**OSF Registration Template Qualitative Research**

### Registration Metadata

1. Title:

Inhibition of manual gestures by salient distractor stimuli

1. Description:

In this project, we want to estimate the effect size and variability of the inhibition of hand movements through salient distractor stimuli in the environment. We will conduct an online study with two tasks that are known to elicit saccadic inhibition (https://pubmed.ncbi.nlm.nih.gov/14769077/), adapted for hand movements.

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3. License
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4. Subjects

Cognitive Science, Psychology

1. Tags

Motor plan selection, perception and action, hand movements, eye movements, saccadic inhibition, motor inhibition

### Study Information

1. Research Aims:

We want to explore the manual inhibition effect in response to salient distractors. Previous work has shown inhibition of button presses when a salient distractor was shown almost simultaneously with the movement target ([Bompas et al. 2017](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5388195/)). This research has also already shown that this effect is rather small but can be reliably estimated with many trials per observer.

Instead of measuring the inhibition of button presses, we will measure the inhibition of reach- and point movements on a touchscreen. The effect size and variability across observers in our task is unclear. The study will be conducted online, which adds another level of uncertainty about the variability in the responses.

The main aim for this study is therefore to to quantify the effect size of the inhibition and the variability in the timing and spatial accuracy of observer’s responses in our tasks. Eventually, we want to use the effect size and variability estimates in a power calculation to compute the number of subjects and trials per condition needed to find a robust effect. These parameters will be applied to an independent study.

1. Research question(s)
   1. (How much) Does the rate of manual movement onsets drop after a salient flash has been presented?
   2. How variable is the drop across participants?
   3. How variable is the onset of the drop?
   4. How many participants will we need to reliably detect the inhibition effect?
2. Anticipated Duration
   1. Estimated project start date (09/2021)
   2. Estimated project end date (11/2021)

### Design Plan

1. Study design
   1. The study is a psychophysical experiment, involving speeded manual responses to stimuli on a touchscreen device.
   2. *Task 1:* In the first part of the study, participants will place their index finger on a central dot on the screen. After a variable delay, this dot will jump, either to the left or to the right (go signal). Participants will be instructed to touch the jumped dot as quickly as possible. Imprecise answers (within a 150 pixels radius around the target) will be counted as correct, but answers that were too slow (reaction times longer than 500ms) will be repeated. After a delay of up to 70ms from the go signal, a combination of two manipulations at two levels of visibility will be shown:

Flash

*Flash visible:* the upper and lower part of the screen turn white for 50ms, producing a short and salient flash.

*Flash invisible:* the upper and lower third of the screen display a fully transparent flash for 50ms, invisible to the observer

Secondary jump

*Jump visible:* the position of the jumped dot is reassigned to a new position. This looks like a shift of the jumped dot by about its own size. This secondary jump can happen in the same direction as the first jump (towards the border or the screen), or in the opposite direction (towards the screen center).

*Jump invisible:* the position of the jumped dot is reassigned to the same position where it’s already located. This is not perceived by the observer.

Overall, this results in 4 different trial types:

Flash visible + secondary jump visible,

Flash visible + secondary jump invisible,

Flash invisible + secondary jump visible,

Flash invisible + secondary jump invisible.

* 1. *Task 2:* In the second part of the experiment, participants will be instructed to collect a series of 6 dots. In the basic series, the 6 dots are spaced apart by 80 pixels horizontally and are aligned vertically to the center of the screen. For every trial, a random jitter between -20 and 20 pixels is added to both the horizontal and vertical component of each dot individually. As soon as a dot was touched, it disappears from the screen. After a delay of up to 700ms, again a combination of two manipulations at different levels of visibility is shown:

Flash

The flash manipulation is identical to the manipulation above, with a visible and an invisible level.

Secondary jump

*Jump visible:* The dots on the screen are replaced by a new series (basic series + random jitter). The changes will only be noticeable in points that have not yet been touched, since all other points remain invisible.

*Jump invisible:* The dots on the screen are replaced with the same series as they were initialized with, resulting in not visible change to the observer.

These manipulations result in the same 4 trial types as above:

Flash visible + secondary jump visible,

Flash visible + secondary jump invisible,

Flash invisible + secondary jump visible,

Flash invisible + secondary jump invisible.

1. Sampling and case selection strategy

We will recruit participants through the platform prolific. We will screen them for normal vision and known reliable participation in other online experiments (>75% valid submissions). We will require them to speak English fluently (to make sure they’ll understand the instructions). We will not restrict any other parameters. Prolific is available for participants in OECD countries (i.e. Europe, Japan, Australia, North America).

### Data Collection

1. Data source(s) and data type(s)

We will collect an original dataset. This dataset will include the time stamped position data of touch responses on the screen of a smartphone or tablet. We will record screen size and resolution, device type and browser used for the study.

During the study, we will show different elements on the screen. Any changes in these elements will be timestamped and recorded. All elements and their potential changes are listed in 4. – Study Design.

Basic demographic data about the participant is available through prolific (age, gender identity, socio-economic status, native language).

Upon completion of the study, we will ask participants to rate their concentration, report if they completed the study in fullscreen mode, which finger they used for the touch responses, and which hand.

1. Data collection methods

We will collect the data through a psychophysical experiment that is described in detail in section 4.

1. Data collection tools, instruments, or plans

We will use the participants’ smartphone screens to display our stimuli. The experiment is implemented in html/javascript (using the [jsPsych](https://www.jspsych.org/) toolbox) and hosted on a server of the psychology department of Humboldt Universität zu Berlin. The tool used to communicate with the server is [jatos](https://www.jatos.org/).

1. Stopping criteria

We will stop the data collection as soon as we have collected 20 complete data sets. A complete data set is defined as containing 192 completed trials of task 1 and 200 completed trials of task 2. If more than 10% of trials need to be removed during pre-processing, the dataset will also be flagged as incomplete, and a new dataset will be collected. Most exclusion criteria are controlled online and incorrectly executed trials will be repeated to ensure complete datasets.

### Analysis Plan

1. Data analysis approach
2. Data analysis process

*Who*

The data will be analyzed by Clara Kuper under the supervisions of Martin Rolfs.

*Tools*

The data will be analyzed in python, using jupyter notebooks stored in this repository: <https://github.com/ClaraKuper/ManualInhibitionOnline>

*Preprocessing*

Preprocessing steps will be:

* Translating the raw data json file into a two data frames (one per task). This will be done using the pandas library in python.
* Align all time stamps collected during one trial to the go signal from that trial.
* Align the position of elements and touch responses to the center of the window. For the html elements (targets on the screen) this involves computing the center of the dot, since html indicates the coordinates as the upper left corner of the element.
* Removing outlier responses: touch responses that were more than 3 standard deviations away from the average response of a participant will be removed.

*Data sanity checks*

Data sanity checks mainly serve the purpose to make sure that the data is not obviously corrupted. They will be performed at different stages during pre-processing to check that that data “behaves” as we would expect it. Those sanity checks are:

* The duration over which participants took the experiment follows a normal distribution with no obvious outliers. The mean duration should be ˜30 minutes. We will not exclude participants due to long or short experiment durations, if all other sanity checks below apply.
* Participants made (few) errors. The tasks are difficult and need to be done at a fast pace. We do not expect perfect performance, but we would expect less than 30% repeated trials. Trials with errors will be repeated during the experiment.
* Every subject successfully completed the full number of trials in each task.
* All screens have a minimal height and width so that they support full stimulus presentation. This will also be checked online.
* Subjects reported being concentrated during the experiment.
* Subjects reported using the index finger during the experiment.

Subjects that don’t pass the data sanity checks will be excluded from the analysis.

*Data quality checks*

We will run a linear regression analysis that will predict the touch response of each participant given the physical location of touch targets on the screen and the timing at which these targets appeared. Only if we see a significant influence of the position of the target and the coordinates of the touch response, we will include the data into subsequent analysis. In the jump tasks, we will compute this correlation only for tasks that included a secondary jump, because the initial jump location is always at the same distance from the center. In the serial task, we will compute the correlation only for trials that did not have a position jump.

The pre-processing and data quality check is implemented here:

<https://github.com/ClaraKuper/ManualInhibitionOnline/blob/master/analysis/Sanity_Check.ipynb>

*Movement rate analysis*

Movement rates will be analyzed as described in [Rolfs et al (2008)](https://jov.arvojournals.org/article.aspx?articleid=2122137).

For each participant, we will compute the difference between the movement rates after visible and invisible flashes. We will take the time point with the strongest suppression effect (rates after visible flash lower than rates after visible flash) and compute the mean and variability across participants.

Next, we will use the mean of this distribution +/- 1 standard deviation to define the inhibition time window where we will look for inhibition. This time window will be saved and applied in the follow-up study.

To define the number of participants we want to collect in the follow-up study, we will compute the mean movement rates for visible and invisible flashes in the inhibition time window for each participant. We will submit the mean and standard deviation of the movement rates across participants to a power analysis.

The results from this power analysis will be used to define the sample size for the follow-up study. What happens if the number of participants suggested by the power analysis is unreasonably high? (we will increase the number of trials per participant??).

The analysis is implemented here:

1. Credibility strategies

The code used to analyze the data, as well as the code used to collect the data are openly accessible via github.

The data itself will be published along with the manuscript for this study.

These strategies ensure maximal transparency and allow any interested person to reproduce the study.

### Miscellaneous

1. Reflection on your positionality

I expect to find an inhibition effect induced by the salient distractor. I expect a small effect size and a relatively late effect (200 – 300ms after the distractor). This might make it difficult to detect the inhibition effect in the jump task.

A second effect I am interested in is the size of response errors after a distractor stimulus. If the distractor helps to recalibrate the perception of the environment, we would expect small errors on responses after the distractor. I will not compute the power in this experiment based on the errors size after a response, but based on the size of the inhibition effect.