Model 1: Final Project

Manuel Alejandro Delgadillo Ferrel
Students number:S4400151

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1 How does your model work? Justify your modelling choices.

The model tries to simulate the experiment 1 and 2 of Acerbi[1]. The experiment takes the same number of subjects, conditions, and trials showed at Acerbi[1]. Firstly, the model takes a different view from other studies which exposed the subjects to simple distribution time intervals (Gaussian or Uniform distribution) and assume that the subjects will follow an internal representation of the experimental distribution. However, in the model, we expect the subjects to acquired, after training trials, to distinguish the conditions. For this, we will be resetting the model for the subjects to introduce them to new conditions without giving any hint from the previous conditions. The conditions consist in several trials, which start with a visual yellow dot displayed after a random delay of 18.5 ms which can vary from trial to trial. Subjects reproduce the target interval (interval), by pressing and holding the white button(ms). This time is converted from seconds to pulses to replicate the brain perception. The pulses are being stored in a declarative memory (fact). Subjects were required to wait at least 250 ms after the flash before starting the interval reproduction, otherwise the trial was discarded and re-presented later. Soon after the button in released, a random delay from 450–850 ms occurred before the feedback of the experiment was displayed for the subjects. The memory of the subjects then is reseted for the next conditions.

2 Show the behaviour of the model in a set of figures similar to Figs 3 and 4 in Acerbi's paper.

Figure 1 describes short and long uniform from experiment 1 intervals. Figure 1 and 2 resemble figure 5, Appendix from Acerbi[1]. Figure 1, is a description of response bias(ms) with a lot of precision. Acerbi found bias ranging from -100 to 100 and our model found -187 to 187. Figure 3 and figure 4 resembles figure 6, Appendix from Acerbi [1]. Figure 3, is a description of response standard deviation(ms) with a lot of precision. Acerbi found bias ranging from -100 to 100 and our model found -187 to 187. Even though the Figure 2 and Figure

4 do not resemble the models found in Acerbi, we can see consistency in the standard deviation.

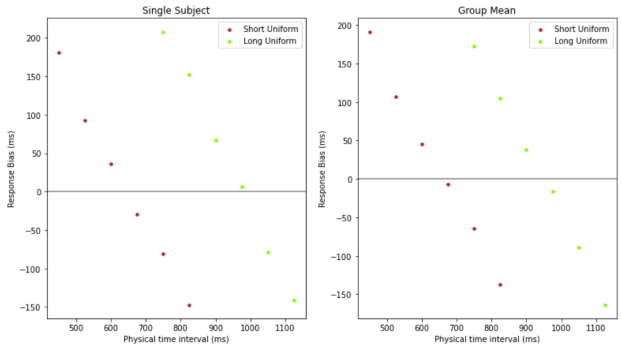

Figure 1: Description short uniform (red) and long uniform (green) vs response bias(ms ranging -200 to 200 in single subjects(left) and group subjects of 4(right)

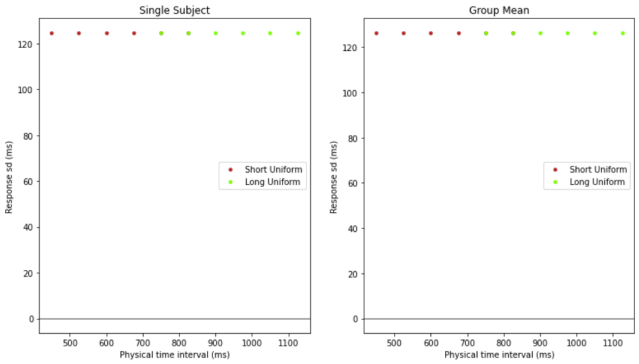

Figure 2: Description short uniform (red) and long uniform (green) vs response standard deviation(ms) ranging 120 to 130 in single subjects(left) and group subjects of 4(right)

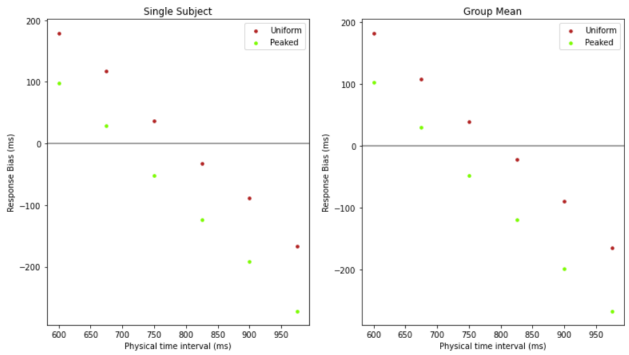

Figure 3: Description of medium values Uniform (red) and Peaked (green) vs response bias(ms ranging -300 to 200 in single subjects(left) and group subjects of 4(right)

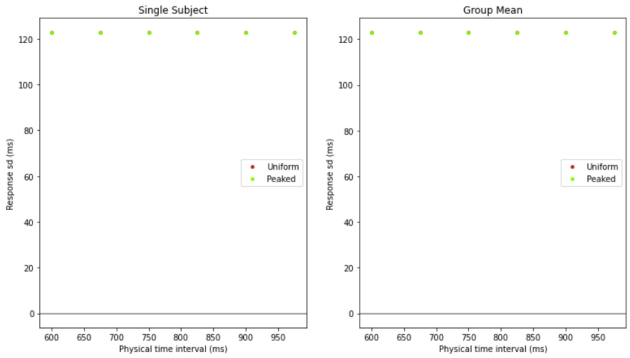

Figure 4: Description short uniform (red) and long uniform (green) vs response standard deviation(ms) ranging 120 to 130 in single subjects(left) and group subjects of 4(right)

3 Compare your model to Acerbi's findings. Are there differences in behaviour? If so, what may be the cause of these differences?

The model shown throughout this paper tries to recreate those experiments 1 and 2 from Acerbi [1], In the experiment 1, we can see from Figure 1 that it looks similar to Figure 5, Appendix from Acerbi [1]. Figure 5 show range of bias ranging from -100 to 100, which can be understood from Acerbi [1] that participants have shown that they perceive shorter bias and a consistency in between trials. From Acerbi[1], we expect the observers to have acquired, after training, an internal representation of the intervals to be as the true Bayesian decision theory. These results give strong support to the hypothesis that subjects considered the temporal statistics to build their decision making process.

From the model showed, we can safely say from figure 1 that our results resemble those found in Acerbi, with a bias ranging from -187 to 187. Due to the feedback, subjects affect their responses with temporal recalibration that shortens the previous duration and leading to a bias nearly 100. In the experiment 2 from Acerbi, we have a Peaked interval 7/12 of probability compared to the rest of the intervals 1/12. This peaked interval has a bias ranging nearly a bias of 50 in figure 6, however, the results in the Peaked blocks in the model in figure 3, we can see that the bias is 25 approximately. This performance of the participants suggest that they consistently feel a Bayesian 'attraction' towards the interval with higher probability. in the response towards the intervals with higher probability of 7/12.

References

[1] L. Acerbi, D. M. Wolpert, and S. Vijayakumar, "Internal representations of temporal statistics and feedback calibrate motor-sensory interval timing," *PLoS Comput Biol*, vol. 8, no. 11, p. e1002771, 2012.

4 Appendix

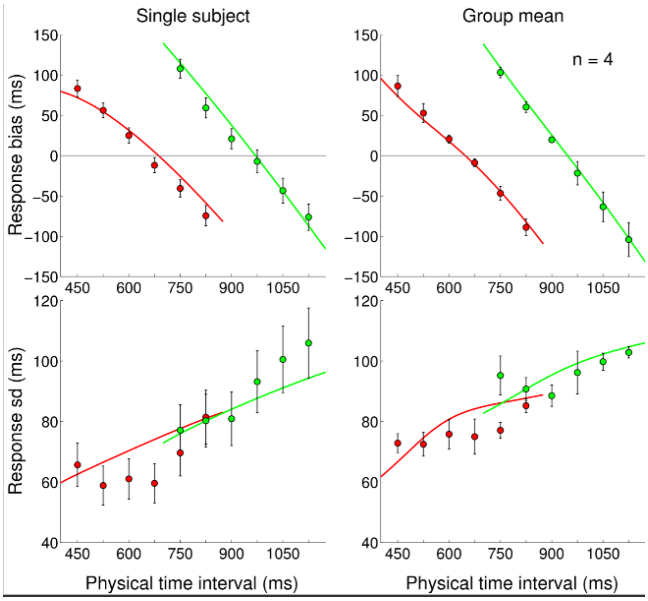

Figure 5: Description short uniform (red) and long uniform (green) vs response bias(left top corner) and response sd (left bottom corner) experiment done in Acerbi, 2012

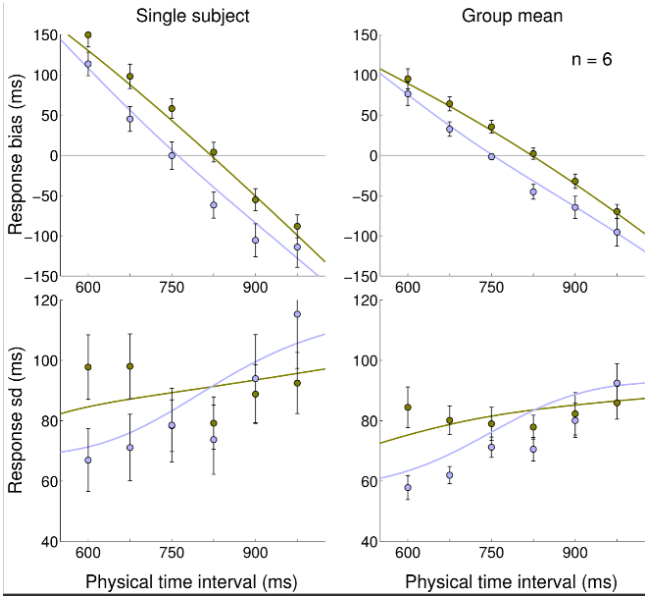

Figure 6: Description medium Uniform (blue) and medium peaked (green) vs response bias(left top corner) and response sd (left bottom corner) experiment done in Acerbi, 2012