Algorithm Reliance, Fast and Slow
Online Appendix 2

Clare Snyder, Samantha Keppler, Stephen Leider
Ross School of Business, University of Michigan

This Online Appendix contains our experimental instructions, the list of twelve jokes associated with the joke recommendation task in our experiment, the post-experiment questionnaire given to all participants, as well as the protocol for the semi-structured interviews we conducted with coaches and managers at ReUp Education.

A. Experiment Instructions

Below are the experiment instructions for participants in the high-load, superior-algorithm treatment:

Welcome! Thank you for participating in today's experiment

From this point on, please refrain from talking with other participants. Additionally, please do not use other electronic devices during this experiment.

Throughout today's experiment, you will be muted in Zoom. However, if any questions arise, please use the Zoom chat box to message the host (experimenter). If you accidentally close the web tab for the experiment, simply click the link in Zoom again to reconnect.

Please make sure you have reviewed the informed consent form we have shared with you. By clicking the "Next" button on the screen, you certify that you have read and agree with the informed consent form.

Experiment Overview

In today's experiment, over the course of five rounds, you will make a series of decisions. Your earnings will be higher or lower depending on the choices you make. The details of these choices and your earnings will be explained in more depth as you continue through the instructions. After reading through the instructions, you will have the opportunity to complete one practice round that will have no bearing on your final payment, to help solidify your understanding of the rules.

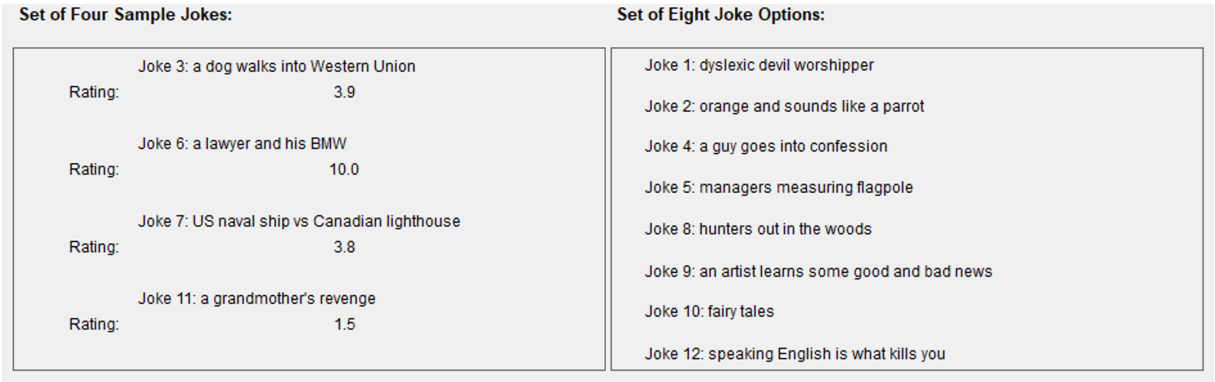
Specifically, throughout this experiment, you will be working in a simulated customer service setting. Your task is to provide a joke recommendation for each sequentially-arriving customer. During each round, which will last five minutes, simulated customers will arrive randomly in real time to receive a recommendation. You may only serve one customer at a time, so other customers who may arrive during your service will wait in line for their turn to be served. It is your goal to give high-quality recommendations, but you will also receive bonuses for moving customers through the system quickly. At the beginning of each new round, the time will restart with new customers.

Joke Recommendation Task

In this setting, each customer is seeking a Joke Recommendation. Your task is to provide a recommendation of a single joke from a set of eight options. To help you make a better recommendation for each customer, you will be given information about how each specific customer has rated a different set of four jokes. Each of these four jokes will be associated with a rating on a scale of -10 to 10 with 10 being the best rating and -10 the worst. Based on these ratings of other jokes, your task is to recommend the joke you think the customer will enjoy most - but not take too long to do so.

For each customer, you will see the same list of 12 jokes divided into a set of recommendation options (eight jokes) and a set of rating samples (four jokes). However, the two sets may not be repeated across customers (so, you might see the first customer's ratings for jokes 1, 2, 3, and 4, and the second customer's ratings for jokes 3, 6, 9, and 12).

Below is an example of how these sets will be presented for one customer, including the short descriptors you will be provided as a reminder of the jokes' contents. Note that you will be able to access the full joke texts throughout the experiment. However, because you will want to serve customers quickly to increase your final payment, please take some time now to familiarize yourself with the list of 12 jokes (which you may access via the 'Joke List' button or at the end of this document).



Recommendation Algorithm

Through this session, you may receive information from a recommendation algorithm which you may use towards your Joke Recommendation Task. The recommendation algorithm will take in the same four sample joke ratings you see for each customer and use this to make a prediction about which of the eight joke options the customer will prefer.

You may think of the algorithm as a tool that can poll hundreds of people and ask them how much they like different jokes. Using a database of ratings, the algorithm will search for the jokes that are most like ones a given customer enjoys, and least like ones this customer did not like.

Payment

Your earnings will be based on the customers' ratings of the joke you recommended to them and the time each customer takes to receive your personalized recommendation, including any time spent waiting in line.

Particularly, your payoff in this experiment will be the sum of the payoffs you earn from each customer served. The customer payoff in turn is the sum of two values: the ratings payoff and the time bonus payoff. The ratings payoff is given by the table below:

Rating	Payoff ($)
-10.0 - 0.0	0.00
0.1 - 3.0	0.05
3.1 - 5.0	0.10
5.1 - 7.0	0.15
7.1 - 9.0	0.20
9.1 - 10.0	0.25

Your time bonus will be calculated according to the table below. Time is measured as being from the time the customer arrives until the time that you submit a recommendation for this customer. Therefore, this includes any time the customer spends waiting in line as well as the time spent while you are viewing their rating samples and thinking about a recommendation decision. The bonus will be awarded as follows:

Time (sec)	Payoff ($)
>25	0.00
10-25	0.01
0-10	0.02

For example, if it takes 23.5 seconds for a customer to receive a recommendation from the time of arrival, and this customer gives their recommended joke a rating of 6.5, then the payment for this customer is

$$\$0.01 + \$0.15 = \$0.16$$

Your total payment for the experiment will be the sum of the payments from each round plus $5 for your participation. You will not be paid for any customers still waiting for a recommendation at the end of a round, when you will have run out time.

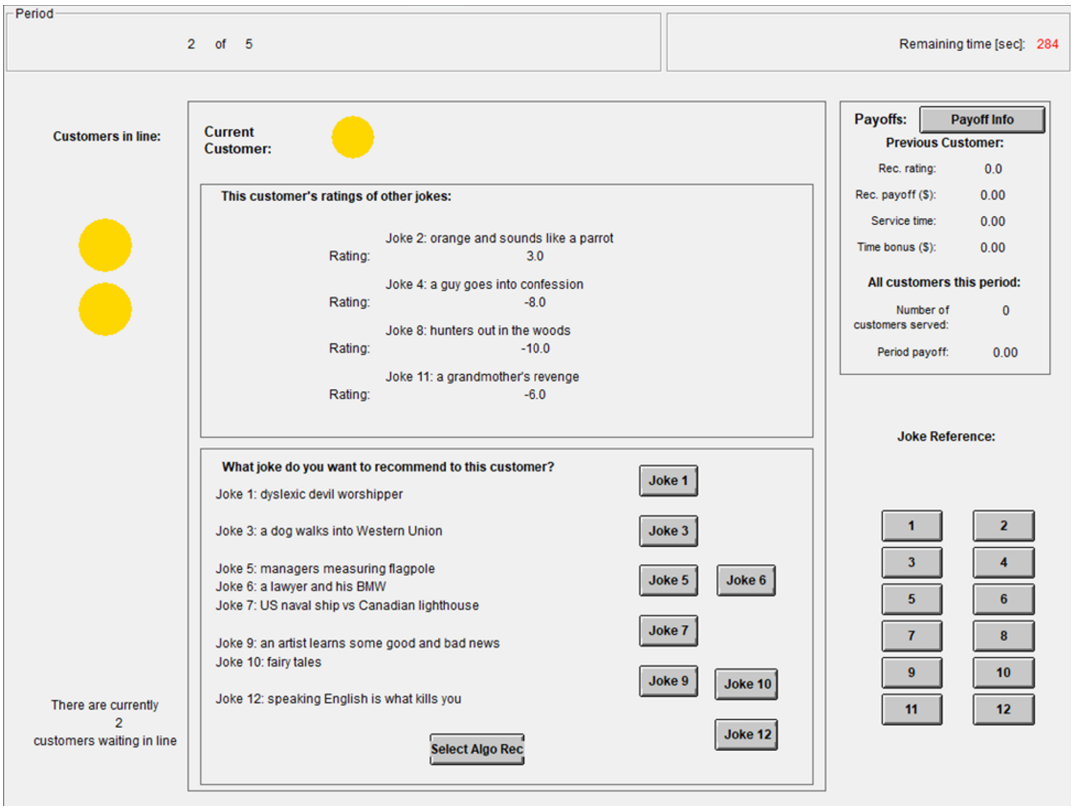
Customer Arrival

As mentioned, customer arrivals will be random. More specifically, arrivals will come an average rate of seven and a half arrivals per minute. This means that on average, the time that passes between one customer arriving and the next is 8 seconds, but the exact timing of the arrivals is unknown. The timing of each arrival is also independent of the arrivals before. This means that if one customer arrives very quickly or very slowly, this does not tell you anything more about the time it will take for the next customer to arrive. As customers arrive, they will form a line that you will see represented on the left side of the screen. This arrival process is sometimes known as a 'Poisson Process'.

You will have a chance to observe this arrival process during the practice round.

Decision Screen Sample

Now that you have been introduced to the background for this experiment, we may review the decision screen you will see throughout the experiment. Here, you see the decision screen as it looks before a recommendation selection has been made.

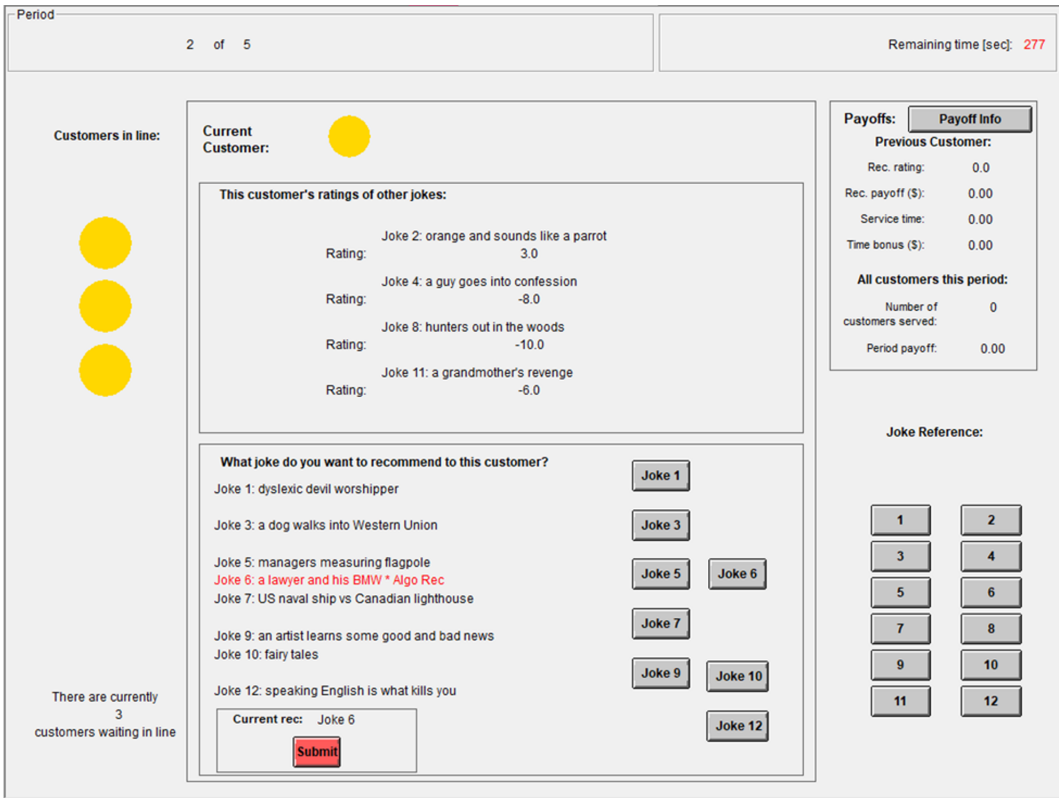


1. Across the top of the decision screen, a header indicates the period number (here, 2 of 5) and the amount of time remaining in seconds (here, 284).
2. Along the left side of the decision screen, you will see the customers waiting in line. Each customer is represented by a yellow circle, so as the line grows, the number of circles will increase. You may also find the number of customers waiting in line (here, 2) at the bottom of this column. In cases where there are more than six customers, these additional customers (Customer 7, Customer 8, etc.) will be represented with a single vertical ellipsis, at the end of the line rather than the exact number of waiting customers. The exact number of customers in line will continue to be represented numerically.
3. In the middle box, you will see the current customer represented by a yellow circle. You will see this customer's ratings of four sample jokes below, and below this you will see the list of recommendation options. You may select your choice by clicking the appropriate button. To select and view the algorithm's recommendation, simply click the "Select Algo Rec" button.
4. Along the right side of the decision screen, you will see the payoff values for the most recently served customer as well as the overall payoff information for the current period.
5. Also along the right side of the decision screen, you may review the joke texts by clicking the corresponding button. E.g. to review Joke 12, you would click button "12". The joke text

will appear in this section of the decision screen; to review another joke, simply exit and click another button. You may also review the payoff rules by clicking the "Payoff Info" button.

Decision Screen Sample - Continued

Once you have made a selection, you may review and submit this recommendation by clicking the red "Submit" button that will appear (as shown below) or you may change your selection by clicking a different joke. If you have clicked the "Select Algo Rec" button, the algorithm's suggestion will turn red and immediately appear as your selection for submission, as shown below.



B. Joke List

We used the following list of twelve jokes throughout our experiment:

1. Q. Did you hear about the dyslexic devil worshipper? A. He sold his soul to Santa.
2. Q. What is orange and sounds like a parrot? A. A carrot.
3. A dog walks into Western Union and asks the clerk to send a telegram. He fills out a form on which he writes down the telegram he wishes to send: "Bow wow wow, bow wow wow." The clerk says, "You can add another 'Bow wow' for the same price." The dog responded, "Now wouldn't that sound a little silly?"
4. A guy goes into confession and says to the priest, "Father, I'm 80 years old, widower, with 11 grandchildren. Last night I met two beautiful flight attendants. They took me home and I

made love to both of them. Twice." The priest says, "Well, my son, when was the last time you were in confession?" "Never Father, I'm Jewish." "So then, why are you telling me?" "I'm telling everybody!"

5. A group of managers were given the assignment to measure the height of a flagpole. So they go out to the flagpole with ladders and tape measures, and they're falling off the ladders, dropping the tape measures–the whole thing is just a mess. An engineer comes along and sees what they're trying to do, walks over, pulls the flagpole out of the ground, lays it flat, measures it from end to end, gives the measurement to one of the managers and walks away. After the engineer has gone, one manager turns to another and laughs. "Isn't that just like an engineer? We're looking for the height and he gives us the length."
6. A lawyer opened the door of his BMW, when suddenly a car came along and hit the door, ripping it off completely. When the police arrived at the scene, the lawyer was complaining bitterly about the damage to his precious BMW. "Officer, look what they've done to my Beeeeemer!" he whined. "You lawyers are so materialistic, you make me sick!" retorted the officer. "You're so worried about your stupid BMW that you didn't even notice your left arm was ripped off!" "Oh my gaaaad..." replied the lawyer, finally noticing the bloody left shoulder where his arm once was. "Where's my Rolex?!"
7. A radio conversation between a US naval ship and Canadian authorities...Americans: Please divert your course 15 degrees to the North to avoid a collision. Canadians: Recommend you divert YOUR course 15 degrees to the South to avoid a collision. Americans: This is the captain of a US Navy ship. I say again, divert YOUR course. Canadians: No. I say again, you divert YOUR course. Americans: This is the aircraft carrier USS Lincoln, the second largest ship in the United States' Atlantic Fleet. We are accompanied by three destroyers, three cruisers and numerous support vessels. I demand that you change your course 15 degrees North, that's ONE FIVE DEGREES NORTH, or counter-measures will be undertaken to ensure the safety of this ship. Canadians: This is a lighthouse. Your call.
8. A couple of hunters are out in the woods in the deep south when one of them falls to the ground. He doesn't seem to be breathing, and his eyes are rolled back in his head. The other guy whips out his cell phone and calls 911. He gasps to the operator, "My friend is dead! What can I do?" The operator, in a calm and soothing voice, says, "Alright, take it easy. I can help. First, let's make sure he's dead." There is silence, and then a gun shot is heard. The hunter comes back on the line. "Okay. Now what??"
9. An artist asked the gallery owner if there had been any interest in his paintings currently on display. "I've got good news and bad news," the owner replied. "The good news is that a gentleman inquired about your work and wondered if it would appreciate in value after your

death. When I told him it would, he bought all fifteen of your paintings." "That's wonderful!" the artist exclaimed. "What's the bad news?" With concern, the gallery owner replied: "The guy was your doctor."

10. A little girl asked her father: Daddy? Do all fairy tales begin with 'Once Upon a Time'? He replied: No, there is a whole series of fairy tales that begin with 'If elected I promise'.

11. When my three-year-old son opened the birthday gift from his grandmother, he discovered a water pistol. He squealed with delight and headed for the nearest sink. I was not so pleased. I turned to Mom and said, "I'm surprised at you. Don't you remember how we used to drive you crazy with water guns?" Mom smiled and then replied... "I remember."

12. The Japanese eat very little fat and suffer fewer heart attacks than the British or Americans. On the other hand, the French eat a lot of fat and also suffer fewer heart attacks than the British or Americans. The Chinese drink very little red wine and suffer fewer heart attacks than the British or Americans. The Italians drink excessive amounts of red wine and also suffer fewer heart attacks than the British or Americans. Conclusion: Eat and drink what you like. It's speaking English that kills you.

C. Post-Experiment Questionnaire

After our experiments, we asked participants to complete the following questionnaire (participants in the no-algorithm treatments saw a slightly modified version of this questionnaire, which excluded **Question 2** in the *Long Answer Questions* section):

Long Answer Questions

1. Please briefly explain your approach to this problem (e.g. how did you decide how long to spend on a customer, how did you decide your recommendations, etc.?):

2. Please briefly explain your feelings about the algorithm through this experiment (e.g. did you use the algorithm, did you appreciate its advice, etc.?):

Demographic Questions

1. To which gender do you most identify?

- Female
- Male
- Transgender Female
- Transgender Male
- Gender Variant/Non-Conforming
- Other
- Prefer Not to Answer

2. What is your major field?

- STEM
- Arts and Humanities
- Other (write in)

3. What is your age (in years)?

Algorithm Multiple-Choice Questions

Please answer a few short questions on your feelings about algorithms:

1. Please indicate how much you agree with the following statements about algorithms:

a. I understand how my credit score is calculated

- Strongly disagree
- Disagree
- Somewhat disagree
- Neither disagree nor agree
- Somewhat agree
- Agree
- Strongly agree

b. I understand how my email provider's spam filter works

- Strongly disagree
- Disagree
- Somewhat disagree
- Neither disagree nor agree
- Somewhat agree
- Agree
- Strongly agree

c. I understand how Amazon recommends products for me to purchase

- Strongly disagree
- Disagree
- Somewhat disagree
- Neither disagree nor agree
- Somewhat agree
- Agree
- Strongly agree

2. Do you believe it is acceptable to use algorithms to make decisions **without** human input in the following settings?

a. Automated resume screening of job applicants
- Unacceptable
- Acceptable
- Unsure

b. Criminal risk assessment for people up for parole
- Unacceptable
- Acceptable
- Unsure

c. Automated video analysis of job interviews
- Unacceptable
- Acceptable
- Unsure

d. Personal finance score using many types of consumer data
- Unacceptable
- Acceptable
- Unsure

3. Do you believe it is acceptable to use algorithms to **supplement** human decision-making in the following settings?

a. Automated resume screening of job applicants
- Unacceptable
- Acceptable
- Unsure

b. Criminal risk assessment for people up for parole
- Unacceptable
- Acceptable
- Unsure

c. Automated video analysis of job interviews
- Unacceptable
- Acceptable
- Unsure

d. Personal finance score using many types of consumer data
- Unacceptable
- Acceptable
- Unsure

D. ReUp Education Interview Protocol

To motivate our research and develop an understanding of issues faced in practice in algorithm-augmented services, we conducted interviews with managers and coaches at EdTech company ReUp Education. These interviews were semi-structured according to the following questions:

1. Biography: Info about Informant
   - **a.** Could you tell me a little bit about your work experience before you joined ReUp?
   - **b.** How did you end up where you are today (at ReUp)?
   - **c.** How long have you worked at ReUp?
   - **d.** How many students are you coaching?
   - **e.** What are your experiences with using algorithms outside of ReUp?
2. Algorithm Development Involvement + Use
   - **a.** What was your role in the development of the algorithms (including the Personas)?
   - **b.** *(coaches only)* How do you use these algorithms in your coaching?
   - **c.** How do you feel about the algorithms (including the Personas)?
   - **d.** *(managers only)* What were your objectives in developing the algorithms (including the Personas)?
3. Algorithm Perceptions
   - **a.** How do you view the use of algorithms at ReUp?
   - **b.** Are your students aware of ReUp's use of algorithms?
   - **c.** How do you think they would view this use of algorithms if they knew?
   - **d.** Is there anything else you want to add?