Animal monitoring with Gemvid

Non-invasive measure of rats physical global activity

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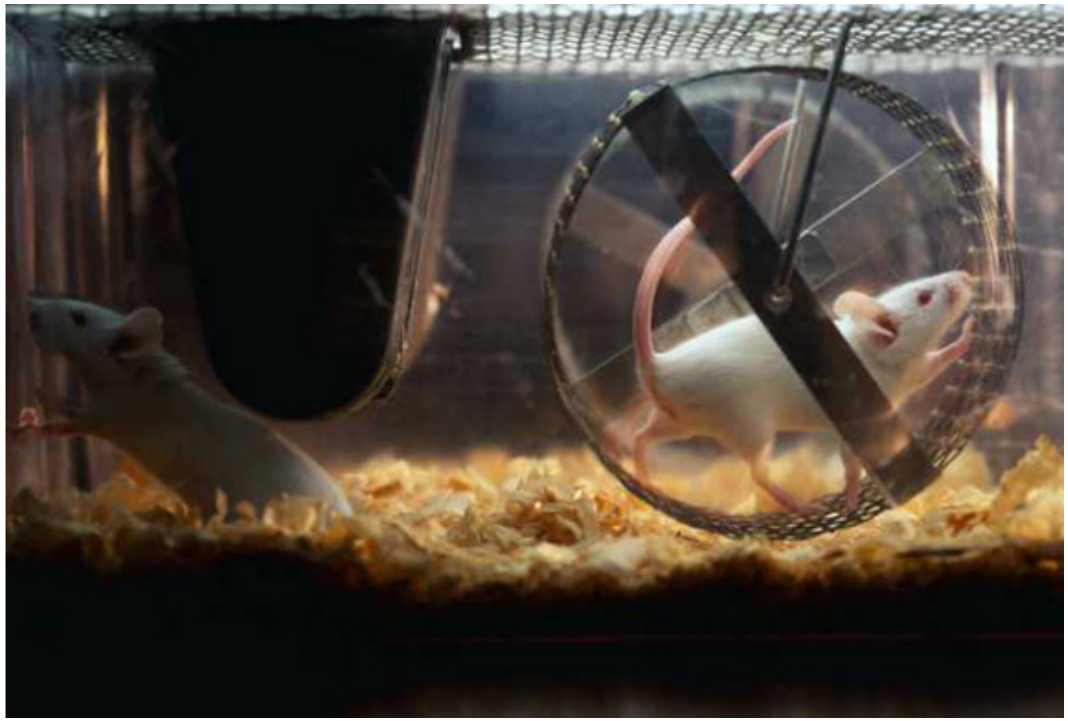
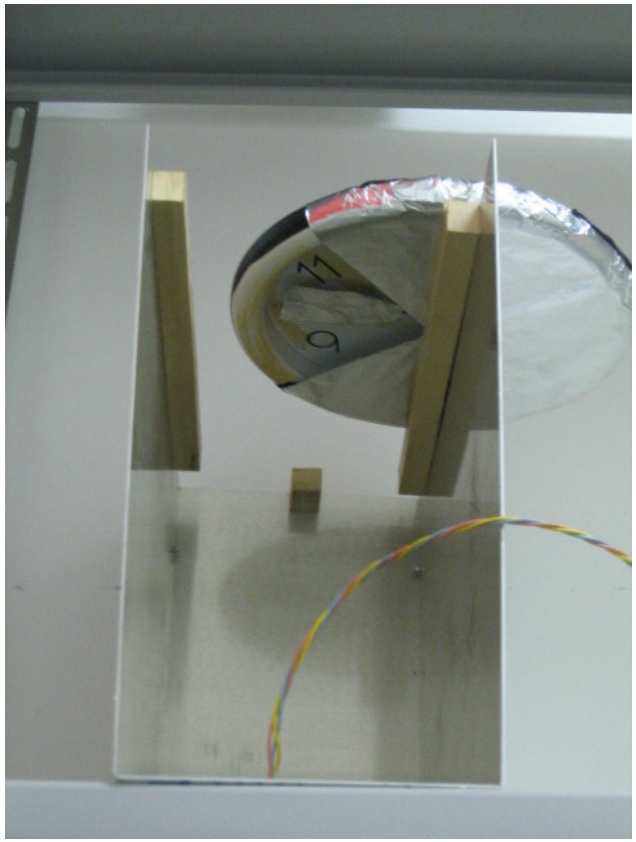
February 7th, 2009

How to measure rats physical activity? Running wheel?



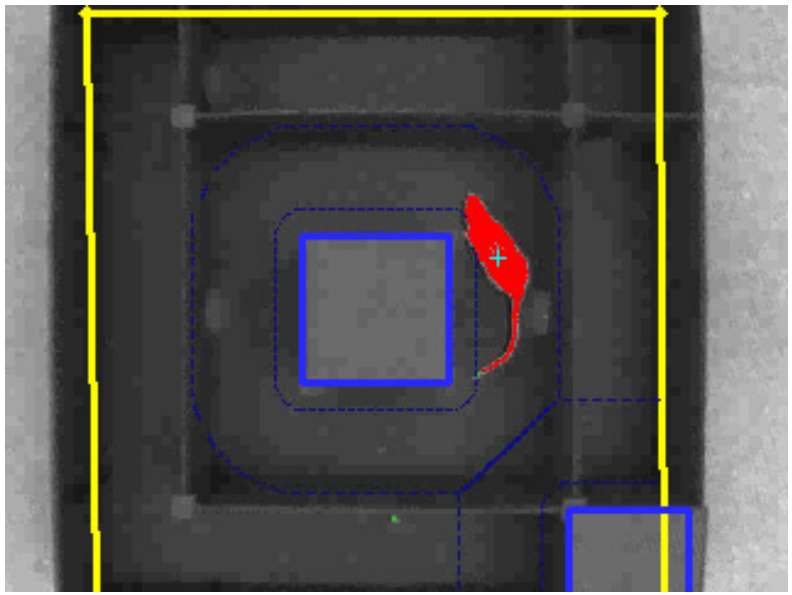
What should you do when your mouse or rat is out of the running wheel?

How to measure rats physical activity? Radar?



Do you really want such a complicated hardware?

How to measure rats physical activity? Video tracking?



Good idea but costly and impractical (center of gravity only)

How to measure rats physical activity? Markers?

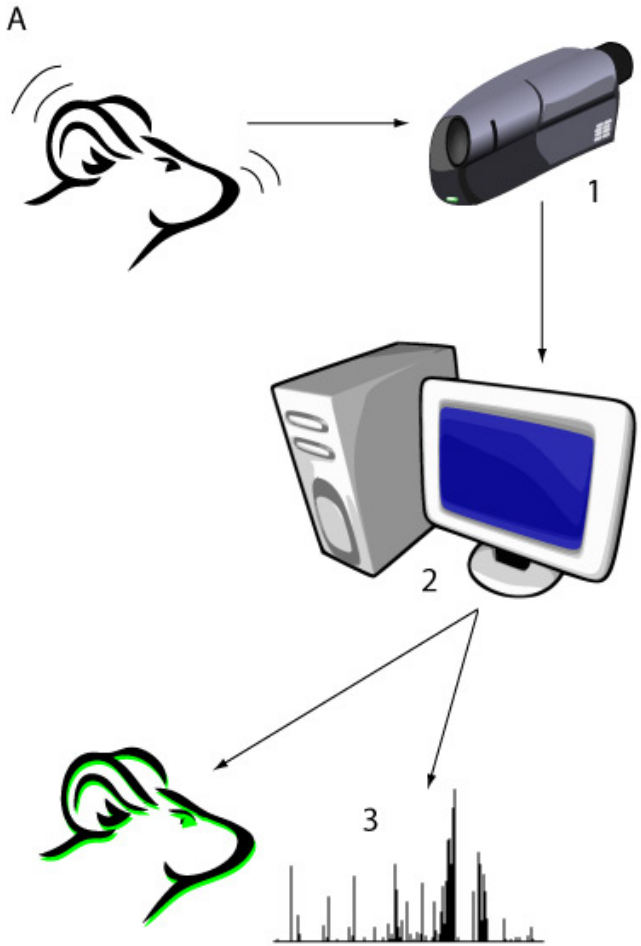
Rats don't like it ...

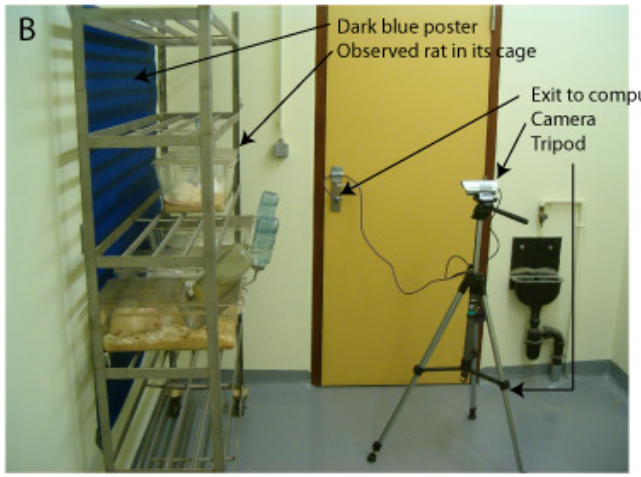
Quantification of overall free movements of rodents without any markers, using a commercially available CCTV and modular, free software

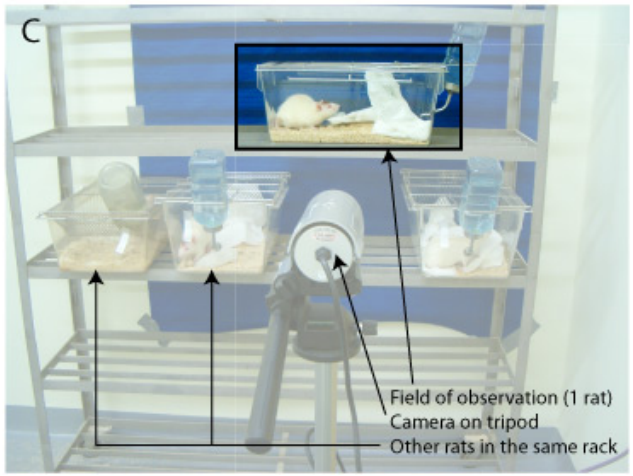
Frame difference analysis, roughly

Each $\frac{1}{25}$s, a photo of the animal is taken and compared to the previous one.
We compute the number of pixels that are different.

Gemvid


A
1
2
3


B
Dark blue poster
Observed rat in its cage
Exit to computer
Camera
Tripod


C
Field of observation (1 rat)
Camera on tripod
Other rats in the same rack

Hardware & Software

- any camera (IR if needed) (Lianyida-806C, 60 EUR)
- any video4linux-enabled framegrabber (ATI Rage 128 AIW, 5 EUR)
- any computer running Linux (PII 350MHz, 35 EUR)

E-bay is your friend!

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- GNU/Linux (RedHat v7.3)
- video4linux API (direct ioctl)
- no other dependencies
- ASCII output (need a pipe anyone?)
- data visualisation with GD, ~~Matlab~~Scilab, PIL, ...

“Theoretical” validation

"Theoretical" validation

Precision

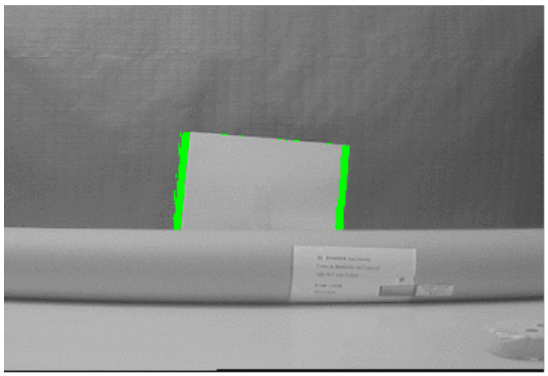
Sensitivity

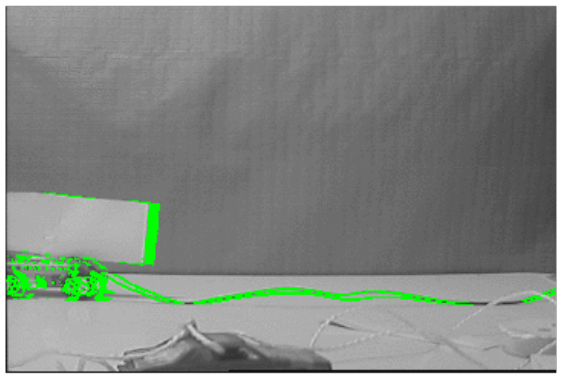
Reproducibility

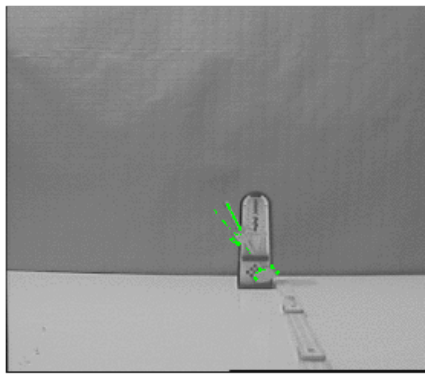
Actiwatch

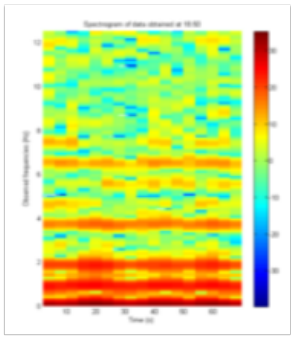
Stability over time

Rodents









Publication

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Research

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Gemvid, an open source, modular, automated activity recording system for rats using digital video

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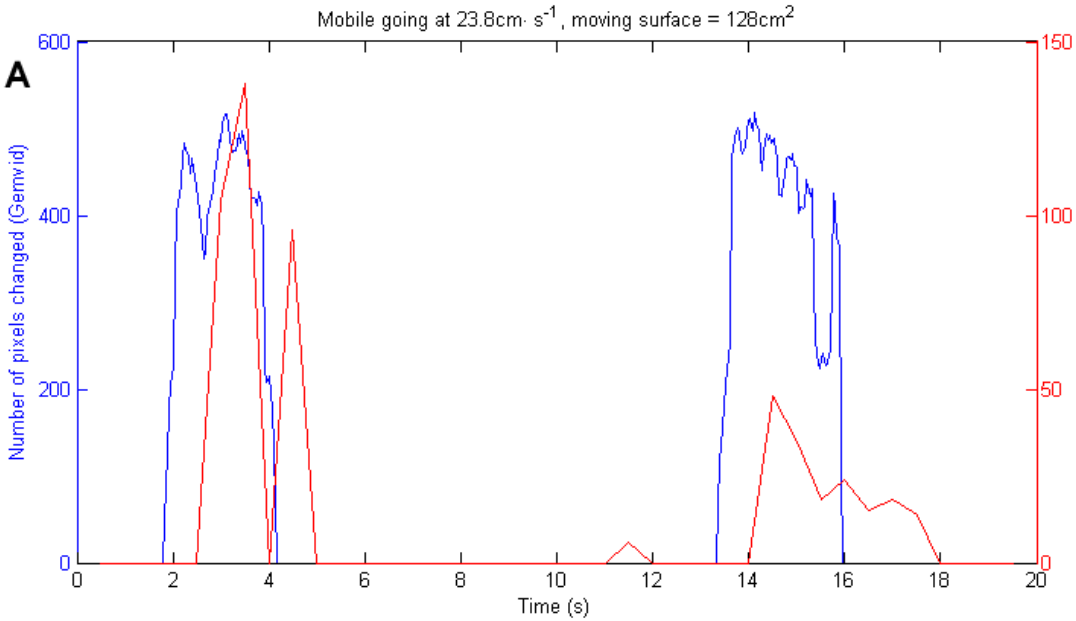
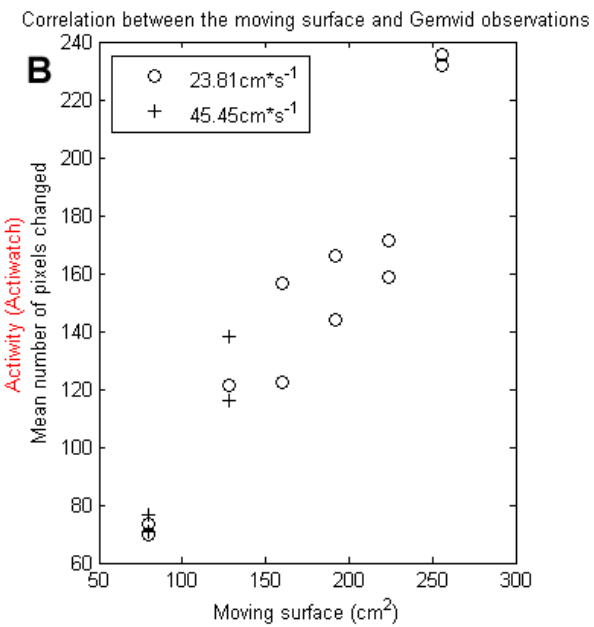
Abstract

Background: Measurement of locomotor activity is a valuable tool for analysing factors influencing behaviour and for investigating brain function. Several methods have been described in the literature for measuring the amount of animal movement but most are flawed or expensive. Here, we describe an open source, modular, low-cost, user-friendly, highly sensitive, non-invasive system

http://dx.doi.org/10.1186/1740-3391-4-10

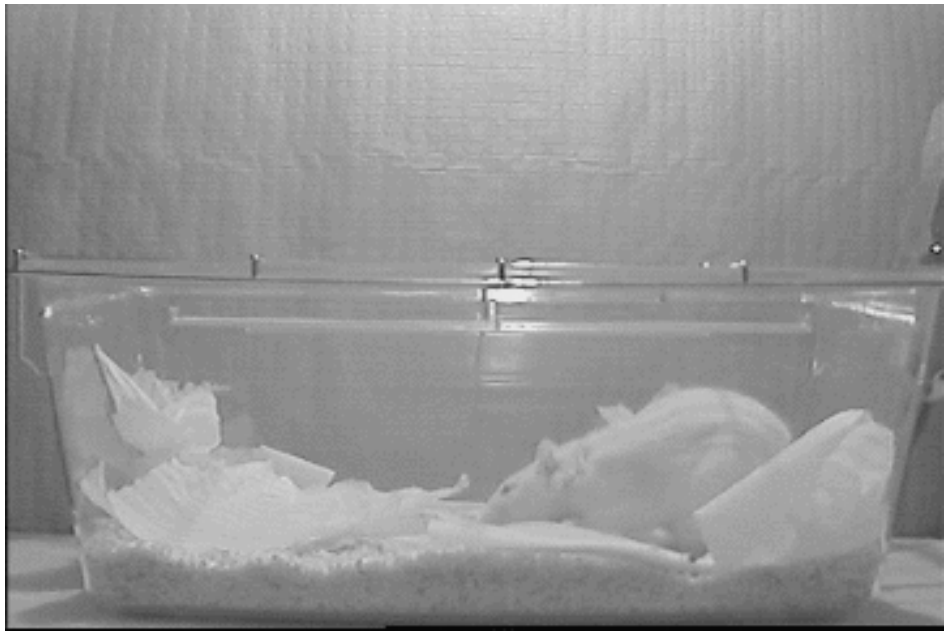
Comparison with an Actiwatch



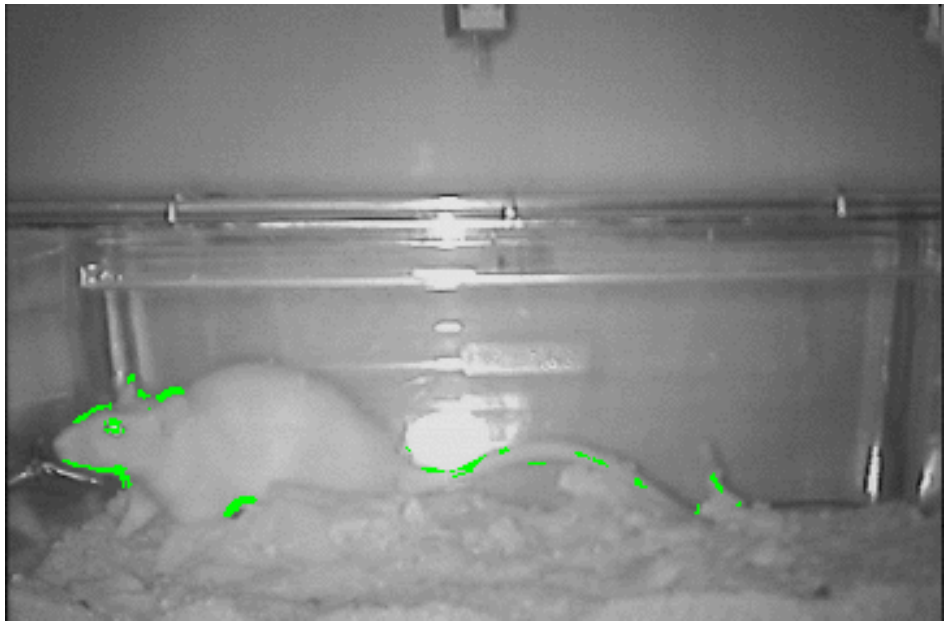


Working with rats (finally)

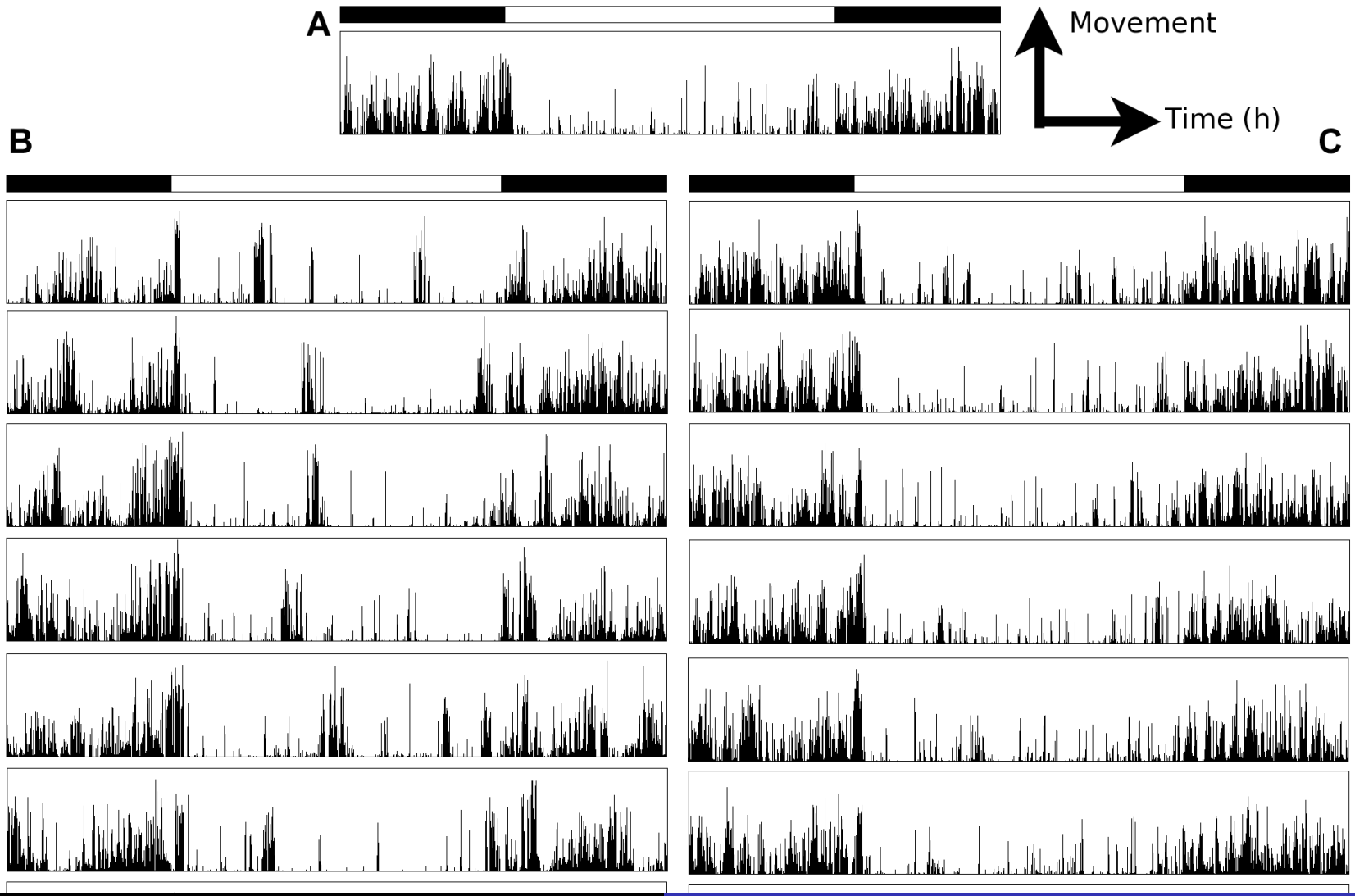
Rat during the day



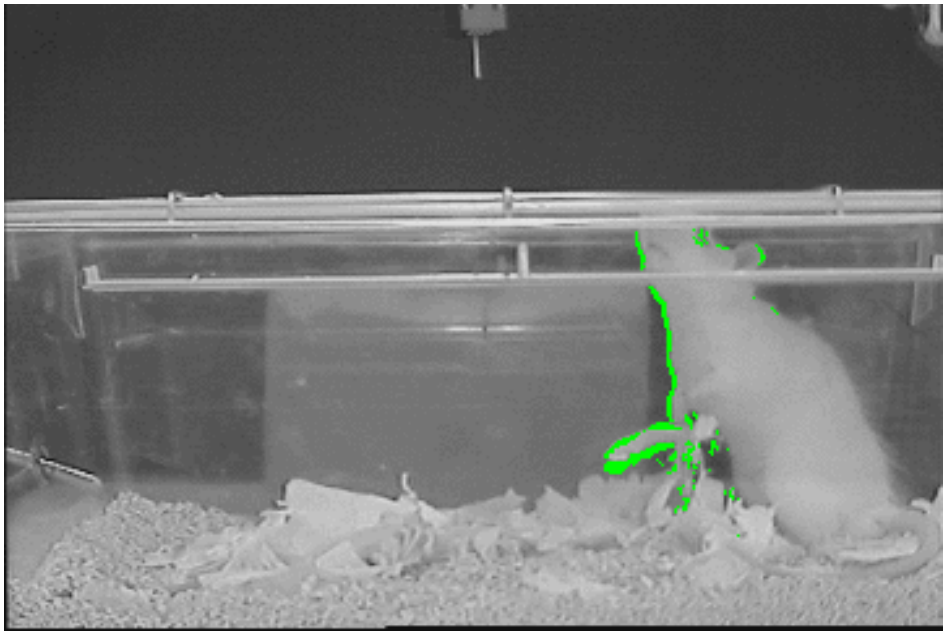
Rat during the night



Rats circadian rhythm



Conclusions



1. Sensitive
2. Reproducible
3. Stable over time
4. More accurate than actiwatch
5. Proven with rodents
6. Non-invasive

And more importantly ...

Use commodity hardware

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Use commodity hardware

Free as in “Free beer”

And more importantly ...

Use commodity hardware

Free as in "Free beer"

Free as in "Free speech"

Many thanks to

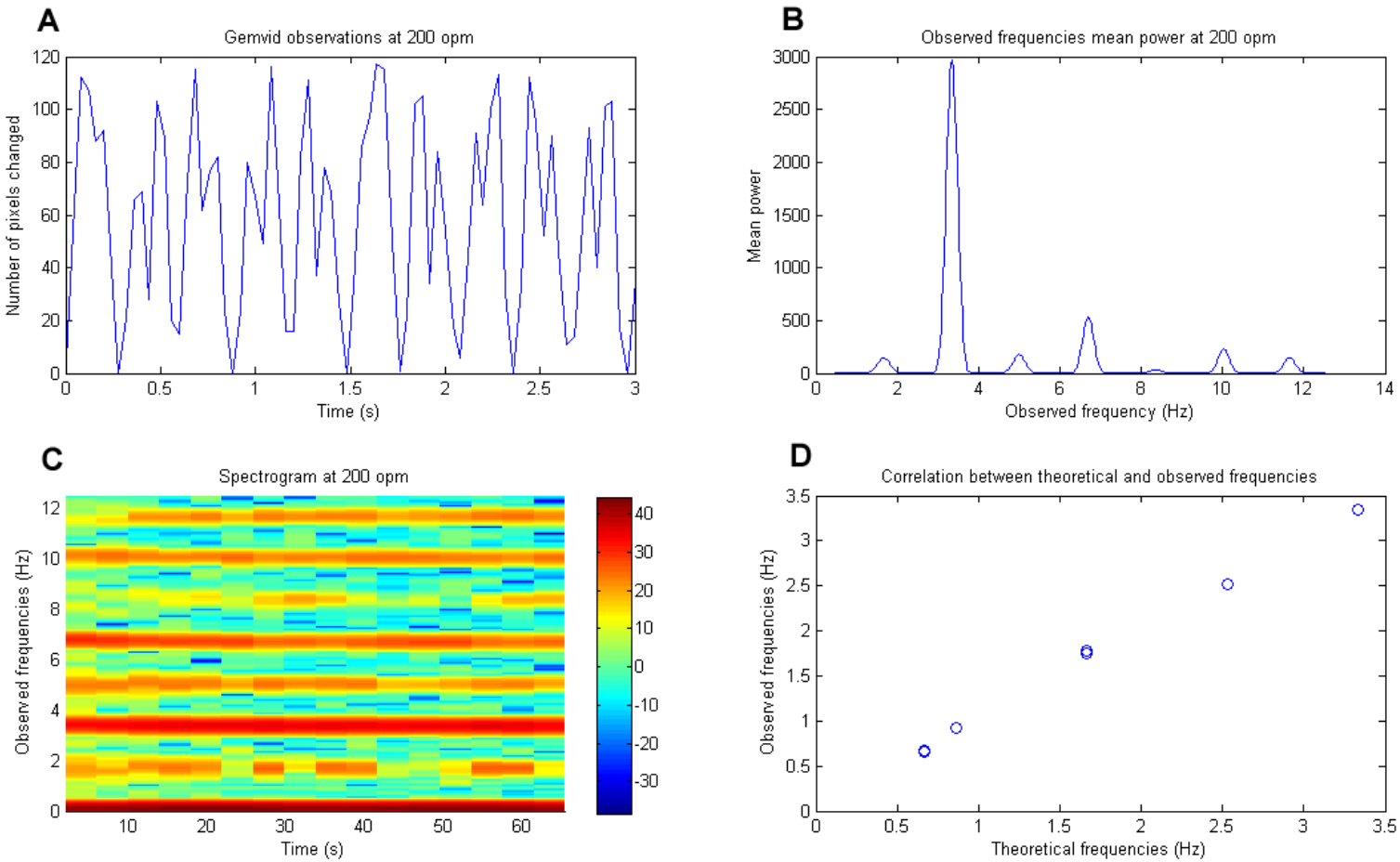
- Professors G. Moonen & A. Luxen
- Drs. P. Leprince & P. Maquet
- F.R.I.A.
- Fonds Leon Fredericq
- B.A.S.S. & C.E.T.E.S.

As well as all the rats that calmly participated in all my experiments

And thanks to you for your attention!
http://www.bioinformatics.org/gemvid
http://dx.doi.org/10.1186/1740-3391-4-10

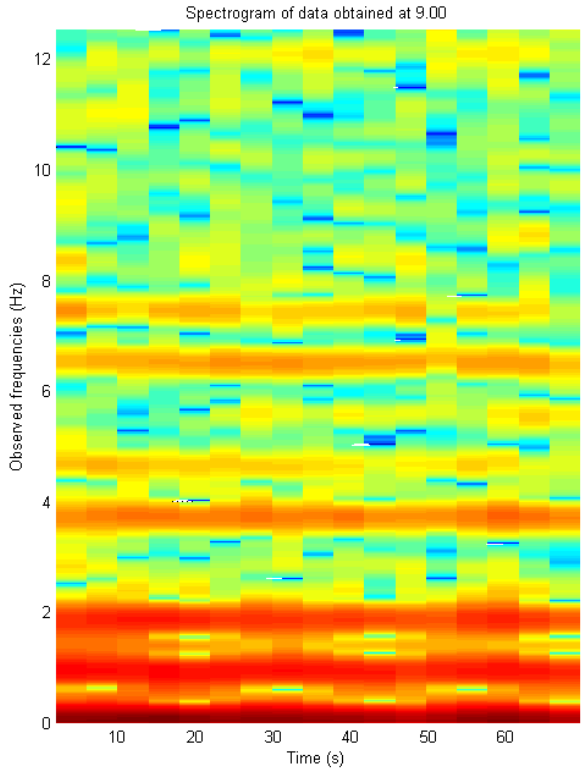
1. Sensitivity & Reproducibility

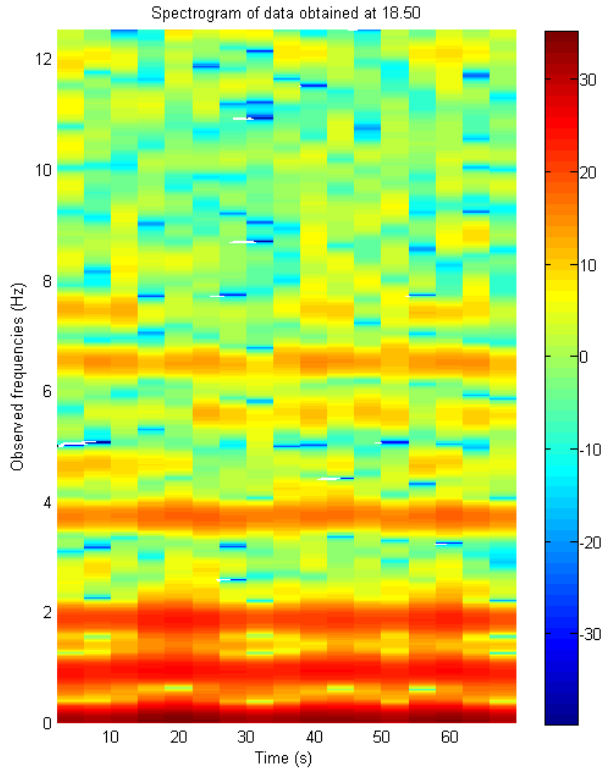
Comparison with a fixed oscillator



2. Stability over time

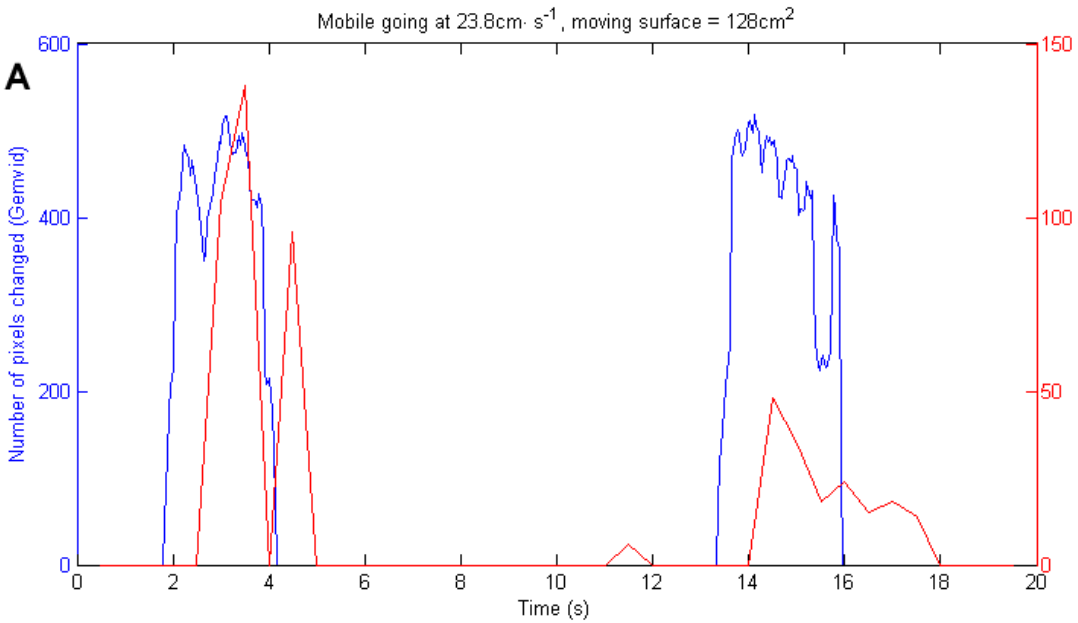
Stability over time

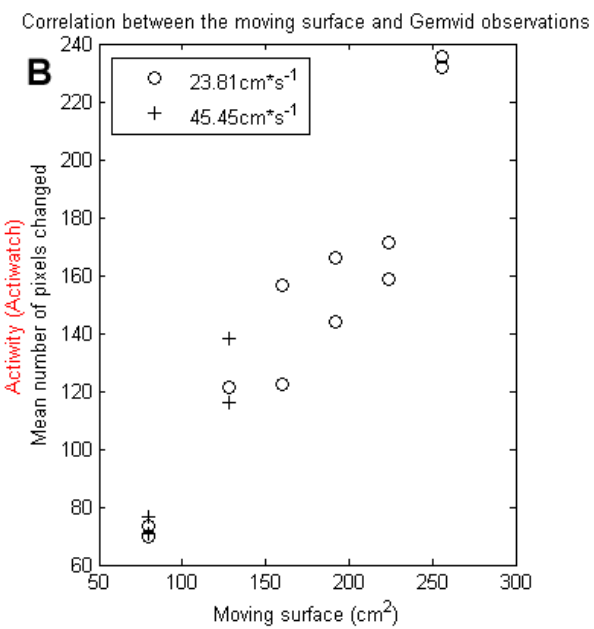




3. Comparison with an existing device

Comparison with an Actiwatch





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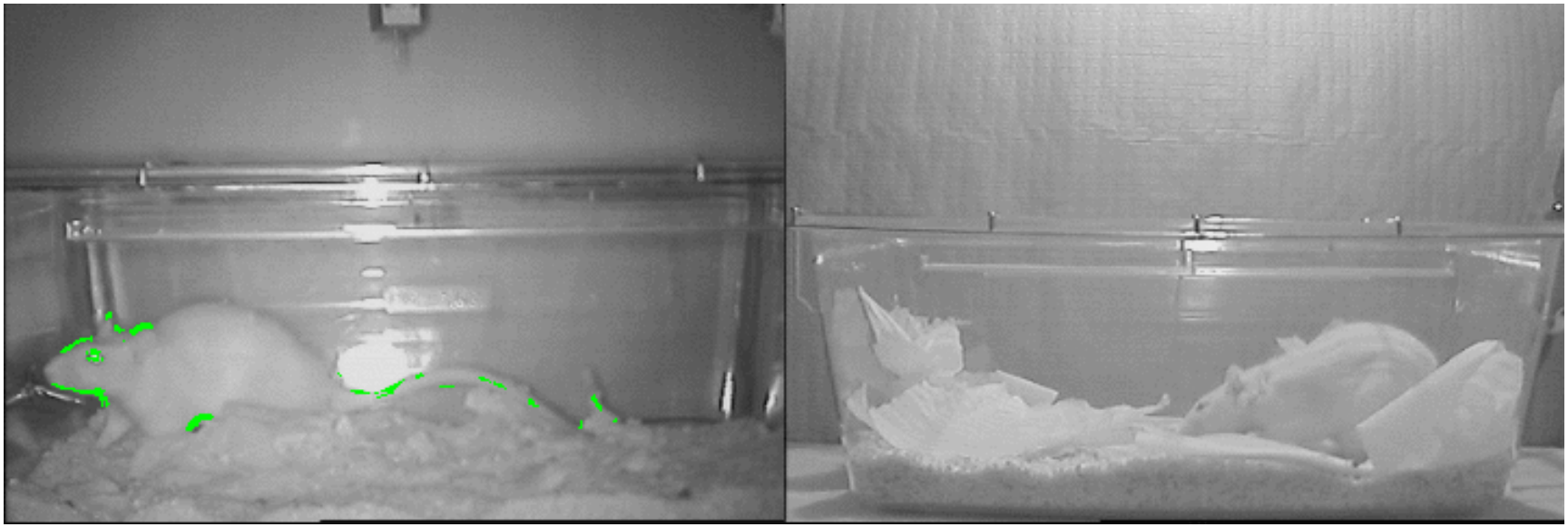
Rats circadian rhythm



Rats circadian rhythm