

## PRIOSCALE: Human nerves and scale



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### Resume

We will work on human sensors located in their skin which are sensitive to pressure variation (Merkel cells) and a scale. Skin sensors send electronical informations through neurons to our brain which process it. Scale measure weight using a resistor which vary the voltage and print digits.

We would like to compare these two sensors on several criteria :

- Precision : using the same object, interpret the different response
- Accuracy : compare the absolute value to the response
- Response time : how many time it's needed to have a final response
- Range : what is the minimum necessary to activate the sensor, the maximum ?
- Saturation : at which point the scale or the nerves can't make the difference in weight

### Material

To record the Arduino Device response	To record the Human Device response	Bottle construction
1.Arduino Uno 2.RoHS leadScale 3.Weight Sensor Module V1.0 4.Links 5. 10K resistor	1. One computer 2. One chronometer 3. Paper 4. Agreement contract	1. 10 bottles of water 2. Journal paper 3. Scotch tape 4. Water 5. Pipette and tips.

## Protocols

We follow the same method for scale and humans (except for the script which is exclusive to human).

### Script :

#### French

- Bonjour ! Nous sommes étudiants en seconde année de la licence Frontières du Vivant. Nous sommes actuellement en projet biosensors dans lequel on compare des senseurs biologique et des senseurs électroniques. Nous avons besoin de vous pour une participation de 2 fois 10 minutes sur 2 jours. Accepteriez-vous de participer ?
- Oui ? Merci beaucoup d'avoir accepté. Voici la charte de consentements. Nous nous engageons, bien sûr, à ne pas communiquer votre identité.
- Tout d'abord nous allons vérifier que les senseurs de votre mains sont en état de marche avec deux tests préliminaires. Ensuite, nous allons vous faire sentir un kilogramme dans votre main forte comme étalon. Vous aurez enfin à estimer 25 masses. Nous vous poserons l'étalon de 1kg entre chaque mesure. Tare mesure estimation tare mesure estimation. On va vous demander de poser la mains sur l'écharpe et de ne pas la bouger de l'expérience.
- Est-ce que vous-souhaitez que je répète ?
- Nous pouvons commencer par le premier test préliminaires. Nous allons placer un plateau sur votre main qui agira comme un plateau de balance et aidera à garder l'équilibre. Pour éviter tout biais, nous allons à présent vous bander les yeux. (on ne pose rien sur le plateau). Sentez vous une pression sur votre main ?
- (Puis, poser une bouteille de 1kg 300g). Sentez-vous une masse sur votre main ?
- Nous allons commencer les estimations.

#### English

- Hello ! We are bachelor students at Borders of life. In our project we compare a biological sensor characteristic to an electronic sensor. We would need your participation during 10 minutes. Would you mind to participate ?
- Yes ? Thanks a lot for participate. Here it is the consent form. We engage ourselves not to diffuse your identity.
- The test is divided into two parts : first, we going to test if your hand sensors work. Secondly we will ask you to estimate 25 masses. We'll give you before each mass a 1kg bottle. So you can compare.
- Do you want me to repeat ?
- Let's begin with the positive test (put 1,3). Can you feel something on your hand ?
- Here is the negative test. (Don't put anything) Can you feel something ?
- We are about to begin, are you ready ?

### Orders :

The bottle have to be in the same order for each measurement. This order must be determined thanks to a random python script.

Here the script :

```
#!/usr/bin/python
import random
A = [i for i in range(25)]
print(A)
for i in range(25):
    B = random.choice(A)
    print(B)
    A.remove(B)
```

Ordre trié :

2  
23  
24  
15  
3  
14  
16  
19  
13  
8  
10  
22  
0  
21  
18  
12  
5  
17  
7  
20  
4  
6  
11  
1  
9

300g : 4 - 11 - 13 - 17 - 20

500g : 7 - 14 - 22 - 23 - 24

800g : 1 - 12 - 16 - 18 - 19

1kg : 2 - 5 - 9 - 10 - 15

1.3kg : 3 - 6 - 8 - 21 - 25

Each bottle is weighed 5 times and between each measure the 1L bottle in place on the hand.

People will be asked to take part of the experiment twice.

We will feel the bottle using a macropipette in the laboratory in order to be precise.

- Positive Control : The aim of that control is to be sure that a mass can induce a response. We will put a 1.3kg (max) bottle on the hand of the participant. (or see if they can feel a different mass)
- Negative Control : The aim of that control is to be sure that it is the mass and no other factors, that induce responses. That can be verified by leaving the hand with no other stimuli.

#### **Measurement of the weight with human device:**

- Say the script
- Ask to put the right hand on the table
- Put the one kg bottle, announce “This is 1kg”
- Replace the bottle by a next one, always in the same order and put at the same time the chronometer
- Wait for the response and stop the chronometer
- Save the data
- Repeat the experiment from “put the one kg bottle” which is included.

#### **Measurement of the weight with the arduino device:**

- Install the arduino device in a flat table. Note your position on the earth
- Say the script
- Put the one kg bottle, tare
- Start the python script
- Put the next bottle
- Stop the script
- Save the script
- Repeat for all the bottle in the same order from “Put the one kg bottle, tare”, included

#### **Analysing the data :**

The data will be presenter in a table to be analyzed with a python script afterwards.

N° of the replicate	N° of the bottle	Values (in g)	Response time (in s)

We'll be able to plot

- the response time in function of the weight. And to compare the mean response time of humans vs scale.
- Response in function of the absolute value. Compare the variation and ecart type
- Print a student test comparaison of to real mean.

## Ethical concerns

Human can feel pain so we need to be as respectful as possible.

We are tested a natural sensor in the skin. We are engage to stop the experiment if the participant experiment uncomfortable feelings.

We will not take any subject that can suffer from our experiment such as:

People under 16 as they might have trouble lifting high weights

People over 70 for the same reason

People who suffer, or recently suffered from health problem that might affect their perception of weight or might injure them in any way

## Budget

The electronic sensors has been borrow from Tanguy Chotel.

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- Format of the Project Proposal largy inspired by first week Biosensors 2017:  
[https://docs.google.com/document/d/106jQE8m6CCilwcX8dA2jFIr\\_H2sTjjHR7mVQkTzb3SA/edit](https://docs.google.com/document/d/106jQE8m6CCilwcX8dA2jFIr_H2sTjjHR7mVQkTzb3SA/edit)