UNIVERSITÉ PARIS DESCARTES | USPC Université Sorbonne Paris Cité | FONDATION BETTENCOURT SCHUELLER | Centre de Recherches Interdisciplinaires

Poworm Rangers: a study of *Chironomus plumosus* reaction to vibrations

CHURLAUD
CONIL
GUERIN

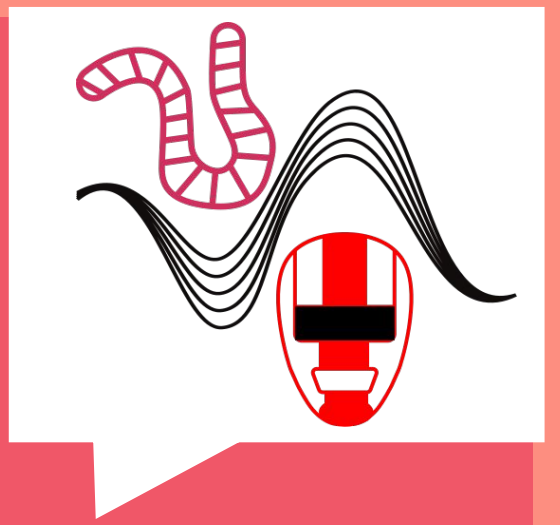
FDV Bore - 2017

Vibrations

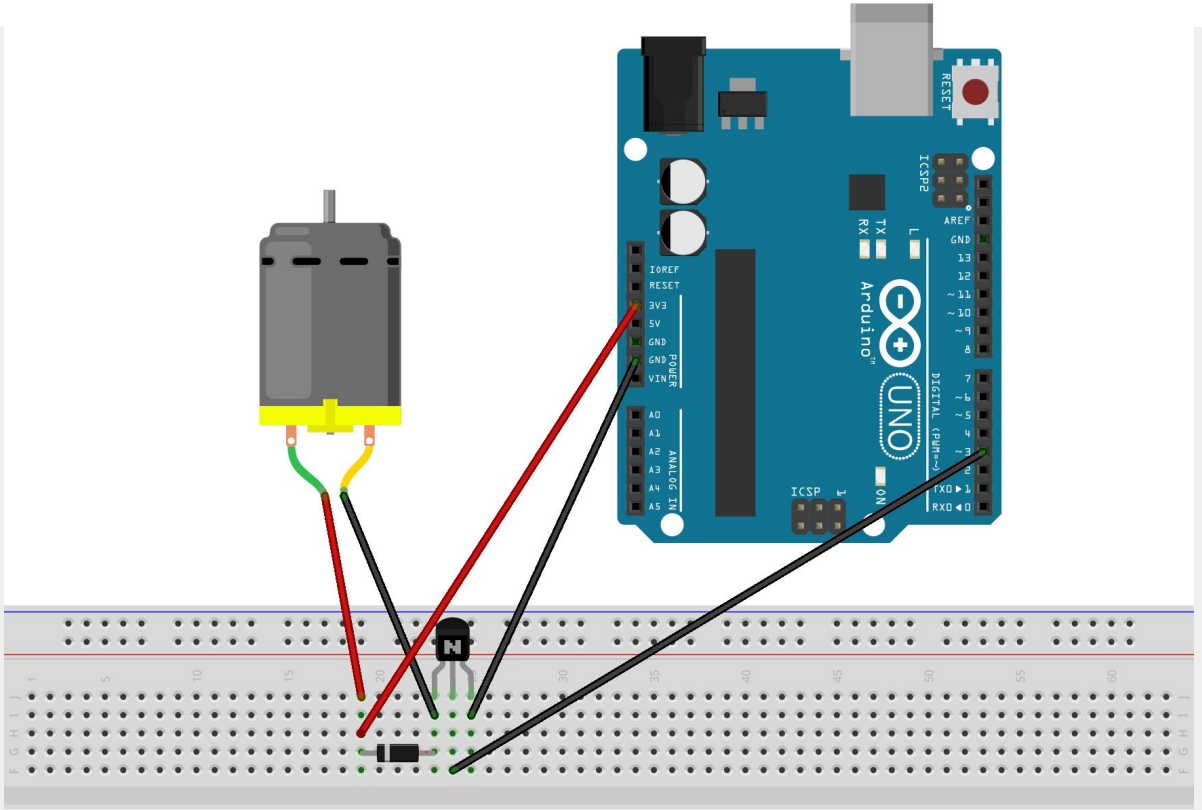
Chironomus plumosus

Piezo

Accuracy



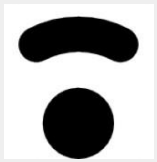
Create vibrations with a vibrating motor



https://cdn-shop.adafruit.com/970x728/1201-01.jpg

3 intensities of vibration

- 6 replicates
- 2 controls



100 AU

150 AU

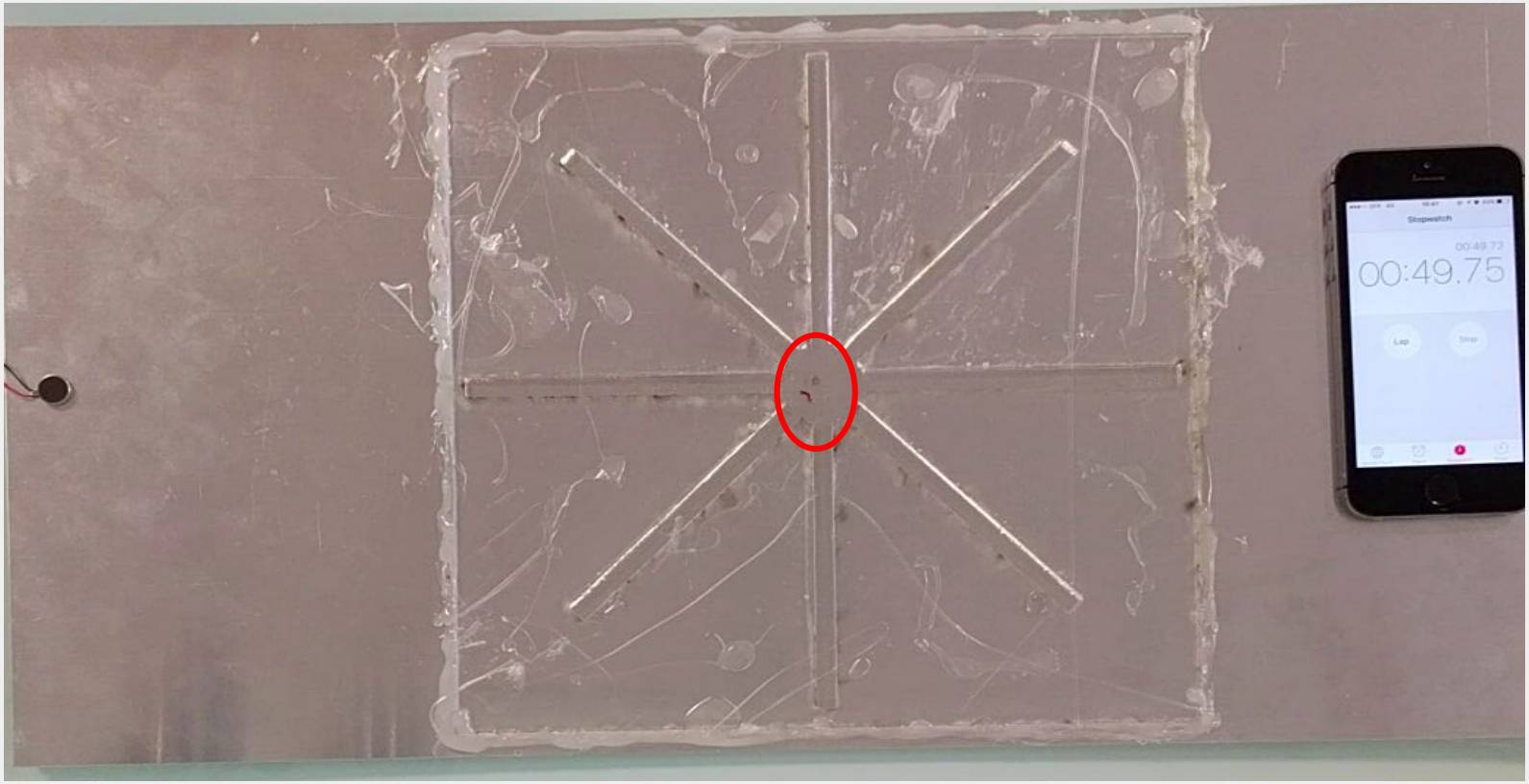
200 AU

freepik.com

Our biosensor: *Chironomus plumosus* larvae

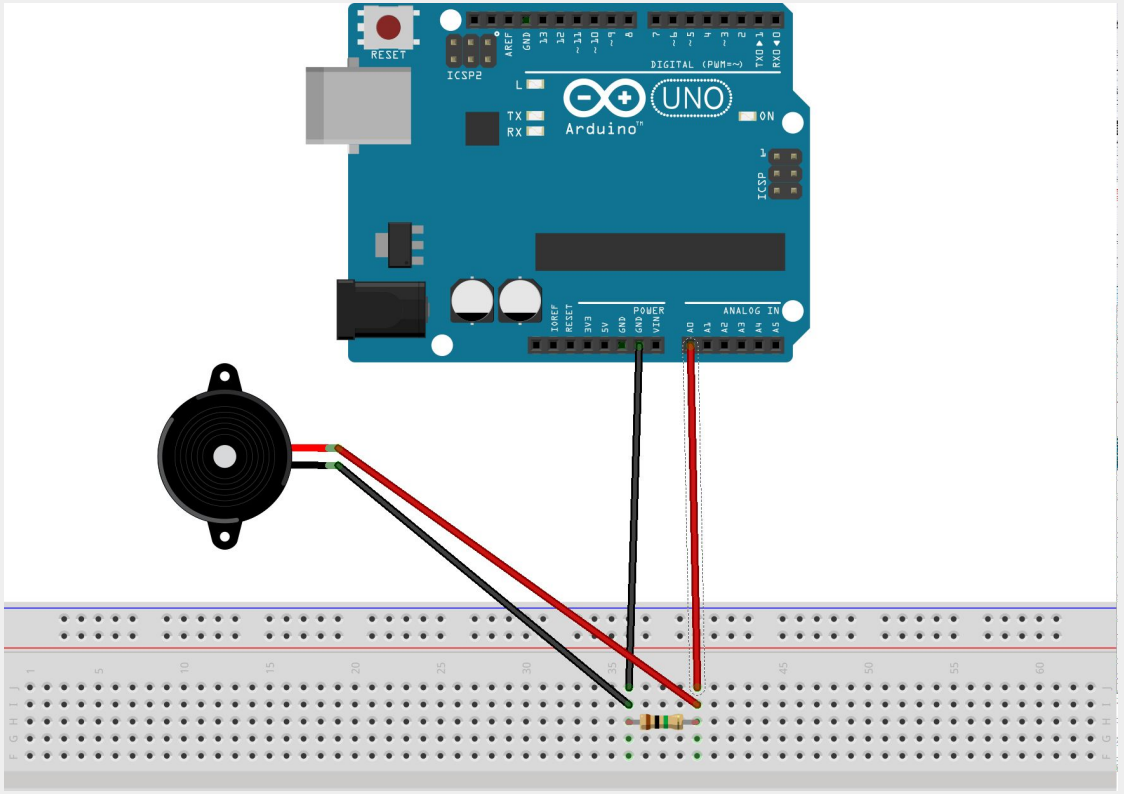
aquafish.free.fr
upload.wikimedia.org

Are they reactive to vibrations ?



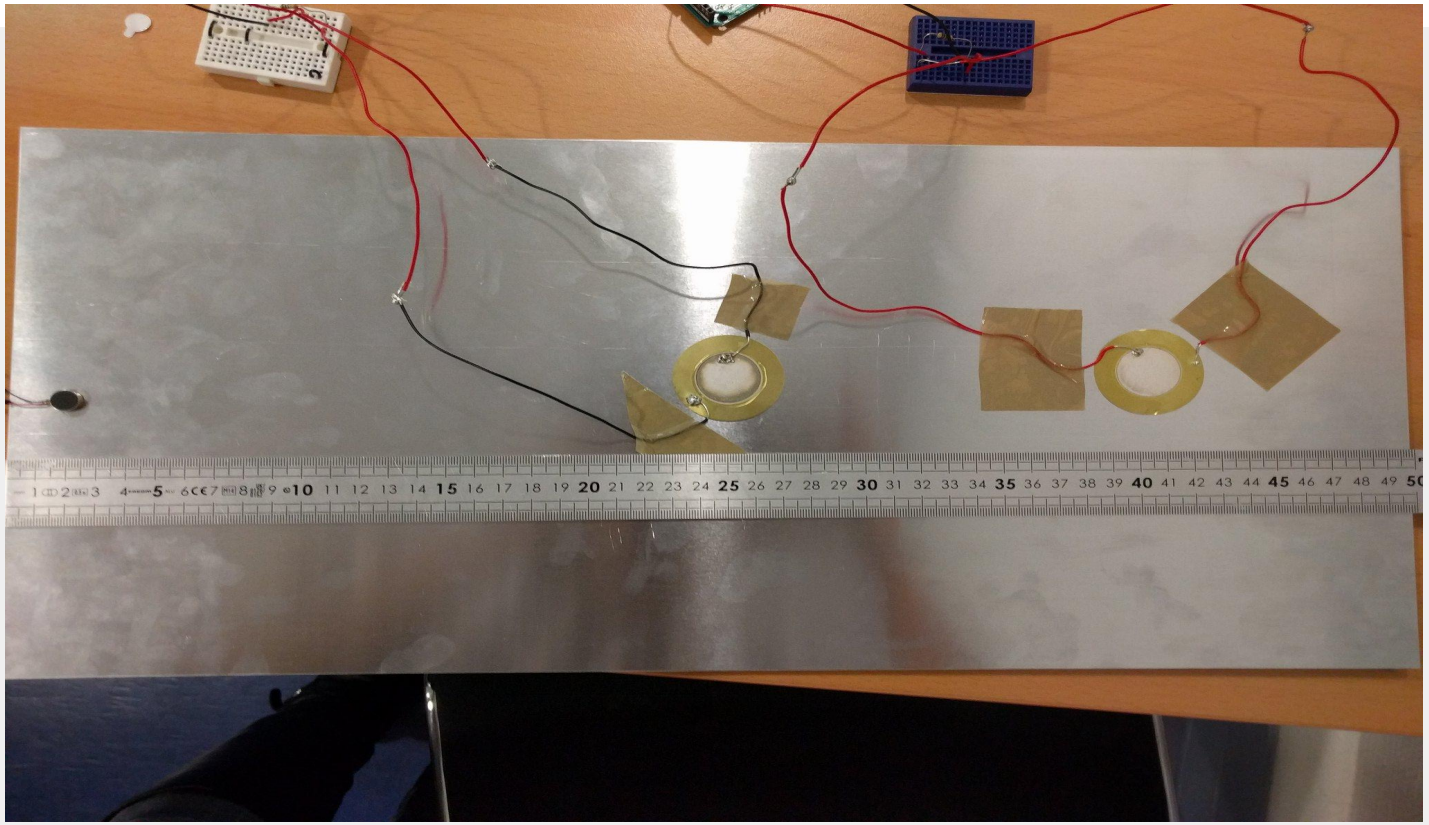
- Vibration motor
- Channels device
- Aluminium plate
- 2 min of experiment, vibrations start at 15 seconds

Our electronic sensor; piezo element



Membrane that can detect vibrations or sound, and read it into voltage value

Is it reactive to vibration?

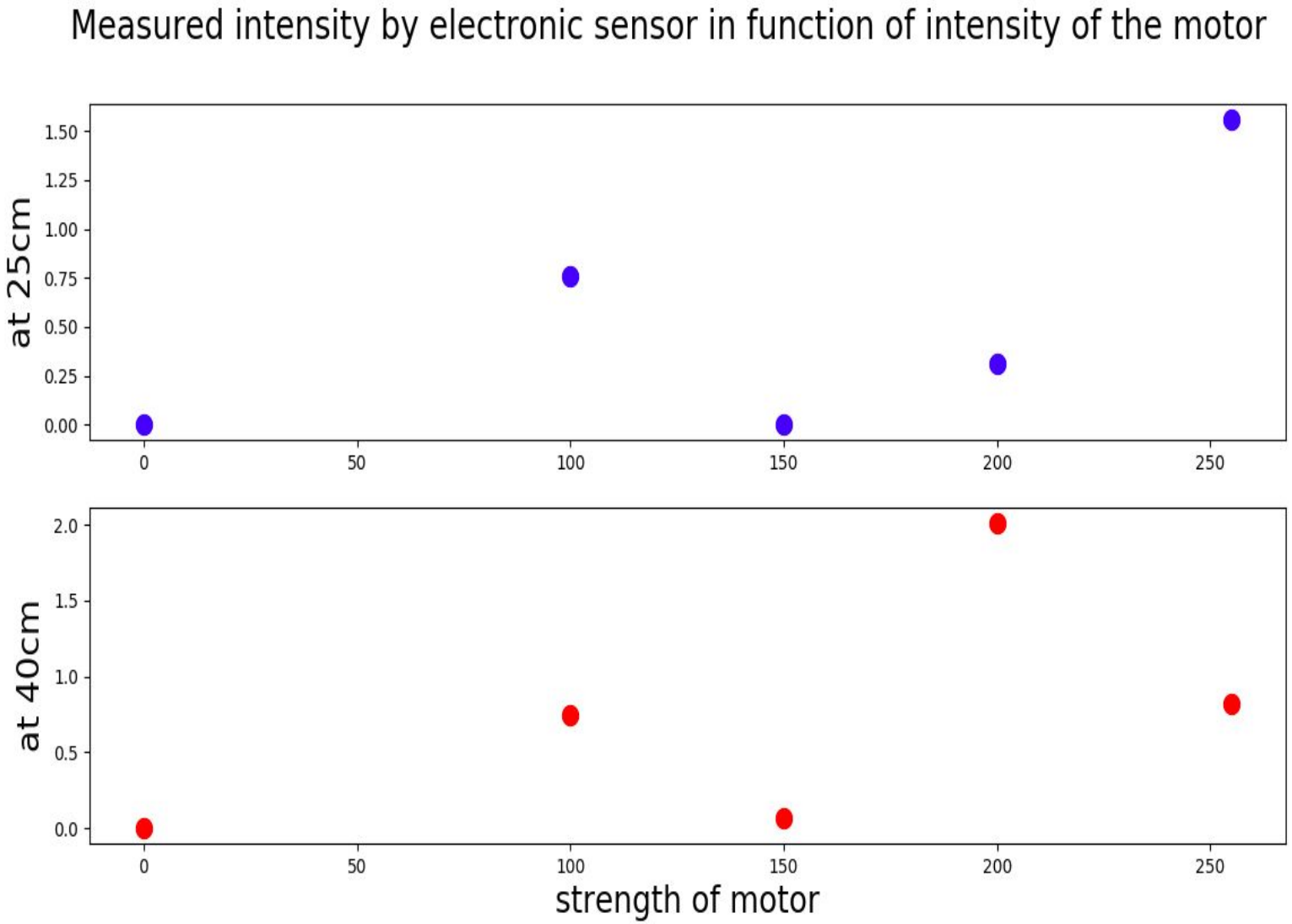


- One piezo at 25 cm, one at 40
- Aluminium plate
- Vibration motor

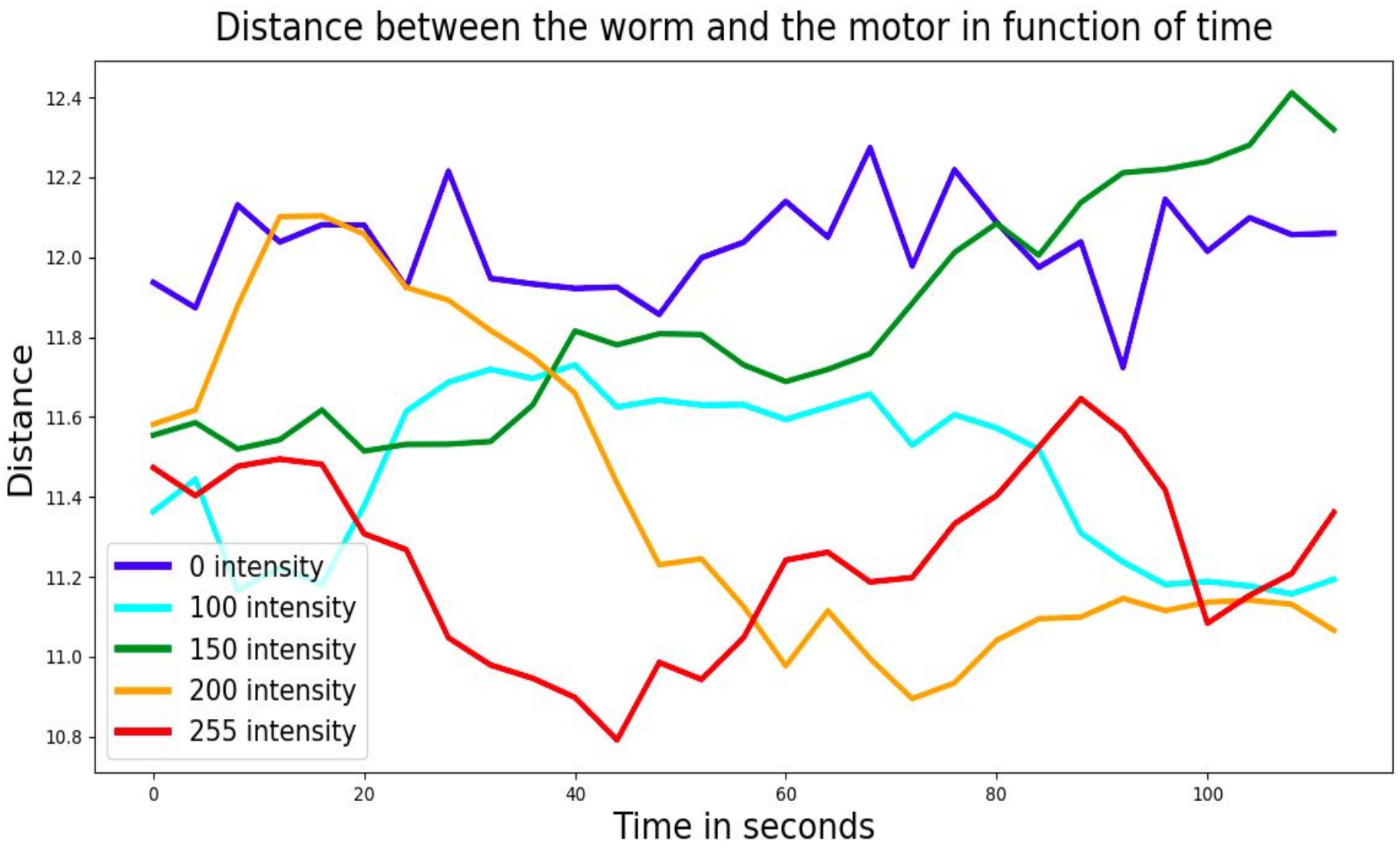
- Run python code
- Wait 3 seconds
- Start motor

Results !

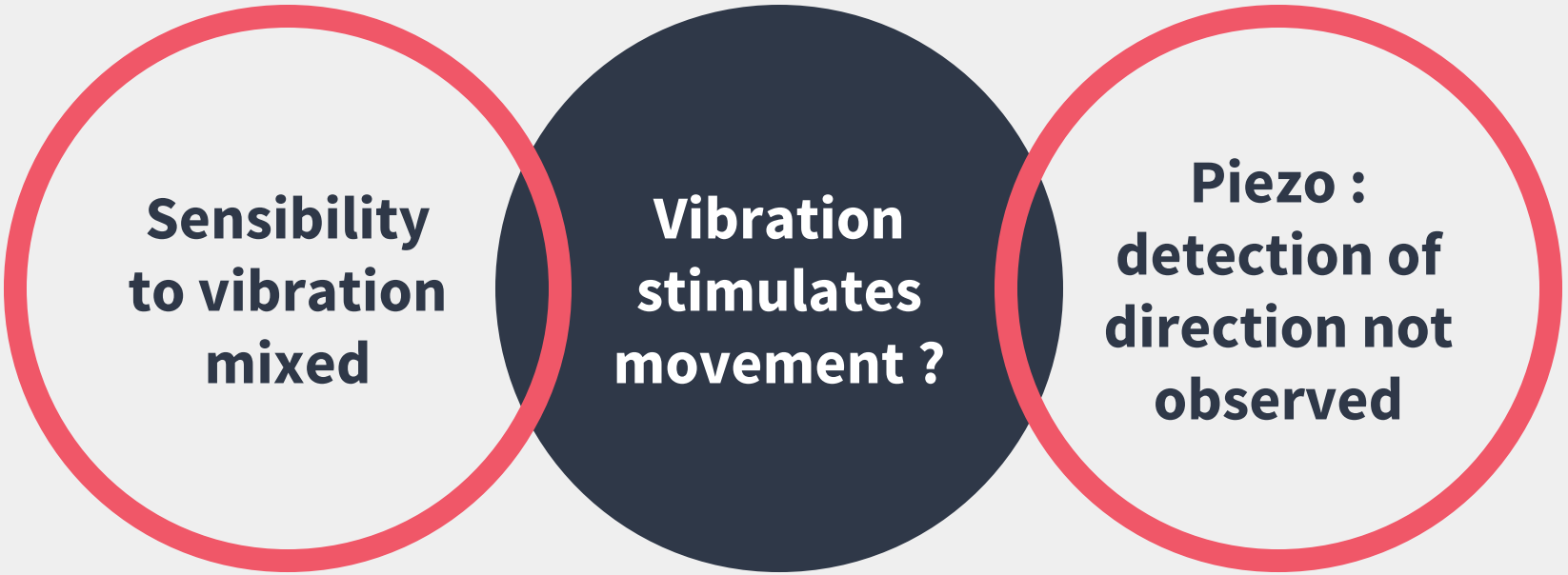
Piezo sensor : accuracy indicator



Biological sensor : hardly define the origin of the vibration



Conclusion


Sensibility to vibration mixed
Vibration stimulates movement ?
Piezo : detection of direction not observed

Bias in our experiment

- Absorption of vibration by the plexiglas, the chronometer
- Medium: difficulty to move for worm
- Leak of water under the plexiglass creating a current
- Size of the channels

Thanks you for your attention!

Special acknowledgement to:

- Tamara Milosevic
- Ivan Cornut
- Kevin Lhoste
- All the biosensors 2017 team
- Our comrades from FDV bachelor
- *Chironomus plumosus* larvae

Resources

- Mankin, R. Applications of acoustics in insect pest management. *CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources* **7,** (2012).
- Arduino Code | Arduino Lesson 13. DC Motors | Adafruit Learning System. Available at: https://learn.adafruit.com/adafruit-arduino-lesson-13-dc-motors/arduino-code. (Accessed: 26th January 2017)
- Arduino - Knock. Available at: https://www.arduino.cc/en/Tutorial/Knock. (Accessed: 26th January 2017)
- Conservation des vers de vase. Available at: https://www.killiclubdefrance.org/forum/index.php?topic=6550.0. (Accessed: 25th January 2017)
- Des vibrations qui font fuir le ver hors de terre. *Sciences et Avenir* Available at: http://www.sciencesetavenir.fr/nature-environnement/des-vibrations-qui-font-fuir-le-ver-hors-de-terre_4323. (Accessed: 27th January 2017)
- Lapshin, D. N. Directional and frequency characteristics of auditory receptors in midges (Diptera, Chironomidae). *Entmol. Rev.* **95,** 1155–1165 (2015).

- How to Build a Piezo Knock Sensor Circuit. Available at: http://www.learningaboutelectronics.com/Articles/Piezo-knock-sensor-circuit.php. (Accessed: 26th January 2017)
- Larve de chironome. *Wikipédia* (2016).
- Lumbriculus variegatus. Available at: http://www.eeob.iastate.edu/faculty/DrewesC/htdocs/Lvgen4.htm. (Accessed: 25th January 2017)
- Seifert, P. & Heinzeller, T. Mechanical, sensory and glandular structures in the tarsal unguitractor apparatus of Chionomus riparius (Diptera, Chironomidae). *Zoomorphology* **109,** 71–78 (1989).
- Microsoft Word - note de cours vibrations alain ERGO-SEHY2002.DOC - malchaire notes de cours vibrations long.pdf.
- Futura. Onde sonore. *Futura* Available at: http://www.futura-sciences.com/sciences/definitions/physique-onde-sonore-15526/. (Accessed: 25th January 2017)
- Overview | Arduino Lesson 13. DC Motors | Adafruit Learning System. Available at: https://learn.adafruit.com/adafruit-arduino-lesson-13-dc-motors/overview. (Accessed: 27th January 2017)
- Piezo Vibration Sensor Hookup Guide - learn.sparkfun.com. Available at: https://learn.sparkfun.com/tutorials/piezo-vibration-sensor-hookup-guide/example-code. (Accessed: 26th January 2017)
- Vibration. *Wikipédia* (2016).