Laboration 2
Sound and Gestures in Interaction

In this lab session, you will use laptops and smartphones to map connections between physical movement and sound. You will use the embedded sensors on the smartphone to detect and differentiate between different gestural actions and connect those actions in a meaningful way to a set of provided sound models.

1 Groups and Equipment

Each lab group should consist of maximum 2 persons and each group should bring at least one **laptop** and one **smartphone** per group. Also, make sure to bring **headphones** for all devices. If any group has difficulties with these equipment requirements, responsible teachers must be made aware about this one week before the lab at the latest, so that suitable arrangements can be done prior to the lab session. This will most likely involve a reorganisation of the groups.

2 Preparation

Besides reading through this document, there are some mandatory preparatory tasks that you need to do before the lab session starts:

- Form a group and book a time for your lab session in the doodle provided via mail.
- Print the lab instructions and bring them to the laboratory session.
- Download the file archive from here.
- Go to `http://www.mobmuplat.com/` and follow the installation instructions found in the section "Setup".
- Go through the pdf slides on Pure Data from the archive (*"introtoPd.pdf"*), look at the example files that are referenced in the slides, and make sure you understand the basics of Pure Data.
- Make sure you can upload and run patches on your mobile phone, using MobMuPlat. See `https://danieliglesia.com/mobmuplat/doc/index.htm` for details.
- Look at the template patch (*"template.pd"*) included in the archive, test it and make sure it runs on your computer and phone (i.e. open *"template.mmp"* on your device).
- Using the lecture notes from Roberto Bresin's lecture (*Sound in Interaction*), try to think of what types of connections between actions and sounds that are reasonable, and why. What would be a bad connection between an action and a sound?
- (Optional) Start to work on the lab and finish as much of it as you can on your own, before the scheduled lab session.

PLEASE NOTE: A group that shows up unprepared or without the right equipment will not be able to pass the lab in time and will need more hours!

3 Lab Procedure

The lab will start with a very brief introduction. After this, you will have the opportunity to discuss issues that may have come up during the preparations, whereafter you will start to work in your group. Lab assistants will be present, but the help files in Pure Data and the other resources provided should allow you to finish the laboratory tasks at a comfortable pace. At the end of the lab, a representative from each group will be called upon to describe and demonstrate one of the created connections.

The task is to select pairs from a set of gestural actions (see Table 1) and a set of audible results (see Table 2) and to create a connection between them. The actions are all movements, and the results are all different types of sounds[1]. It is important that the patch reliably ensures that the chosen action leads to the desired result. Still, the connection must also be motivated by the students, e.g., *"We imagined use case scenario number X, so we chose to map Y to Z because..."* Lab assistants will only be able to approve a connection when design decisions for the connection have been presented with an adequate motivation. You need at least 5 approved connections to pass the lab.

[1]The sounds listed in Table 2 are taken from the example patches developed by Andy Farnell (see `http://mitpress2.mit.edu/designingsound/` and `https://mitpress.mit.edu/books/designing-sound` for further details). If you need sound files for your synthesis, you could register at `https://www.freesound.org/` to access free sound samples.

Table 1: Gestural Actions

ACTIONS
The phone...
...is shaken.
...is spun while lying on a flat surface.
...is used to point at the entrance.
...is used to point straight up.
...is used to point towards north east.
...is placed flat in the hand and tilted from side to side.
...is held and used to detect all very small movements, but not large ones.
...is held and used to detect all very large movements, but not small ones.
...free falls for more than 30 cm.
...is used to measure the angle of a surface, like a level.

Table 2: Sounds synthesized using Pure Data.

SOUNDS	
Additive synth (e.g. bell sound)	Alarm
Bell	Boing
BouncingBall	Bubbles
Clock	Creaking door
Electricity	Explosion
Fan	FM synth
Granular synth (requires wav-file)	Helicopter
Insects (fly, cicada, cricket)	Jet engine
Motor	Police siren
Pouring liquid	Rain
Robot (R2D2)	Running water
Sci-Fi (laser beam, photon torpedo)	Switches
Thunder	Wind

Table 3: Messages received from mobile hardware system [receive fromSystem].

MESSAGES			
/shake	int	[1]	shake gesture occured (iOS only)
/tilts	float float	[-1,1]	x and y tilt values
/accel	float float float	[-1,1]	raw accelerometer data (x,y,z)
/gyro	float float float	$[-\pi, \pi]$	gyro data, in radians per second, around roll, pitch, yaw
/motion	float float float	$[-\pi, \pi]$	device attitude in space, at roll, pitch, yaw
/location	9 floats	[-1,1]	device location info. See MMPExamples-GPS.pd for full explanation.
/compass	float	[0,360]	compass value, in degrees

4 Useful Time Saving Hints!

Check Your Hardware

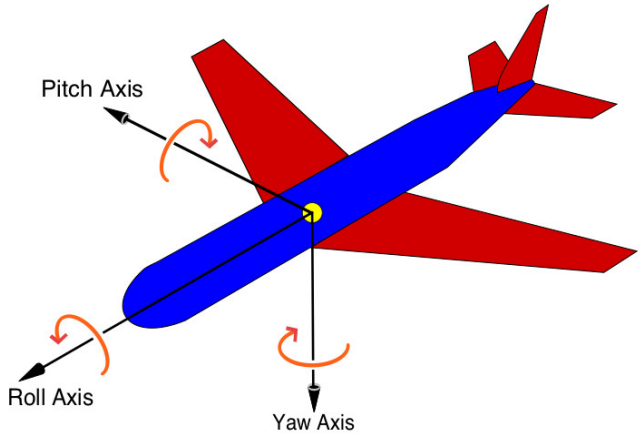
While the information in the documentation is usually accurate, there is always a possibility that a particular combination of device, OS version, and settings results in you receiving data that is different from the specification. Sometimes what the hardware allows your patch to do can also be affected. There are examples that come with MobMuPlat that can help you check the communication with your device, use them!

- **MMPExamples-Motion.mmp** – Tilt, Accelerometer, Gyro Rotation, Device Motion
- **MMPTutorial3-Hardware.mmp** – Tilt, Flash, Vibration
- **MMPExamples-GPS.mmp** – Latitude, Longitude, Altitude, Compass Heading

Note: You might need to activate GPS-services for your patch to receive GPS data!

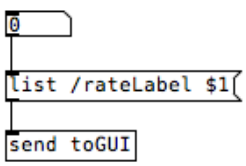
Gyroscope Angles

The gyroscope data is in *yaw*, *pitch*, and *roll* format, illustrated in the picture below. The data for each axis is $-\pi$ to π, meaning that there are discontinuities or jumps in the data when you move past certain rotational positions. Take this into account when you design your patches. Consult the Wikipedia page if this is unfamiliar to you.



Print Your Data

It is often very useful to print variables or data streams in your patch on the screen of the device you are using. The example **MMPExamples-Motion.mmp** shows how this can be done. The objects pictured below (taken from MMPExamples-Motion.mmp) set the content of the label with the address `/rateLabel`. Use this to debug your code while it is running on your device.



5 Results

Please list your connections between gestural actions and sounds in the table below.

Table 4: Suggested Mappings

NUMBER	ACTION	SOUND
1		
2		
3		
4		
5		
(6)		
(7)		
(8)		

6 Examination

You have to hand in this page to your laboratory assistants at the end of the lab session.

Group Members

.....
Name 1

.....
Name 2

The above specified students have successfully completed the lab requirements.

....
Laboratory Assistant Date