Notes:

**Slide 1:** HGF for behavioral analysis on anxiety patients during lockdown

**Slide 2:** We would like to briefly present the context that led us to the idea for this project.

-> We are 3 Italian students whose families have lived the lockdown in italy in first person. We wanted to combine our personal experience with the subject of the course.

->The first inspiration was brought by the lack of healthcare goods, such as masks or hand sanitizers, in italy since the very beginning of this period, which led to a general concern whithin the population.

->From this, we developed our project idea for anxiety analysis during lockdown.

-> Right afterwards, we started doing our test to build our own dataset from italian subjects.

**Slide 3:** Let me introduce you to the goal of our project.

We developed 3 test which we are going to describe more in details in a moment, namely 1 anxiety quiz, used to validate our results, 1 impartial test, 1 psychologically involving test.

->These three tests are delivered to the agents via a webapp developed by us, in order to make the experiment easier and accessible to a wider pool of subjects.

->Then we collect the results and we analyse and model them via HGF library and finally we use a clustering algorithm to separate anxiety patients from healthy controls.

Our goal is to compare the clustering obtained from the two tests with the ground truth provided by the anxiety quiz.

The hypothesis we want to validate is that the involving test provides results consistent with the ground truth, while the impartial test provides more random results, when compared to it.

**Slide 4:** Let's describe the tests we proposed.

With the animation you can see the interface presented to our subjects.

Anxiety quiz: composed by 20 questions taken from STATE TRAIT ANXIETY INVENTORY.

the other two tests are structured in the same way.

the agent imagines to be in a daily situation at the supermarket, where they have to buy a certain good, which may or may not be present there.

After knowing this, they are asked to guess whether the same good is present or not in a nearby supermarket and they are shown the correct answer.

the information about the presence or absence of the good, which is our input is provided as visual cues, as you can see in the demo.

The fundamental difference between the two tests relies on the involved good: biscuits for the impartial context, hand sanitizer for the psychologically involving one.

**Slide 5:** This is how we generated the binary sequences for the experiment.

The correct outcomes are produced by a generative model which takes as input some parameters and the probability of outcomes themselves, given the cues. in particular this probability is shown here with the black line and it's a step function. (used to control the bernoulli distribution in the generative model).

The output of the generative model is shown with the blue line, which then we binarize and discretize and it is shown at the bottom with the green dots.

The cues are produced backwards via a bernoulli distribution of the correct outcomes and they are shown with the orange dots.

**Slide 6:** The heart of our analysis consists of the estimation of three parameters of the perceptual model, namely the two default volatilities of the hidden states and the initial value of the random walk (mean value of the normal distribution of state\_3).

These parameters are shown on the axes of the two graphs, which depict the distribution of the user in the parameter space, for the two scenarios. the groups are identified via the two colors, accordingly to the result of the anxiety quiz, and are more or less in the same quantity.

As you can notice, the involving test presents two fairly visible regions, quite consistent with the ground truth, while the impartial test presents a more spread and chaotic point cloud.

**Slide 7:** Moreover, regarding the parameter, we analysed their correlation in the different configurations.

In all the cases, as you can see, they are never correlated which means they independently identifiable. Consequently, changing a parameter is never fully equivalent to change another one.

(Including a readout of mu3 in the response model allows to get rid of the indeterminacy observed when using other models we tested during exercises.)

**Slide 8:** Starting from the estimation of the parameters, we carry out K-means clustering to ideally distinguish healthy controls from anxiety patients and we compare the obtained results to our ground truth.

in this slide we present the results for the impartial test.

on the left you can see the classification of the subject according to the ground truth, while on the right there is output of the k-means clustering for the two groups.

We can see that in the impartial context the accuracy obtained is quite low, very close to 50%, which means that in this scenario all the users behave in a very similar way.

->Here there is a visual aid to identify the centroids of the clusters and the parameters of the ideal model in green.

**Slide 9:** Here the same graphs are shown for the involving scenario.

As you can see, the behaviour of the k-means is way more consistent with the ground truth, leading to an accuracy of 76%.

This means that, as supposed, in a psychologically involving context the two groups behave differently enough to be distinguished in the majority of the cases.

->Moreover, as an additional insight, the estimation of the ideal parameters is closer to the healthy controls, which could possibly mean that the anxious people tend to drift from the ideal behaviour.

**Slide 10:** Finally, we want to compare the simulation with the ideal parameters and with healthy and anxious centroids, in the involving context.

The analysis shows that the simulation with the healthy centroid has a trend more similar to the ideal model than the anxious centroid, which confirms what we just observed in the previous slide.

-> In addition these responses, compared to the correct outcomes, lead to the shown scores.

Healthy controls have a higher score when compared to the anxious patients, which AGAIN means that their response is closer to the ideal model than the other group.