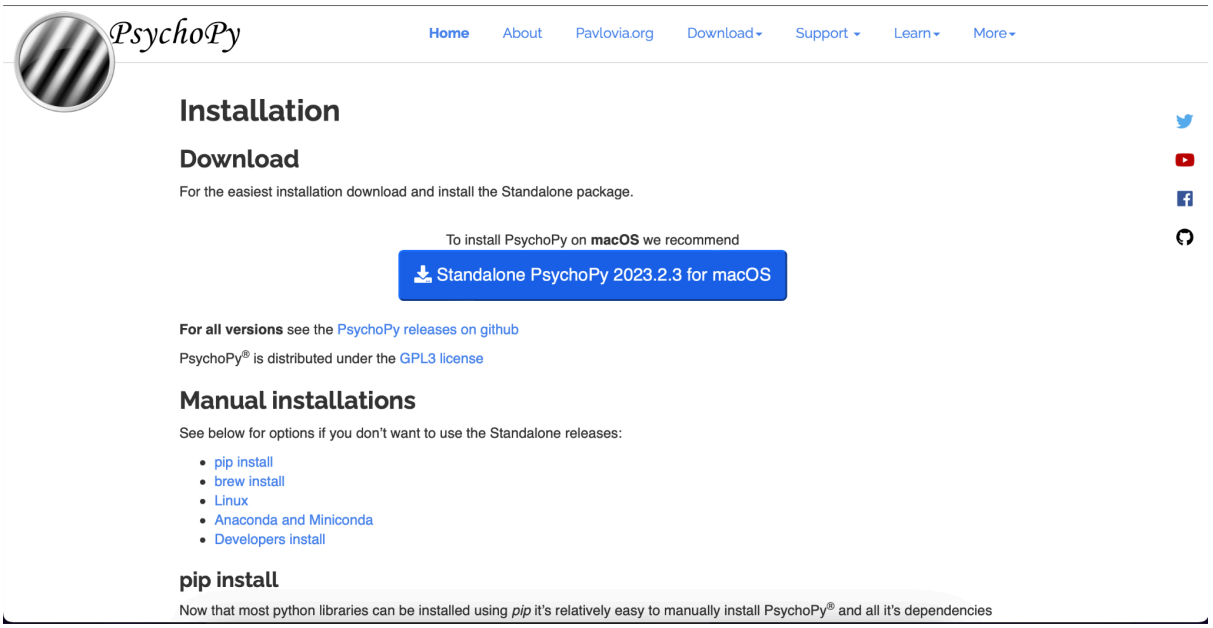
Section: Designing stimuli in Psychopy

Zebrafish live in shallow pools and streams which often have currents that push the fish downstream. The optomotor response (OMR) is an innate visuomotor reflex characterized by the fish swimming in the same direction as a high-contrast visual grating. The swimming movement helps to stabilize the fish's position with respect to the stimulus, and this stops the fish from being pushed downstream by the current.

In this part of the section, we will build the visual grating and we will test it on some live zebrafish from the EPFL fish facility. We will make this visual stimulus using a software called psychopy (https://www.psychopy.org/). Psychopy is a python based application for designing psychophysics experiments, log data, and synchronising with hardware. It is a very useful software that allows for the user to either code up their experiments or to use the GUI "builder" window.

- **Install Psychopy**

If you have not done so already go to https://www.psychopy.org/ and install the standalone version of psychopy (downloads).

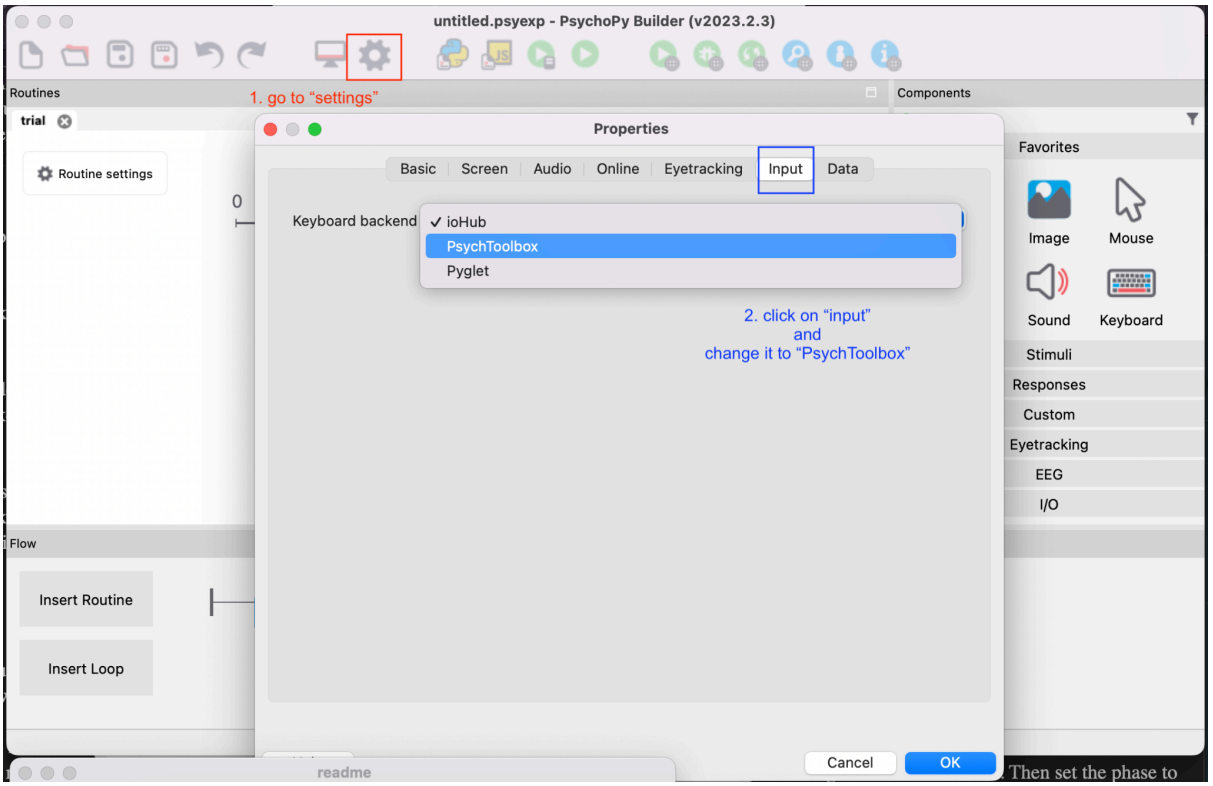


- **Open Psychopy**

click on the installed icon to open the psychopy application

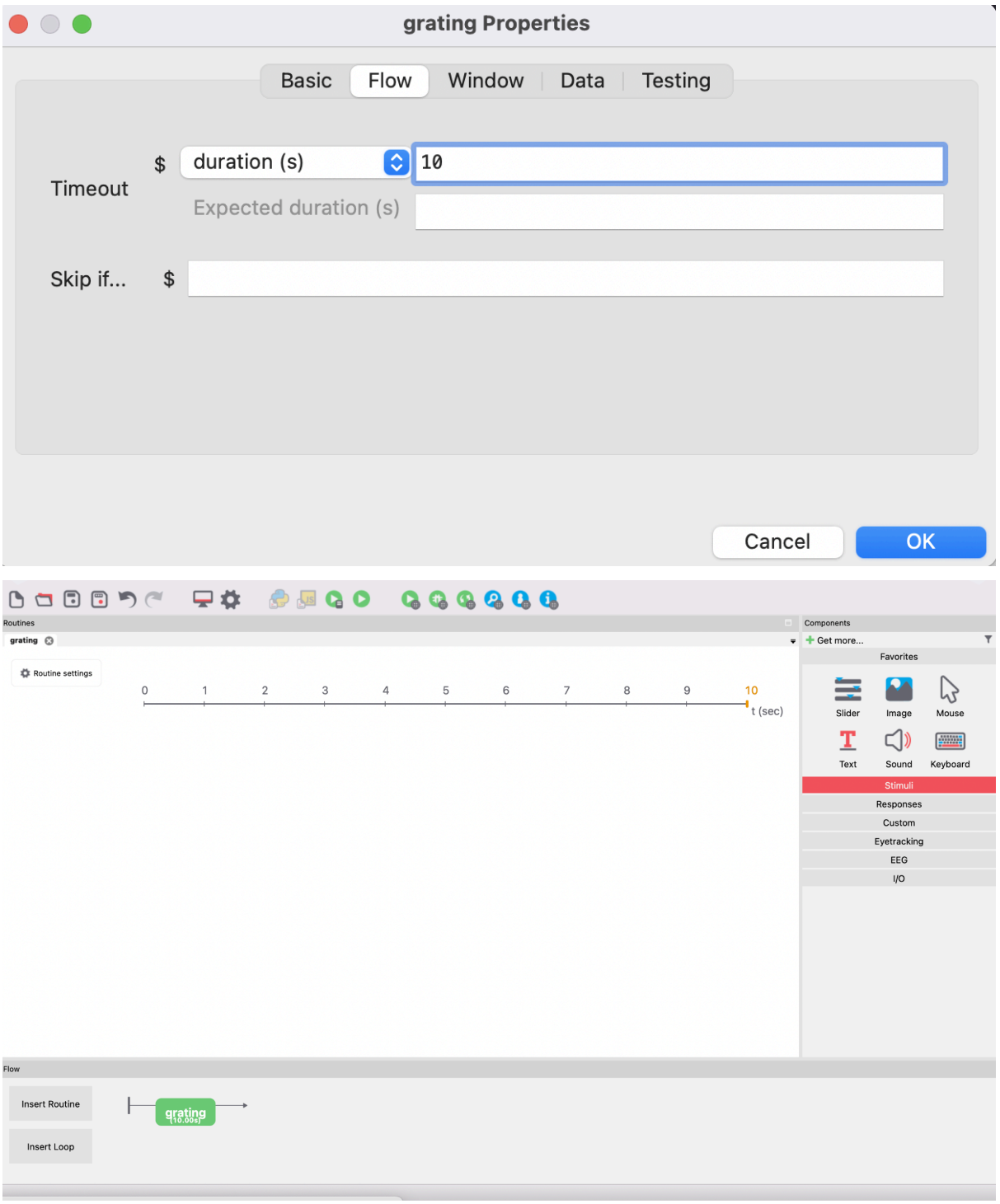
- **Change settings**

As default psychopy uses a repo on the internet to log data. You will want to disable this. To do so go to settings > input and then change the keyboard backend to psych toolbox.

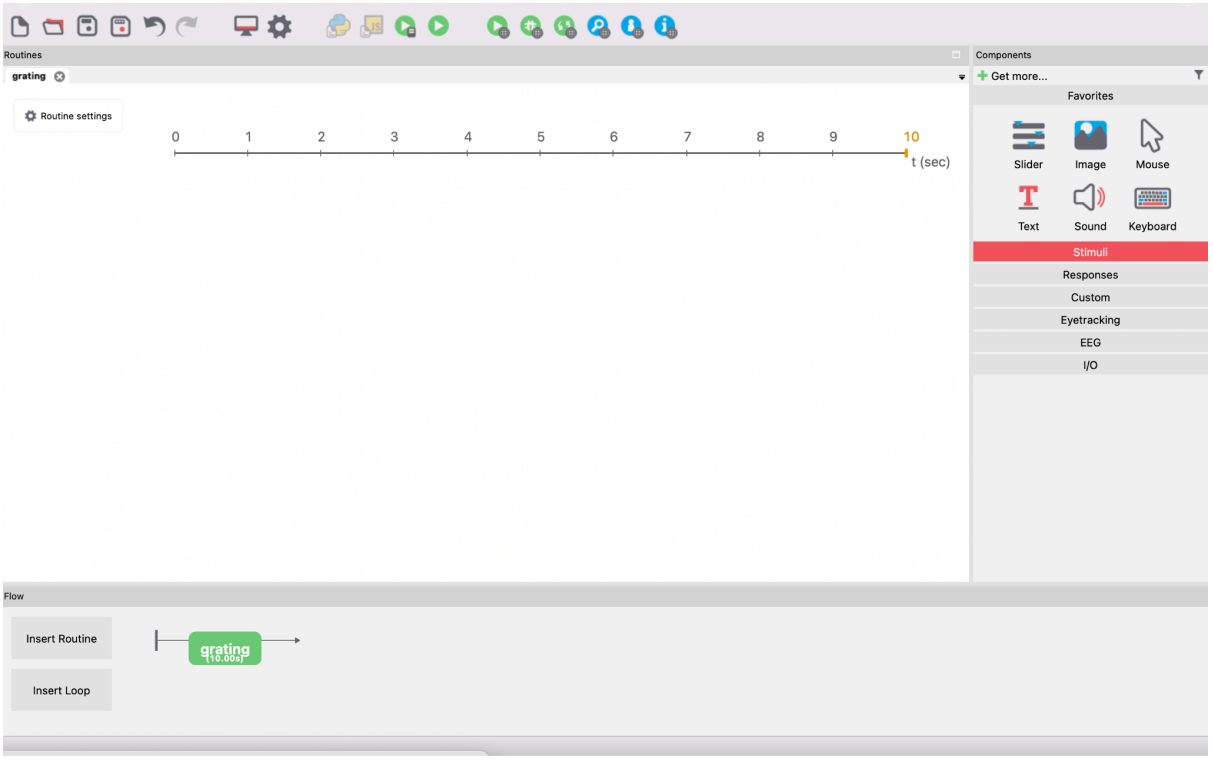


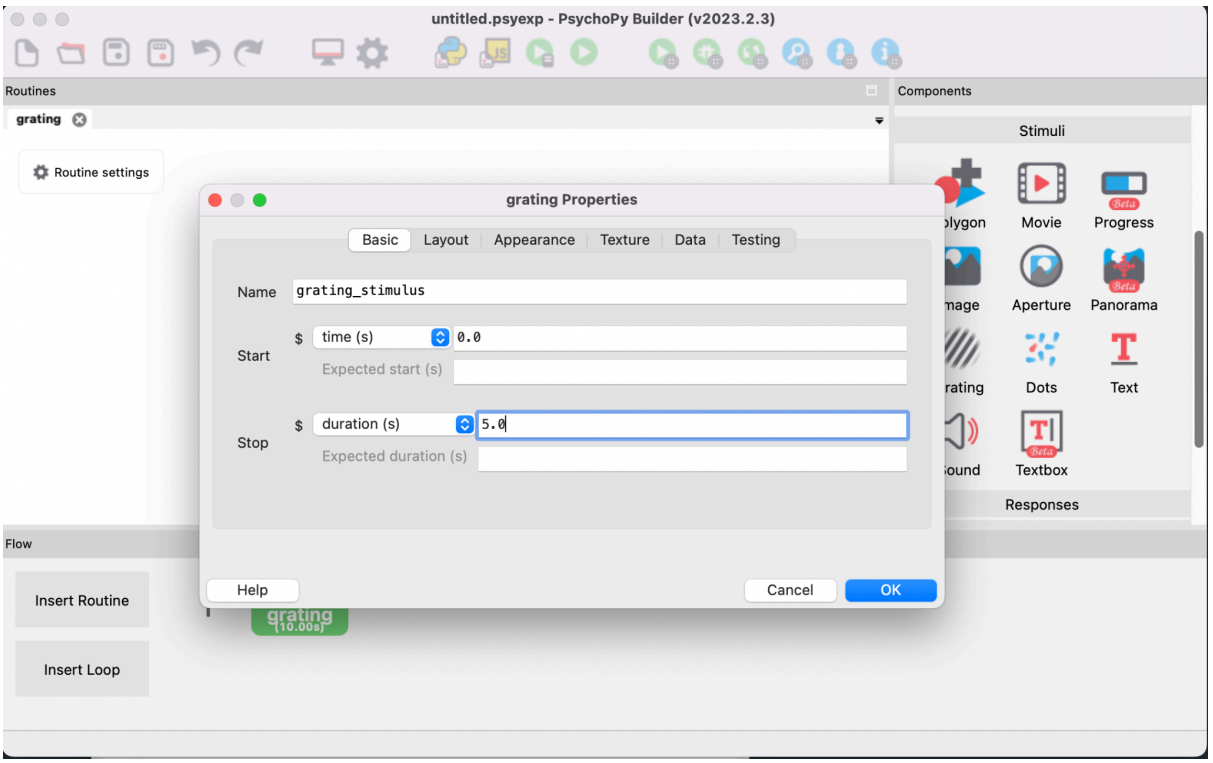
- **Create a visual stimulus**

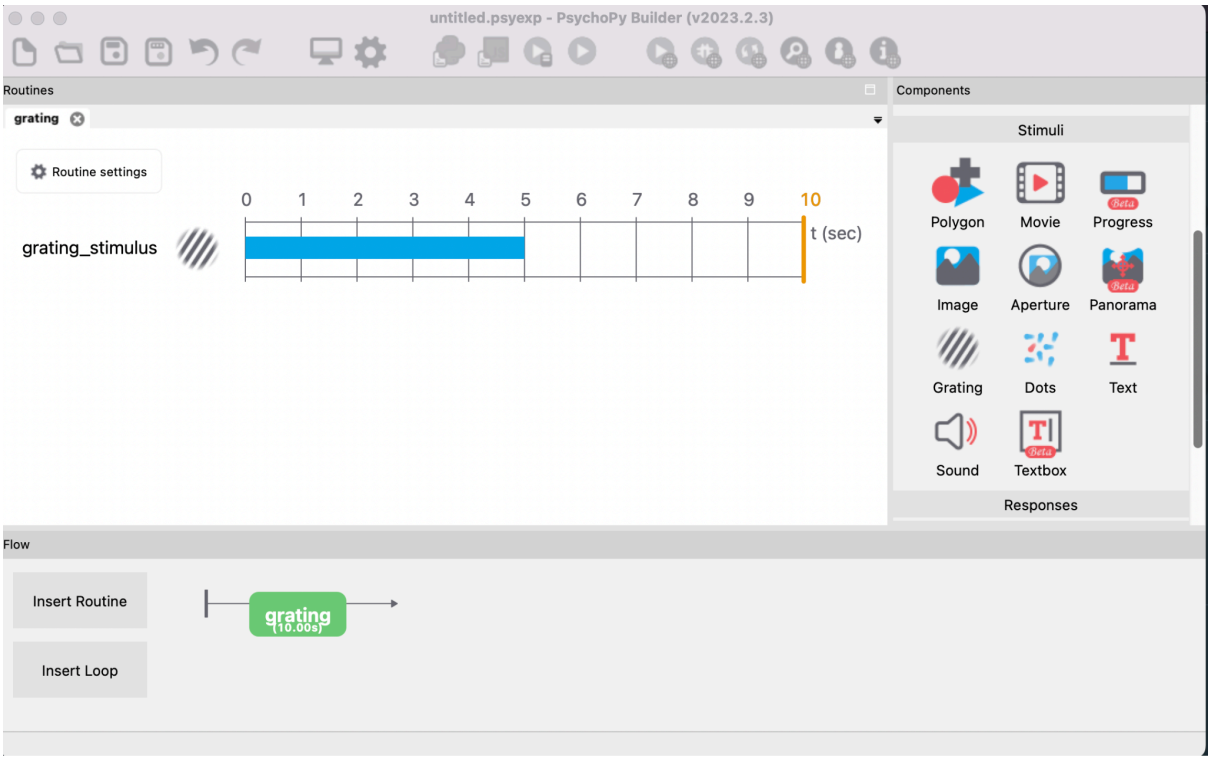
In psychopy experiments are organized into routines, you can think of a routine as a trial where you show a specific stimulus. To create a routine simply click on the insert routine button in the builder window and give it a name such as "grating". Then on the routine settings set the duration to be 10s. Then add in a stimulus from the column on the right-hand side such as a grating:



This will cause a window to pop up where you can change the features of the grating. Set the duration to be 5s. Then click on the play icon and you should see your stimulus appear in a new window after a pause. You should see your grating followed by a grey screen. Why might this grey screen (also known as an inter-trial interval (ITI)) be useful when designing an experiment?


Routines
grating
Routine settings
0
1
2
3
4
5
6
7
8
9
10
t (sec)
Components
Get more...
Favorites
Slider
Image
Mouse
Text
Sound
Keyboard
Stimuli
Responses
Custom
Eyetracking
EEG
I/O
Flow
Insert Routine
Insert Loop
grating
(10.00s)

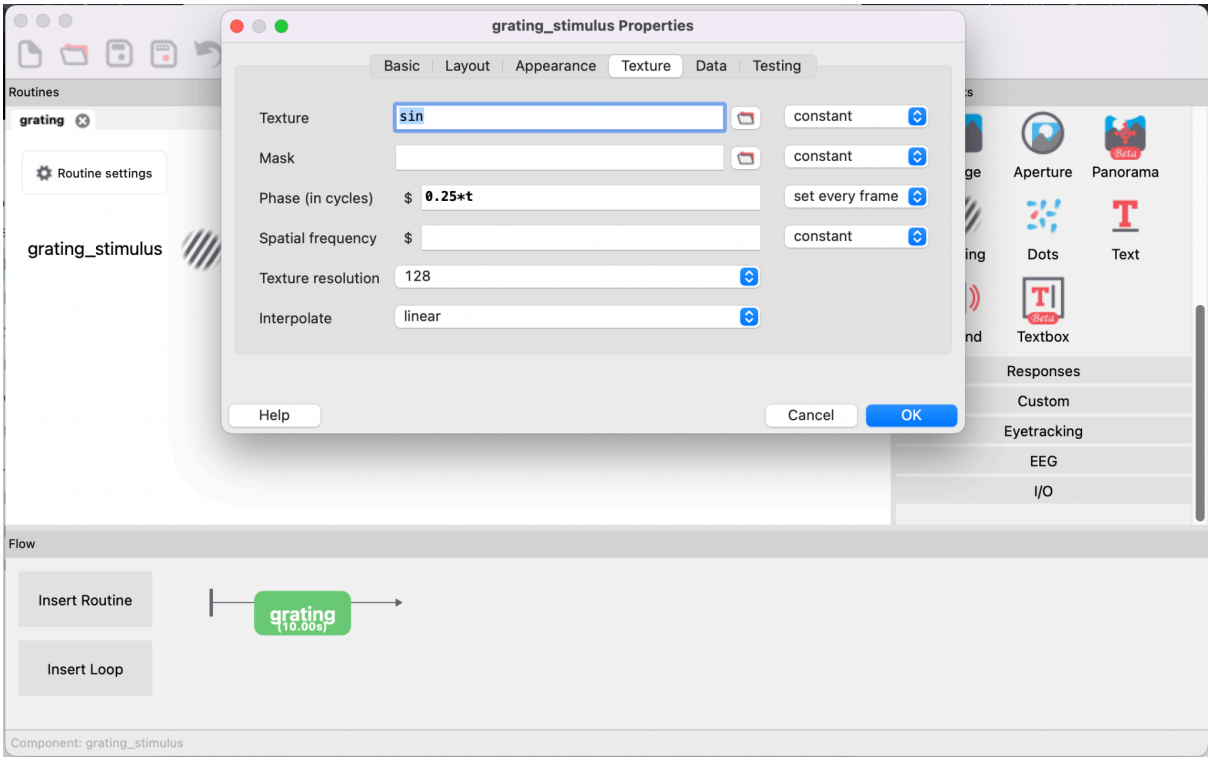




- **Make the grating move**

You may have noticed that your grating doesn't actually move! To change this click on the grating and navigate to the texture tab. Then set the phase to "change on every frame". Then set the phase to be 0.25*t. This will

cause the phase to change at every time t. Now hit play and you should see the grating move.



- **Click on the “run” button to see the result!**

Try playing around with the scaling factor of the phase to make the grating move faster or slower. Also try changing the spatial frequency, how does this affect the grating?
Now you're ready to try out your stimulus on the fish!

Design an experiment:

Now that you can make a visual stimulus try designing an experiment. When doing this, consider what you have learned about the visual system. Direction-selective neurons are tuned to different visual features such as size and speed. How could you design an experiment to test this? If you have time, have a go at creating a looming stimulus! How do the fish react to this?