WPI IRB Application

Updated By: Ali Yousefi20-Apr-2021 0

GENERAL INFORMATION

APPLICATION TYPE

Record #: IRB-21-0568

* What type of application are you submitting?
Standard IRB application

* There are 3 application types available

Use this application if neither of the options listed above is applicable.

* Is this a student project?
☐ Yes ☑ No

* Title of Study
Artificial Intelligence Backed Rock-Scissor-Paper Game (AI-RPS)

* Locations of Research: *(If at WPI, please indicate where on campus. If off campus, please give details of locations.)*
The game will be posted to https://testmybrain.org/ and will be hosted at: https://taisen.wpi.edu//web_rps/exp1.htr

Anticipated Dates of Research:

* Start Date:
01-May-2021

* Completion Date:
31-Dec-2021

* **Which of the following categories best describes your study?**
Biomedical, engineering and related research

* **Purpose of Study:**

(Please provide a concise statement of the background, nature and reasons for the proposed study. Insert below using non-techn language that can be understood by non-scientist members of the IRB.)

Recent shift from symptom- to a behavior-based diagnosis of mental disorders has spurred efforts to observe and characterize behavior. Social settings in particular present significant challenges to sufferers of mental disorders, and are potentially rich in that can differentiate pathologic and healthy state. However, the social setting is inherently dynamic and reciprocal, making it challenging to characterize behavior of the participants because it is difficult to standardize social interactions across different participants. Artificial intelligence (AI) agents that adapt to the behavior of the human player, evoke a more natural range of be and emotion, and make a game more engaging, but also allows the standardization of social interactions by making them parametrically variable and statistically repeatable. The proposed research aims to 1) design AI agents that employ simple, he rules to play a simple yet strategically deep iterated rock-scissor-paper (iRPS) game and 2) develop analytical tools to identify behavioral phenotypes from a large pool of player data.

A major bottleneck to innovation is the lag time between an idea, its implementation, and its evaluation. The current proposal addresses this lag time by proposing an iterative test development procedure, based on recruitment of large samples over the and randomization of participants to different items and test parameters. This allows tests to be fine-tuned prior to inclusion in costly formal validation procedures.

* Has an IRB ever suspended or terminated a study of any investigator that will be listed on this protocol?

☐ Yes ☑ No

Please indicate if your study involves:

* Investigational drugs or investigational medical devices

☐ Yes ☑ No

* Hazardous Materials

☐ Yes ☑ No

* Special diets

☐ Yes ☑ No

* Collaborating Institutions: *(Please list all collaborating Institutions.)*

TestMyBrain.org
PI: Germine, Laura Thi

FUNDING INFORMATION

How will the study be funded?

- [ ] Grant/Contract/Subaward (Federal)
- [ ] Grant/Contract/Subaward (Non-Federal)
- [ ] Departmental funds
- [ ] Faculty start-up or incentive funds
- [ ] Investigator out-of-pocket
- [x] No funding anticipated

STUDY PERSONNEL

All study personnel having direct contact with subjects **must** take and pass a training course on human subjects res
There are links to web-based training courses that can be accessed under the Training link on the IRB website
https://www.wpi.edu/research/support/compliance/institutional-review-board.

Name
Yousefi, Ali

Involvement Start Date	End Date	Role
20-Apr-2021		Principal Investigator

Please upload a copy of your relevant HS training certificate(s):

SUBJECT INFORMATION

Record #: IRB-21-0568

Please provide the exact number of subjects you plan to enroll in this study and describe your subject population. (eg. WPI Stud
Staff, UMASS Medical patient, Other)

* Males: 500

* Females: 500

* Description:
Participants will be recruited from people who come to TestMyBrain.org through search engines, social media posts (generate
others), and popular media. No formal advertisement will be done, except for on the front page of TestMyBrain.org.
We expect to get at least 1000 participants to play our game, and we expect to have a balanced populations with regard to ge

* Will subjects who do not understand English be enrolled?
☐ Yes ☑ No

* Are there any circumstances under which your study population may feel coerced into participating in this study?
☐ Yes ☑ No

* Are the subjects at risk of harm if their participation in the study becomes known?
☐ Yes ☑ No

* Are there reasons for excluding possible subjects from this research?
☐ Yes ☑ No

Recruitment

How will subjects be recruited for participation?
(Check all that apply)

☐ Direct subject advertising, including: *(Please provide a copy of the proposed ad. All direct advertising must be approved by t
IRB prior to use.)*

- ☐ Newspaper
- ☐ Bulletin Board
- ☐ Radio
- ☐ Flyers
- ☐ Letters
- ☐ Television
- ☑ Internet
- ☑ E-mail

☐ Referral

☐ Database

☑ Other

* Identify: TestMyBrain.org through search engines, social media posts (generated by others), and popular media

Are the subjects being paid for participating?
(Consider all types of reimbursement, ex: stipend, parking, travel.)
☐ Yes ☑ No

Vulnerable Populations
The proposed research will involve the following (Check all that apply):

☐ Pregnant women (check only when pregnancy is material to the study)

☐ Human fetuses

☐ Neonates

☐ Persons under the age of 18

☐ Prisoners

☐ WPI Students

☐ Individuals with mental disabilities

☐ Individuals with physical disabilities

INFORMED CONSENT

Record #: IRB-21-0568

A. Informed Consent Process

Who will discuss the study with and obtain consent of prospective subjects?
(Check all that apply)

☑ Principal Investigator ☐ Co-Investigator(s) ☐ Student Investigator(s)

* Will you ask all subjects to read and sign an informed consent form prior to their participation in the study?
☐ Yes ☑ No

* Please explain under some circumstances informed consent can be waived
We provide study information at the first page of the game (https://taisen.wpi.edu//web_rps/rulesExp1.html).

Participants will then decide if they want to play the game or not.
No personal information will be collected from participants and they can leave the game at anytime they want.

* Do you agree that the person obtaining consent will explain the risks of the study, the subjects right to decide not to participate, subjects right to withdraw from the study at any time?
☑ Yes ☐ No

* Do you agree to spend as much time as needed to thoroughly explain and respond to any subject's questions about the study, a them as much time as needed to consider their decision prior to enrolling them as subjects?
☑ Yes ☐ No

B. Consent Form

Upload a copy of the informed consent form(s) that you will be using. Your forms should follow the templates at: http://wpi.edu/o /irb/forms.html

Consent Form:

C. Documentation of Informed Consent

How will you maintain documentation of participant's informed consent?
(Choose one)

☐ The principal investigator will retain all of the signed informed consent agreements in a secure location for at least three yea end of the study.

☐ The principal investigator will provide the signed informed consent agreements to the IRB at the end of the study.

☑ No documentation of consent will be kept.

* The IRB can, under certain conditions, waive the requirement for documentation of informed consent. Please provide a justifica

No personal information of participants will be recorded. The experiment will solely collect participants game and answer to questionnaires, without any personal information.

POTENTIAL RISKS

Record #: IRB-21-0568

A risk is a potential harm that a reasonable person would consider important in deciding whether to participate in research. All p
risks and discomforts must be minimized to the greatest extent possible by using e.g. appropriate monitoring, safety devices and
withdrawal of a subject if there is evidence of a specific adverse event.

Identify below the potential risks that participants in your study will be exposed to, as well as the procedures for minimizing such

- [ ] Physical pain or discomfort
- [ ] Injury
- [ ] Illness or infection
- [ ] Exposure to hazardous materials
- [ ] Exposure to radiation
- [ ] Stress
- [ ] Loss of privacy
- [ ] Embarrassment or risk to reputation
- [ ] Exposure of sensitive or confidential data
- [ ] Risk of financial loss
- [ ] Legal liability
- [ ] Other
- [x] No risk greater than experienced in everyday life

POTENTIAL BENEFITS

Record #: IRB-21-0568

* What potential benefits other than payment may subjects receive from participating in this study?

When a participant completes all parts of the study, he/she/they will receive feedback on their performance on our cognitive tests.

* What potential benefits can society expect from the study?

The experiment outcome will let us to build hypothesis about human decision making in competitive settings, and come up wit tuned experiments better probing human emotional traits in connection to decision making.

DATA COLLECTION, STORAGE, AND CONFIDENTIALITY

Record #: IRB-21-0568

* How will data be collected?

Experiment information and title page will be hosted on TestMyBrain.org, and a link will bring participants to a javascript and HTML5-based web-application and questionnaire hosted on a server at WPI.

* Where will the data be stored and how will it be secured?

Data entered by participants will be securely transmitted via SSL (secure sockets layer) communication link to the server, and stored in a protected database on the server.

* Will personally identifying information be recorded?

☐ Yes ☑ No

* Will a subjects voice, face or identifiable body features (eg. tattoo, scar) be recorded by audio, video recording or photography?

☐ Yes ☑ No

* Can data acquired in the study adversely affect a subject's relationship with other individuals? (e.g. employees, supervisor, stud teacher, family relationships)?

☐ Yes ☑ No

* Do you plan to use or disclose personally identifiable information outside of the investigation personnel?

☐ Yes ☑ No

* Do you plan to use or disclose personally identifiable information outside of WPI including non-WPI investigators?

☐ Yes ☑ No

* What will happen to the data when the study is completed?

We deposit a copy of the data in the WPI computer science central repository. The data will be kept for at least three years. It to mention that no personal information will be recorded in this experiment.

INCIDENTAL FINDINGS

Record #: IRB-21-0568

An incidental finding is information discovered about a subject which should be of concern to the subject but is not the focus of t research. For example, a researcher monitoring heart rates during exercise could discover that a subject has an irregular heartb

* Is it possible that the investigator will encounter any incidental findings?

☐ Yes ☑ No

DECEPTION

Record #:

Will your study involve deception of participants or incomplete disclosure of study details?

Deception means intentionally provide misleading or false information to participants.
Incomplete disclosure means withholding information from participants about the true purpose or nature of the research.

☐ Yes ☑ No

CONFLICT OF INTEREST

Record #: IRB-21-0568

A conflict of interest occurs when an investigator's financial interests have the potential to compromise the objectivity of the rese
conflict also occurs when an investigator may enjoy material benefits based on study results. Relationships that give rise to a co
interest or the appearance of a conflict of interest must be disclosed in the informed consent statement provided to study subjec

* Do any of the investigators listed on this application have a potential or actual conflict of interest with regard to this study?

☐ Yes ☑ No

STUDY INFORMATION

* Expected Research Subjects:

(e.g. museum visitors under the age of 12)

Participants will be recruited from people who come to TestMyBrain.org through search engines, social media posts (generate others), and popular media.

* Project Mission Statement and Objectives:

We are doing this research to develop better
ways to measure human capability in making decisions in adaptive and competitive, social
settings.

* Brief Methods Listing:

(e.g. "Survey of public to ascertain knowledge and opinions about climate change" or "Interview of professionals working on clima change regarding effective city climate change program")

We run AI-backed RPS game. The AI decides about the next move to beat human participants; this will evoke spectrum of ga strategy on the human participant. We then study connection between the game strategy and participants' response to questic we collect at the end of the game.

* Does the proposed research involve vulnerable research subjects?

(e.g. children, prisoners, students, persons with mental or physical disabilities)

☐ Yes ☑ No

* Does the research involve human subjects in ways other than as participants in interviews, focus groups, or surveys?

(e.g. observation of public behavior, use of archived data or experimental procedures)

☐ Yes ☑ No

* Will the researchers collect information that can be used to identify the subjects?

☐ Yes ☑ No

* Could the disclosure of a human subject's identity and responses place the subject at risk of criminal or civil liability or be dama the subject's financial standing, employability or reputation?

☐ Yes ☑ No

* Will the researchers disclose the identity or the individual responses of any human subjects?

(e.g. by quoting an individual, whether or not identified by name or title)

☐ Yes ☑ No

Appendix 1

Attach the statement of research methods or draft methodology chapter:

Attach a draft of surveys and/or a list of questions to be used for interviews or focus groups:

If sample questions are included in Appendix 1, Methodology chapter, indicate the page numbers here:

ADDITIONAL DOCUMENTS

If you have any additional documents you would like to include with your application, you can upload them here.

Additional document:
Additional document:
Additional document:
Additional document:
Additional document:
Additional document:
Additional document:
Additional document:

INVESTIGATOR'S ASSURANCE

* ☑ I certify that the information provided in this application is complete and correct.

* ☑ I understand that I have ultimate responsibility for the conduct of the study, the ethical performance of the project, the protec the rights and welfare of human subjects, and strict adherence to any stipulations imposed by the WPI IRB.

* ☑ I agree to comply with all WPI policies, as well as all federal, state and local laws on the protection of human subjects in rese including:
  - ensuring the satisfactory completion of human subjects training.
  - performing the study in accordance with the WPI IRB approved protocol.
  - implementing study changes only after WPI IRB approval.
  - obtaining informed consent from subjects using only the WPI IRB approved consent form.
  - promptly reporting significant adverse events to the WPI IRB.

* ☑ I certify that I have added all Study Personnel, including students to the study personnel page.

Appendix 1

EForm Name: IRB Application
Page: Informed Consent
Section: B. Consent Form
Question: Consent Form:
File Name: Study Information _RPS.pdf

Study Information

Study Title: Competitive Social Interaction Game - AI Rock Scissor Paper

Principal Investigator: Ali Yousefi, Ph.D

The following fact sheet is here to provide you with information about a research study in which you have expressed interest in participating. Please read it carefully. Once you have read this information, you will be able to begin the study assessment. If you go on to complete the study assessment, you will be agreeing to participate in this study and to have your data used as described below.

What is the purpose of this research study? We are doing this research to develop better ways to measure human capability in making decisions in adaptive and competitive, social settings.

Who is sponsoring this research? This research is being sponsored by Worcester Polytechnic Institute.

What will happen in this research study? If you choose to participate in this research study, you will be asked to complete a series of surveys and cognitive tasks that will help us better understand how you think. The study is expected to take about 15 minutes. Once you have completed all of the surveys and cognitive tasks, you will get feedback about your scores.

How will we protect your privacy? We are not collecting any information in this study that could be used to identify you. The data we collect will come from questions you answer about yourself, how you are feeling, and your performance on the cognitive tests. All of this data will be stored on secure databases and will not be shared together with any information that could be used to identify you.

Who will see your data? All of your information is stored in a secure database. All of our databases are password-protected and secure. Data from your participation may be shared with other researchers, software developers, or submitted to a repository as part of a dataset that is publicly available and can be used to answer further research questions. This dataset will not include any information that can be used to uniquely identify you.

What are the risks of participating in this study? Taking part in this research study has some risks and requirements that you should consider carefully. While we do not expect any serious risks to you, you may find that some of the questions we ask in this study are of a personal nature, such that you feel uncomfortable answering them. If you experience

discomfort, you are free to refrain from answering any question or to end your participation in the study.

It is also important to consider the time commitment that this study requires. If you choose to participate, the study will take 15 minutes

What are the benefits of participating in this study? You will not benefit directly from participating in this research study. However, if you complete all parts of the study, you will receive feedback on your performance on our cognitive tests. You will also be helping us develop better tools for studying the mechanism of decision-making in people with different backgrounds and moods.

What happens if I don't want to participate in this study? Your participation in this study is completely voluntary. If, after learning more about the study, you have decided you don't want to participate, you may leave this page instead of going on to the study assessment. If you start
the assessment but then decide that you don't want to continue, you may end the study assessment at any time by leaving this page or closing the browser tab.

This study is being conducted by researchers affiliated with the Worcester Polytechnic Institute.

How can I find out more about this study? Ali Yousefi, Ph.D, is the person in charge of this research study. You can contact her at ayousefi@wpi.edu. Feel free to get in touch with any questions or concerns you may have.

If you'd like to speak to someone not involved in this research about your rights as a research subject, or any concerns or complaints you may have about the research, contact WPI Institutional Review Board, 508-831-5000.

Appendix 2

EForm Name: IRB Application
Page: Study Information
Section:
Question: Attach the statement of research methods or draft methodology chapter:
File Name: TestMyBrain_IRB detailed_protocol_RPS.pdf

PRINCIPAL/OVERALL INVESTIGATOR
Ali Yousefi, Ph.D

PROTOCOL TITLE
Artificial Intelligence Backed Rock-Scissor-Paper Game (AI-RPS)

FUNDING
To be developed

VERSION DATE
4/5/2021

I. BACKGROUND AND SIGNIFICANCE

Recent shift from symptom- to a behavior-based diagnosis of mental disorders has spurred efforts to observe and characterize behavior [1,2]. Social settings in particular present significant challenges to sufferers of mental disorders, and are potentially rich in behavior that can differentiate pathologic and healthy state. However, the social setting is inherently dynamic and reciprocal, making it challenging to characterize behavior of the participants because it is difficult to standardize social interactions across different participants [3-10]. Artificial intelligence (AI) agents that adapt to the behavior of the human player, evoke a more natural range of behavior and emotion, and make a game more engaging, but also allows the standardization of social interactions by making them parametrically variable and statistically repeatable. The proposed research aims to 1) design AI agents that employ simple, heuristic rules to play a simple yet strategically deep iterated rock-scissor-paper (iRPS) game and 2) develop analytical tools to identify behavioral phenotypes from a large pool of player data.

A major bottleneck to innovation is the lag time between an idea, its implementation, and its evaluation [11]. The current proposal addresses this lag time by proposing an iterative test development procedure, based on recruitment of large samples over the internet and randomization of participants to different items and test parameters. This allows tests to be fine tuned prior to inclusion in more costly formal validation procedures. [12]

II. SPECIFIC AIMS

Aim 1. Through iterative tests, refine game interface that maximizes the intuitiveness and ease of use of the game across subject demographics and devices used to play the game, and also parameters of the game that maximizes the engagement and concentration of test subjects.

Aim 2. Collect preliminary data to assess whether 1) different AI RPS algorithms can be discerned through the gameplay experience by human opponents, and 2) there is a differential effectiveness of rules employed by the AI among the participants .

The familiar RPS game was chosen for the simple rules and rich strategy of its play. The AI decides among various rules to decide what move to make next, some based on recent moves, some rely on frequency of moves accumulated over a longer period of time, some mimic aspects of the opponent. The AI can also use corresponding counter strategies, ie mentalization to impute what our opponent might think we're going to do next, and explicitly playing to beat that imputed move. These rules may require utilization of different cognitive facilities (medium to long term vs short term memory, pattern recognition, mimicry, mentalization etc.) to successfully play against. Because the instantaneous rule the AI is playing with is known at all times, it may be possible to ascribe a social context in which each human move is made, and outcomes interpreted along possible mental/behavioral phenotype extracted from the self-reported **Social Ability Questionnaire**.

Test development will begin with a prototype adapted for web-based self-administration. Test prototypes will go through successive phases of data collection, until a set of criteria are reached that maximize reliability, usability, accessibility, and engagement characteristics of the test and no further modifications are identified. We will use a combination of HTML5, JavaScript to design prototypes that enable self-administration, including example and practice trials, and instruction formats validated for self-administration [13].

Links to test prototypes will be posted on the research website TestMyBrain.org for 3-5 days (500-1500 participants per iteration). TestMyBrain receives 500-1000 new participants per day, most of whom have never done a research study before. For each test, participants will be randomly assigned to one of 2+ possible forms of the test (known in software development as A/B testing). These forms may vary in test parameters like number of trials, or aspects of the user interface (e.g. instructions) to evaluate how these factors impact reliability, accessibility, and engagement. Participants leave structured and unstructured feedback regarding instructions, technical issues, and other factors that impacted their testing experience.

III. SUBJECT SELECTION

This study will include between 500 and 1,000 participants of all ages. Participants will be recruited from people who come to TestMyBrain.org through search engines, social media posts (generated by others), and popular media. No formal advertisement will be done, except for on the front page of TestMyBrain.org.

Recruitment: Participants will be recruited through links on the front page of TestMyBrain.org, an online cognitive testing platform. Text for this link is shown in the document **Recruitment Examples**. We will rotate different recruitment messages on the front page to see if it changes the demographic composition of participants.

IV. SUBJECT ENROLLMENT

Subject Registration and Enrollment: Participants will navigate to TestMyBrain.org through search engines, social media, and other links posted on the web by former participants, and can participate in a study by clicking on the study link on the front page of TestMyBrain.

Consenting: At the onset of the study assessment, eligible participants will view a study fact sheet containing information about the purpose of the study, a description of what participation will entail, a summary of potential risks and benefits of participation, and contact information for the PI. Consent forms will not be completed since participants will not be contacted in person or by phone to allow for written or verbal consent; instead, participants will be informed that by completing the study assessments they are implying their consent to participate in the study.

V. STUDY PROCEDURES

Before the study begins, participants will be told that they will receive the results of their assessments once they have completed all measures. They will then be asked to complete the following questionnaires.

1) Demographic Questionnaire. All participants will then complete a brief demographic questionnaire, which asks them to report their age, gender, whether English is their primary or native language, along with a free text field for them to enter other information (see **Initial Demographics Questionnaire**).

2) Cognitive Tests. Participants will complete the cognitive test described in **Cognitive Tests**. Participants will be randomly assigned to particular alternate forms of a cognitive test. These alternate forms may vary in terms of stimuli, timing parameters, aspects of the user interface, and other test characteristics as described in **Cognitive Tests**.

3) Emotional State Questionnaire. Participants will complete a questionnaire asking them about their current mood, sleepiness, or other factors that would be expected to cause short-term improvements or decrements in cognitive function. See **Emotional State Questionnaire**.

4) *Social Ability Questionnaire*. Participants will complete the BAPQ questionnaire asking them about how they see themselves functioning in society. See **Social Ability Questionnaire**.

5) *Final Questionnaire*. Participants will complete a final demographics questionnaire that will ask about race, ethnicity, education, and sexual orientation. See **Final Questionnaire.**

6) *Results / debriefing.* At the end, participants will be presented with results of their assessment, based on comparing their scores to the scores of participants from our normative database and get links to resources if they have concerns about their cognitive health or would like to learn more about cognition and the brain (see **Debriefing and Feedback** document).

VI. BIOSTATISTICAL ANALYSIS

Data from this study will consist of non-identifying demographic information, self-report questionnaire data, and game play data (recorded RPS hands). Cognitive data will be interpreted with respect to participant scores from our normative database through TestMyBrain.org, and through analysis of RPS response patterns to AI rules.

Sample Size

The sample size will depend on traffic and number of iterations needed to achieve psychometric, accessibility and engagement criteria (defined below). The sample size is expected to be between 500 to 1500 participants. TestMyBrain.org have previously tested 2.2 million participants in different cognitive tasks.

Analysis Plan

After each data collection period, tests will be evaluated for potential modifications along the following criteria: Psychometric Criteria - (1) RPS scores show reasonable difficulty of the AI, with population mean score near a tie performance; (2) All major device types are well represented, with expected distributions of outcome variables; (3) Participants across all age ranges and education ranges are represented, with expected distributions of outcome variables; (4) Participants did not identify strategies for cheating; (5) Participants understood instructions; (6) Participants had no systematic technical difficulties; (7) Participants had no systematic discomfort or frustration associated with testing. Engagement Criteria - (8) Participant ratings exceed 3 out of 5 "stars", indicating a mostly positive experience; (9) Participant attrition (i.e., failing to complete a test) was not higher than expected based on other tests of similar length on TestMyBrain.org.

This iterative procedure is repeated until a test meets criteria and no further modifications are identified from user feedback or test data. If a proposed test does not meet criteria and no

modifications are identified to address unmet criteria, development of that test will be halted. This iterative test development method through TestMyBrain.org is well-validated for fine tuning psychometric and user interface characteristics to create reliable and engaging tests for research using web and mobile-based testing [11-13]. These tests have attracted over 2.2 million participants to TestMyBrain.org and have generated some of the largest published samples in cognitive research.

The results will help us to develop high quality, sensitive, and reliable measures that have passed basic validation across a diverse range of participants and device types.

VII. RISKS AND DISCOMFORTS

a) *Privacy*. A potential risk is a breach of confidentiality. To protect against the loss of confidentiality, TestMyBrain (TMB) has the following security measures in place, administered by the 501c3 Many Brains Project. We also will not collect any personal information as part of this project that could be used to identify someone.

1.1 Application server, Database and Web Hosting:

Experiment information and title page will be hosted on TestMyBrain.org, and a link will bring participants to a javascript and HTML5-based web-application and questionnaire hosted on a server at WPI. Data entered by participants will be securely transmitted via SSL (secure sockets layer) communication link to the server, and stored in a protected database on the server.

1.2 Access control:

Only personnel conducting the study will have access to the participant data through password-protected Linux accounts.

1.3 Data Transfer between Client (Browser) and Server:

The web application uses SSL (secure sockets layer) encryption to protect any information that is being transferred between a browser and the server. All Study links will use secure communications protocols incorporating SSL (https).

1.5 Data Monitoring and Quality Assurance:

1.5.1 Protection from Malicious Attack: The Linux host and database at WPI are updated with the latest security patches to protect from malware. The default administration and connection passwords are changed. Unused ports are deactivated.

1.5.2 Transmission of Data: All participant test data are transmitted directly to the Researcher using secure protocols.

b) *Discomfort.* In the event that participants experience discomfort when completing the study questionnaires or experimental tasks, they are free to leave the experiment at any time by closing their browser window. This will be explained in the study information form.

VIII. POTENTIAL BENEFITS

Participants will not receive any immediate benefits from their participation, aside from feedback about their performance which most participants find educational and interesting. Completion of study aims will allow the community of cognition researchers new tools that have been assessed across a range of device types, as well as tools and best practices for building new tests for the web and mobile devices.

IX. MONITORING AND QUALITY ASSURANCE

a) The site PI will have responsibility for continuous monitoring of data and safety of subjects in the study, in collaboration with other members of the research team. Data and safety monitoring will take place continuously throughout the study's duration. TestMyBrain.org has been in operation since 2008 with over 2.2 million people tested worldwide. During that time, there have been no adverse events or major complaints, and similar study procedures have been vetted for other studies by various IRBs nationally. A version of this protocol has also been active through the Harvard University IRB since 2008.

(b) We will report both adverse events and all serious adverse events that occur during the course of the trial to the Institutional Review Board. Specifically, we will record all adverse events in a tracking log based on IRB templates, which will be submitted to the IRB at each continuing review.

(c) At the time of the continuing review we will provide the IRB with a summary of any unexpected and related adverse events as well as any other unanticipated problems that occurred since the last continuing review.

(d) Adverse events and unanticipated problems will be reported to the IRB per PHRC reporting guidelines. We will report to the IRB any unanticipated problems and adverse events that occur: (a) during the conduct of the study, (b) after study completion, or (c) after subject withdrawal or completion. Reports will be submitted within 5 working days/7 calendar days of the date the investigator first becomes aware of the problem.

X. REFERENCES

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2. S. E. Morris and B. N. Cuthbert. Research domain criteria: Cognitive systems, neural circuits, and dimensions of behavior. Dialogues in Clinical Neuroscience, 14(1):29–37, 2012. PMID: 22577302.
3. H. Kim, D. Lee, Y.-m. Shin, and J. Chey. Impaired strategic decision making in schizophrenia. Brain Research, 80, 2007.
4. K. T. Kishida, B. King-Casas, and P. R. Montague. Neuroeconomic approaches to mental disorders. Neuron, 67(4):543–554, 2010. PMID: 20797532.
5. A. Mokros, B. Menner, H. Eisenbarth, G. W. Alpers, K. W. Lange, and M. Osterheider. Diminished Coop- erativeness of Psychopaths in a Prisoner's Dilemma Game Yields Higher Rewards. Journal of Abnormal Psychology, 117(2):406–413, 2008. PMID: 18489216.
6. P. Gruner and C. Pittenger. Cognitive inflexibility in Obsessive-Compulsive Disorder. Neuroscience, 345:243–255, 2017.
7. D. Lee. Decision Making: From Neuroscience to Psychiatry. Neuron, 78(2):233–248, 2013. PMID: 23622061.
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Appendix 3

EForm Name: IRB Application
Page: Study Information
Section:
Question: Attach a draft of surveys and/or a list of questions to be used for interviews or focus groups:
File Name: Questionnaire_Final_RPS.pdf

Final Questionnaire

Questions

1. Do you consider yourself Hispanic or Latino?

Yes

No

Not sure

I'd rather not say

2. Which best describes your ethnic background (check all that apply)?

American Indian or Alaska Native

Asian

African/Black

Native Hawaiian or Pacific Islander

European/White

Not sure

I'd rather not say

3. How would you define your sexual orientation

Attracted to women only

Attracted to men only

Attracted to both men and women

Not attracted to men or women

I'd rather not say

4. What is the highest level of education you have completed?

Primary school (less than 7 years)

Middle or junior high school (7-10 years)

Secondary school (high school diploma or GED)

Some college / university

Technical training or associate’s degree

Bachelor’s degree

Graduate degree

None of the above

I’d rather not say

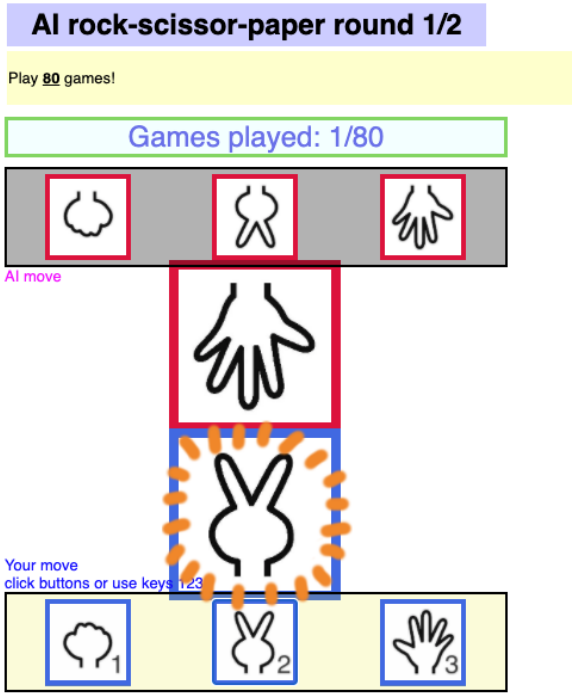
Appendix 4

EForm Name: IRB Application
Page: Additional Documents
Section:
Question: Additional document:
File Name: CognitiveTests_RPS.pdf

Cognitive Test

Our protocol includes repeated rock-scissor-paper (RPS). This protocol will be amended as needed to add more tests, with future tests added will depend on the results of initial data collection.

AI-Backed RPS



In this test, participants are asked to play the familiar rock-paper-scissor game repeatedly (80~120 games each round) against the computer, with the standard rules rock beats scissors, scissors beats paper and paper beats rock. Participants are asked to do their best to win as many games as they can. The AI, adapted from a top-10 scoring entry in a kaggle competition, is programmed with several base rules of next-hand generation that likely would exercise different cognitive capacities should a human employ similar rules. The machine is also able to switch between these rules by assessing which one is most likely to win the next game, as well as play counter moves to these rules, which rely on mentalization-like strategy of imputing an opponent's next move. The test collects participants' hands and response time per trial along with the machine hand and game outcome - win, lose, tie. Two rounds will be played by the participant, and the AIs repertoire of strategy may or may not be the same in these two rounds. After two rounds of play, the participant will be asked whether the two AIs played similarly or differently. Further, participants will be asked what they think their net win/loss in each of the rounds were. From this basic paradigm, we will modify the following randomly for each participant:

- The AI game strategies that produce the most noticeable differences.

- Number of games being played per each round. The number of games will be a number between 80 and 120 per round.

We assume participants are familiar with the game rules. Participants will have the choice to play exercise rounds before getting to the test rounds.

The task per participant will take about 5~8 minutes on average depending on individual response time per trial. Participants can leave the game at any time they encounter any discomfort following the game.

Appendix 5

EForm Name: IRB Application
Page: Additional Documents
Section:
Question: Additional document:
File Name: Questionnaire_Initial_Demographics_RPS.pdf

Initial Demographics Form

1) What is your age? [required]

2) What is your gender?
- Male
- Female
- Non-binary or Gender queer

3) Is English your primary or native language?
- Yes
- No

4) Other information: [optional]

Appendix 6

EForm Name: IRB Application
Page: Additional Documents
Section:
Question: Additional document:
File Name: Questionnaire_Psychological State_RPS.pdf

Psychological State Questionnaire

Questions

1. Did you sleep well last night?

Yes **No**

2. Were you focused or distracted while playing the game?

Focused **Distracted**

3. Did you become more energetic or fatigued during the course of the games?

Energetic **Fatigued** **No change**

Appendix 7

EForm Name: IRB Application
Page: Additional Documents
Section:
Question: Additional document:
File Name: Questionnaire_Social_Ability_RPS.pdf

Social Ability Questionnaire

The following questions to be answered on a scale of 1 (very rarely), 2 (rarely), 3 (occasionally), 4 (somewhat often), 5 (often), 6 (frequently). The *underlined, italicized questions* refer to conversations or situations with acquaintances, and not people close to you.

1. I like being around other people.
2. I find it hard to get my words out smoothly.
3. I am comfortable with unexpected changes in plans.
4. It's hard for me to avoid getting sidetracked in conversation.
5. I would rather talk to people to get information than to socialize.
6. People have to talk me into trying something new.
7. I am ''in-tune'' with the other person during conversation.
8. I have to warm myself up to the idea of visiting an unfamiliar place.
9. I enjoy being in social situations.
10. My voice has a flat or monotone sound to it.
11. *I feel disconnected or "out of sync" in conversations with others.*
12. *People find it easy to approach me.*
13. I feel a strong need for sameness from day to day.
14. People ask me to repeat things I've said because they don't understand.
15. I am flexible about how things should be done.
16. I look forward to situations where I can meet new people.
17. I have been told that I talk too much about certain topics.
18. *When I make conversation it is just to be polite.*
19. I look forward to trying new things.
20. I speak too loudly or softly.
21. *I can tell when someone is not interested in what I am saying.*
22. I have a hard time dealing with changes in my routine.

23. I am good at making small talk.

24. I act very set in my ways.

25. I feel like I am really connecting with other people.

26. People get frustrated by my unwillingness to bend.

27. Conversation bores me.

28. I am warm and friendly in my interactions with others.

29. I leave long pauses in conversation.

30. I alter my daily routine by trying something different.

31. I prefer to be alone rather than with others.

32. I lose track of my original point when talking to
people.

33. I like to closely follow a routine while working.

34. I can tell when it is time to change topics in conversation.

35. I keep doing things the way I know, even if another way might be better.

36. I enjoy chatting with people.

Appendix 8

EForm Name: IRB Application
Page: Additional Documents
Section:
Question: Additional document:
File Name: Study Information _RPS.pdf

Study Information

Study Title: Competitive Social Interaction Game - AI Rock Scissor Paper

Principal Investigator: Ali Yousefi, Ph.D

The following fact sheet is here to provide you with information about a research study in which you have expressed interest in participating. Please read it carefully. Once you have read this information, you will be able to begin the study assessment. If you go on to complete the study assessment, you will be agreeing to participate in this study and to have your data used as described below.

What is the purpose of this research study? We are doing this research to develop better ways to measure human capability in making decisions in adaptive and competitive, social settings.

Who is sponsoring this research? This research is being sponsored by Worcester Polytechnic Institute.

What will happen in this research study? If you choose to participate in this research study, you will be asked to complete a series of surveys and cognitive tasks that will help us better understand how you think. The study is expected to take about 15 minutes. Once you have completed all of the surveys and cognitive tasks, you will get feedback about your scores.

How will we protect your privacy? We are not collecting any information in this study that could be used to identify you. The data we collect will come from questions you answer about yourself, how you are feeling, and your performance on the cognitive tests. All of this data will be stored on secure databases and will not be shared together with any information that could be used to identify you.

Who will see your data? All of your information is stored in a secure database. All of our databases are password-protected and secure. Data from your participation may be shared with other researchers, software developers, or submitted to a repository as part of a dataset that is publicly available and can be used to answer further research questions. This dataset will not include any information that can be used to uniquely identify you.

What are the risks of participating in this study? Taking part in this research study has some risks and requirements that you should consider carefully. While we do not expect any serious risks to you, you may find that some of the questions we ask in this study are of a personal nature, such that you feel uncomfortable answering them. If you experience

discomfort, you are free to refrain from answering any question or to end your participation in the study.

It is also important to consider the time commitment that this study requires. If you choose to participate, the study will take 15 minutes

What are the benefits of participating in this study? You will not benefit directly from participating in this research study. However, if you complete all parts of the study, you will receive feedback on your performance on our cognitive tests. You will also be helping us develop better tools for studying the mechanism of decision-making in people with different backgrounds and moods.

What happens if I don't want to participate in this study? Your participation in this study is completely voluntary. If, after learning more about the study, you have decided you don't want to participate, you may leave this page instead of going on to the study assessment. If you start
the assessment but then decide that you don't want to continue, you may end the study assessment at any time by leaving this page or closing the browser tab.

This study is being conducted by researchers affiliated with the Worcester Polytechnic Institute.

How can I find out more about this study? Ali Yousefi, Ph.D, is the person in charge of this research study. You can contact her at ayousefi@wpi.edu. Feel free to get in touch with any questions or concerns you may have.

If you'd like to speak to someone not involved in this research about your rights as a research subject, or any concerns or complaints you may have about the research, contact WPI Institutional Review Board, 508-831-5000.

Appendix 9

EForm Name: IRB Application
Page: Additional Documents
Section:
Question: Additional document:
File Name: TestMyBrain_IRB detailed_protocol_RPS.pdf

PRINCIPAL/OVERALL INVESTIGATOR
Ali Yousefi, Ph.D

PROTOCOL TITLE
Artificial Intelligence Backed Rock-Scissor-Paper Game (AI-RPS)

FUNDING
To be developed

VERSION DATE
4/5/2021

I. BACKGROUND AND SIGNIFICANCE

Recent shift from symptom- to a behavior-based diagnosis of mental disorders has spurred efforts to observe and characterize behavior [1,2]. Social settings in particular present significant challenges to sufferers of mental disorders, and are potentially rich in behavior that can differentiate pathologic and healthy state. However, the social setting is inherently dynamic and reciprocal, making it challenging to characterize behavior of the participants because it is difficult to standardize social interactions across different participants [3-10]. Artificial intelligence (AI) agents that adapt to the behavior of the human player, evoke a more natural range of behavior and emotion, and make a game more engaging, but also allows the standardization of social interactions by making them parametrically variable and statistically repeatable. The proposed research aims to 1) design AI agents that employ simple, heuristic rules to play a simple yet strategically deep iterated rock-scissor-paper (iRPS) game and 2) develop analytical tools to identify behavioral phenotypes from a large pool of player data.

A major bottleneck to innovation is the lag time between an idea, its implementation, and its evaluation [11]. The current proposal addresses this lag time by proposing an iterative test development procedure, based on recruitment of large samples over the internet and randomization of participants to different items and test parameters. This allows tests to be fine tuned prior to inclusion in more costly formal validation procedures. [12]

II. SPECIFIC AIMS

Aim 1. Through iterative tests, refine game interface that maximizes the intuitiveness and ease of use of the game across subject demographics and devices used to play the game, and also parameters of the game that maximizes the engagement and concentration of test subjects.

Aim 2. Collect preliminary data to assess whether 1) different AI RPS algorithms can be discerned through the gameplay experience by human opponents, and 2) there is a differential effectiveness of rules employed by the AI among the participants .

The familiar RPS game was chosen for the simple rules and rich strategy of its play. The AI decides among various rules to decide what move to make next, some based on recent moves, some rely on frequency of moves accumulated over a longer period of time, some mimic aspects of the opponent. The AI can also use corresponding counter strategies, ie mentalization to impute what our opponent might think we're going to do next, and explicitly playing to beat that imputed move. These rules may require utilization of different cognitive facilities (medium to long term vs short term memory, pattern recognition, mimicry, mentalization etc.) to successfully play against. Because the instantaneous rule the AI is playing with is known at all times, it may be possible to ascribe a social context in which each human move is made, and outcomes interpreted along possible mental/behavioral phenotype extracted from the self-reported **Social Ability Questionnaire**.

Test development will begin with a prototype adapted for web-based self-administration. Test prototypes will go through successive phases of data collection, until a set of criteria are reached that maximize reliability, usability, accessibility, and engagement characteristics of the test and no further modifications are identified. We will use a combination of HTML5, JavaScript to design prototypes that enable self-administration, including example and practice trials, and instruction formats validated for self-administration [13].

Links to test prototypes will be posted on the research website TestMyBrain.org for 3-5 days (500-1500 participants per iteration). TestMyBrain receives 500-1000 new participants per day, most of whom have never done a research study before. For each test, participants will be randomly assigned to one of 2+ possible forms of the test (known in software development as A/B testing). These forms may vary in test parameters like number of trials, or aspects of the user interface (e.g. instructions) to evaluate how these factors impact reliability, accessibility, and engagement. Participants leave structured and unstructured feedback regarding instructions, technical issues, and other factors that impacted their testing experience.

III. SUBJECT SELECTION

This study will include between 500 and 1,000 participants of all ages. Participants will be recruited from people who come to TestMyBrain.org through search engines, social media posts (generated by others), and popular media. No formal advertisement will be done, except for on the front page of TestMyBrain.org.

Recruitment: Participants will be recruited through links on the front page of TestMyBrain.org, an online cognitive testing platform. Text for this link is shown in the document **Recruitment Examples**. We will rotate different recruitment messages on the front page to see if it changes the demographic composition of participants.

IV. SUBJECT ENROLLMENT

Subject Registration and Enrollment: Participants will navigate to TestMyBrain.org through search engines, social media, and other links posted on the web by former participants, and can participate in a study by clicking on the study link on the front page of TestMyBrain.

Consenting: At the onset of the study assessment, eligible participants will view a study fact sheet containing information about the purpose of the study, a description of what participation will entail, a summary of potential risks and benefits of participation, and contact information for the PI. Consent forms will not be completed since participants will not be contacted in person or by phone to allow for written or verbal consent; instead, participants will be informed that by completing the study assessments they are implying their consent to participate in the study.

V. STUDY PROCEDURES

Before the study begins, participants will be told that they will receive the results of their assessments once they have completed all measures. They will then be asked to complete the following questionnaires.

1) Demographic Questionnaire. All participants will then complete a brief demographic questionnaire, which asks them to report their age, gender, whether English is their primary or native language, along with a free text field for them to enter other information (see **Initial Demographics Questionnaire**).

2) Cognitive Tests. Participants will complete the cognitive test described in **Cognitive Tests**. Participants will be randomly assigned to particular alternate forms of a cognitive test. These alternate forms may vary in terms of stimuli, timing parameters, aspects of the user interface, and other test characteristics as described in **Cognitive Tests**.

3) Emotional State Questionnaire. Participants will complete a questionnaire asking them about their current mood, sleepiness, or other factors that would be expected to cause short-term improvements or decrements in cognitive function. See **Emotional State Questionnaire**.

4) *Social Ability Questionnaire*. Participants will complete the BAPQ questionnaire asking them about how they see themselves functioning in society. See **Social Ability Questionnaire**.

5) *Final Questionnaire*. Participants will complete a final demographics questionnaire that will ask about race, ethnicity, education, and sexual orientation. See **Final Questionnaire.**

6) *Results / debriefing.* At the end, participants will be presented with results of their assessment, based on comparing their scores to the scores of participants from our normative database and get links to resources if they have concerns about their cognitive health or would like to learn more about cognition and the brain (see **Debriefing and Feedback** document).

VI. BIOSTATISTICAL ANALYSIS

Data from this study will consist of non-identifying demographic information, self-report questionnaire data, and game play data (recorded RPS hands). Cognitive data will be interpreted with respect to participant scores from our normative database through TestMyBrain.org, and through analysis of RPS response patterns to AI rules.

Sample Size

The sample size will depend on traffic and number of iterations needed to achieve psychometric, accessibility and engagement criteria (defined below). The sample size is expected to be between 500 to 1500 participants. TestMyBrain.org have previously tested 2.2 million participants in different cognitive tasks.

Analysis Plan

After each data collection period, tests will be evaluated for potential modifications along the following criteria: Psychometric Criteria - (1) RPS scores show reasonable difficulty of the AI, with population mean score near a tie performance; (2) All major device types are well represented, with expected distributions of outcome variables; (3) Participants across all age ranges and education ranges are represented, with expected distributions of outcome variables; (4) Participants did not identify strategies for cheating; (5) Participants understood instructions; (6) Participants had no systematic technical difficulties; (7) Participants had no systematic discomfort or frustration associated with testing. Engagement Criteria - (8) Participant ratings exceed 3 out of 5 "stars", indicating a mostly positive experience; (9) Participant attrition (i.e., failing to complete a test) was not higher than expected based on other tests of similar length on TestMyBrain.org.

This iterative procedure is repeated until a test meets criteria and no further modifications are identified from user feedback or test data. If a proposed test does not meet criteria and no

modifications are identified to address unmet criteria, development of that test will be halted. This iterative test development method through TestMyBrain.org is well-validated for fine tuning psychometric and user interface characteristics to create reliable and engaging tests for research using web and mobile-based testing [11-13]. These tests have attracted over 2.2 million participants to TestMyBrain.org and have generated some of the largest published samples in cognitive research.

The results will help us to develop high quality, sensitive, and reliable measures that have passed basic validation across a diverse range of participants and device types.

VII. RISKS AND DISCOMFORTS

a) *Privacy*. A potential risk is a breach of confidentiality. To protect against the loss of confidentiality, TestMyBrain (TMB) has the following security measures in place, administered by the 501c3 Many Brains Project. We also will not collect any personal information as part of this project that could be used to identify someone.

1.1 Application server, Database and Web Hosting:

Experiment information and title page will be hosted on TestMyBrain.org, and a link will bring participants to a javascript and HTML5-based web-application and questionnaire hosted on a server at WPI. Data entered by participants will be securely transmitted via SSL (secure sockets layer) communication link to the server, and stored in a protected database on the server.

1.2 Access control:

Only personnel conducting the study will have access to the participant data through password-protected Linux accounts.

1.3 Data Transfer between Client (Browser) and Server:

The web application uses SSL (secure sockets layer) encryption to protect any information that is being transferred between a browser and the server. All Study links will use secure communications protocols incorporating SSL (https).

1.5 Data Monitoring and Quality Assurance:

1.5.1 Protection from Malicious Attack: The Linux host and database at WPI are updated with the latest security patches to protect from malware. The default administration and connection passwords are changed. Unused ports are deactivated.

1.5.2 Transmission of Data: All participant test data are transmitted directly to the Researcher using secure protocols.

b) *Discomfort.* In the event that participants experience discomfort when completing the study questionnaires or experimental tasks, they are free to leave the experiment at any time by closing their browser window. This will be explained in the study information form.

VIII. POTENTIAL BENEFITS

Participants will not receive any immediate benefits from their participation, aside from feedback about their performance which most participants find educational and interesting. Completion of study aims will allow the community of cognition researchers new tools that have been assessed across a range of device types, as well as tools and best practices for building new tests for the web and mobile devices.

IX. MONITORING AND QUALITY ASSURANCE

a) The site PI will have responsibility for continuous monitoring of data and safety of subjects in the study, in collaboration with other members of the research team. Data and safety monitoring will take place continuously throughout the study's duration. TestMyBrain.org has been in operation since 2008 with over 2.2 million people tested worldwide. During that time, there have been no adverse events or major complaints, and similar study procedures have been vetted for other studies by various IRBs nationally. A version of this protocol has also been active through the Harvard University IRB since 2008.

(b) We will report both adverse events and all serious adverse events that occur during the course of the trial to the Institutional Review Board. Specifically, we will record all adverse events in a tracking log based on IRB templates, which will be submitted to the IRB at each continuing review.

(c) At the time of the continuing review we will provide the IRB with a summary of any unexpected and related adverse events as well as any other unanticipated problems that occurred since the last continuing review.

(d) Adverse events and unanticipated problems will be reported to the IRB per PHRC reporting guidelines. We will report to the IRB any unanticipated problems and adverse events that occur: (a) during the conduct of the study, (b) after study completion, or (c) after subject withdrawal or completion. Reports will be submitted within 5 working days/7 calendar days of the date the investigator first becomes aware of the problem.

X. REFERENCES

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Appendix 10

EForm Name: IRB Application
Page: Additional Documents
Section:
Question: Additional document:
File Name: Debriefing_Feedback_Document _RPS.pdf

Debriefing and Feedback Document

Understanding Results

In this study, we looked at how you choose a game strategy to beat the AI. You played two rounds of the game, and we want to understand how you remember previous hands and pick game strategies. We also want to know whether you picked differences in the AI game strategy and how you respond to it. We are further interested to know how your game strategy is affected by your mood, sleepiness, and your stress level. Your data helps us answer these questions. Your data also helps us to build better tests of things like social interactions and decision makings under competitive settings.

If you are surprised by any of your results, don't be concerned. Scores can vary widely for normal reasons like being distracted or using a different computer. Our research focuses on patterns of performances across all participants, together. It is hard to interpret the way these results apply to any one person. We *can* tell you how your results compare to other people. But, we ***can't*** tell you what your individual results mean for your personal health. Thanks to your participation, we are learning about how decision-making in a game like RPS is related to mental health.

The "average score" is the average of everyone who has done the test. Since people score differently at different ages, we also show the average scores for people at 20, 45, and 65 years old where this data is available. The yellow bars show the range of scores found in about 95% of people.

If you have questions about these or any of your results, please email us: ayousefi@wpi.edu

[Below is an example of how the game information will be graphically presented to participants after completing the test.]

Results

Round	Wins		Losses	Ties	Round that felt more challenging	AI machine	Do you think AIs similar/different
1	0	<	79	1		multistep perceptron	DIFFERENT
2	5	<	75	0	THIS ROUND	1-step frequentist	

You played against different machines. You're very perceptive!.

We appreciate your participation in the repeated RPS experiment! If you enjoyed it and want to try again, we would be appreciate further participation. If you do, please indicate that it is not your first time participating in the questionnaire. Thank you!

If you have any questions or comments about your results, please contact us at ayosefi@wpi.edu

Additional Information

Clinical Resources:
Although these measures are not meant to assess you, if you would like to speak with a clinician or other medical professional about your cognitive health, you can consult the MGH Psychological Assessment Center: https://www.massgeneral.org/psychiatry/contact/

Related Research:

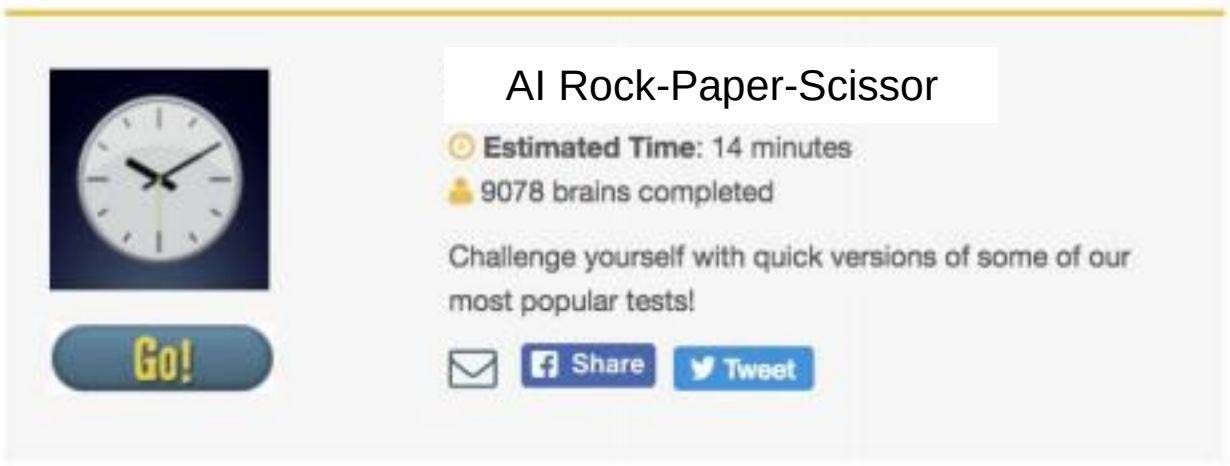
For additional information on how memories are stored in the brain, you can read this article written by researchers at University of Queensland Brain Institute: https://qbi.uq.edu.au/brain-basics/memory/where-are-memories-stored

Appendix 11

EForm Name: IRB Application
Page: Additional Documents
Section:
Question: Additional document:
File Name: Recruitment_Examples_RPS.pdf

Recruitment Examples

Participants will be recruited from the front page of TestMyBrain.org. At any given time, six studies are posted on TestMyBrain.org. The study proposed here will occupy 1-2 of those study slots. There is a standard format for study recruitment on the front page of TestMyBrain.org (shown below). Note that the study titles and descriptions are limited to 100 characters based on the layout of the front page of TestMyBrain.org



All studies include links for sharing the study through email, facebook, and twitter (standardized across studies).

Below we show text that will be used for titles, descriptions, as well as images for recruitment for this study.

Titles (one of the following):
Social Interaction
Rock-Scissor-Paper (RPS) Game
Decision Making
Game Strategy
Holding Information in Mind
Thinking on Your Feet

Descriptions (one of the following):
Here, we look at your game strategy to bear AI RPS.
How quickly you can change your game strategy?
How well do you hold previous information in your mind?
How well you can read your component mental state?
How well you can guess your component strategy?
Are you better at an adaptive or strategic game planning?
How well do you sustain your memory and adjust your decision?
Games. Challenge yourself with quick versions of popular tests!

Images: