Preferential Distributions of Harmful and Beneficial Experiences Across a Neutral and Homogeneous Population

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Introduction

The research investigated how people prefer to spread positive and negative experiences across a neutral and homogeneous population. According to Kahneman and Tversky's (1979) prospect theory [1], agents asymmetrically feel losses greater than that of an equivalent gain. Its mathematical equivalent is stated as follows:

$$V = \sum_{i=1}^{n} \pi(p_i) \cdot v(x_i) \tag{1}$$

where $v(x_i)$ is described by the following graph:

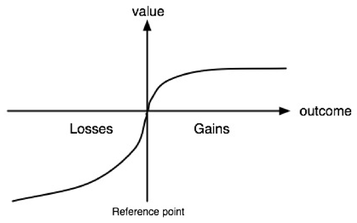

Figure 1: Value Function in Prospect Theory

Using this model, assuming that spreading harms is a mechanism of harm reduction, distributing harms yields a faster growth in value relative to spreading positive experiences. Therefore, we predicted that people would be more willing to spread negative experiences across a population than positive experiences.

Methods

Critical Assumption

Assume that every human experience can be ranked on a scale from -100 to +100, such that:

- A -100 experience corresponds to the worst thing a human could possibly experience
- A +100 experience corresponds to the best thing a human could possibly experience
- A 0 experience corresponds to an experience that is exactly neutral

Using this assumption, we could ask questions such as, "Would you prefer that 4 people experience a +25 event, or that 1 person experiences a +100 event?"

Participants: 32 participants ($\overline{y}_{age} = 34.78$, $s_{age} = 14.16$, 17 females, 15 males) completed an online survey

Statistical analyses: As a first step, we may collect our preferential distribution data using a series of pairwise comparisons. However, this approach may lead to intransitive preferences. Therefore, we adapted Thurstone's (1927) Method of Paired Comparisons for Social Values [2] to create preference scales with ranking data.

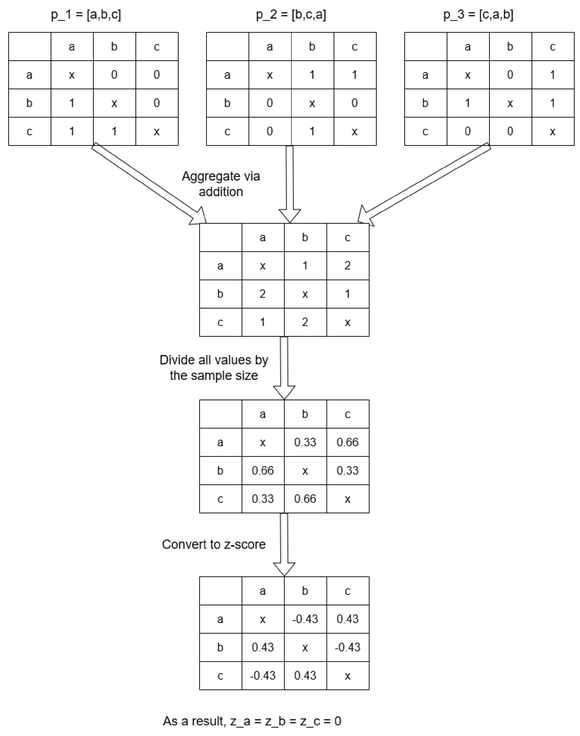

Figure 2: Computational Representation of Thurstone's Approach using Ranking Data

The stimuli a, b, and c represented different distributions of positive or negative experiences. Furthermore, we decomposed these items into bundles that each contain the number of people and the per-person magnitude and valence of the experience. Then, we associated a utility value for each bundle using the values from our preference scale, such that we obtain a 3D graph. Pushing our analysis further, we used a symbolic regression software (PySR [3]) that uses machine-learning and genetic algorithms to derive our participants' average utility functions for positive and negative experiences.

Design and Procedure:

- Randomized within-subjects design
- Condition 1: Rank the following set of items in order of increasing preference: [1,+100], [2,+50], [4,+25], [100,+1], [10,+20], and [40,+5].
- Condition 2: Rank the following set of items in order of increasing preference: [1,-100], [2,-50], [4,-25], [100,-1], [10,-20], and [40,-5].

Results

Number of People (x_0)	Per-person Experience Value (x_1)	Preference Value
10	+20	0.82
2	+50	0.78
1	+100	0.68
4	+25	0.50
40	+5	0.38
100	+1	0.0

Utility function for positive items: $f(x_0,x_1) = 0.717 - 0.00726x_0$

Number of People (x_0)	Per-person Experience Value (x_1)	Preference Value
100	-1	1.82
40	-5	1.19
4	-25	0.70
10	-20	0.68
2	-50	0.30
1	-100	0.0

Utility function for negative items: $f(x_0,x_1) = 2.42e^{x_1 \cdot (0.00264x_0 + 0.0381)}$

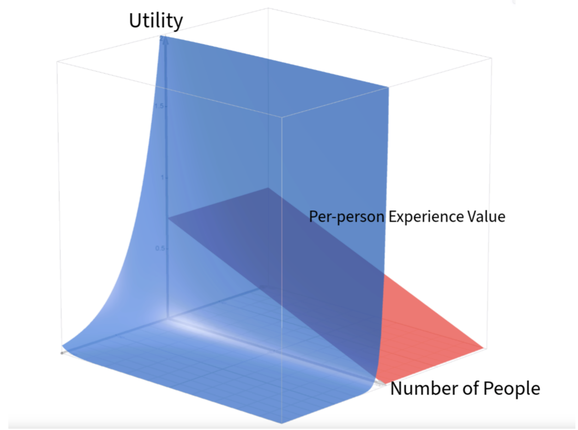

Figure 3: Graphical Representation of Utility Functions (red:+, blue:-)

Discussion

From our results, we deduce that when distributing positive experiences, our participants were attentive to the number of people. Conversely, when spreading negative experiences participants considered per-person experience value and the number of people, placing greater emphasis on the number of people. Finally, from the preference scale values, we infer that participants had a stronger proclivity to spread negative experiences than positive experiences.

References

[1] Kahneman, D., Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2), 263–291. https://doi.org/10.2307/1914185

[2] Thurstone, L. L. (1927). The method of paired comparisons for social values. *Journal of Abnormal and Social Psychology*, 21(4), 384–400. https://doi.org/10.1037/h0065439

[3] Cranmer, M. (2023). Interpretable Machine Learning for Science with PySR and SymbolicRegression.jl. https://doi.org/10.48550/arxiv.2305.01582