

use your garmin without garmin's cloud  
<https://github.com/pseyfert/fitfile-jugglers>

pseyfert

**1 initial problem****2 solution****3 the inevitable problem avalanche that was hiding behind the solution****4 join fitfile-jugglers on github!**

I have a Garmin sports watch

## design

Sync watch with smartphone to the cloud and let garmin harvest data and watch result in the webbrowser

## what i want

- have analysis fun myself!
- have analysis fun even on bad wifi
- have data for my eyes only

1 initial problem

2 solution

3 the inevitable problem avalanche that was hiding behind the solution

4 join fitfile-jugglers on github!

# modus operandi

- device needs charging anyway
- automounts w/o problem (on home user linux)

```
[ins] pseyfert@robusta /media/pseyfert/GARMIN > mount | \grep "GARMIN"          10:41:36  
/dev/sde on /media/pseyfert/GARMIN type vfat (rw,nosuid,nodev,relatime,uid=1000,gid=1000,fmask=0022,dmask=0022,codepage=437,iocharset=ascii,shortname=mixed,showexec,utf8,flush,errors=remount-ro,uhelper=udisks2)
```



```
robusta:/media/pseyfert/GARMIN tree -d -n           10:39:36  
[ins] 130 pseyfert@robusta /media/pseyfert/GARMIN > tree -d -n  
  
GARMIN  
├── ACTIVITY  
├── APPS  
│   ├── DATA  
│   ├── LOGS  
│   └── MAIL  
└── SETTINGS  
    ├── COOKIES  
    ├── EVENTLOGS  
    ├── GOALS  
    ├── LOCATION  
    ├── MLTSUPPORT  
    ├── MONITOR  
    ├── NEWFILES  
    ├── PREFERENCES  
    ├── REMOTESW  
    ├── SCHEDULE  
    ├── SETTINGS  
    └── SPORTS  
        ├── TEMPFIT  
        └── ZAF_HR  
    ├── TEXT  
    ├── TOTALS  
    └── WIFI  
    └── WORKOUTS  
        ├── INTERVAL  
        └── SCHEDULE  
LOST.DIR  
28 directories
```

# modus operandi

- device needs charging anyway
- automounts w/o problem (on home user linux)

```
[ins] pseyfert@robusta /media/pseyfert/GARMIN > mount | \grep "GARMIN"          10:41:36  
/dev/sde on /media/pseyfert/GARMIN type vfat (rw,nosuid,nodev,relatime,uid=1000,gid=1000,fmask=0022,dmask=0022,codepage=437,iocharset=ascii,shortname=mixed,showexec,utf8,flush,errors=remount-ro,uhelper=udisks2)
```



```
robusta:/media/pseyfert/GARMIN ls GARMIN/ACTIVITY  
[ins] pseyfert@robusta /media/pseyfert/GARMIN > ls GARMIN/ACTIVITY -1  
insgesamt 1427  
-rw-r--r-- 1 pseyfert pseyfert 149847 [REDACTED] 77F60304.FIT  
-rw-r--r-- 1 pseyfert pseyfert 34421 [REDACTED] 78390300.FIT  
-rw-r--r-- 1 pseyfert pseyfert 66272 [REDACTED] 783J2132.FIT  
-rw-r--r-- 1 pseyfert pseyfert 15496 [REDACTED] 78404701.FIT  
-rw-r--r-- 1 pseyfert pseyfert 45632 [REDACTED] 78493011.FIT  
-rw-r--r-- 1 pseyfert pseyfert 38108 [REDACTED] 784K2246.FIT  
-rw-r--r-- 1 pseyfert pseyfert 307480 [REDACTED] 786D0503.FIT  
-rw-r--r-- 1 pseyfert pseyfert 64389 [REDACTED] 78AJ1720.FIT  
-rw-r--r-- 1 pseyfert pseyfert 44883 [REDACTED] 78GI3806.FIT  
-rw-r--r-- 1 pseyfert pseyfert 16072 [REDACTED] 78HH2325.FIT  
-rw-r--r-- 1 pseyfert pseyfert 70184 [REDACTED] 78HH5659.FIT  
-rw-r--r-- 1 pseyfert pseyfert 282356 [REDACTED] 78JI1510.FIT  
-rw-r--r-- 1 pseyfert pseyfert 318904 [REDACTED] 78KH3244.FIT  
-rw-r--r-- 1 pseyfert pseyfert 4621 [REDACTED] 780K4354.FIT
```

# modus operandi

- fit files are (afaik) an open standard
- parsers and helpers are around
  - gpsbabel
  - python-fitparse / fitdump
  - FIT-TO-TCX

## my favourite: fitdump

- dumps *all* content of a fit file to the command line
- a few 100k lines for my largest files so far
- great point to start bodging

# dump

```

1. file_id
  * product: fr910t
  * manufacturer: garmin
  * serial_number: [REDACTED]
  * time_created: 2017-08-08
  * type: device_info
  * unknown_2: None
  * unknown_3: None

2. file_creater
  * hardware_version: None
  * software_version: 910
  * event
    * event_type: timer
    * event_group: 0
    * event_subgroup: start
    * timer_trigger: manual
    * timestamp: 2017-08-08 [REDACTED]

3. event
  * event_type: timer
  * event_group: 0
  * event_subgroup: start
  * timer_trigger: manual
  * timestamp: 2017-08-08 [REDACTED]

4. device_info
  * ant_device_number: None
  * ant_return_id: None
  * ant_tx_power: None
  * battery_status: None
  * battery_voltage: None [V]
  * calendar_timezone: None [s]
  * device_index: creator
  * device_name: creator
  * device_type: creator
  * garmin_product: fr910t
  * hardware_version: None
  * manufacturer: GARMIN
  * serial_number: [REDACTED]
  * source_type: local
  * timestamp: 2017-08-08 [REDACTED]
  * unknown_15: None
  * unknown_16: None
  * unknown_17: None
  * unknown_18: None
  * unknown_19: None
  * unknown_20: None

5. device_info
  * ant_device_number: None
  * ant_return_id: None
  * ant_tx_power: None
  * battery_status: None
  * battery_voltage: None [V]
  * calendar_timezone: None [s]
  * device_index: 1
  * device_name: [REDACTED]
  * device_type: [REDACTED]
  * garmin_product: fr910t
  * hardware_version: None
  * manufacturer: GARMIN
  * serial_number: [REDACTED]
  * source_type: local
  * timestamp: 2017-08-08 [REDACTED]
  * unknown_15: None
  * unknown_16: None
  * unknown_17: None
  * unknown_18: None
  * unknown_19: None
  * unknown_20: None

6. device_info
  * ant_device_number: None
  * ant_return_id: None
  * ant_tx_power: None
  * battery_status: None
  * battery_voltage: None [V]
  * calendar_timezone: None [s]
  * device_index: 1
  * device_name: [REDACTED]
  * device_type: [REDACTED]
  * garmin_product: fr910t
  * hardware_version: None
  * manufacturer: GARMIN
  * serial_number: [REDACTED]
  * source_type: local
  * timestamp: 2017-08-08 [REDACTED]
  * unknown_15: None
  * unknown_16: None
  * unknown_17: None
  * unknown_18: None
  * unknown_19: None
  * unknown_20: None

7. device_info
  * ant_device_number: None
  * ant_return_id: None
  * ant_tx_power: None
  * battery_status: None
  * battery_voltage: None [V]
  * calendar_timezone: None [s]
  * device_index: 1
  * device_name: [REDACTED]
  * device_type: [REDACTED]
  * garmin_product: fr910t
  * hardware_version: None
  * manufacturer: GARMIN
  * serial_number: [REDACTED]
  * source_type: local
  * timestamp: 2017-08-08 [REDACTED]
  * unknown_15: None
  * unknown_16: None
  * unknown_17: None
  * unknown_18: None
  * unknown_19: None
  * unknown_20: None

8. device_info
  * ant_device_number: None
  * ant_return_id: None
  * ant_tx_power: None
  * battery_status: None
  * battery_voltage: None [V]
  * calendar_timezone: None [s]
  * device_index: 1
  * device_name: [REDACTED]
  * device_type: [REDACTED]
  * garmin_product: fr910t
  * hardware_version: None
  * manufacturer: GARMIN
  * serial_number: [REDACTED]
  * source_type: local
  * timestamp: 2017-08-08 [REDACTED]
  * unknown_15: None
  * unknown_16: None
  * unknown_17: None
  * unknown_18: None
  * unknown_19: None
  * unknown_20: None

9. device_info
  * ant_device_number: None
  * ant_return_id: None
  * ant_tx_power: None
  * battery_status: None
  * battery_voltage: None [V]
  * calendar_timezone: None [s]
  * device_index: 1
  * device_name: [REDACTED]
  * device_type: [REDACTED]
  * garmin_product: fr910t
  * hardware_version: None
  * manufacturer: GARMIN
  * serial_number: [REDACTED]
  * source_type: local
  * timestamp: 2017-08-08 [REDACTED]
  * unknown_15: None
  * unknown_16: None
  * unknown_17: None
  * unknown_18: None
  * unknown_19: None
  * unknown_20: None

10. sport
  * name: Open Water
  * sub_sport: None
  * sub_sub_sport: None
  * timestamp: 2017-08-08 [REDACTED]
  * unknown_10: (0, 0, Name)
  * unknown_11: None
  * unknown_12: None
  * unknown_13: None
  * unknown_14: None
  * unknown_15: None
  * unknown_16: None
  * unknown_17: None
  * unknown_18: None
  * unknown_19: None
  * unknown_20: None

11. record
  * cadence: 0 (rpm)
  * distance: 0.0 (km)
  * enhanced_speed: 0.0 (km/h)
  * fractional_cadence: 0.0 (rpm)
  * speed: 0.000 (km/h)
  * timestamp: 2017-08-08 [REDACTED]

12. record
  * cadence: 0 (rpm)
  * distance: 0.0 (km)
  * timestamp: 2017-08-08 [REDACTED]

13. record
  * distance: 0 (km)
  * enhanced_speed: 0.0 (km/h)
  * fractional_cadence: 0.0 (rpm)
  * speed: 0.000 (km/h)
  * timestamp: 2017-08-08 [REDACTED]

14. record
  * distance: 0 (km)
  * enhanced_speed: 0.0 (km/h)
  * fractional_cadence: 0.0 (rpm)
  * speed: 0.000 (km/h)
  * timestamp: 2017-08-08 [REDACTED]

15. record
  * distance: 0 (km)
  * enhanced_speed: 0.0 (km/h)
  * fractional_cadence: 0.0 (rpm)
  * speed: 0.000 (km/h)
  * timestamp: 2017-08-08 [REDACTED]

16. record
  * distance: 0 (km)
  * enhanced_speed: 0.0 (km/h)
  * fractional_cadence: 0.0 (rpm)
  * speed: 0.000 (km/h)
  * timestamp: 2017-08-08 [REDACTED]

17. record
  * distance: 0 (km)
  * enhanced_speed: 0.0 (km/h)
  * fractional_cadence: 0.0 (rpm)
  * speed: 0.000 (km/h)
  * timestamp: 2017-08-08 [REDACTED]

18. device_info
  * ant_device_number: 28003
  * ant_return_id: antplus
  * ant_tx_power: None
  * battery_status: 33
  * calendar_timezone: None
  * device_index: 33
  * device_name: heart_rate
  * device_type: heart_rate
  * garmin_product: fr910t
  * hardware_version: 2.510025 [V]
  * manufacturer: com.apple
  * serial_number: [REDACTED]
  * source_type: antplus
  * timestamp: 10019406 [s]
  * unknown_15: 40049
  * unknown_16: 0
  * unknown_17: None
  * unknown_18: None
  * unknown_19: None
  * unknown_20: None

19. record
  * cadence: 22 (rpm)
  * distance: 0.00023 (km)
  * enhanced_speed: 3.4954 (km/h)
  * fractional_cadence: 0.0 (rpm)
  * speed: 3.4954 (km/h)
  * timestamp: 2017-08-08 [REDACTED]

20. record
  * cadence: 41 (rpm)
  * distance: 0.00023 (km)
  * enhanced_speed: 3.4954 (km/h)
  * fractional_cadence: 0.0 (rpm)
  * speed: 3.4954 (km/h)
  * timestamp: 2017-08-08 [REDACTED]

21. record
  * cadence: 41 (rpm)
  * distance: 0.00023 (km)
  * enhanced_speed: 3.4954 (km/h)
  * fractional_cadence: 0.0 (rpm)
  * speed: 3.4954 (km/h)
  * timestamp: 2017-08-08 [REDACTED]

22. record
  * cadence: 33 (rpm)
  * distance: 0.00023 (km)
  * enhanced_speed: 3.4954 (km/h)
  * fractional_cadence: 0.0 (rpm)
  * speed: 3.4954 (km/h)
  * timestamp: 2017-08-08 [REDACTED]

```



# dump

5640. record  
• activity.type: running  
• altitude: 400.8 [m]  
• cardType: 7 [m]  
• distance: 21.17 [km]  
• enhanced\_altitude: 470.8 [m]  
• enhanced\_speed: 20.0 [km/h]  
• fitnessScore: 74; v: 0.0 DPM  
• heartRate: 143 [bpm]  
• position\_lat: 46.5197294 [deg]  
• position\_lat: 46.5197294 [deg]  
• position\_long: 10.0998429 [deg]  
• position\_long: 10.0998429 [deg]  
• stateTime: 25.0 [ms]  
• stateTime\_balance: 10.0 [percent]  
stateTime\_percent: 10.0 [percent]  
• timestamp: 2077-06-08  
• vertical\_acceleration: 943 [mm]  
• vertical\_balance: 499 [percent]  
• unknown\_51: 494  
• unknown\_66: 650

9133. hr  
• event\_LTimestamp: 17.2001953125 [s]  
• event\_LTimestamp: 17.5845234075 [s]  
• event\_LTimestamp: 17.919321875 [s]  
• event\_LTimestamp: 18.2763671675 [s]  
• event\_LTimestamp: 18.6119054125 [s]  
• event\_LTimestamp: 18.9570703125 [s]  
• event\_LTimestamp: 19.3523390625 [s]  
• event\_LTimestamp: 19.7060546875 [s]  
• event\_LTimestamp: 20.04521875 [s]  
• event\_LTimestamp: 20.0 [s]  
• filtered\_Ltype: [bpm]

9134. hr  
• event\_LTimestamp: 20.0654298675 [s]  
• event\_LTimestamp: 20.3829441406 [s]  
• event\_LTimestamp: 20.7881328125 [s]  
• event\_LTimestamp: 21.1416015625 [s]  
• event\_LTimestamp: 21.4951171675 [s]  
• event\_LTimestamp: 21.838634375 [s]  
• event\_LTimestamp: 22.18260546875 [s]  
• event\_LTimestamp: 22.57421875 [s]  
• event\_LTimestamp: 24.0 [s]  
• event\_LTimestamp: 24.0 [s]  
• event\_LTimestamp: 24.0 [s]  
• event\_LTimestamp: 24.0 [s]  
• event\_LTimestamp: 32: (67, 46, 27, 37, 19, 73, 251, 5, 119, 221, 200, 164)  
• filtered\_Ltype: [bpm]

9135. hr  
• event\_LTimestamp: 26.9384765125 [s]  
• event\_LTimestamp: 27.252964875 [s]  
• event\_LTimestamp: 28.078859375 [s]  
• event\_LTimestamp: 28.0986351975 [s]  
• event\_LTimestamp: 28.3662109375 [s]  
• event\_LTimestamp: 28.7295825 [s]  
• event\_LTimestamp: 29.07236984375 [s]  
• event\_LTimestamp: 29.443559375 [s]  
• event\_LTimestamp: 32.0 [s]  
• event\_LTimestamp: 32.0 [s]  
• event\_LTimestamp: 32.0 [s]  
• event\_LTimestamp: 32.0 [s]  
• event\_LTimestamp: 32: (733, 203, 210, 153, 126, 0, 119, 161, 46, 87, 100, 92)  
• filtered\_Ltype: [bpm]

9136. hr  
• event\_LTimestamp: 33.082734375 [s]  
• event\_LTimestamp: 34.162193375 [s]  
• event\_LTimestamp: 34.5205078125 [s]  
• event\_LTimestamp: 34.878824375 [s]  
• event\_LTimestamp: 35.2373046875 [s]  
• event\_LTimestamp: 35.5922734375 [s]  
• event\_LTimestamp: 36.05061125 [s]  
• event\_LTimestamp: 36.306449825 [s]  
• event\_LTimestamp: 40.0 [s]  
• event\_LTimestamp: 42: (54, 105, 138, 21, 74, 104, 243, 252, 229, 205, 175, 19)

9137. hr  
• event\_LTimestamp: 40.4662109375 [s]  
• event\_LTimestamp: 41.071791875 [s]  
• event\_LTimestamp: 41.37109375 [s]  
• event\_LTimestamp: 41.6713954125 [s]  
• event\_LTimestamp: 42.0810546875 [s]  
• event\_LTimestamp: 42.4326171675 [s]  
• event\_LTimestamp: 42.70725 [s]

- 1 initial problem
- 2 solution
- 3 the inevitable problem avalanche that was hiding behind the solution
- 4 join fitfile-jugglers on github!

# problems ...

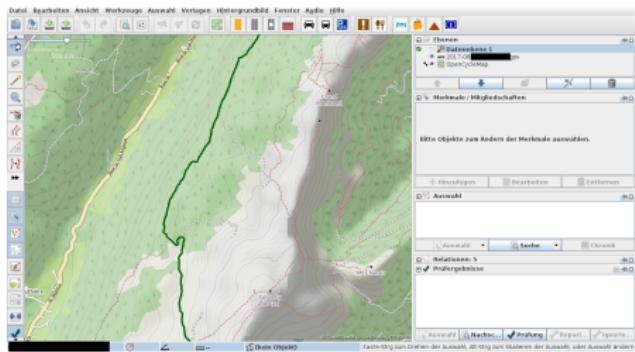


## locations

- Can store locations when walking
  - find point again
  - add gate to OSM
- stored in `Garmin/Locations/Locations.fit`

but...

# problems ...



## locations

- Can store locations when walking
  - find point again
  - add gate to OSM
- stored in `Garmin/Locations/Locations.fit`

but...

- not understood by `gpsbabel`

# problems ...

## locations

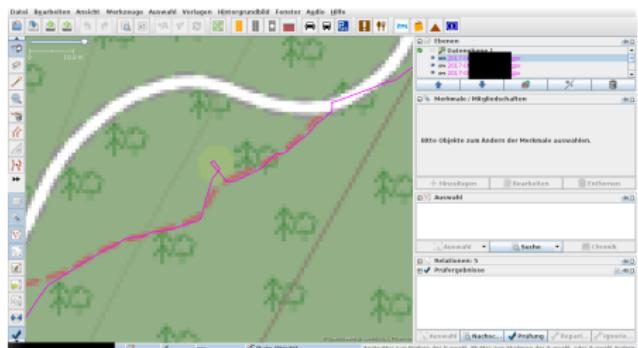
- Can store locations when walking
  - find point again
  - add gate to OSM
- stored in *Garmin/Locations/Locations.fit*

```
[1] lsx pseyfert@robusta /media/pseyfert/GARMIN python3 -fitdump Locations.fit | grep '^13' -A10
13: unknown_29
* unknown_0: DATE
* unknown_1: 552782317
* unknown_2: 552782355
* unknown_253: 871482360
* unknown_254: 10
* unknown_3: 23
* unknown_4: 5296
* unknown_5: None
* unknown_6: None
```

## but...

- not understood by gpsbabel
- not known to python-fitparse

# problems ...



## locations

- Can store locations when walking
  - find point again
  - add gate to OSM
- stored in `Garmin/Locations/Locations.fit`

but...

- not understood by `gpsbabel`
- not known to `python-fitparse`
- I don't want to walk in circles to mark positions on tracks

# problems ...

- heart rate is not recorded on the watch while swimming (gets download at the end)
- and is dumped to the end of a fitfile

```
9133. hr
* event_timestamp: 17.2001953125 [s]
* event_timestamp: 17.5615234375 [s]
* event_timestamp: 17.919921875 [s]
* event_timestamp: 18.27631875 [s]
* event_timestamp: 18.6330853125 [s]
* event_timestamp: 18.9937070125 [s]
* event_timestamp: 19.3525393125 [s]
* event_timestamp: 19.7060548675 [s]
* event_timestamp: 20.0 [s]
* event_timestamp: 20.0 [s]
* event_timestamp: 12: (205, 244, 99, 174, 183, 145, 141, 216, 191, 105, 61, 237)
* filtered_bpm: ██████████ [bpm]
```

```
9134. hr
* event_timestamp: 20.0654298875 [s]
* event_timestamp: 20.4240048875 [s]
* event_timestamp: 20.7861328125 [s]
* event_timestamp: 21.1416015625 [s]
* event_timestamp: 21.4951171875 [s]
* event_timestamp: 21.859375 [s]
* event_timestamp: 22.2158209125 [s]
* event_timestamp: 22.57421875 [s]
* event_timestamp: 24.0 [s]
* event_timestamp: 24.0 [s]
* event_timestamp: 12: (67, 48, 27, 37, 19, 73, 251, 5, 119, 221, 200, 164)
* filtered_bpm: ██████████ [bpm]
```

```
9135. hr
* event_timestamp: 26.9384765625 [s]
* event_timestamp: 27.29296875 [s]
* event_timestamp: 27.6494140625 [s]
* event_timestamp: 28.0068359375 [s]
* event_timestamp: 28.3662109375 [s]
* event_timestamp: 28.728515625 [s]
* event_timestamp: 29.0849609375 [s]
* event_timestamp: 29.443359375 [s]
* event_timestamp: 32.0 [s]
* event_timestamp: 32.0 [s]
* event_timestamp: 12: (193, 209, 210, 153, 126, 0, 119, 161, 46, 87, 100, 92)
* filtered_bpm: ██████████ [bpm]
```

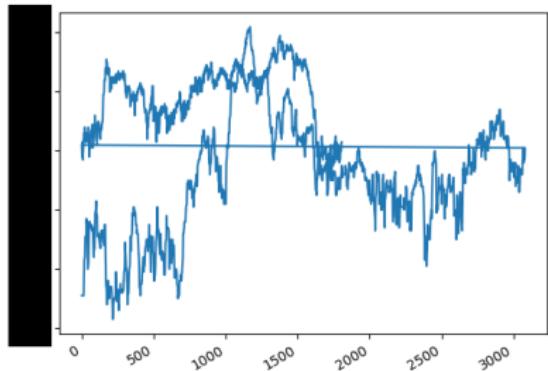
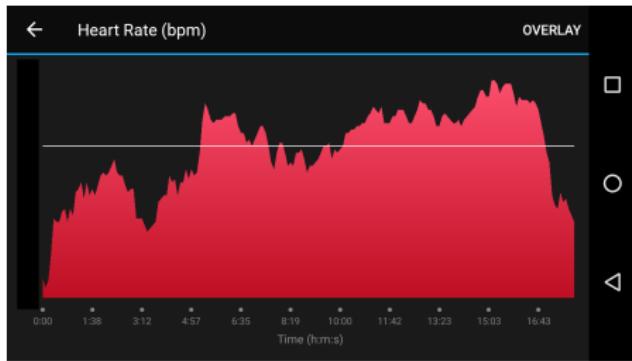
```
9136. hr
* event_timestamp: 33.802734375 [s]
* event_timestamp: 34.162109375 [s]
* event_timestamp: 34.5205078125 [s]
* event_timestamp: 34.87890625 [s]
* event_timestamp: 35.2373046875 [s]
* event_timestamp: 35.5927734375 [s]
* event_timestamp: 35.95234375 [s]
* event_timestamp: 36.308640625 [s]
* event_timestamp: 40.0 [s]
* event_timestamp: 40.0 [s]
* event_timestamp: 12: (54, 103, 138, 21, 74, 184, 243, 252, 229, 205, 175, 19)
* filtered_bpm: ██████████ [bpm]
```

```
9137. hr
* event_timestamp: 40.662109375 [s]
* event_timestamp: 41.017578125 [s]
* event_timestamp: 41.37106175 [s]
* event_timestamp: 41.734539375 [s]
* event_timestamp: 42.0816548675 [s]
* event_timestamp: 42.4328171875 [s]
* event_timestamp: 42.78125 [s]
```

# problems ...

- heart rate is not recorded on the watch while swimming (gets downloaded at the end)
- and is dumped to the end of a fitfile

- strange encoding of timestamps
- gets reset
- some “extra data” at the start



# limits of GPS

- gpsbabel works reasonably well with most data once one found the command line switches to include heart rate, temperature, ...in the output

```
gpsbabel -i garmin_fit -f $INPUTFILE -o gpx,gpxver=1.1,garminextensions -F $OUTPUTFILE
```
- but fails for records before GPS fix is established  
(record of heart rate, speed, cadence, ...is available in fitfile)  
affects
  - running
  - cycling
  - all indoor sports
- ^\_^(ゞ)\_/\_okay for mapping/location related data mining

1 initial problem

2 solution

3 the inevitable problem avalanche that was hiding behind the solution

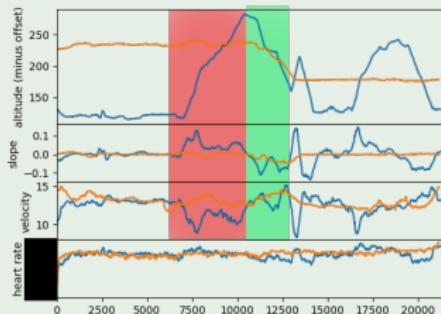
4 join fitfile-jugglers on github!

# what **fitfile-jugglers** is about

## I want to

- nerd around with my garmin data w/o the need of a smartphone or garmin's app or the cloud
- develop patches for python-fitparse, gpxpy, gpsbabel to understand more of the data garmin's devices record
- collect example code to analyse your own data

## what's there



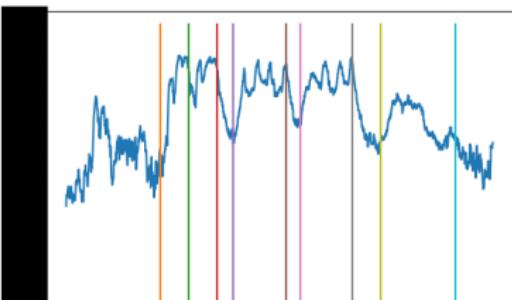
- uphill I run slower than downhill!

# what **fitfile-jugglers** is about

## I want to

- nerd around with my garmin data w/o the need of a smartphone or garmin's app or the cloud
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- collect example code to analyse your own data

## what's there



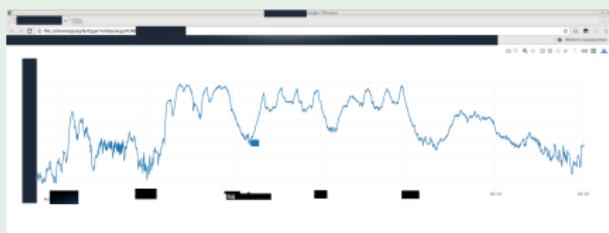
- plotting gps less, time stamped data

# what **fitfile-jugglers** is about

## I want to

- nerd around with my garmin data w/o the need of a smartphone or garmin's app or the cloud
- develop patches for python-fitparse, gpxpy, gpsbabel to understand more of the data garmin's devices record
- collect example code to analyse your own data

## what's there



- plotting gps less, time stamped data
- making html+javascript pages (if you need to show your friends on a smartphone)

<https://github.com/pseyfert/fitfile-jugglers>