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Behavioral Insights with Professor Elena Reutskaja

The Rode to Performance:
Priming Effects of Language on Decision-Making Performance

1. Introduction

Was that based on sound reasoning or was it a gut reaction? Without a predicate to associate with *that*, our interpretation and answer to the question has no meaning. Once clarified (e.g. *that* = a decision), the answer follows directly from the association between the stimuli *that* and the clarifying explanation. Even with this simple example, we see the power of priming: the presentation of a stimulus designed to subconsciously implant a concept in working memory that alters subsequent behavior (Bargh & Ferguson, 2000). Research has shown that when individuals are presented stimuli related to creativity or achievement, they subsequently come up with more creative ideas or perform better (Bargh, Lee-Chai, Barndollar, Gollwitzer, & Trötschel, 2001; Dennis, Minas, & Bhagwatwar, 2012). Priming therefore has potentially great impact on our behavior within the limits of our environment.

In this paper, I assume the individuals are boundedly rational, searching for satisfactory alternatives within the limits of their aspiration level and environment (March & Simon, 1958). Behavioral economists have built off this premise, using empirical data to describe how people actually make decisions and experiments to determine the degree to which behavior deviates from the perfectly rational ideal premised in classical economics (A. Tversky & Kahneman, 1974; Amos Tversky & Kahneman, 1986). One of the most impactful contributions to come out of this work is dual process theory (Kahneman, 2003) which posits that decision-making depends on two systems. System one is quick and efficient but can bias decision-making. In contrast, system two is calculative and analytical but can delay and fall short. Both systems thus can be a vice or a virtue. Recognizing that scientific endeavors are themselves anchored to their premises and likely find theoretical support where attention is given (Miller, 2001; O'Mahony & Ferraro, 2005), theories of decision-making themselves likely effect the manifest decision-making they attempt to assess objectively. Do we see a similar biased effect on tried and tested objective decision-making tasks depending simply on how decision making itself is framed in the wording of the instructions, i.e. as a virtue or a vice?

To begin to address this question, I conduct four online experiments with Amazon Mechanical Turk participants using four treatment conditions. Participants were asked to complete ten logical reasoning questions from a basic IQ test following one of four primes corresponding to systems 1 and 2 as either a virtue or vice[1]: conscious deliberation improves decision-making performance (*system 2 virtue*), thinking too much reduces decision-making performance (*system 2 vice*), heuristics can improve decision-making performance (*system 1 virtue*), and biases can reduce decision-making performance (*system 1 vice*). For each condition, the null hypothesis is the prime will have no effect and speed of completion and accuracy will be roughly normally distributed. We hypothesize however that the primes will produce behavior

[1] See 6. Appendix for full instruction prompts

consistent with how the theories that find evidence for each condition would predict. We find support for the latter on accuracy but not speed. Framing instructions as a virtue or vice has a statistically significant effect on improving and reducing performance, respectively. Section 2 frames the premise behind this effect in the decision-making literature. The final section presents the experiment, results, and comments.

2. Background

Theories of decision-making differ with respect to their axioms regarding the rationality of the decision-maker. Microeconomics considers the decision-maker to be fully rational both in terms of their knowledge of alternatives and their ability to reliably select the best alternative, the one that maximizes their utility. This model affords general explanations of behavior when aggregated to the macro level but disregards uncertainty and assumes value is completely contained in the pricing mechanism. Alternative theories of judgement and decision-making which incorporate an element of uncertainty (i.e. acknowledging alternatives are not all known, and that satisfaction depends in-part on subjective aspiration levels) are more congruent with reality (March & Simon, 1958). And theories more congruent with reality are more likely to be discussed and thus replicated in the marketplace for ideas. It is therefore wise to consider how the stories we propagate regarding the limits of our abilities will manifestly limit our abilities.

Prospect theory was developed to detail how behavior deviates from the fully rational model (Kahneman & Tversky, 2007). Prospect theory amends the axioms of decision-making by incorporating two elements of uncertainty: (a) the contingency of environmental and how the problem is framed (Amos Tversky & Kahneman, 1986), and (b) utility as changes from a time-variant base rate. A key tenet to come out of this work is dual-process theory (Kahneman, 2003, 2011) which posits that we have two cognitive systems: system 1 corresponds to intuitive often unconscious judgement while system 2 corresponds to conscious and deliberative judgement that may override system 1. Since impressions produced by system 1 determine preferences unless modified, research on dual-processing theory has sought to uncover what operations determine how and when system 2 can correct system 1. System 1 may provide fast and frugal heuristics (Gigerenzer, 1991) but can lead to suboptimal biases depending on the complexity of the decision environment (Hogarth, 2002). Consequently, system 1 can be either a vice or a virtue. Systems 2 on the other hand is employed for non-intuitive tasks that require deliberation and logical reasoning. Reasoning however may not always be a virtue according to some research, even in non-intuitive tasks. Wilson and Schooler (Wilson & Schooler, 1991) found that students who deliberated over product quality or class selection made poorer choices than domain experts. Priming participants to think about their choice led them to consider suboptimal reasons. If primed judgements suppressed by system 2 can have detectable effects in subsequent responses (Kahneman 2003, p. 717), ***how does framing the two systems as normatively* enabling *or hindering prime decision-making performance?***

Priming is the activation of internal mental representations in an attempt to influence subsequent behavior (Bargh et al. 2000). In an early study demonstrating the effect, individuals presented with everyday objects were less likely to come up with novel uses for the objects because of preconceived notions of what the objects were meant to be used for (Mcculloch, 1945). Semantic priming is the idea that words can activate semantic networks, creating associations between words and beliefs about concepts (Martin & Chao, 2001). This effect has been demonstrated to improve individual performance in online tasks by presenting users with words associated with achievement and creativity (Dennis et al. 2013; Bargh et al. 2001). Subjects primed with words such as ability and out-of-the-box-thinking are more likely to identify themselves or the

task with those concepts, improving their ability and out-of-the-box-thinking. This mechanism undergirds the contested Pygmalion effect: Liberman, Samuels, and Jacobson found that if teachers were led to expect enhanced performance from children, the children performed better (2004). In another example, labeling a Prisoner's Dilemma experiment as either Wall Street Game or Community Game elicited responses congruent with the participants' expectations of norms to defect or cooperate (ibid). Achieving internal validity in experimental studies implies that effects are not confounded by unidentified endogenous influences, including the language of theoretical assumptions.

That a word or idea can influence subsequent behavior corresponds with the anchoring effect in dual process theory. Individuals are much less likely to alter their behavior in a discrete choice in opposition to the norm (Kahneman, Knetsch, & Thaler, 2018; Samuelson & Zeckhauser, 1988). Anchoring is the tendency of individuals to adjust their answers around an implicit reference point related to an explicit linguistic cue (A. Tversky & Kahneman, 1974). Though the observation that theoretical norms can become self-fulfilling (Ferraro, Pfeffer, & Sutton, 2005; Miller, 2001) has received empirical validation (Marwell & Ames, 1981; Miller & Ratner, 1998), the norms examined have focused on classical economics. This work extends this mechanism to dual-process theory, a body of work where the assumptions effecting potential primes are more ambivalent but no less salient. By priming subjects' self-conception to a combination of fast/slow and useful/harmful, we find that performance conforms to the expectation of useful/harmful cognition.

Hypotheses:

- *System 2 virtue*: Critical reasoning skills help us make better decisions. When this ability is associated with the subject, it has the potential to positively reinforce the behavior it purports. The *System 2 virtue* prime is thus self-reinforced if (Hypothesis 1a) speed is lower and (Hypothesis 1b) accuracy is higher in the treated group.
- *System 2 vice*: Thinking too much can lead to suboptimal decisions (Wilson et al. 1991). This observation primes deliberation as a vice by suggesting that less thinking would be better. The *System 2 vice* prime is thus self-reinforced if (Hypothesis 2a) speed is higher and (Hypothesis 2b) accuracy is lower in the treated group.
- *System 1 virtue*: Gigerenzer conceptualizes the mind as boundedly rational, adapting to the world through a toolbox filled with fast and frugal heuristics" (1999). This model emphasizes "rationality through simplicity and accuracy through frugality" (ibid). The *System 1 virtue* prime is self-reinforcing then if (Hypothesis 3a) speed is higher and (Hypothesis 3b) accuracy is higher in the treated group.
- *System 1 vice*: Heuristics are highly economic and usually effective but can lead to systematic errors (Tversky et al. 1974). When errors, biases, and illusions are presented as a feature of human decision-making supported by evidence, participants may perform sub-optimally because they make a semantic connection between their own ability and the possibility for error (as in Wilson et al. 1991). The System 1 vice prime is self-reinforcing then if (Hypothesis 4a) speed is lower and (Hypothesis 4b) accuracy is lower in the treated group

3. Experiment and Results

The aim of this experiment was to test the priming effect of language associated with decision-making as either fast or slow (system 1 or 2) and useful or harmful (good or bad).

Sixty subjects on Amazon Mechanical Turk were spread randomly across four treatment groups. Subjects were provided ten questions including an attention check from a standard logical reasoning section of an IQ test. Subjects were paid $0.20 per correct answer to ensure subjects were amply motivated to perform well. An IQ test was used because it provides an objective indicator of observable performance with an expected normal distribution. Depending on the treatment, participants were primed with a paragraph prompt that included a description which served as a the prime followed by the instructions.

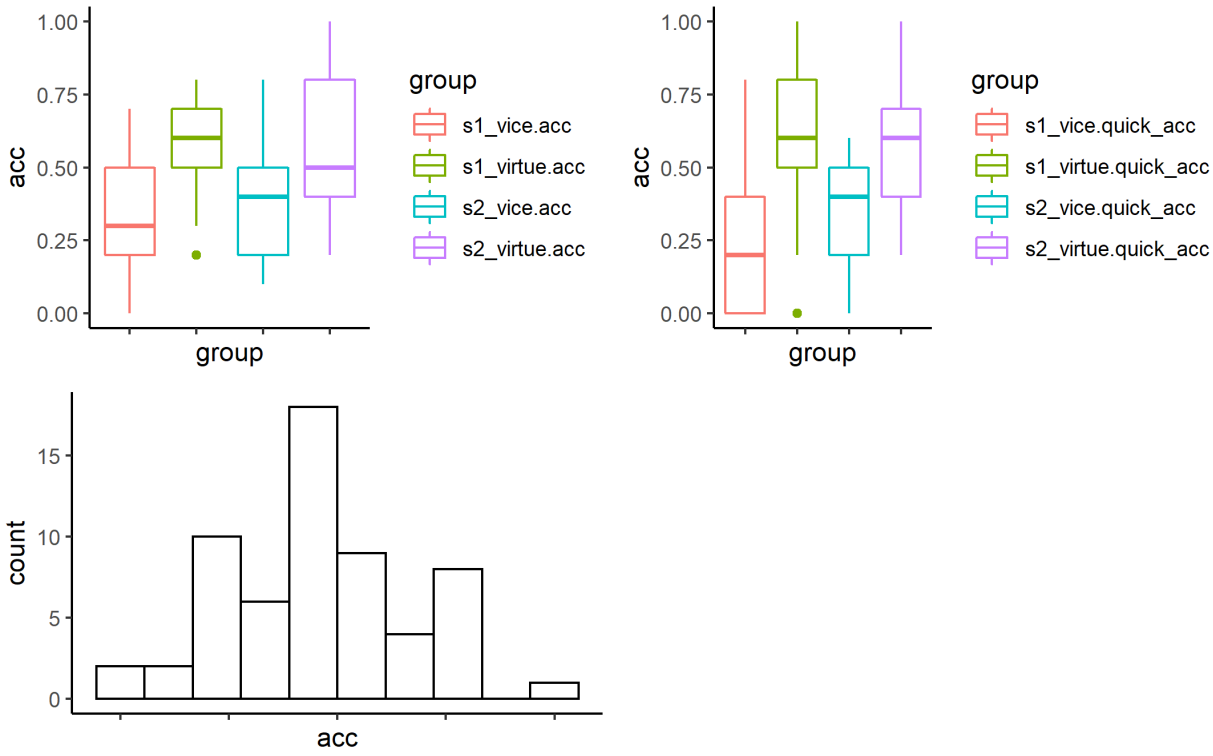

Table 1. Means and distribution of decision-making task accuracy. Kruskal-Wallace t.test between by vice/virtue frame and with all four are significant at the alpha = 0.001 level.

Consistent with the null expectation, performance as a whole was relatively normally distributed. ***Consistent with the predictions however, accuracy was 59% higher when decision-making was primed as a virtue.*** No effect was observed with regard to which system was presented; it did not matter if decision making was described as fast or slow, only if described as a virtue or vice. The effect raises to 97% when just considering the multiple-choice questions, suggesting virtuous primes may increase intuitive accuracy by placing a subconscious cue for trusting intuitions. Again, no effect was observed with regard to which system was presented. No effect was observed with regard to decision-making speed either; participants as a whole took 55 seconds on average to answer a question and 10 minutes to complete the experiment. Support is therefore found for the hypotheses 1-4b but not 1-4a.

To the degree that theories become taken for granted, their assumptions and language can propagate and shape reality (Ferraro et al. 2005). I attempt to illustrate this mechanism with an online experiment. Though dual-process theory integrates two perspective of cognition and therefore necessarily assumes ambivalence with regard to potential for performance, which system receives the most emphasis and what is emphasized implicates its development and our understanding of human decision-making.

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6. Appendix

Four treatment instructions:

1. System 1 vice

   Research has shown that unconscious biases often cause people to make poor decisions. Though people can be biased in their decision-making, scientists remain interested in determining how people perform in reasoning tasks. You have 20 minutes to complete 10 reasoning questions. Payment will be made for each correct answer. There will be one attention check question. Payment will only be made to individuals who pass the attention check.
2. System 2 vice

   Research has shown that introspection can cause people to make worse decisions compared to those that don't think. Though people can think too much, scientists remain interested in determining how people perform in reasoning tasks. You have 20 minutes to complete 10 reasoning questions. Payment will be made for each correct answer. There will be one attention check question. Payment will only be made to individuals who pass the attention check.
3. System 1 virtue

   Research has shown that people can solve complex problems using simple rules of thumb or cognitive heuristics. Though people are often unaware of their heuristics, scientists remain interested in determining how they affect performance in reasoning tasks. You have 20 minutes to complete 10 reasoning questions. Payment will be made for each correct answer. There will be one attention check question. Payment will only be made to individuals who pass the attention check.
4. System 2 virtue

   Research has shown that people can improve their decision-making by attending to problems with deliberate and conscious effort. Consequently, scientists remain interested in determining how conscious reasoning helps people perform in certain reasoning tasks. You have 20 minutes to complete 10 reasoning questions. Payment will be made for each correct answer. There will be one attention check question. Payment will only be made to individuals who pass the attention check.

Questions[2]:

1. 2 #33
   a. Type: Fill in the blank
   b. Q: You have 59 cubic blocks. What is the minimum number that needs to be taken away in order to construct a solid cube with none left over?
   c. A: 32: the next cube number below 64 (4 × 4 × 4) is 27 (3 × 3 × 3). In order to construct a solid cube, therefore, with none left over, 59 – 27 = 32 blocks need to be taken away
2. 3 #4
   a. Type: Fill in the blank

[2] Sources: for Q1-Q5 http://elibrary.bsu.az/books_aysel/N_179.pdf ; for Q5-Q10: http://elibrary.bsu.az/books_rax/N_357.pdf

    b. Q: Which is the odd number out? 462 683 385 198 253 781 594
    c. A: 683: in the other numbers add the first and last digits to arrive at the middle digit
3. 3 #9
    a. Type: Fill in the blank
    b. Q: 1, 50, 6, 45, 11, 40, 16, 35, 21, ?, ? Which numbers should replace the question marks?
    c. A: 30, 26: there are two alternate sequences. Add 5 starting at 1. Subtract 5 starting at 50;
4. 3 #21
    a. Type: Fill in the blank
    b. Q: MTD is to PXB as FRJ is to?
    c. A: IVH: the first letter moves three places in the alphabet forwards: FghI; the second letter moves four letters in the alphabet forwards: RstuV; the third letter moves two places in the alphabet backwards: JiH
5. 4 #18
    a. Type: Fill in the Blank
    b. Q: Jack is twice as old as Jill, but in five years time he will only be one and a half times as old. How old are Jack and Jill now?
    c. 10 5
6.
    a. Type: Multiple choice
    b. Q: If Eriselda gives Aleandro $6.00 the money they each have is in the ratio 2 : 1; however, if Aleandro gives Eriselda »1.00 the ratio is 1 : 3. How much money have Eriselda and Aleandro each before they exchange money?
        i. E 62, A 22
        ii. E 64 A 18
        iii. E 66 A 22
        iv. E 46 A 24
        v. E 46 A 22
    c. A: Eriselda $62 (62-6=56; 62+1=63), Aleandro $22 (22+6=28; 22-1=21)
7.
    a. Type: Multiple choice
    b. Q: Boris and Ben share bus passes in the ratio of 3 : 5. If Boris has 180 bus passes, how many does Ben have?
        i. 260
        ii. 300
        iii. 240
        iv. 340
        v. 320
    c. A: 300 ((180/3)*5)
8.
    a. Type: Multiple choice
    b. Q: Tom, Dick and Harry wish to distribute a certain sum of money between them. Tom gets two-fifths, Dick gets 45% and Harry gets 21.00. How much is the original sum of money?
        i. 165

ii. 155
iii. 140
iv. 125
v. 122

c. A: $140 (2/5 = 0.4; 0.4 + 0.45 = 0.85 → 21 = 0.15 AND (21/15) * 100=140)

9.

a. Type: Multiple choice
b. How long are the sides of a rectangle which has a perimeter of 70 units and an area of 276 square units?
    i. 20 and 15
    ii. 25 and 10
    iii. 24 and 11
    iv. 23 and 12
    v. 19 and 9
c. A: 23 and 12 (23*12=276 ; (23+12)*2 = 70)

10.

a. Type: Multple choice
b. Q: The hospital received its highest number of enquiries between 3 p.m. and 4 p.m., which was 40% more than the 250 enquiries it received between 2 p.m. and 3 p.m. How many calls did the hospital receive between 3 p.m. and 4 p.m.?
    i. 495
    ii. 315
    iii. 350
    iv. 410
    v. 290
c. A: 350 (250*0.4)