

A Synthesis of Behavioral and Mainstream Economics

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CUNY Economics Seminar

8 September 2020

Appeared in

NATURE HUMAN BEHAVIOR

Volume 3 (July 2019) pp. 666-670

<http://www.ma.huji.ac.il/raumann/documents/NatureHumanBehavior.pdf>

Q: Why do Economic Theory?

A: To understand how the economic world works.

Q: But Economic Theory assumes **rationality**—that people act to promote their goals. Behavioral Economics has shown that they do not; they act by rules of thumb (**heuristics** and **biases**), often with poor results.

Hegel: Thesis—Antithesis—Synthesis

- Thesis: Economic Theory (ET): Rationality—
people act to promote their goals.
- Antithesis: Behavioral Economics (BE): Irrationality—
people act by rules of thumb, often with poor results.
- Synthesis: Rule Rationality—
people act by rules of thumb that usually, but not always,
promote their goals.
- Conclusion: ET is relevant after all.

We don't claim priority for the observation that the rules **usually** promote people's goals

“**In general**, these heuristics are quite useful, but **sometimes** they lead to severe and systematic errors.”

Tversky, A. & Kahneman, D., Judgment under uncertainty: Heuristics and biases. *Science* **185**, 1124-1131 (1974).

“... these heuristics are **often** useful, but they **sometimes** lead to characteristic errors or biases.”

Kahneman, D. & Tversky, A. On the reality of cognitive illusions. *Psychol. Rev.* **103**, 582-591 (1996).

So what **IS** new today?

- Behavioral Economics dwells exclusively on the “**sometimes**”—the “severe and systematic errors,” where the heuristics do not work. IOHO, the insight that BE yields into the “**in general**”—where the heuristics do work—is much more important.
- **And**

We **do** claim priority on **this** observation:

- Q: **When** do the rules lead to “severe and systematic errors”?
- A: In **exceptional** or **contrived** situations.
- Q: Why?
- A: Because the rules, which were not consciously adopted, did not spring from nowhere; they **evolved**, biologically or culturally (i.e., were learned). **Evolution does not work on the exceptional or contrived situation.** Evolution works by survival of the fittest: a rule survives—i.e., is adopted—if and only if it works well, when applied repeatedly. An occasional instance where it does not work has no effect. And of course, a contrived situation certainly has no effect, since it **never** occurs in practice.

Examples

1. Overeating
2. Ultimatum Game
3. 100% vs. 99%
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9. Anchoring
10. Selten's umbrella
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13. Focusing
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15. Sunk costs
16. The cashmere sweater
17. Hyperbolic Discounting
18. Linda

1. Overeating

- **Behavior:** Obese people often overeat.
- **Rule:** *Eat when you're hungry; eat tasty food.*
- **Analysis:** Though we need food for energy, growth, and various vital bodily functions, that is not what makes us eat. We eat because we're hungry and/or enjoy food. Hunger and food enjoyment are **mechanisms** that evolved in order to motivate us to eat. But evolution has not yet had time to take account of the sedentary nature of much of modern life; evolutionarily, obesity is exceptional. So the rule is rational, in spite of its irrational consequences for the obese.

2. Ultimatum Game

- **Game:** Two players, the proposer (P) and responder (R), must divide \$100. If they agree how, each gets his agreed share. If not, both get nothing. They sit at computers in separate rooms and can't communicate directly. P starts by making a numerical offer to R, without words. R responds by clicking "yes" or "no"; no other response is possible. The game is then over; the players get their payoffs (if any) and leave by separate doors. They never see each other nor learn each other's identity. The subjects are students, not particularly long on money.
- **Behavior:** Most P's offer around 35. Smaller offers—say 20—are rejected.
- **Rule:** *Don't let people kick you in the stomach: Reject lop-sided offers.*
- **Analysis:** The **mechanism** for executing the rule (like hunger for eating) are feelings of wounded pride, insult, desire for revenge, honor. The rule and its mechanism evolved in natural scenarios, where the negotiators know each other. If in such scenarios you accept lop-sided offers, you'll get a reputation for doing so, and in the future will get **only** such offers; so rejecting is highly rational. In the contrived, artificial ultimatum game, reputational effects don't apply, as the players are totally anonymous; but the rule and its mechanism evolved in natural situations, where they do apply. The rule is rational, in spite of its irrationality in the contrived ultimatum game.

3. 100% vs. 99%

- **Behavior:** \$100,000 with certainty might be preferred to a gamble yielding \$150,000 with probability 0.99 and nothing otherwise.
- **Rule:** *Uncertain is uncertain.*
- **Analysis:** Probability assessments in everyday life are rarely objective (i.e., governed by coin tosses, roulette wheels, or the like). When you invite people to an intimate dinner with a handful of carefully chosen guests, and they say 99% they'll come, that means that they want to be counted in but themselves reserve the right to opt out. When a contractor tells you that 99% your house will be ready in eight months, you'd better figure at least a year. There is a qualitative difference in everyday parlance between certainty and probability 0.99.

4. Risk Aversion

Behavior: Rabin and Thaler (JEP 2001) consider a risk-averter who rejects a half-half lottery between losing \$10 and winning \$11 at any asset level. They show that according to NM utility theory, such a risk-averter also rejects a half-half lottery between losing \$100 and winning ten billion dollars. So they reject NM utility theory.

Rule: *Avoid undue risk.*

Analysis: Practically, risk aversion refers to considerable risks. A half-half lottery between losing \$10 and winning \$11 is contrived, does not occur naturally; so evolution does not apply to it. The rule “avoid undue risk” evolved in the natural setting, where the risks are considerable. It **may** be **mistakenly** applied in the contrived Rabin-Thaler example, to which evolution does not apply.

5. Endowment Effect

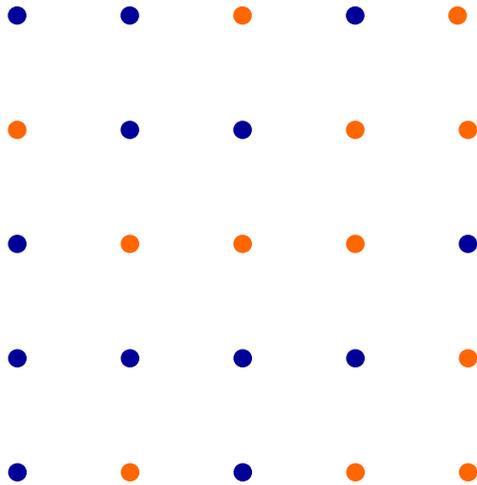
Behavior: In an experiment, subjects first given a Swiss chocolate bar were generally unwilling to trade it for a coffee mug, whereas subjects first given a coffee mug were generally unwilling to trade it for a chocolate bar. (Kahneman, Knetsch, and Thaler, 1991)

Rule: *Prefer your own, unless you have good reason not to.*

Analysis: Already the 2000-year old Talmud notes that

“A person prefers one measure of his own to nine of another’s.” Presumably the reason is familiarity. Would you trade your 2018 Subaru for someone else’s? It isn’t that people figured this out rationally, but that it has worked well for millenia under natural circumstances. So it has been internalized, and is automatically applied to trivial, contrived situations like coffee mugs and chocolate bars, where it doesn’t apply.

6. Bees, artificial flowers, and nectar



Set-up: First only the yellow flowers get nectar, then only the blue flowers.

Behavior: In the first period, the bees learn to visit only yellow flowers. In the second, they continue to visit only yellow flowers, until they starve to death.
(Andreas Bertch, circa 1985, unpublished)

Rule: *Go by what you have learned, go by experience.*

Analysis: If you were dying of thirst in the desert, would you try to extract water from a stone? To the bees, blue flowers are like stones. This is a caricature of BE demonstrations of irrational behavior—utterly contrived, utterly unnatural, completely ignoring the workings of evolution.

Conclusions

1. Economic Theory (ET) is valid after all. On the whole, people **do behave rationally**. It is not true that “people do not behave as economists think.”
2. Behavioral Economics (BE) is also valid, indeed **very important**. People do not consciously optimize; they **follow rules of thumb** (aka heuristics and biases). So it’s important to know what the rules are. A restaurant serving wholesome but tasteless food will quickly go out of business.
3. In short, far from contradicting each other, ET and BE complement each other beautifully. **BE is what makes ET work.**

Thank You!

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7. Probability Matching

Set-up: A subject is seated in front of a device that emits, once in ten seconds, either a red or a green light at random. The probability of red is $1/4$, that of green $3/4$. Each time, the subject must predict the color of the light. Success is rewarded. (Siegel and Goldstein 1959)

Behavior: Overwhelmingly, subjects predict red $1/4$ of the time, green $3/4$ of the time. That is not optimal, as the probability of success is then only $5/8$, whereas always predicting green has a success probability of $1/4$.

Rule: “*Social Desirability*”: *Do what’s expected, what looks good.*

Analysis: People are not used to sitting in front of devices that emit colored lights at random; they have not developed rules to deal with such situations. So they use the social desirability rule, which applies specifically to surveys. In our case, subjects want to show their skill at “guessing right;” always predicting the same would make them look obtuse, dull, obsessive.

Incidentally: In practice, people do not probability-match. Most of us have a choice of routes in getting to work; sometimes one route is faster, sometimes another. But people take the same route every day, which is precisely the optimal strategy.

8. The Bombing Mission

Set-up: During WW II, a squadron of American bombers based on the island of Saipan was assigned the mission of flying twenty-five bombing sorties to Tokyo, 2000 miles away. Because of the great distance, most of the weight that the bombers could carry was needed for fuel; very little could be used for bombs. The mission was very dangerous; in similar previous missions, only a quarter of the airmen survived.

As the mission was about to begin, an OR officer arrived from Washington with a brilliant proposal: half the airmen—to be chosen by lot—would fly just one sortie, but it would be one-way. Thus much more weight could be devoted to bombs, and in that single one-way sortie, as many bombs could be delivered as in twenty-five round-trip sorties. And, each airman's survival probability would increase from $1/4$ to $1/2$.

Behavior: The airmen unanimously refused the offer. When individually asked why, each replied that he is a better pilot than average, that he will not be shot down.

Rule: *In the Army, look ahead just one day; tomorrow will take care of itself.*

Analysis: Especially in a war, changes are so rapid and unexpected that it makes no sense for soldiers to make long-term plans. The airmen were following this rule subconsciously.

Irrelevant Postscript: The story has a beautiful, surprising denouement. After 3 sorties, the island of Iwo Jima—600 miles from Tokyo—fell to the Americans, and the Saipan mission was cancelled. So the airmen had been right: the unconsciously adopted rule worked! That, of course, does not change the irrationality of the decision, since a priori, the cancellation was unlikely. (Related by Kenneth Arrow, who attributed the story to Merrill Flood)

9. Anchoring

Behavior: A pregnant elephant carved in stone is offered to a western tourist in India who has no idea of the market price. The vendor asks for 2,000 rupees; the tourist, who knows he must bargain, offers 300. Thereupon the vendor bargains him up to 600, and the deal is closed at that price; the sale price is largely determined by the asking price. The next customer, an Indian, buys a similar elephant from the same vendor for 50 rupees.

Rule: *Use whatever information is available, even if it is skimpy.*

Analysis: This is related to the Relevance maxim, discussed above. Actually, the asking price does contain some information. The vendor must take into account not only his estimate of what the customer is willing to pay, but also the least that he himself is willing to accept. In any case, the effect is only moderately important. If you are buying a house or a car in your hometown, rather than a pregnant elephant in a far-off country, you know the market, and the vendor knows that you know. Though anchoring may still kick in, it is a second-order effect.

10. Selten's Umbrella

Behavior: The late Professor Reinhard Selten took an umbrella everywhere, even to Israel's Negev desert in midsummer, when it **never** rains.

Rule: *Go by experience.*

Analysis: Selten lived in Germany, where it may **always** rain, even if the sky is completely blue when you go out. He internalized this experience, and went by it; could not be bothered to adjust his habits to the particular place in which he found himself. This is admittedly an extreme instance of rule rationality, in which the DM is himself aware that he is adhering to the rule, rather than fitting his behavior to the particular situation at hand.

11. NYC Taxi Drivers

Behavior: NYC Taxi drivers set themselves a goal of how much money to earn every day. When they have reached the goal, they go home. In good weather, it takes time to reach the goal, so they work comparatively long days. When it rains, there is a lot of demand, they reach the goal quickly, and are able to enjoy a good rest at home. This is clearly irrational. (Camerer, Babcock, Loewenstein, and Thaler, QJE 1997)

Rule: When Maya Bar Hillel told me about this about a year ago, I was really puzzled. It was the first time I'd seen a convincing example of truly irrational economic behavior in the real world: not exceptional, not contrived, long-lasting, systematic. I frankly did not know what to make of it, and started to doubt my thesis.

More behavior: It ain't so; doesn't replicate. (Farber, QJE 2015)

Rule: *Maximize utility.*

My hat is off: to Maya, who graciously informed me of Farber's paper.

12. Not buying subsidized flood insurance

Set-up: The Mississippi valley is frequently flooded. Large tracts of land are inundated, crops destroyed, cattle drowned, houses, barns, etc., destroyed. The federal government offers highly subsidized flood insurance—really an excellent deal.

Behavior: Very few farmers buy the insurance.

(Private communication from Kenneth Arrow, who was really puzzled.)

Rule: *Depend on Uncle Sam.*

Analysis: Often, when a flood occurs, the area is declared a Federal Disaster Area. The few farmers who bought the insurance are compensated. So are the many who didn't.

13. Focusing:

placing "too" much importance on one aspect of an event

Behavior: Respondents in a survey were asked to rank the following outcomes from most to least likely (assuming that Björn Borg reaches the 1981 Wimbledon finals):

1. Borg will win the match.
2. Borg will lose the first set.
3. Borg will lose the first set but win the match.
4. Borg will win the first set but lose the match.

Most (72%) of the respondents rated 3 more likely than 2, which is nonsensical .

Rule: Respondents focus on Borg's outstanding reputation. If they're told only that he loses the first set, he sounds like a loser; if they're told that he loses the first set but wins the match, he sounds like a winner, which seems more likely.

To be sure, placing "too" much importance on one aspect of an event is not a good idea; that's what "too" means. But how much is too much? That depends on the circumstances. When the incentives justify devoting time and effort to analyzing the situation, then focusing on one aspect is likely to be suboptimal. But in the Borg example that was not the case; it's safe to assume that the incentives did not justify spending much time to come up with a response. That means that it would be irrational to do so; using a shortcut that focuses on the salient feature---in this case Borg's ability---seems not only reasonable, but optimal.

14. Generosity (the Dictator Game)

Set-up: An experimental subject D is endowed with a non-trivial sum of money (perhaps \$20) and is told that he may either take it all for himself, or give part of it to some specific other person R, whom he does not know.

Behavior: Many subjects give away a considerable part, sometimes as much as 30%.

Rule: *Be generous.*

Analysis: In repeated interactions, cooperation is known to be rational. It may then take the overt form of generosity: I help you today, ostensibly without any quid pro quo, and you help me tomorrow, also ostensibly without any quid pro quo. This is rational because people expect others to be forthcoming, and if they are not, may well "punish" them. But even in one-time encounters, generosity may well be rational. Rather than keeping accounts of who helped whom when, it may be simpler just to be generous, as a rule. Many human interactions are at least potentially repeated or long-term; in such cases, acting generously as a rule will work vis-à-vis others who also are generous as a rule, and also vis-à-vis others who do "keep accounts."

So the observed behavior **is** rule-rational. But it definitely is **not** rational. Why should D grant anything at all to a totally anonymous R? If he wants to be generous, why doesn't he take the entire endowment, then grant a part to a needy relative, or a worthy cause, or whatever he deems appropriate?

This is a good example of our main thesis: That rules have evolved, and so do not work in contrived, artificial situations—of which the DG is a prime example.

15. Sunk Costs

Behavior: *Jeffrey and I somehow get two free tickets to a professional basketball game in Buffalo, normally an hour and a half drive from where we live in Rochester. The day of the game there is a big snowstorm. We decide not to go, but Jeffrey remarks that, had we bought the (expensive) tickets, we would have braved the blizzard and attempted to drive to the game.*

This is inconsistent with economic theory: Jeffrey is ignoring the economists' dictum to "ignore sunk costs," meaning money that has already been spent. (Richard Thaler, *Misbehaving*, 2015, p.20)

Rule: Buying expensive tickets shows that you really want to go. When you get them for free, you also want to go, but probably not with the same intensity of desire. Sunk costs constitute a heuristic that subconsciously enables you to gauge your own feelings.

16. The Cashmere Sweater

Behavior: *Lee's wife gives him an expensive cashmere sweater for Christmas. He had seen the sweater in the store and decided that it was too big of an indulgence to feel good about buying it. He is nevertheless delighted with the gift. Lee and his wife pool all their financial assets; neither has any separate source of money.*

This is inconsistent with ET. Lee feels better about spending family resources on an expensive sweater if his wife made the decision, though the sweater was no cheaper. (Richard Thaler, *Misbehaving*, 2015, pp.20-21)

Rule: *Appreciate your wife's love.*

Analysis: Many of us value our personal relationships very highly. Lee's wife gives him the sweater as a sign of love. Lee realizes this and appreciates it; it makes him feel good. That he really likes the sweater also for its own sake, and was even considering buying it, makes him feel all the better.

IOHO, it's really strange to consider this a challenge to ET—i.e., irrational. Rationality is about promoting your goals, but not only your financial goals.

Besides, this is a Christmas gift; surely Lee expects money to be spent for that. He's justifiably delighted that it was spent on something he really wanted. Even ignoring immaterial goals, how is that inconsistent with economic theory?

17. Hyperbolic Discounting

- **Behavior:** Offered a choice between \$10 on the spot and \$11 tomorrow, some experimental subjects choose \$10 on the spot; whereas the same subjects, offered a choice between \$10 in a year and \$11 in a year and a day, choose \$11 in a year and a day, which may be viewed as irrational.
- **Rule:** *A bird in the hand is worth two in the bush.*
- **Analysis:** If you give me \$10 now, I pocket it, and that's the end of the story. \$11 tomorrow? Maybe yes, maybe no; like the difference between certainty and uncertainty, there's a qualitative difference between now and later. Between 365 and 366 days, there is no such difference.

18. Linda

- **Linda** is young, single, outspoken, and very bright; as a student, she was deeply concerned with discrimination and social justice. Is it more likely that Linda is a bank teller or that she is a bank teller and an active feminist?
- **St. Ives**

As I was going to St. Ives,

I met a man with seven wives,

Every wife had seven sacks,

Every sack had seven cats,

Every cat had seven kits.

Kits, cats, sacks and wives,

How many were going to St. Ives?

$$1 + 1 + 7 + 7 \cdot 7 + 7 \cdot 7 \cdot 7 + 7 \cdot 7 \cdot 7 \cdot 7 = 2802$$

Right?

No, wrong; the correct answer is 1.

- Q: Why did Napoleon wear suspenders?
A: To hold up his pants.
- Q: So, what's the rule (heuristic, "bias")?
- A: The **Relevance** Maxim

Ecological Rationality (ER)

Closely related to the idea of Rule Rationality (RR) is that of ER (Smith 2003, Todd & Gigerenzer 2012): that behavior is shaped by cultural and biological evolution and so is optimal in the environment. RR and ER differ in several ways. Perhaps most important is that ER does not account for—or even acknowledge—the systematic irrational behavior reported by behavioral economists. Gigerenzer (Psych Rev 1996) goes so far as to say that the Linda respondents who say that "feminist bank teller" is more likely than "bank teller" are actually right. And while Smith does not say that ER is always optimal, he does intimate that the exceptions sit "in the tails of distributions", so presumably may be ignored.

Contrariwise, RR behavior is not always optimal. The exceptions are significant and systematic; they do not sit out there randomly in the tails of distributions. We know exactly where they occur: namely, where the scenario—the context of the behavior, the environment—is unusual or contrived. The reason is that evolutionary selection does not apply then. Like ER, RR rests squarely on evolution; but unlike ER, RR accounts for both rational and irrational behavior. The Linda respondents, though rule-rational, definitely don't behave rationally. In plain English, they're wrong: "feminist bank teller" is less likely than "bank teller." It's the rule (the relevance maxim) that is rational; the behavior is definitely not.

Questions (Dragos, Alex, Chris, Emanuel, Weichao)

1. Can behavioral economics be implemented to explain undesirable social outcomes such as high levels of poverty or unemployment, or incommensurate income and wealth concentration?
2. You have explained a good number of cognitive biases in the rule-rationality framework. Are there any biases highlighted by behaviorists that you are having trouble explaining in this framework? If so, do you believe further research is warranted in that area?
3. Related to the examples, how do we construct the models under the proposed framework of rule-rationality? How are those models different from the present framework, relaxing and/or tightening assumptions of rationality, for instance Risk aversion, hyperbolic utility, bounded rationality?
4. Can we model the rule-rationality with the usual method of economics? Choosing a rule that maximizes the most in usual cases?
5. In both the Linda example and the Borg example you cite, it appears that individuals are told to rank the outcomes based on how probable the individual thinks the event is. In neither case are the individuals making pairwise comparisons only (i.e., they are not being directly asked if A is more likely than B). How well do you think people would perform if the questions were instead asked to compare the events in a pairwise manner, and do you think some of the incorrect rankings are due to people being unable to see the relationship between the outcomes when provided many choices?

6. Has BE found evidence about that people act according to a rule of behavior that prescribes “treat others the same way you would like to be treated yourself”? If this rule could favor altruism, which incentives can be designed to make it part of the rule-rationality? Could this rule somehow drive player’s decisions in the ultimatum and dictator games? Following this line, do you find some relationships between the synthesis of rule-rationality and the common sense?
7. “Prospect theory” has been proposed by behaviorists as an alternative to the “expected utility theory” on which mainstream economics is built. While rule-rationality challenges some of the tenets of prospect theory, do you find standard utility theory is a proper foundation for mainstream economics?
8. If current framework can somehow model the reality and so can rule-rationality, is there a way to design an experiment to test whether people are act-rational or rule-rational?
9. How can we find the rule-rational behaviors? As you mentioned, experiments might be different with real world cooperation. Also surveys are too. Is neural science or inspection of human thought is needed? As in philosophy?
10. In the case of rule rationality, you state that individuals may perform very poorly in “unusual or contrived scenarios”. What does your approach have to say about how individuals behave when they are in these situations, the situation is becoming less unusual over time and the individual realizes the rule is performing poorly? In the long run, presumably the rule is updated, but in the short run, how would people behave?

11. Regarding the distinction between “why” and “how” humans behave, would it be beneficial to increase the understanding of these concepts by the general public in order to improve economic decisions and the living standard in our societies? In the same vein, do you think that it would be useful to promote the scientific understanding of human behavior (its causes and consequences) during the last years of mandatory schooling? Would you recommend some guidelines for this?
12. Tversky and Kahneman have linked a number of cognitive biases to subjects’ difficulties with Bayesian inference. Have you found any rules (in the rule-rationality framework) that involve statistical thinking?
13. Are you suggesting that, the **rule-rationality is developed by humans as a group (through social interactions, educations, social norms), and simply (most of the case) individual decision makers are not maximizing utility** but detecting some factors that will trigger the rules of behavior to adopt? Beyond this, what are the mechanisms you believe that those rules of behavior are chosen when individual making decisions? Is this mechanism to choose among the rules of behavior fundamentally utility maximization? Or this is more just **a mapping question that is directing to Psychology/Biology** instead of Economics?
14. In the conclusion, it is written that economic behavior is largely rational. But what if something unusual happens to the economy, such as Covid 19. Do we need to modify the economic models on these happenings?

15. In your example of certainty, you mention that when people say they are 99% certain they will attend an event or have a task completed by a certain time, that may not be an objective assessment. Additionally, you say that this may affect how people perceive objective probabilities. People may not take a gamble that has a very large payoff with a .99 probability because, in the past, when they were told that something was 99% likely, it was not often the case. Do you think perceptions of objective probabilities have changed over time, and if so, what do you see as the broader impacts of this? For example, with text messaging and other forms of non face to face interaction, it is easier to cancel plans as you do not have to tell a person verbally that you are no longer planning to attend. Therefore, more people may say that they are 99% likely to attend and then back out at the last minute, which may affect the organizers perception of what 99% likely means. Could this result in a downward trend in risk taking and affect things such as long run growth and innovation?

Questions (Kyungtae)

1. When we conduct the survey, does order of the multiple-choice matter? If so, would it be possible that how we construct the survey question affect the survey result?
2. According to the behavior economic aspect, people evolve biologically or culturally. Then why do the experimental results in Linda, St.Ives, Anchoring and Focusing show relatively similar results when people come from different backgrounds.
3. What was the sampling process of the experiment? Were people from different cultures and biological backgrounds selected equally or were they randomly pulled out?
4. In the conclusion you mentioned that BE underlies ME. Do you think that economists should pay more attention to behavior economics when introducing/expanding models? Could we say that we are going in that path?
5. In the part of Altruism: “In an interaction that is one-time for sure--such as tipping in a far-off restaurant that will not be visited again– one could do better by acting selfishly” ...Do you mean better in term of money?
6. Continuing with the situation mentioned above...What about the utility that generates such generous action? One person could feel better with herself when giving tips, so the utility of tipping is greater than the utility of keeping that money. Is this person acting in her best interest? Isn't the previous example act-rational?
7. The article clearly differentiates act-rational from act-irrational. Within these two realms of the human behaviors defined, would you say that the study of economics still has space for more definitions that can build upon (or in between) these two concepts?

8. The study of economics is commonly unlinked to linguistics, but frequently placed at the level of political discussions in the media and news outlets, that can be surrounded by verbatim. If the mainstream economics incorporated greater analysis of behavioral economics, and thus a better understanding of heuristics (for example, as the “conversational maxim”), could we expect to improve the quality and clarity of public debates?
9. Do you believe that in the following years, mainstream economics will continue allowing behavioral economics to play more significant role in the academic formation of future economists?
10. It is stated in the paper that “behavioural rules are the product of evolutionary processes”, is there enough evidence to support this claim? And what is the relationship between genetic evolution and memetic evolution?
11. Can the concept of “Rule-rationality” help explain human behavior in stock market? Should stock market be considered as “exceptional or contrived situations”?
12. Is it possible to provide accurate definitions to differentiate between “usual, naturally occurring situations” and “exceptional or contrived situations” besides illustrating by using examples?

13. In page 666, 'Specifically, they evolved because they prescribe optimal behavior in usual, commonly occurring situations; but in exceptional or contrived situations, they may lead to systematically inferior results, because then evolutionary pressures do not apply. Evolution is driven by survival of the fittest, and the fittest are determined by their behavior in commonly occurring situations (needless to say, situations contrived by an experimental scientist play no role at all in evolution).' According to these words, experiment data or questionnaire may be unreliable. Is it means economist can and only can collect data from standardize process, the experiment data or questionnaire date is not reliable? And data from experiment or questionnaire will lead to biased result?
14. In page 669, '(i) that indeed people do not consciously maximize utility, but act by rules—heuristics or biases—that have evolved, biologically or culturally;' If BE is a branch of ME, can we use strictly mathematical model to axiomatic BE? The foundation theory of economics and mathematical axiom provide a solid basis for BE?
15. In page 670, 'Far from contradicting it, BE actually underlies ME.' This paper mention that ME is why and BE is how. If people haven't evolved, biologically or culturally, they would all make the same decision and this decision is the only 'max their utility', the rational behavior?