I hypothesize that happiness is a result of the difference between an individual’s expectations and the actual outcome they experience. If we let r represent quantifiable reality and e represent expectations, happiness can be modeled as a function f where:

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

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

and non-material factors influence emotional well-being, with practical implications for personal development, mental health, and societal policies.

2 Methodology

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

$$\%\Delta\text{expectation} = \frac{\text{Predicted percentile} - \text{actual percentile}}{\text{Predicted percentile}} \tag{2}$$

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.

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

If there is a positive correlation between the difference in 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

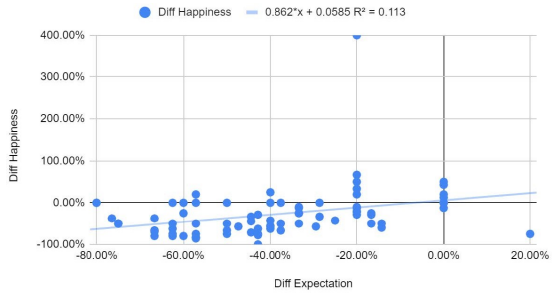

Figure 1: Difference in happiness vs. expectation

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

Trends and Patterns:

- 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.

- If the difference in expectations is obtained by the function $f(r-e)$ and the difference in happiness somewhat correlates with the difference in expectations, then we can conclude that happiness = $f(r-e)$ holds some truth.

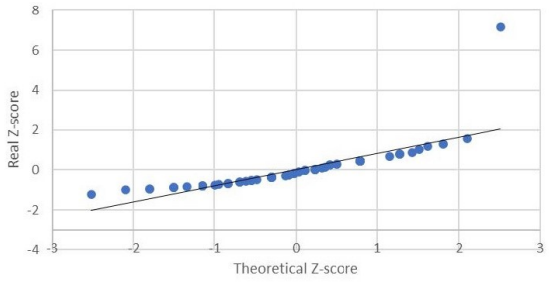

Figure 2: QQ plot

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

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 in happiness may not accurately represent the correlation between difference in expectations and difference in happiness. In the first survey, participants were asked, "How happy are you from a scale of 1-10?" which implies that participants are being asked for their general happiness, not their happiness in regards to their IQ. Then, they are asked in the second survey, "From 1-10, how happy are you with your score?"

The values used to calculate the difference in happiness is the percentage of the difference between the initial reported happiness and the happiness with the IQ score. However, this may not really be a difference in happiness, because if a participant reported how happy they felt in general, then their reported happiness with their score was not very related with their initial reported score. The participant may have initially reported a 1 on the scale of happiness overall, but reported a 5 in happiness levels relative to his IQ score, not in general. This results in a major difference between the two reported happiness values.

This issue may be fixed by rewording the question. Instead 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 leads to increased happiness, this assumption may need reevaluation. It may not be the condition of resources themselves but rather the standards set for them that influence happiness levels. Given the established impact of expectations on happiness, the definition of happiness and the methods for attaining it warrant reconsideration. While many individuals attempt to enhance their circumstances to achieve happiness, a potentially more effective approach might be to lower expectations.

These findings may also explain why expressing gratitude is associated with elevated happiness levels. Lowering expectations could result from contentment with less. Gratitude involves appreciating one's current reality without seeking more. Individuals often seek therapy when experiencing depression or dissatisfaction, and these therapies frequently include cognitive and behavioral interventions. Cognitive therapies aim to alter a patient's thought patterns, potentially influencing their sense of gratitude or expectations. Further research is needed to explore the relationship between expectations and happiness, as well as

the efficacy of therapeutic interventions that target expectations or gratitude.

While significant research has focused on the biochemical mechanisms of happiness, such as dopamine and serotonin, there is insufficient attention to the cognitive factors. Greater emphasis should be placed on investigating the cognitive science underlying happiness. If the mind is indeed a powerful tool, it is essential to harness its potential by exploring how cognition affects quality of life. The practical application of this research holds promise for significantly improving overall well-being.

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5 Appendix I: Data

Table 1: Data from 84 participants of surveys.

ID	How happy are you from a scale of 1-10	What percentile of IQ do you believe you fall in?	Score out of 80	Actual Percentile	From 1-10, how happy are you with your score?	Difference in Expectation	Difference in 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%
32	8	70%	29	40.00%	3	-42.86%	-62.50%
33	8	60%	28	40.00%	6	-33.33%	-25.00%
34	6	60%	35	50.00%	3	-16.67%	-50.00%
35	3	90%	38	50.00%	2	-44.44%	-33.33%
36	3	50%	29	40.00%	4	-20.00%	33.33%
37	2	80%	9	20.00%	1	-75.00%	-50.00%
38	8	70%	17	30.00%	4	-57.14%	-50.00%
39	8	50%	38	50.00%	7	0.00%	-12.50%
40	7	50%	38	50.00%	10	0.00%	42.86%
41	8	50%	17	30.00%	3	-40.00%	-62.50%
42	7	50%	20	30.00%	4	-40.00%	-42.86%
43	3	70%	35	50.00%	3	-28.57%	0.00%
44	1	50%	15	20.00%	1	-60.00%	0.00%
45	6	70%	25	30.00%	1	-57.14%	-83.33%
46	5	50%	32	40.00%	4	-20.00%	-20.00%
47	4	60%	29	40.00%	3	-33.33%	-25.00%
48	10	60%	30	40.00%	9	-33.33%	-10.00%
49	7	50%	35	50.00%	7	0.00%	0.00%
50	7	90%	38	50.00%	2	-44.44%	-71.43%
51	8	70%	32	40.00%	2	-42.86%	-75.00%
52	3	50%	17	30.00%	3	-40.00%	0.00%
53	5	90%	20	30.00%	1	-66.67%	-80.00%
54	7	60%	35	50.00%	5	-16.67%	-28.57%
55	7	80%	45	60.00%	4	-25.00%	-42.86%
56	8	80%	35	50.00%	4	-37.50%	-50.00%
57	8	60%	30	40.00%	7	-33.33%	-12.50%
58	8	80%	25	30.00%	3	-62.50%	-62.50%
59	3	70%	38	50.00%	2	-28.57%	-33.33%
60	2	80%	15	20.00%	1	-75.00%	-50.00%
61	5	80%	17	30.00%	1	-62.50%	-80.00%
62	9	50%	29	40.00%	7	-20.00%	-22.22%
63	10	50%	29	40.00%	9	-20.00%	-10.00%
64	6	80%	30	40.00%	2	-50.00%	-66.67%
65	8	50%	12	20.00%	6	-60.00%	-25.00%
66	10	50%	41	50.00%	10	0.00%	0.00%
67	8	50%	29	40.00%	7	-20.00%	-12.50%
68	4	50%	25	30.00%	5	-40.00%	25.00%
69	9	80%	38	50.00%	9	-37.50%	0.00%
70	10	50%	40	50.00%	10	0.00%	0.00%
71	1	50%	32	40.00%	5	-20.00%	400.00%
72	9	50%	8	10.00%	9	-80.00%	0.00%
73	7	95%	38	50.00%	3	-47.37%	-57.14%
74	7	80%	20	30.00%	7	-62.50%	0.00%
75	8	85%	9	20.00%	5	-76.47%	-37.50%
76	8	90%	48	60.00%	6	-33.33%	-25.00%
77	8	90%	17	30.00%	5	-66.67%	-37.50%
78	7	70%	29	40.00%	5	-42.86%	-28.57%
79	10	75%	35	50.00%	5	-33.33%	-50.00%
80	4	50%	52	60.00%	1	20.00%	-75.00%
81	5	70%	27	30.00%	6	-57.14%	20.00%
82	7	75%	53	60.00%	5	-20.00%	-28.57%
83	8	60%	25	30.00%	8	-50.00%	0.00%
84	7	85%	50	60.00%	3	-29.41%	-57.14%