Short distance speed discrimination task (Felix)

**Preparations**

Before Participant arrives:

* Switch on:
  + Lab-PC (‘Cecile Setup PC’)
    - Open Matlab 2017a :
      * Open ‘SSHMain\_pilot’
      * Prepare ‘myHome’ before switching on the belt power supply
    - Confirm windows sound setting is at 100%
  + Power supply BELT :
    - Switch on the first power supply (white bottom left button)
    - Push the grey OFF/ON button, AND immediately run ‘myHome’ function in Matlab to return the box/belt to its starting position. If not done properly the box will be ripped of the belt, and will have to be readjusted with double sided tape.
  + Visually confirm the correct starting position of the box with the help of tape and marker signs. Adjust if necessary.
  + Start Arduino software and run ‘test\_Force\_sensitve\_resistor’ script. Confirm proper function of the force plate with the serial plotter.
  + Close black window shades, put the cover box over the belt power supply unit and cables. Control all other possible light sources

During Experiment:

* Inform consent signature
* Reading of instructions
* Selection of the finger holder : The size should be as small as possible, so the fingertip has next to no space to move in the box movement direction, however there should be no pressure on the finger knuckles (to ensure this, the fingertip holder are lightly cone shaped towards the tip). Movement should not restricted in the Z-axis direction.
* Familiarize participant with the force plate thresholds in the Arduino serial plotter. Repeat the notion that, too much pressure will lead to nullification and restart of a trial.
* Start ‘SSHMain\_pilot’ in Matlab, put in desired values for subject ID etc.
  + At the beginning 5 training trials will be held in the presence of the experimenter (chosen randomly from the complete set of trials). The training trials responses will not be recorded. After the training and before the main experiment a pause is held. During training trials check that the participant:
    - Has the hand and finger in the apparatus correctly
    - Knows when to apply pressure on the force plate (see ‘fingerFig’)
    - Does not mistake box resetting movements with regular interval movements (see ‘resetFig’)
    - Uses the correct answer keys (i.e. ‘1’ or ‘2’ on numpad or regular keyboard)
    - Has any more questions?
* After training is completed push the boxes on which the apparatus rests, into the position marked by tape on the ground. Move the cloth cover over the back of the participants’ hand. Confirm the participant cannot see any possible box movements.
* Still open: how do we provide background acoustic input (white noise? Music?) to mask the motor noises? I did my own pilot run while listening to music on headphones over my phone, since matlab uses the audio port.
* The Experiment will run for **336 trials** (in the pilot setup). This corresponds to two runs through our set of 168 different trials. A pause will be held after the training trials, and then every 50 trials.

Stimulus Configurations:

The set of 168 different trials is a result on the following conditions:

* 7 different speeds from 300 to 4800 in 750's steps, corresponding to actual speeds of 1 cm/s, 3.5 cm/s, 6 cm/s, 8.5 cm/s (standard stimulus), 11 cm/s, 13.5 cm/s, 16 cm/s.
* 3 position distance configurations based on 2 distances ("both trials move 6000", "both

trials move 12000", "one trial moves 6000 the other moves 12000"), where "6000 distance"

corresponds to 3.9 mm and “12000 distance” to 7.8 mm distance

* 4 different movement direction configurations ("first trial to the left, and second to the

left", "first trial to the left, and second to the right" ...)

* 1 vibration amplitude multiplier which regulates tractor input (value = 1), amplitude multiplier is always constant within a trial. If we decide we want a control condition with no tractor action we can easily add conditions with other values here.
* 2 trial order configurations (interval with the standard stimulus first or second)

This gives us a set of 7\*3\*4\*1\*2=168 different trials. The input for the tractor is determined by the movement speed and the distance of the interval. The possible different inputs are the result of our calibration procedure.

Calibration procedure:

The aim of the calibration procedure was to extract movement induced vibrations caused by the sliding of the fingertip over a cardboard surface. For this a piece of cardboard (~2\*7 cm) was cut out of the back of one of my notebooks, and attached to the glass surface of the box construction.

Testing runs were conducted while an Arduino controlled accelerometer recorded the vibrations caused by the movement of the fingertip over the cardboard surface. The accelerometer was fixed into a small printed plastic piece which was in turn attached to the fingertip with double sided adhesive tape. The printed plastic piece ensured that the accelerometer was sitting horizontally, so the Z-Axis of the accelerometer data aligns with the tractor action angle. It also made sure that the accelerometer did not touch any part of the fingertip holder.

Calibration runs were done with modified matlab scripts, which allowed for single trials runs with only one interval controlled by manual trial input (i.e. no design matrix involved). These modified scripts also controlled accelerometer data collection with a fixed duration.

Accelerometer data was then fourier transformed and aggregated over at least 5 successful trials. A trial was successful if the box did not start to tilt under the fingertip pressure resistance, and if the accelerometer had recorded with at least 320 Hz sampling rate (sadly sampling rate was sometimes unstable), and if the resulting raw data did not look too noisy. This was done for each of the 7 speeds with a fixed distance of 12000. For the resulting mean amplitude spectra see ‘mean\_amplitude\_spectra(cardboard).fig’ (uploaded on github).

The sound files were created in ‘create\_sound\_file’, for each speed and the two distances. After that the cardboard was removed, and playback testing began by playing the sound as input for the tractor, while the accelerometer records the resulting vibrations on the resting fingertip.

For each speed an amplitude modifier was estimated, which amplifies (or dampens) the accelerometer input, until the resulting mean vibrations of the playback testing were of a similar magnitude than those originally recorded by from cardboard movement. These mean accelerations were restricted into a certain frequency range: the lower frequency bound is given by tractor which only functions reliably above 30 Hz, and the upper bound of 160 Hz is given by the sampling frequency of the accelerometer (~320 Hz). The amplitude multipliers (i.e. [7 13 12 30 10 50 6]) are then applied to the sound input in the ‘SSHMove’ each trial.