Behavioural Economics

Topics in Experimental Economics

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Elicitation Techniques

- Eliciting the utility function under PT.
- Eliciting loss aversion under PT.
- Eliciting the probability weighting function under PT.

- Readings: Wakker & Deneffe (1996)*, Abdellaoui (2000)*, Abdellaoui et al. (2007)*, Abdellaoui et al. (2008)*
- Application: Bleichrodt & Pinto (2000)*, (Dhami 2016, pp 213-278)*

Elicitation Techniques: Why

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- Allais (1953) challenged the descriptive validity of expected utility theory.
- Several generalizations of expected utility theory, known as non-expected utility theories, were proposed in the literature (cf. Starmer, 2000).
- Among these generalizations, prospect theory Tversky & Kahneman (1992) accommodate a large set of behavioral biases.

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- Among these generalizations, prospect theory Tversky & Kahneman (1992) accommodate a large set of behavioral biases.
  - Two key reasons for deviation from expected utility:
    1. Loss aversion
       People interpret outcomes as gains and losses relative to a reference point,
       They are more sensitive to losses than to absolutely commensurate gains.
    2. Non-linear probabilities
       A probability weighting function that is concave in low probabilities,
       and is convex in medium to high probabilities.

Elicitation Techniques: Examples

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- Loss aversion explains:
  - the equity premium puzzle
  - asymmetric price elasticities
  - downward-sloping labor supply
  - myopic loss aversion

    people may evaluate return on lotteries over very short time horizons while the actual returns are long term.

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    people may evaluate return on lotteries over very short time horizons while the actual returns are long term.
- Non-linear probabilities explains:
  - extreme events (or tail events in finance) are more salient
  - positively (negatively) skewed returns portfolios/assets may be more attractive to investors
  - the equity premium puzzle
  - purchase of lotteries and insurances
  - panic buying

Elicitation Techniques: Prospect Theory

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- In prospect theory (PT), measures utilities in terms of gains and losses.
- The value function is normalized to zero at a reference point
- The kink in the value function reflects loss aversion.
- PT's value function is a ratio scale:

  it can be normalized for one outcome other than the reference point.
- Methods for eliciting PT's value function are invaluable tools in decision analysis.

Loss Aversion, A Definition

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Definition

Kahneman & Tversky (1979): Let $\prec$ be a binary preference relation over lotteries. An individual is loss averse if $(y, 0.5;\ -y, 0.5) \prec (z, 0.5; -z, 0.5)$ *where* $y > z \geq 0$

Other studies define loss aversion based on the utility function (and not the probability weighting function).

Reaction to losses in terms of utility

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- Reference dependence: the value function is defined on deviations from a reference point (origin)
  - Value function is concave for gains (implying risk aversion) and convex for losses (risk seeking)

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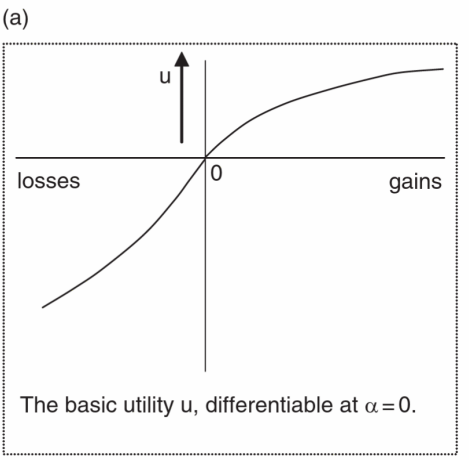
- Diminishing sensitivity: the effect of the change diminishes with distance to the reference point.

Reaction to losses in terms of utility



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$$V(\alpha) = \begin{cases} \alpha^{\theta} & \alpha > 0 \\ 0 & 0 \\ -\lambda(-\alpha)^{\theta'} & \alpha < 0 \end{cases}$$

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Tversky & Kahneman (1992) find that: $\theta' = \theta = 0.88$, $\lambda = 2.25$

Loss Aversion

Study	Index	Estimate
Fishburn & Kochenberger (1979)*	$\frac{v'(-x)}{v'(x)}$	4.8
Tversky & Kahneman (1992)	$-\frac{v(-1)}{v(1)}$	2.25
Bleichrodt et al. (2001)*	$\frac{v(-x)}{v(x)}$	2.17, 3.06
Schmidt & Traub (2002)*	$\frac{v'(-x)}{v'(x)}$	1.43
Pennings & Smidts (2003)*	$\frac{v'(-x)}{v'(x)}$	1.81
Booij et al. (2010)*	$\frac{v_{\uparrow}(-x)}{v_{\downarrow}(x)}$	1.79, 1.74

Loss Aversion

Study	Index	Estimate
Abdellaoui et al. (2007)*	$-\frac{v(-x)}{v(x)}$	2.04
$x > 0,\ y < 0$	$\frac{\min(v(-y)/y)}{\min(v(-x)/x)}$	1.07
	$\frac{v'(-x)}{v'(x)}$	1.71
	$\frac{\min v(-y)}{\min v(-x)}$	0.74
	$\frac{x_{0.015}}{y_{0.015}}$	8.24

Optional Readings

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Further readings on elicitation techniques*:
Köbberling & Wakker (2005), Gächter et al. (2021), Abdellaoui et al. (2016), Johnson et al. (2006), Blavatskyy (2021), Mukherjee et al. (2017),

Belief Elicitation Techniques

- Scoring rule.
- Introspective Judgment:

  Example: What do you think is the percent chance that even E occurs? Please reply a specific value or a range of values, as you see fit.

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  1. Matching probabilities:
     Example: if event E happens the outcome is x, else 0; a risky prospect: $x, E;\ 0, E^c \sim x, p;\ 0, 1-p$

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  1. Matching probabilities:
     Example: if event E happens the outcome is x, else 0; a risky prospect:
     $x, E;\ 0, E^c \sim x, p;\ 0, 1-p$
  2. Certainty Equivalence:
     Example: if event E happens the outcome is x, else 0; a certain amount:
     $x, E;\ 0, E^c \sim x_c$

Why Scoring Rules

- Scoring rules are used for those unobservable variables, such as beliefs.
- Why Eliciting Beliefs at all?
- One short answer: providing foundations for behavioural models of learning.

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- Scoring rules are used for those unobservable variables, such as beliefs.
- Why Eliciting Beliefs at all?
- One short answer: providing foundations for behavioural models of learning.
- Equilibrium analysis + the time path to the equilibrium: the temporal learning behaviour of economic agent.
- However the big question is where these preferences are coming from?

  Why do we observe prosocial behaviour such as altruism?

  If selffishness has a higher fitness, how can altruism survive?

  How culture transmitted across generations?

Scoring Rules

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- Proper scoring rules are used for those unobservable variables, such as beliefs
- There many different scoring rules.
- Proper Scoring Rules: a scoring rule which is a dominant strategy for decision-makers to reveal beliefs truthfully.

Proper Scoring Rules

- There many different scoring rules.

	$s_1(y)$	$s_2(y)$
Quadratic	$1-(1-y)^2$	$1-y^2$
Generalised binary	$a-b(1-y)^2$	$c-by^2$
Logarithmic (Toda, 1963)	$-\log(y)$	$-\log(1-y)$
Spherical (Roby, 1964)	$\frac{y}{(y^2+(1-y)^2)^{0.5}}$	$\frac{1-y}{(y^2+(1-y)^2)^{0.5}}$
Power quadratic (Selten, 1998)	ay^{a-1} $-(a-1)(y^a+(1-y)^a)$	$a(1-y)^{a-1}$ $-(a-1)(y^a+(1-y)^a)$

- However, they make the assumptions that subjects are risk neutral expected utility maximising.
- Generalisation to Non-Expected utility (Offerman et al. 2009).

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- If truth-telling is a cognitive low-cost thing to do, properness seems less crucial.

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- If truth-telling is a cognitive low-cost thing to do, properness seems less crucial.
- A flat fee may work just as well (Sonnemans & Offerman 2001)*.
- For a comprehensive review of incentived belief elicitation read Schlag et al. (2015)*

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- Subjects use their stated beliefs as the basis of their choices? (Nyarko & Schotter 2002)*.
- Subjects best-response to their stated beliefs? (Blanco et al. 2014)*.
- Constant average beliefs over two elicitation methods? (Costa-Gomes & Weizsäcker 2008)*.

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- Constant average beliefs over two elicitation methods? (Costa-Gomes & Weizsäcker 2008)*.
- Elicitation of beliefs make subjects think harder.

Belief Elicitation Techniques, which one?

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- Comparing belief elicitation techniques: Trautmann & van de Kuilen (2015)*.

  They find no significant differences between elicitation techniques (in terms of additive beliefs).

  Incentivised techniques perform slightly better than non-incentivised ones.

Scoring Rules

- Beliefs about n possible events $i = 1, 2, \ldots, n$
- Reported beliefs $r = (r_1, r_2, \ldots, r_n)$
- Scoring functions $S = (S_1, S_2, \ldots, S_n)$
- The most commonly used scoring rule: Quadratic Scoring Rule (QSR) (Brier, 1950)*.
- The score when event r occurs:

$$S_i(r) = a - b\sum_{k=1}^{n}(I_k - r_k)^2$$

- where $a, b > 0$ and $I_k = 1$ if event k is realised and 0 otherwise.

Quadratic Scoring Rule

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  applicable to non-expected utility theories
- A QSR prospect is given by:

$$p, \quad \underbrace{(a - b(1-r)^2)}_{\text{score if true}} \quad \text{or} \quad (1-p), \quad \underbrace{(a - cr^2)}_{\text{score if not true}}$$

Quadratic Scoring Rule for Eliciting Beliefs

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- Consider the following QSR prospect, $r \in [0, 1]$, for simplicity $a = 1, b = 1, c = 1$

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- Evaluating the prospect

$$\max_r \quad w(p)\, u(1 - (1 - r)^2) \; + \; w(1 - p)\, u(1 - r^2)$$

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$$\max_r \quad w(p)\, u(1 - (1 - r)^2) \; + \; w(1 - p)\, u(1 - r^2)$$

$$\iff r = \frac{w(p)}{w(p) + (1 - w(p)) \frac{u'(1-r^2)}{u'(1-(1-r)^2)}}$$

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- If u is a linear function:
- optimal solution is $r^* = w(p)$
- In an experimental setup:

Quadratic Scoring Rule: An Example

- Generating objective probabilities
  dice 1: numbers $0, 1, 2, \ldots, 9$, and
  dice 2: numbers $00, 10, 20, \ldots, 90$;
  The sum of the two dice gives a number between 0 and 100, p

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p_R (%)	If the statement is true your score is	If the statement is not true your score is
0	40000	60000
⋮	⋮	⋮
15	45550	19550
20	47200	19200
25	48750	18750
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100	60000	40000

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  "The computer rolls the two dice. The outcome is smaller than 20." $p = 0.2 \quad > p_R$

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Mood Induction

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- Many experiments rely on specific emotions or moods for participants
- Perhaps a positive mood can relate to higher productivity
- Or, a negative mood may reduce reciprocity
- Thus, various methods are used to induce specific moods

Mood Induction Techniques

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- Film/Story: Using some funny clip or otherwise induce mood to participants
- Music: Similarly to film, to induce some mood
- Feedback: Both positive and negative
- Social: Interaction Expose participants to particular social interactions
- Gift: Give sweets, or 'reward'..?

Velten MIP: Statement Examples - A

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- We have two kinds of nouns denoting physical things: individual and mass nouns.
- The Orient Express travels between Paris and Istanbul
- Slang is a constantly changing part of the language
- Boeing's main plant in Seattle employs 35,000 people

Velten MIP: Statement Examples - B

- Every now and then I feel so tired and gloomy that I'd rather just sit down than do anything
- I've had important decisions to make in the past and I've sometimes made the wrong ones
- I've doubted that I'm a worthwhile person

Velten MIP: Statement Examples- C

- I feel enthusiastic and confident now
- My favourite song keeps going through my head
- Life is firmly in my control
- If I set my mind to it, I can make things turn out fine.

Why Mood Induction?

- Why not just ask people what their mood might be?
- Reported mood has many weaknesses
- Problems:

  Do people know?

  Are they truthful?

  How to incentivize?

  Control?

  Causation?

Mood Induction in Economics

- Early work in psych suggests that there is a link between mood and several factors that should matter in the workplace (note the huge importance of Alice Isen):
- Positive emotion influences the capacities of choice and innovative content (Isen, 2000), improves memory recall (Isen et al. 1978; Teasdale and Fogarty 1979), leads to greater altruism (Isen and Simmonds 1978).
- Isen and Reeve (2005) show that positive affect induces subjects to change their allocation of time towards more interesting tasks.
- Isen et al (1978) find that positive affect leads to greater altruistic helping of others. These findings apply to unpaid settings.
- Survey data also suggests a link between mood & productivity.

Experiment: Mood and Productivity

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Happiness and productivity, Journal of Labor Economics 33(4): 789-822, 2015 by Andrew Oswald, Eugenio Proto and Daniel Sgroi.

Which MIP to use?

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- The key difficulty is how to 'assign' emotions to people to produce a randomized trial.
- Mood-induction procedures: the best is supposedly a mix: e.g. audio-visual (Westermann et al, 1996).
- So we used a comedy clip: https://www.youtube.com/watch?v=ggOa9aSG-Ow
- Restricted the laboratory pool to subjects of an English background who had likely been exposed to similar humour before.

When to use MIP

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- Likely to last only for a short period.
- Needed to be shown just before a task designed to reveal productivity
- Control Group: A neutral setting:
  - no clip
  - a neutral clip (a placebo): essentially a screensaver involving colourful sticks).
- It seemingly made no difference which control was used, but this was important to check (e.g. the time spent watching the movie might have been important).

Productivity

- Main productivity task previously used in Niederle and Vesterlund (2007), which entails asking subjects to add sequences of five 2-digit numbers under timed conditions.
- Example: 31 + 56 + 14 + 44 + 87 = ?
- Comparatively simple but is taxing under pressure.
- It might be thought of as representing in a highly stylized way an iconic white-collar job: both intellectual ability and effort are rewarded.

Controls: ability

- They also require subjects to undertake GMAT math-style questions.
- They supplement this with information about A-Levels (high school) final marks
- The aim was to allow us to control for heterogeneous ability levels, while remaining open for happiness to affect ability too.

Controls: payment

- Payment is essential is we are trying to model the workplace.
- But what sort of payment?
- We used piece rates (pay per correct answer) which were specified precisely (£0.50 per correct answer).
- And a "hidden" bonus where participants were told they would be paid a bonus if they did well, but the precise amount was left unspecified.
- This captures a piece-rate wage and a performance related bonus.
- The results were robust to payment type.

When to ask about happiness?

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- At the end of the experiment:

  After the questionnaire was completed, subjects received payment as calculated by the central computer.
- At the very start of the experiment and after the treatment.

  Think about the reasons why asking before or after the clip or main tasks might be better

A real-life MIP

- In real life there are lots of things that raise or lower happiness.
- Ethically we cannot induce anything too serious in the lab, but if people have suffered bad life events in the real world we can see if these have an effect.

A real-life MIP

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- They looked at deaths in the family (parents, siblings, grandparents) and serious illness in the close family (parents, siblings): “bad life events” or BLEs.
- They asked subjects to report deaths/illness in the family and when these took place.
- They asked this during the final questionnaire (we did not want the memory to generate an effect).
- They can think of BLEs as nature-induced MIP: shocks randomly distributed by nature so they satisfy the idea of a random assignment.

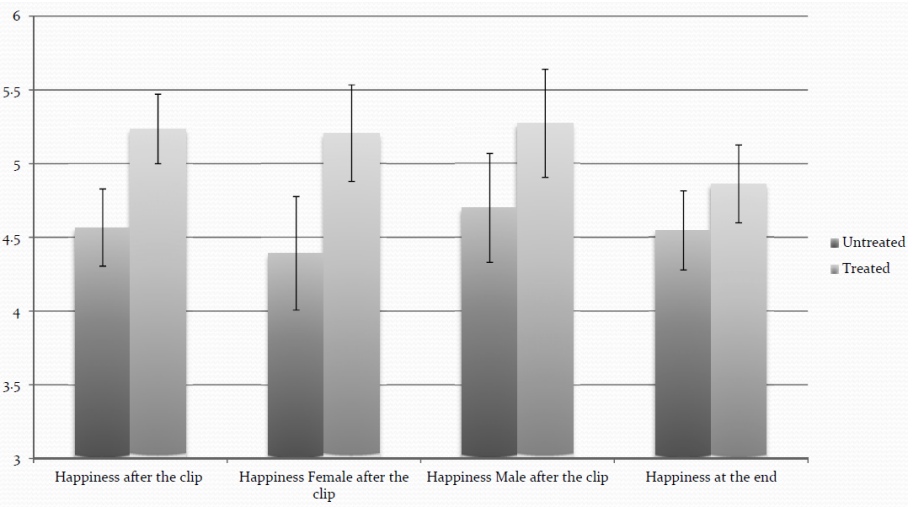
6
5·5
5
4·5
4
3·5
3
Happiness after the clip
Happiness Female after the clip
Happiness Male after the clip
Happiness at the end
Untreated
Treated

Figure: MIP

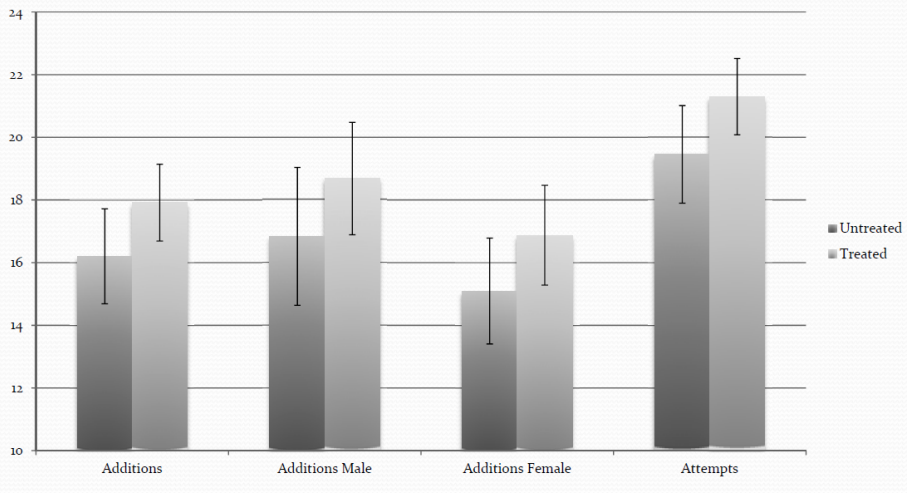

Figure: Productivity

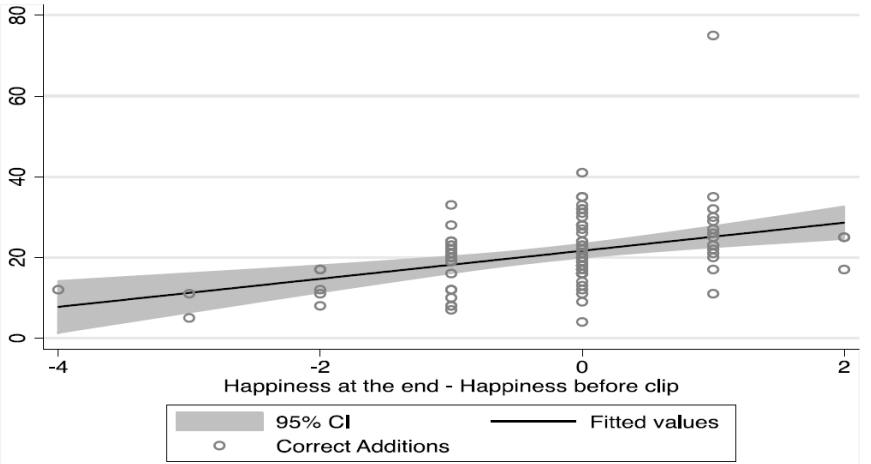
0
20
40
60
80
-4
-2
0
2
Happiness at the end - Happiness before clip
95% CI
Fitted values
Correct Additions

Figure: Corr

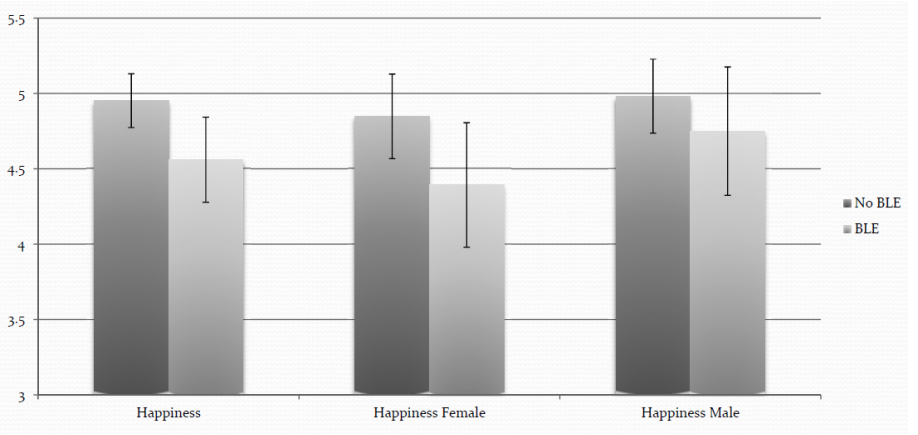
5·5
5
4·5
4
3·5
3
Happiness
Happiness Female
Happiness Male
No BLE
BLE

Figure: BLE

Happiness, Cooperation and Language, Journal of Economic Behavior & Organization 168: 209-228, 2019 by Eugenio Proto, Daniel Sgroi and Mahnaz Nazneen.

Mood and Cooperation

- Proto, Sgroi and Nazneen (2019) look at whether happier people are more or less cooperative.
- They use the repeated prisoner's dilemma: typically experiments show that there is a fair bit of cooperation (despite the one-shot dominance of the "defect" action).
- Cooperation falls when individuals are exposed to a happiness boosting MIP (in this case a Velten plus music MIP) as compared to the neutral (Velten plus music) MIP.
- This holds regardless of uncertainty about the number of repetitions or whether there is pre-play communication.
- Using pre-play communication (text entry) they also analyse the text to find evidence that happier individuals are more inward-oriented words (greater use of "I") and in general use more negative and less positive language.

Time and Risk

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- Static Decision Making Under Risk

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  1. Exponential discounting model
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  3. Demand for commitment devices

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   - Constant discounting: Loewenstein & Prelec (1992), Laibson (1997) Loewenstein (1987)
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2. **Interaction of time and risk***
   - Theory: Andreoni & Sprenger (2012a) Andreoni & Sprenger (2012b) Andreoni & Sprenger (2015), Benzion et al. (1989), Halevy (2008), Chakraborty, Halevy et al. (2016), Pan, Webb & Zank (2019), Chakraborty, Halevy & Saito (2020)
   - Empirics: Keren & Roelofsma (1995), Abdellaoui, Diecidue & Öncüler (2011), Abdellaoui, Kemel, Panin & Vieider (2018), Baucells & Heukamp (2012)

   *: with an exception for Halevy (2008) and Keren & Roelofsma (1995)

Time and Risk Trade-off

- Consider the decision-maker prefers a smaller outcome now to a larger outcome later.
- With an equal delay in both options, the decision-maker prefers the larger-later outcome to the smaller-sooner outcome.
- This is known as present bias and hyperbolic discounting explain this behaviour.
- However, Weber & Chapman (2005)*, Keren & Roelofsma (1995) and Baucells & Heukamp (2012) experimentally show that:

  when the present (smaller) outcome is risky, the decision-maker prefers the larger-later outcome with and without time-delay.

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Motivating Example

Hyperbolic Discounting can explain time delay

A) £100, for sure, now v.s. £110, for sure, 4 weeks

82% v.s. 18%

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Time and Risk Trade-off

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Readings: Keren & Roelofsma (1995)

- Their findings show that present bias becomes weaker when the certainty of obtaining the outcome in the present is reduced.
- This preference reversal is a result of the decision-maker's perception of the probability rather than time inconsistency.
- Theories of intertemporal choice, such as quasi-hyperbolic discounting, cannot account for this experimental evidence.

Time and Risk Trade-off

Readings: Halevy (2008)

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- This approach takes the future as a random process that stops delivering future outcomes with a positive probability.
- With this interpretation, the delayed outcome is risky since there might be events between today and the future, which prevents obtaining future outcomes.
- This explains how intertemporal choices may be perceived as being risky choices.

Time and Risk

- Halevy's (2008) framework explains this experimental evidence through the decision-maker's perception of the probability.
- This line of literature establishes an equivalence between the decision-maker being disproportionately sensitive to certainty, as in Allais (1953) and Kahneman & Tversky (1979) and exhibiting present bias.
- The difference between the present and the future is attributed to the possibility of reaching the future.

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- Denote the termination probability by $1 - p$, hence the continuation probability is p.
- A decision-maker utility of outcomes is evaluated by:

$$DEU_H(\mathbf{x}) = \sum_{t=0}^{\infty} w_H(p^t)\, \delta^t\, u(x_t) \tag{2}$$

- δ is the constant pure time preference,
- w_H is an increasing and convex function from the unit interval to itself, satisfying $w_H(0) = 0$, $w_H(1) = 1$,
- $u(x_t)$ is the decision-maker's utility function.

Time and Risk

- w_H represents a pessimistic attitude toward obtaining future outcomes (Wakker 1994)*
- Since all outcomes are deterministic, the risk that future outcomes will stop is amplified through the possibility of reaching the next period or obtaining the outcome at t.
- Hence, the decision-maker assigns smaller weights to future outcomes relative to the present outcome.
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- Hence, the decision-maker assigns smaller weights to future outcomes relative to the present outcome.
- The weights attached to the future outcomes fall rapidly.
- Formally, discounting future outcomes has two components:
  1. the decision-maker's time discounting
  2. perception of the probability

$$D(t) = w_H(p^t)\,\delta^t \tag{3}$$

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