**Needle in the Haystack: The Search for Truth in the 21st Century**

**Research Proposal**

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**Overview**

Intended Audience: The University of California Berkeley Research Leadership Team

Misinformation has pervaded and corrupted societies across the globe. It has contributed to political division[1], rising authoritarianism[2] , a fatal mistrust in science[3], and domestic terrorism[4]. However, misinformation is nothing new[5]. What is new, is the abundance of information we consume and share daily. In 2019, Americans spent—on average—over 12 hours a day consuming traditional and digital media[6]. Just as computers face processing limitations, so does the human mind; and we believe the inundation of information is negatively affecting people’s ability to identify fake news and thus contributing to the dissemination of misinformation. We are proposing an experimental study to better understand how excessive information consumption may affect our ability to discern fake news, other variables removed.

In this study, we will test current University of California at Berkeley students’ ability to correctly classify fake/non-fake news. We will limit our treatment groups’ mobile and desktop information consumption time to see whether they better classify non-fake and fake news compared to the control group.

Key Terms

Below are definitions for terms that will be used throughout the proposal:

* Fake News: news that contains substantially misleading and/or inaccurate information.
* Freedom: the application we will be using to monitor and restrict content usage on desktop and mobile devices
* Non-Fake News: news that does not contain substantially misleading and/or inaccurate information.
* Restricted Content: social media, news sites, and any other information outlets identified in the initial survey in phase 1 that we will be restricting usage of

**Research Question**

Primary Research Question:

Will reducing an individual’s time spent consuming information improve their ability to correctly classify fake and non-fake news?

* As part of our analysis of this question, we will also examine participants’ accuracy in classifying news (fake/non-fake) as a function of their reduction in time spent consuming restricted content.
* We will identify any discernible trends or features in this relationship (e.g., linear relationship, asymptotic relationship of diminishing returns, thresholds for stepwise effects, etc.).

Sub-Questions:

Does one’s baseline consumption rate of media (prior to intervention, as measured by time) affect their ability to accurately classify fake and non-fake news?

* If one’s ability to discern fake news is a function of time spent consuming media, a lower baseline consumption of media may correlate with greater accuracy.

Does one’s news consumption profile (proportions of social media and traditional media) affect their ability to correctly classify news as fake or non-fake?

* If a correlation is observed, further investigation may be necessary to determine whether/how this proportion acts as a mediating variable.

Does one’s academic field of study and year within that field affect their ability to correctly classify news as fake or non-fake?

* Plausible methods of impact: may impact the means by which, or how discerning participants are, in evaluating sources of information; may predispose individuals to consume less media overall due to the time demands of their field of study; may predispose individuals to consume media profiles (topics or sources) that differ significantly from average, impacting their rate of exposure to fake news.

Does reducing one’s information consumption affect their certainty in classifying fake and non-fake news?

* Allowing select Control and Experimental groups to only answer yes/no if an article constitutes fake news, while allowing other groups a third “I’m not sure” option, will investigate whether the treatment causes participants to become more skeptical about an article’s veracity, even if they do not have the certainty to select between the yes/no choices.

**Data**

We will be collecting and creating data from our participants. Our first dataset will be the participant’s responses to whether or not the articles sent to them were fake news. Depending on the participant’s group, their response options will consist of yes/no (Experiment/Control Group 1) or yes/no/not sure (Experiment/Control Group 2). The articles we use will be fact checked from Snopes, a 3rd party fact-checking site. We will use articles that Snopes has checked within the prior two weeks from the day they are sent the article.

The second dataset will be collected via an application the participants will download on their devices to track how much time they spend online. We will collect smartphone usage data and desktop usage data via the application Freedom. Freedom is an app for smartphones and desktops used to limit device use by blocking websites and apps for a pre-scheduled amount of time. It also syncs across devices. Each week, we will artificially decrease the amount of time allowed on selected applications and web-browsing per day based on data from the applications.

We will also be collecting some general demographic information from the participants such as school year and major via a survey before the start of the experiment.

We will not be able to track the exact urls the participants use during the week and therefore will not be able to do analysis on the content that a participant consumes, only the amount of time spent interacting with content. We do not plan to generalize our findings to a larger population outside of UC Berkeley. This study is meant to be exploratory.

**Study Design**

We would like to investigate the relationship between cognitive load, quantified by time spent consuming content, and an individual’s ability to classify fake news and non-fake news. To do so, we would like to conduct a study during the summer of 2022 on students currently attending University of California at Berkeley in two phases.

Phase 1: Monitoring

* All participants are monitored for a week without any time or content restrictions. We will gather baseline information about the participant’s information consumption habits and information diet.
* All participants will also fill out a short online survey asking general demographics, including their year and field of study.

Phase 2: Experiment

*Experiment Process*

| **Time Period** | **Groups Affected** | **Reduce information consumption time allocated daily to:** |
| --- | --- | --- |
| Week 1  (7 days) | Experiment Group 1 and Experiment Group 2 | 80% of baseline |
| Week 2  (7 days) | Experiment Group 1 and Experiment Group 2 | 60% of baseline |
| Week 3  (7 days) | Experiment Group 1 and Experiment Group 2 | 40% of baseline |
| Week 4  (7 days) | Experiment Group 1 and Experiment Group 2 | 20% of baseline |

Upon signing up for the study, participants will choose what three days in the week they would like to receive a short activity. On the day they selected at 6 pm their time, we will email the participants with a link to access the activity. After the email is sent, participants have two hours to complete the activity otherwise the link will expire. Once clicking the link, participants will access a site where they will interact with three randomly assigned articles. Once clicking an article the participant will have 5 minutes to read the article. We are assigning this time constraint to prevent participants from researching more information than what is available in the article. Once the participant finishes reading the article or the 5 minute timer ends, a Qualtrics web intercept survey will pop up asking the participant if they believed the article contained misleading and/or inaccurate information. At the conclusion of the experiment, each participant will receive an email listing the different articles they read, the answer by the 3rd party checker’s fake news assessment, and what the misleading and/or inaccurate information if applicable.

* **Control Group 1:** Participants will continue without any time or content restrictions like everyone in the monitoring phase. This group will also receive the same answer choices as experiment group 1.

* **Control Group 2:** Participants will continue without any time or content restrictions like everyone in the monitoring phase. This group will also receive the same answer choices as experiment group 2.
* **Experiment Group 1 Treatment:**
  + Once a participant reaches their allotted information consumption time, which is the total time allocated to consuming content on their phone and desktop, Freedom will restrict access to social media, news sites, and any other information outlets identified in the initial survey in phase 1.
  + During the activity, when asked about an article’s accuracy, the answer choices will be:
    - Yes, this article contains substantially misleading and/or inaccurate information.
    - No, this article does not contain substantially misleading and/or inaccurate information.

* **Experiment Group 2 Treatment:**
  + Once a participant reaches their allotted information consumption time, which is the total time allocated to consuming content on their phone and desktop, Freedom will restrict access to social media, news sites, and any other information outlets identified in the initial survey in phase 1.
  + During the activity, when asked about an article’s accuracy the answer choices will be:
    - Yes, this article contains substantially misleading and/or inaccurate information.
    - No, this article does not contain substantially misleading and/or inaccurate information.
    - I’m not sure.

Website and Content Requirements

The website that participants access will contain three random articles from the previous 2 weeks which will contain a portion of fake news and non-fake news according to Snopes. Each article will be sanitized so that only the textual content will be available for review to prevent participants from judging an article’s factuality based upon aesthetics, source notoriety or party association.

**Sample**

Our sampling frame are those students enrolled at the University of California, Berkeley, who volunteer for participation in the study, with consideration to the following criteria:

* Inclusion Criteria
  + Current enrollment in degree-conferring Undergraduate or Graduate program
  + Average daily consumption of internet-accessed media (websites, social media, news apps, etc.) of at least two hours
* Exclusion Criteria
  + Personal electronic devices (mobile devices and computers) not compatible with the Freedom application, respectively.

Using UC Berkeley sponsored print media, social media accounts, and relevant student email distros, we will advertise for participation in our study starting four weeks prior to its commencement. Our study will take place during the summer, in order to minimize concerns of potential volunteers restricting their phone/computer use during fall/spring semesters.

We will advocate for sufficient resources to offer scaling incentives for participants - either cash, or gift cards to UC Berkeley stores - which increase the longer a participant continues to participate in the study. We will also coordinate with Department heads to register our study for credit in any programs that require or reward participation in UC Berkeley-sponsored studies.

From our volunteer sampling frame, students will be categorized according to their degree level of study (Undergraduate/Graduate), as well as the field of study of their declared or expected major (if applicable): humanities, social sciences, natural sciences, formal sciences, and applied sciences. Using quota sampling, we will strive for at least 40 and no more than 60 students from each of the ten categories. Within each of these categories, participants will be randomly selected for inclusion in either of our control groups or either of our experimental groups, distributed equally among the four groups. Using this method will ensure that each category of students has between 10 and 15 participants in each of the control and experimental groups This will give us a total sample size between 400 and 600 total students, ensuring that our proposed incentive is not prohibitively expensive while also achieving a minimum overall sample size as prescribed by available sample size calculators (http://www.raosoft.com/samplesize.html).

**Variables and/or Intervention**

Our primary focus for this study is to better understand how much the quantity of information (measured by time spent consuming information) participants consume affects their ability to classify news as fake or non-fake. We have designed our study to isolate time spent consuming information, removing other variables such as political affiliation, news source preferences, etc. These decisions limit our ability to generalize our findings beyond our study, but our intention is to determine if this variable is important and worth exploring further in a more “real-world” setting.

Intervention:

We will limit the time spent consuming information on desktop and mobile by an additional 20% of the individual's baseline each week for four weeks.

Variables of Interest:

* Independent Variable: Time spent consuming information via mobile and desktop, captured/monitored with Freedom
  + We are also interested in time spent on specific categories of applications: news aggregators, social media, general internet browsing, and content sites.
* Dependent Variable: Performance on classifying non-fake and fake news, captured via assessments. Non-fake news articles will be treated as positives and fake news articles will be treated as negatives.
  + Accuracy (True / Total)
  + Precision (True Positives / Total Positives)
  + Recall (True Positives / True Positive + False Negatives)
  + F1 Score (2 \* (Recall \* Precision) / (Recall + Precision))
* Supplementary Independent Variables: Participant Information
  + Age
  + Race/Ethnicity
  + Gender
  + College Degree Level
  + Major/Focus
  + School Year
  + Part-Time/Full-Time Student
  + No/Part-Time/Full-Time Job

**Statistical Methods**

For this study, we will not be able to do a random sample. Because of that we will focus on trends and differences between the different groups. We can use the different demographic information and experiment groups to filter by factors like major, age, time spent online, and gender. Since we will try to have relatively large groups and multiple control groups, the differences should be pronounced and easy to spot if they occur. We would be looking at each group’s accuracy, precision, recall and F1 Score.

**Potential Risks**

We have identified 3 areas of concern:

1. Participants may consume media outside of restricted devices. Even though we’re able to control the amount of time the participants consume media using their phone and desktop, we cannot control if participants consume media outside of these devices. To mitigate this issue, in our communications with participants we will frequently emphasize the importance of avoiding media consumption outside of restricted devices.
2. Participants may quit the experiment because of the length of the experiment and the disruption to their normal media consumption. We will aim to create incentives that are sufficient to convince participants to complete the experiment, but there is a risk that some will still leave and that could reduce the sample size or potentially introduce bias to the data.
3. The ethics of our experiment and the privacy of participants will be secured by:
   1. Sending the research proposal and consent/disclosure documents for review by an institutional review board.
   2. Not capturing or retaining the content of a participant’s online activity during the experiment.
   3. De-identifying all data after collection.

**Deliverables**

It will take us about a month to gather the participants for our study. After the IRB process is done, we could formally start the experiment in June 2022 and be done by the beginning of July. From there it would take us about another month and a half to analyze our findings and do a formal write-up with next-step recommendations for the research. We hope to be able to present at data conferences by the end of September. We would be working in collaboration with the application Freedom and credit them in any documents or presentations.

**Statements of Contribution**

* John-Michael Stilb: My primary contributions to the project fall into three buckets: problem articulation, question formation, and conceptualization. Additionally, I worked with my team to complete our designated sections in the proposal and presentation, while providing edits & feedback to my teammates’ sections. Importantly, this project has been collaborative, and everyone has contributed during each stage of the project. Together we drafted appropriate sections, crafted our presentation, edited each other’s work, and made decisions about our study design.
* Andrew Miller: Our team did a great job of discussing the project extensively prior to and throughout the process of drafting the deliverables. Each team member brought valuable insights to every section of this document and the presentation. My areas of responsibility research sub-questions and the sample section for the document, and sampling and analysis slides for the presentation. Otherwise, editing and reviewing all sections of both deliverables were entirely collaborative.
* Gauri Ganjoo: Like everyone mentioned, the team did a great job brainstorming and outlining the sections before we started individually fleshing them out. Big thanks to JM who as the leader really helped us stay on track and of course came up with the big ideas for the experiment. My responsibilities were the sections on data, statistics and deliverables. I also helped edit the other sections within the proposal.
* Jacquie Nesbitt: I am incredibly grateful to have worked with such a collaborative, considerate, and insightful team. We worked together to flesh out the proposal over the course of several meetings and had the autonomy to develop individual sections. My areas of responsibility were the study design and potential risks. Additionally, I helped to edit and refine other sections within the proposal. Additionally, I also assisted with creating the slides and script for the study design slides.

**References**

1. <https://arxiv.org/abs/1706.05924>
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