Pre-Analysis Plan
Temperature and Economic Choices

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Abstract

This document describes the design and analysis plan for a pilot experiment at the Busara Center in Nairobi, summer 2016. The plan is to pilot a study on how temperature affects behavior and economic decision making.

1 Introduction

There is an extensive literature documenting a relationship between high temperature, conflict and poor economic performance, yet to date, little is known about the causal effect of temperature on individual decision-making (Burke et al., 2009; Hsiang et al., 2013). This question, important in and of itself, is made even more salient given the predicted rise in global temperature and variation in weather patterns. Related is a nascent literature addressing how environmental factors and neurobiology influence economic choices, which includes work on the psychology of poverty, hunger and stress (Mani et al., 2013; Bushman et al., 2014; Haushofer and Fehr, 2014). In this research project, we aim to study the causal effect of temperature on individual decision making as well as the mechanisms behind this effect. To this end, we plan to conduct a sequence of experiments and tests at the Busara Center in Nairobi, Kenya.

2 Research strategy

The experiments and tests will be designed to study the causal effect of temperature on standard economic choices as well as stress and cognitive performance. In particular, we will employ versions of standard laboratory experiments to test the effect of temperature variation on productivity, cognitive ability, pro-social behavior, trust, trustworthiness, cooperation, destruction, time preferences, and risk preferences.

We will also attempt to identify mechanisms by which temperature affects behavior. The literature on the psychology of poverty has found that stress and mental fatigue are key mechanisms for how poverty influences decision making (Mani et al., 2013; Haushofer and Fehr, 2014). We hypothesize that similar mechanisms explain how temperature influences behavior and will therefore test whether temperature causes stress (measured by saliva samples). The set-up of the experiment will also allow us to make suggestive statements about whether temperature affects behavior via its effect on productivity and mental acuity.

The participants will be recruited through the Busara Center in Nairobi and all experiments will be conducted there. The pilot sample will consist of 60 participants.

3 List of experiments

Below we list and explain the experiments.

1. **Production phase.**

   - The production phase serves two purposes. First, it enables us to measure the effect that temperature has on productivity. Second, it provides the necessary work effort to create real effort stakes in the dictator game.

2. **Real effort dictator game.**

   - The purpose of this game is to study whether temperature affects pro-social behavior. We will use the production phase as a determinant of earnings in order to establish clear entitlements. We will distinguish between "high" (weakly above median) and "low" (below median) productivity. We will match participants with equal productivity (either high or low) and give them the information about what each of them have earned in the production phase, i.e., we give them a clear suggestion that the fair outcome is an equal split. Participants are matched in pairs and asked how much of the joint earnings they want to transfer to the other participant.

     All participants will act as dictators and they will know that there is a fifty percent chance that their decision will be implemented.

3. **Time preference game.**

   - This game will serve two purposes. First, it enables us to identify patience, and the effect of temperature on patience. Second, it enables us to identify time inconsistency. We will use the traditional protocol for eliciting so-called "beta-delta" preferences, namely a price list with different choices about the timing of payments. [1]

4. **Risk game.**

   - In order to look at risk behavior and the effect of temperature on this behavior, we include a risk game involving coin flips. The plan is to have six different coins with different amounts for heads and tails. Subjects can choose which coin they want to flip and then receive the money that's associated with either heads or tails.

5. **Trust game.**

[1] Note that there have been recent important developments in the literature on time preferences their elicitation. This has lead many researchers to prefer games with convex budget sets allowing for non-linear consumption utility (see e.g., Andreoni and Sprenger 2012). However, in order to limit the time needed for this experiment, we will conduct the traditional price-list version of the game. As we also elicit risk preferences, we will be able to study the results from the time preferences game conditional on the observed risk preferences (see Andersen et al. 2008).

- In order to study how temperature affects trust and trustworthiness, we will conduct a standard trust game. In the trust game, the participants are matched in pairs where one of them, participant A, is given a fixed amount of money, say X KSh and the other, participant B, is not given any money. Participant A can decide to keep the money, in which case player A will receive the actual payment of X KSh and player B will receive nothing. Participant A can also decide to send part or all of the money, $Y \leq X$ to player B in which case player B will receive $3Y$ KSh. In this case player B is given the option to send money back to player A (any amount he or she likes). If participant A trusts that some money will be sent back, he or she will benefit from sending the money to participant B. If, on the other hand, the trust is lower, participant A may decide to keep the money. Hence, the amount sent from A measures the level of trust of the participants. The amount sent back from B, reveals the player's trustworthiness which is also an interesting measure to study in itself.

6. **Public goods game.**
   - Again, we would like to elicit how pro-social behavior – in particular cooperation – may be affected by temperature. We will conduct a standard public goods games with 3 players.

7. **Cognitive ability.**
   - The test of cognitive ability will enable us to identify the effect of temperature on mental acuity. We will use Raven's matrices to measure cognitive ability.

8. **Joy of destruction.**
   - Here we would like to measure whether willingness to destruct increases with temperature (following Abbink and Sadrieh 2009). Participants will be informed that everyone has won different amounts of air time (vouchers in multiples of 1 dollar). They are then matched in pairs and told how much the other person has won. The computer then randomly draws a number of vouchers (less than the total of what the other person has). In addition, the participant can also decide to destroy the other player's cards. The lab assistant will destroy the total number of card's of the other player given by the computer's and first player's choice. The other participant does not know whether the cards were destroyed because of the computer draw or because of the other participant's decision (though some inference is possible). The idea here is that participants can partly hide their purposeful destruction behind random destruction. The game is conducted with real scratch cards, so that actual (physical) destruction takes place.

9. **Contextualized dictator game: charity donation**
   - In this game we want to measure how a person's willingness to donate part of their earnings to charity varies with geographic location of the charity, which in turn is strongly correlated with linguistic and ethnic group of the likely beneficiaries.

     Participants are randomly allocated to charities on a list and can donate in multiples of 50 up to a maximum of 250 KSh.

4 Treatment

Our treatment is temperature. In the pilot we will implement three treatments: 18, 24, and 30 degrees Celsius.

5 Scripts for experiments

Production phase

- "In this part of the experiment, you will earn money from conducting a task. The final payment will depend on your performance and also decisions made by you and another participant after the task. We will now describe the task to you. You will be asked to move a slider to match the goal number given to you. Try to correctly match the number to the goal as many times as you can within the time allotted. If you have any questions, please raise your hand and an assistant will come to you. If you do not have any questions, please press the OK-Button. We will now have practice rounds. When you are ready, press the OK-Button. We will now start the task. When you are ready, press the OK-Button."

Dictator decisions

- "You and another participant are now paired. You have both worked on the slider task and earned 25 (75)[2] Together you have earned 50 (150). You are now going to determine how much of the 50 you suggest for yourself and how much you suggest for the other participant. You are free to choose any amount in whole shillings between 0 and 50. Examples:

  1. If you assign 50 KSh (150 KSh) to yourself, the other participant gets 0 KSh (0 KSh).
  2. If you assign 25 KSh (75 KSh) to yourself, the other participant gets 25 KSh (75 KSh).
  3. If you assign 0 KSh (0 KSh) to yourself, the other participant gets 50 KSh (150 KSh).

  The other participant in your pair, is also going to determine how to distribute the earnings between the two of you. The computer will randomly choose one of the decisions, either yours or your partners, which will be implemented. Payments are made based on this.

  Press "OK" when you are ready to continue.

  You are now the decision maker. You have 25 KSh (75 KSh) available to you. You can choose to send any amount between zero and 25 KSh (75 KSh), to the receiver.

Time preferences

- "On the following screens you will find a series of questions. In each question, you are asked to choose between Option A and Option B.

  If you choose Option A, you will get a smaller amount but sooner. If you choose Option B, you will get a larger amount but later. Please choose the option you prefer. There are no right or wrong answers.

  After you make all your choices, the computer will randomly pick one of the questions and your payment will be determined by the option you chose in that question.

  Remember that the computer will pick only one question and any question could be picked. Therefore, it is in your interest to answer each question as if it is the only question you are answering.

  If everything is clear, please click on the OK button.
  ...
  For each question below, please choose either Option A OR Option B [randomize order]

[2] If performance below the median, earnings are 25, if performance equal to or above, earnings are 75. We match in pairs so that earnings are always the same in each pair. If uneven number, we give the one below the median 75.

- Today (A) versus three months (B):
    * A: 100 today, B: 100 in three months
    * A: 100 today, B: 120 in three months
    * A: 100 today, B: 140 in three months
    * A: 100 today, B: 160 in three months
    * A: 100 today, B: 180 in three months
    * A: 100 today, B: 200 in three months
- Three months (A) versus six months (B):
    * A: 100 in three months, B: 100 in six months
    * A: 100 in three months, B: 120 in six months
    * A: 100 in three months, B: 140 in six months
    * A: 100 in three months, B: 160 in six months
    * A: 100 in three months, B: 180 in six months
    * A: 100 in three months, B: 200 in six months

”

Risk preferences

- “In this task, you will be asked a set of questions, which ask you about different amounts of money you can receive with a game of coin toss. You have the choice between six coin tosses and you will need to choose the one you would like to play. Each toss is the same except for differing amounts of money you can win depending on the result of the coin toss. After you choose, we will actually play the toss you chose and pay you depending on the result. Remember, there is no correct answer; what we are interested in is your personal preference.”

  Coin 1: KSh 80 if heads and KSh 80 if tails Coin 2: KSh 70 if heads and KSh 110 if tails Coin 3: KSh 60 if heads and KSh 140 if tails Coin 4: KSh 50 if heads and KSh 170 if tails Coin 5: KSh 40 if heads and KSh 200 if tails Coin 6: KSh 30 if heads and KSh 210 if tails

  [Coin toss]

Trust Game

- **First round**: In this part of the experiment, you will be matched with another player. You are given KSh 50, whereas the other player is not given anything. You, Player 1, can choose to send any amount between 0 and KSh 50 to the other player, Player 2. Any KSh not sent, you will keep for sure. Any amount you send to Player 2 will be multiplied by 3. Player 2 can then choose to send any amount of KSh back to you. Any amount that is not sent back to you will be kept by Player 2.

  How many KSh do you wish to send to Player 2?

  We will now match you with another participant, and you will act as Player 2.

- **Second round**: You are Player 2. Player 1 has decided to send x[computer put in number] of his KSh 50 to you. This has been multiplied by 3, so you have [KSh3x] at your disposal. Any KSh not send, you will keep for sure. Please state the amount that you want to send back to Player 1, you can choose any amount between 0 and [3x].

Public Goods Game

- "You are now matched with two other players. You have each received 75 KSh. You must now decide how much of your 75 KSh to put into a shared fund. The other players will simultaneously decide how much to put into the shared fund. Each KSh put into the fund is multiplied by 2 and shared equally between the three of you. Each KSh you do not put into the fund you get to keep for sure.

  We will now give you a few examples: If you put 50, and both other participants put 50, the fund will increase to 300 and you all get back 100.

  If on the other hand, no-one gives anything, you will just keep the original amount. And if one of you gives 50, the fund will be 100 and all of you get 33 back from the fund.

  Let's do an example to see whether you understood the instructions. Say you put 60 KSh into the pot, the second player puts 30 KSh and the third player puts 60 KSh into the pot, how much money would you get in the end? [Calculate example for them].

  "You have decided to give KSh[Give]. Please press okay to confirm or redo to select another option."

  "You are now asked what you believe the other player will put in the fund. Depending on the accurateness of your guess, you can earn money. If you guess correctly, you will receive KSh 30. Please select how much you think Player 2 put into the fund."

  "You have selected KSh [Guess] Please press okay to confirm or retry to select another option."

Ravens

- "We will now do a series of practice rounds to get you familiar with the puzzles we will be doing in this game. For each puzzle, there is a piece missing – it is your task to identify the correct piece. We will do 2 practice puzzles and then you will be given 6 real tasks. Your earnings from this task will be given in air time vouchers, and your earnings will depend on the number of correct answers."

  "Observe the image below. Then, put your finger on the missing element that completes the image."

Joy of destruction

- "You and another participant are now paired. You have both completed the Raven's matrices and earned some airtime vouchers. We will now give you the opportunity to destroy some of your partner's vouchers. This will happen anonymously, so that your choices will never be revealed to any other participant. After your choice has been made, the computer will also randomly destroy some of the other players vouchers.

  Here are three examples: Your partner has 6 (12) vouchers.[3] You decide to destroy 2 (4) of these and the computer randomly decides to destroy 1 (2) of them. Hence, we will destroy 3 (6) of your partner's vouchers.

  Your partner has 6 (12) vouchers. You decide not to destroy any of your partner's vouchers and the computer randomly decides to destroy no vouchers. Hence, we will not destroy any of your partner's vouchers.

[3]If performance below the median, say 6, if performance equal to or above, say 12. We match in pairs so that earnings are always the same in each pair. If unequal number, we give the one below the median 12.

Your partner has 6 (12) vouchers. You decide to destroy 3 (6) of your partner's vouchers and the computer randomly decides to destroy 3 (6) vouchers. Hence, we will destroy all of your partner's vouchers.

Now we start and you can make an actual choice. You and your partner have both earned (6) 12 airtime vouchers.[4] You can choose to destroy up to 3(6) vouchers of your partner, but you do not have to destroy any. Then, after you made your choice, the computer will randomly decide to destroy any number between 0 and 3 (6) vouchers. Your partner will then learn how many of his/her vouchers were destroyed, but they will not learn how much of the destruction is due to your choice versus the computer's random choice. And, as stated, the other participant will not know that it was you who made the destruction decision, and you will not learn who you made the destruction decision for.

Before you leave the room, the number of your vouchers that the computer and other participant decided to destroy will be destroyed by the lab team, the rest will be given to you.

How many of your partner's vouchers do you want to destroy?" ANSWER.

Calculation of payout for each participant

Donation

- "You have earned xxxx[5]. You can either keep this entire amount, or you can donate parts of it to a charity.

  You will now have the opportunity to donate to a charity organization helping children and youth in Kenya, "[Charity Name]"[randomized]. You can decide to donate 0, 50, 100, 150, 200 or 250 KSh [6]

  Please make your donation now."

  List of Charities to be randomised from:

  Kiambu Orphans Iniciative

  Kanyawegi childrens home

  Destined Childrens Home Kikuyu

  Kakamega Orphans Care Centre

  Upendo Childrens Centre Nyeri

  Huruma Childrens Home Ngong

  Baraka Childrens Home Mombasa

[FINAL PAYOUT]

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[4] If performance below the median, earnings are 6, if performance equal to or above, earnings are 12. We match in pairs so that earnings are always the same in each pair. If unequal number, we give the one below the median 12.

[5] rounded to the nearest shilling

[6] highest option shown will be less than total amount earned so far

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