

CODECHECK certificate 2024-019

<https://doi.org/10.5281/zenodo.14279041>



Item	Value
Title	Quality in Question: Assessing the accuracy of four heart rate wearables and the implications for psychophysiological research.
Authors	Mohammadamin Sinichi  , Martin Gevonden, Lydia Krabben-dam
Reference	https://doi.org/10.31219/osf.io/wkzsn
Codechecker	Yasel Quintero  , Tornike Skhirtladze, Joslyn Sun  , Gabriella Low Chew Tung, Roel Janssen 
Date of check	2024-12-04 14:00:00
Summary	The codecheckers were able to reproduce most of the figures in the manuscript and its supplementary documentation.
Repository	https://github.com/codecheckers/wearable-hrv

Table 1: CODECHECK summary

Summary

This codecheck was done as part of the “CodeCheck goes NL” workshop in Erasmus University Rotterdam, The Netherlands. The codecheck process was carried out in two stages. During the workshop, the reproduction of Figure 5 in the manuscript was achieved with help from the authors. Following the workshop, the authors provided the codecheckers with a Jupyter notebook capable of generating most of the figures presented in the manuscript, along with those in the supplementary materials.

Output	Comment	Size (b)
cco/fig2_empatica.png	manuscript Fig. 2 (empatica)	56796
cco/fig2_heartmath.png	manuscript Fig. 2 (heartmath)	44295
cco/fig2_kyto.png	manuscript Fig. 2 (kyto)	56815
cco/fig2_rhythm.png	manuscript Fig. 2 (rhythm)	58015
cco/fig4_meanhr.png	manuscript Fig. 4 (mean hr)	110965
cco/fig4_rmssd.png	manuscript Fig. 4 (rmssd)	114322
cco/fig5.png	manuscript Fig. 5	337355
cco/fig6_arithmetic_meanhr.png	manuscript Fig. 6 (arithmetic, meanhr)	50919
cco/fig6_arithmetic_rmssd.png	manuscript Fig. 6 (arithmetic, rmssd)	44752
cco/fig6_biking_meanhr.png	manuscript Fig. 6 (biking, mean hr)	47154
cco/fig6_biking_rmssd.png	manuscript Fig. 6 (biking, rmssd)	45337
cco/fig6_sitting_meanhr.png	manuscript Fig. 6 (sitting, mean hr)	52890
cco/fig6_sitting_rmssd.png	manuscript Fig. 6 (sitting, rmssd)	50468
cco/fig7_meanhr.png	manuscript Fig. 7 (mean hr)	43812
cco/fig7_rmssd.png	manuscript Fig. 7 (rmssd)	68654
cco/fig8_meanhr.png	manuscript Fig. 8 (mean hr)	111754
cco/fig8_rmssd.png	manuscript Fig. 8 (rmssd)	119671
cco/fig9_arithmetic_meanhr.png	manuscript Fig. 9 (arithmetic, meanhr)	74972
cco/fig9_arithmetic_rmssd.png	manuscript Fig. 9 (arithmetic, rmssd)	75713
cco/fig9_biking_meanhr.png	manuscript Fig. 9 (biking, mean hr)	76652
cco/fig9_biking_rmssd.png	manuscript Fig. 9 (biking, rmssd)	74850
cco/fig9_sitting_meanhr.png	manuscript Fig. 9 (sitting, mean hr)	69047
cco/fig9_sitting_rmssd.png	manuscript Fig. 9 (sitting, rmssd)	74330
cco/table1.png	manuscript Table 1	145956
cco/sfig4_empatica.png	supplement Fig. 4 (empatica)	234107
cco/sfig4_heartmath.png	supplement Fig. 4 (heartmath)	249889
cco/sfig4_kyto.png	supplement Fig. 4 (kyto)	230523
cco/sfig4_rhythm.png	supplement Fig. 4 (rhythm)	236669
cco/sfig5_empatica.png	supplement Fig. 5 (empatica)	224014
cco/sfig5_heartmath.png	supplement Fig. 5 (heartmath)	235022
cco/sfig5_kyto.png	supplement Fig. 5 (kyto)	203060
cco/sfig5_rhythm.png	supplement Fig. 5 (rhythm)	223397
cco/sfig6_empatica.png	supplement Fig. 6 (empatica)	246719
cco/sfig6_heartmath.png	supplement Fig. 6 (heartmath)	239713
cco/sfig6_kyto.png	supplement Fig. 6 (kyto)	231056
cco/sfig6_rhythm.png	supplement Fig. 6 (rhythm)	242470
cco/sfig7_kyto.png	supplement Fig. 7 (kyto)	224516
cco/sfig7_rhythm.png	supplement Fig. 7 (rhythm)	227924
cco/sfig8_empatica.png	supplement Fig. 8 (empatica)	233657
cco/sfig8_heartmath.png	supplement Fig. 8 (heartmath)	232465
cco/sfig9_kyto.png	supplement Fig. 9 (kyto)	220444
cco/sfig9_rhythm.png	supplement Fig. 9 (rhythm)	219419
cco/stable3.png	supplement Table 3	170643
cco/stable4.png	supplement Table 4	54580
cco/stable5.png	supplement Table 5	110237

Table 2: Summary of output files generated

CODECHECKER notes

The authors have made available the necessary code and data to reproduce the figures and tables in the manuscript and supplementary documentation. These resources can be accessed at <https://osf.io/y2q3r/>.

Reproduction of Figure 5

Figure 5 was reproduced by running the Jupyter notebook **Empatica.ipynb**(<https://osf.io/7h48c>). The authors assisted the codecheckers in fixing minor issues in the code, mainly related to incorrect paths to the data files needed to generate the plot. The following changes were made to the code:

- Modified the `path` variable in the notebook's second cell; its value was set to `<local-path>/osfstorage-archive/Raw Data/Empatica Avro Files`
- Modified the `events_path` variable the fourth cell; its value was set to `<local-path>/osfstorage-archive/Raw Data/" + pp + "_events.csv`

All the necessary libraries to run the notebooks, except for Jupyter itself, were obtained by installing the **wearablehrv** package as documented in the README file of the repository <https://github.com/Aminsinic hi/wearable-hrv>.

Reproduction of all other figures and tables

Following the workshop, the authors uploaded to the article's OSF project the Jupyter notebook **Quality in Question - Reproduce Results.ipynb** (<https://osf.io/x6t5n>) which was used by the codecheckers to reproduce all the other figures and tables included in this report.

Recommendations

The codechekers suggest to the authors to consider the following suggestions for their next publication or workflow:

- Providing readers with jupyter notebooks that generate all the figures in the article. These notebooks can be submitted along with the article, as supplementary documentation.
- Using the function `os.path.join` to handle the paths in Python code

Manifest files

fig2_empatica.png

Comment: manuscript Fig. 2 (empatica)

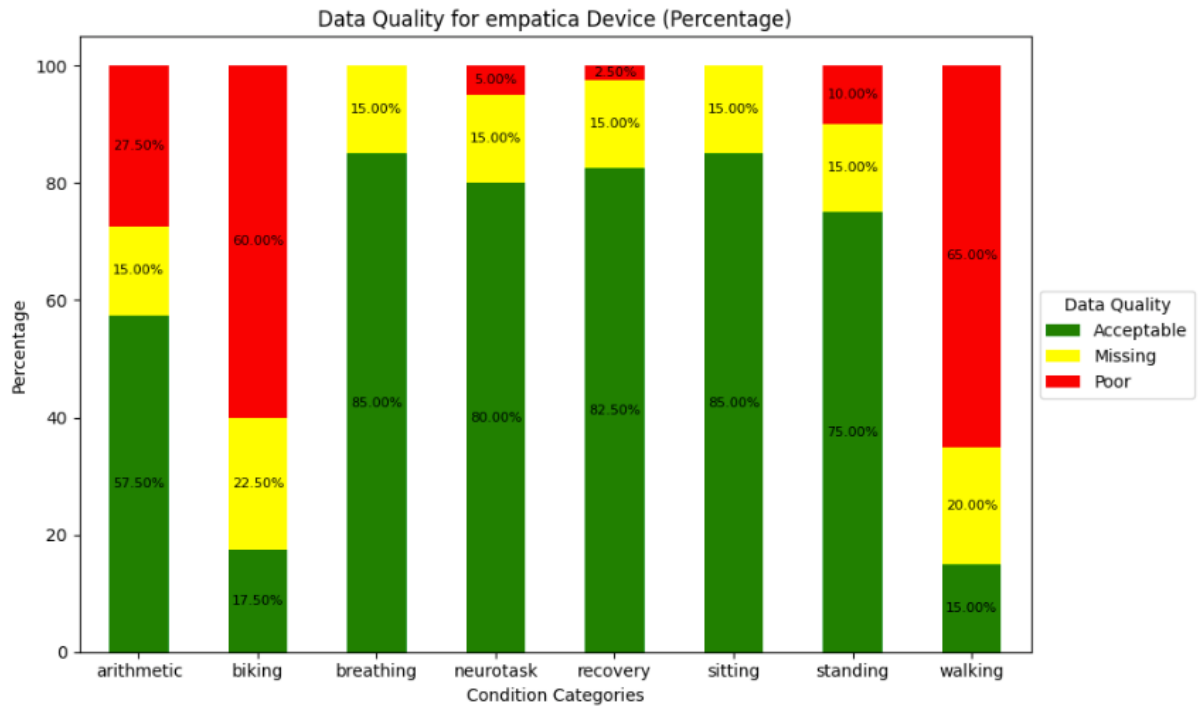


fig2_heartmath.png

Comment: manuscript Fig. 2 (heartmath)

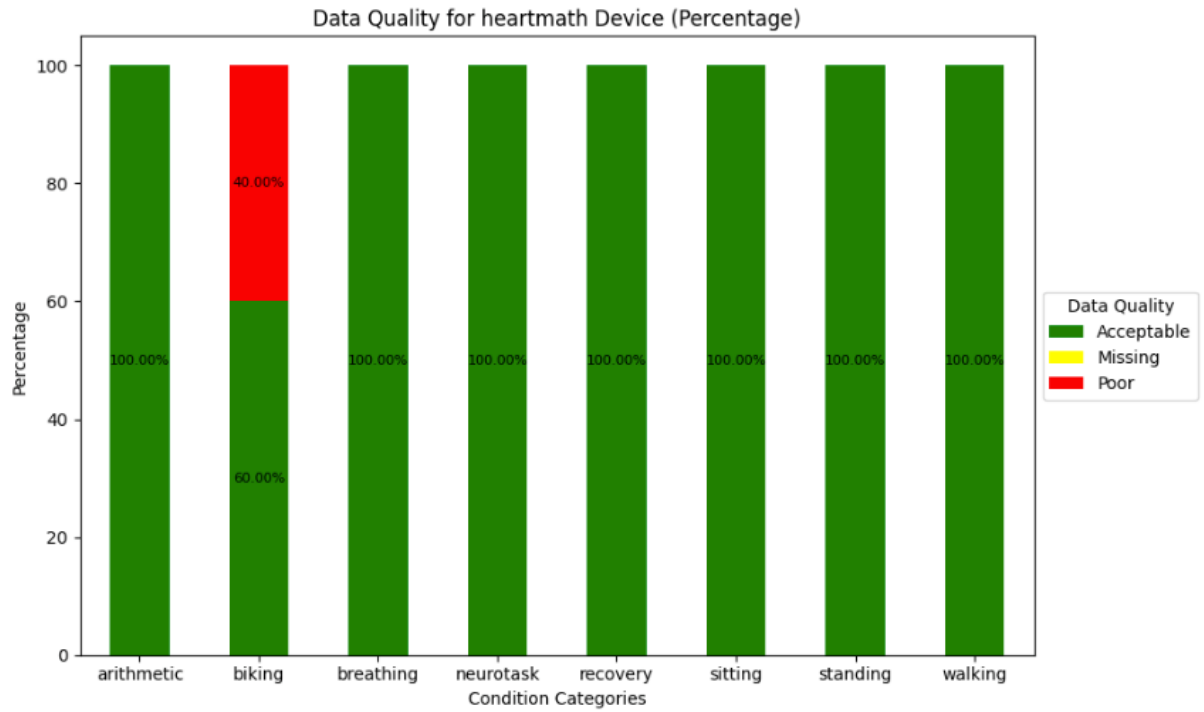


fig2_kyto.png

Comment: manuscript Fig. 2 (kyto)

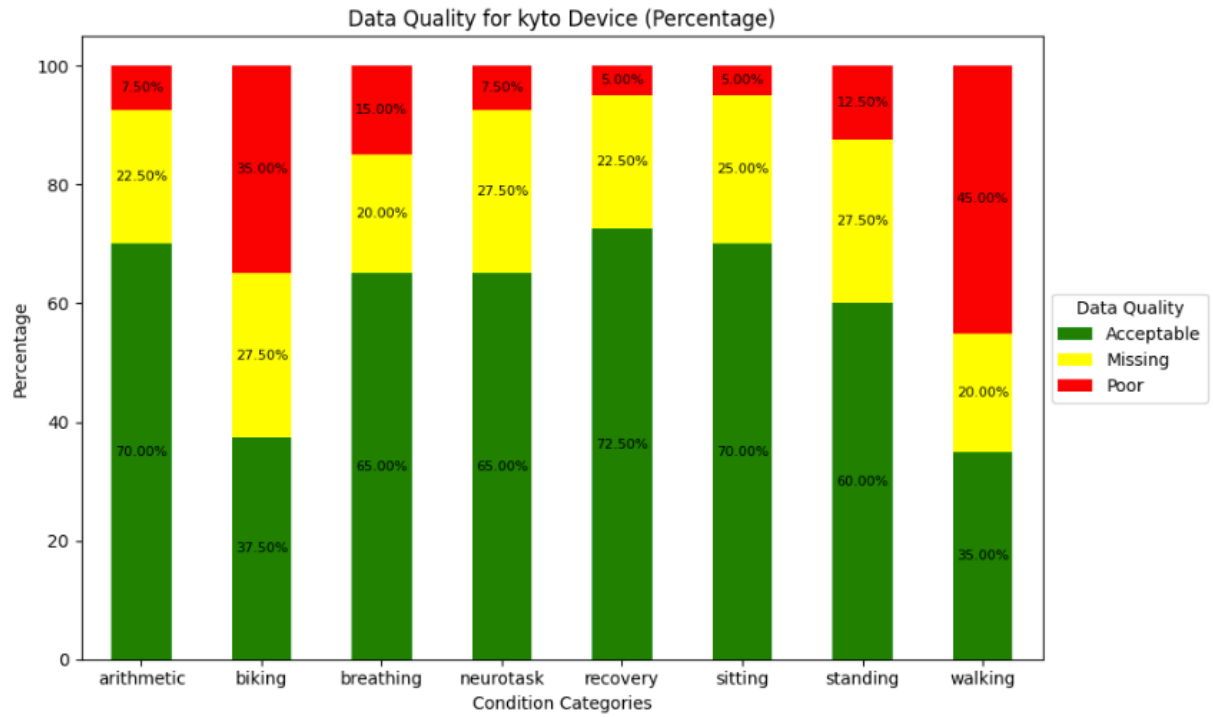


fig2_rhythm.png

Comment: manuscript Fig. 2 (rhythm)

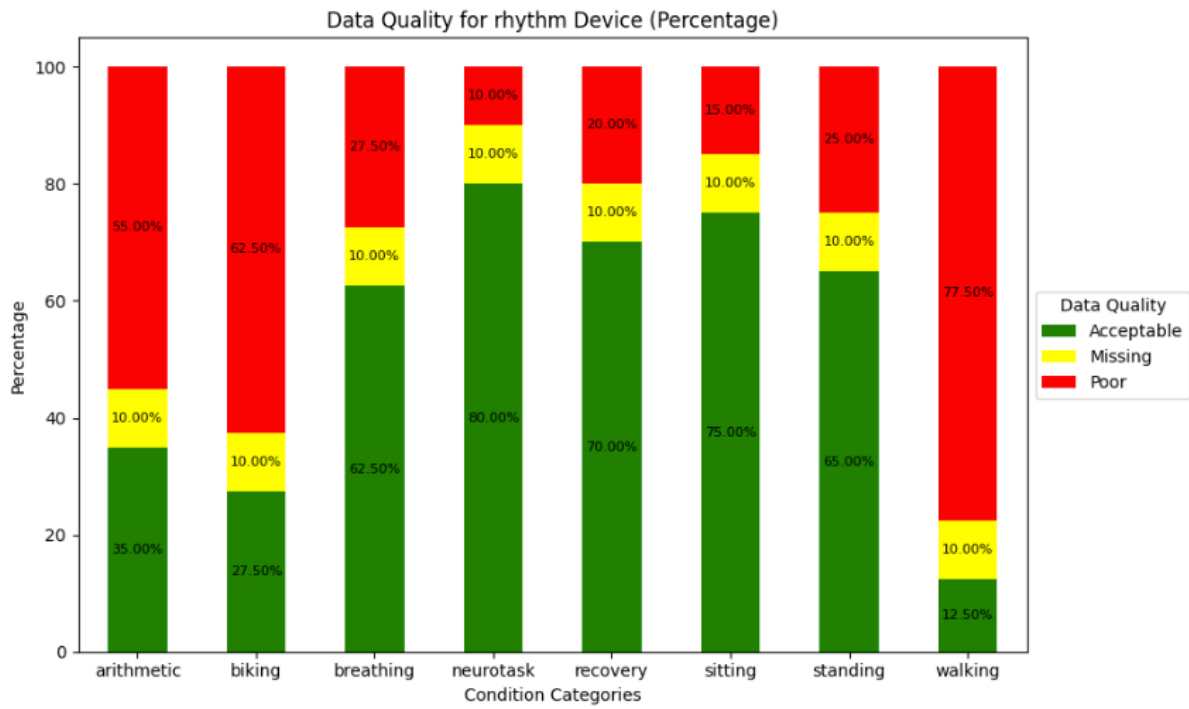


fig4_meanhr.png

Comment: manuscript Fig. 4 (mean hr)

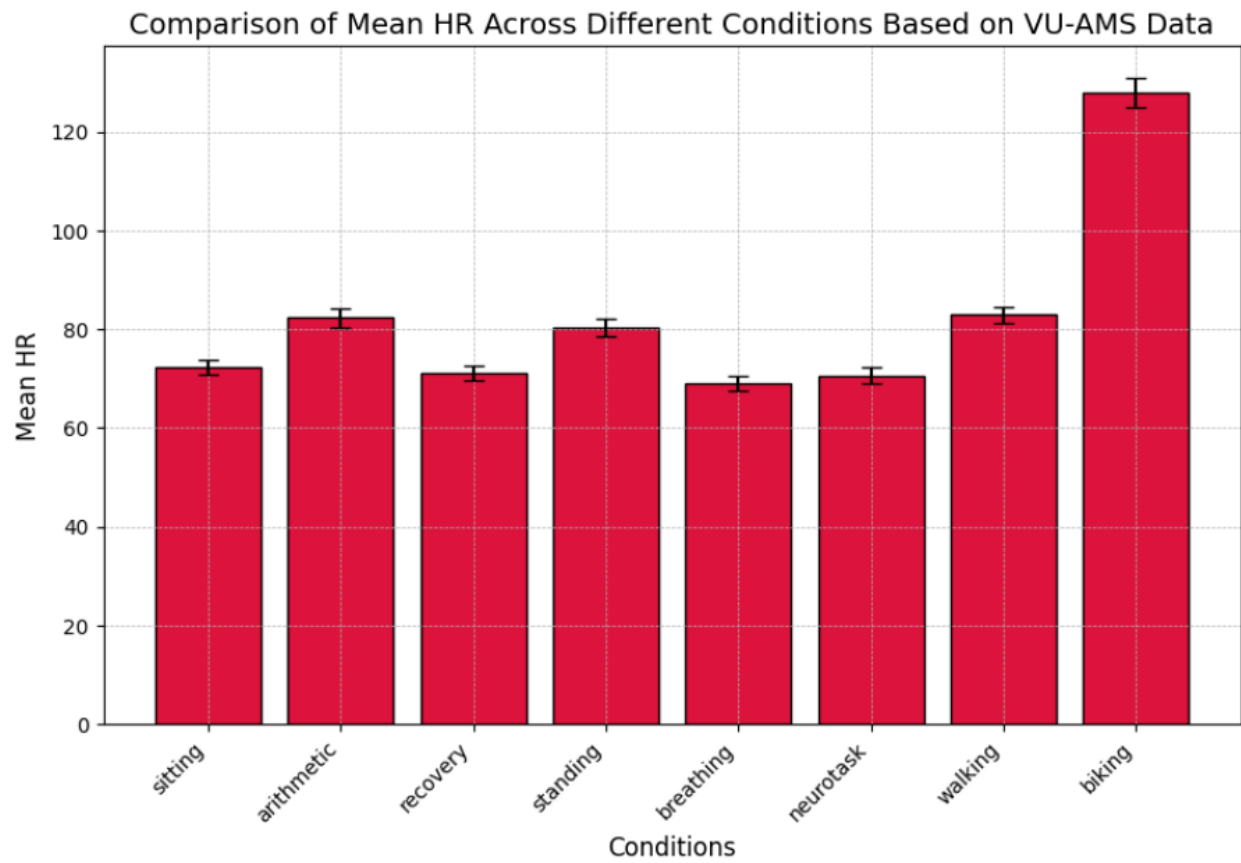


fig4_rmssd.png

Comment: manuscript Fig. 4 (rmssd)

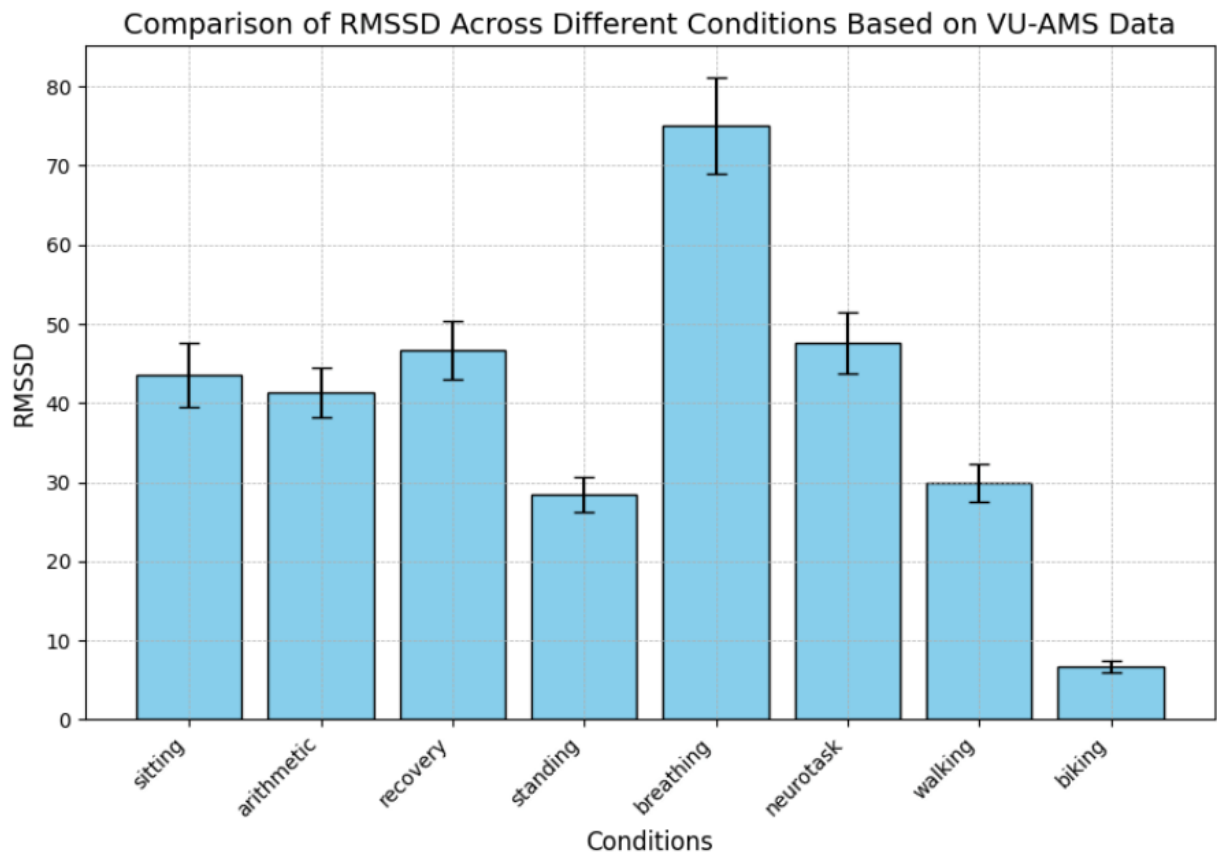


fig5.png

Comment: manuscript Fig. 5

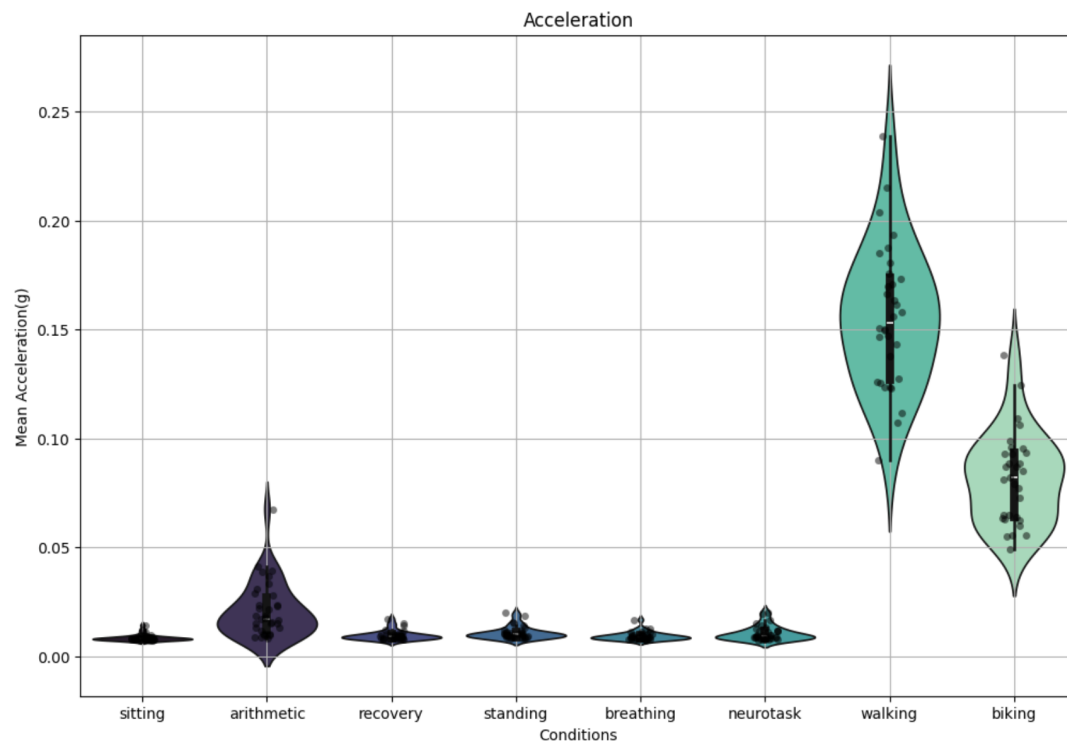


fig6_arithmetic_meanhr.png

Comment: manuscript Fig. 6 (arithmetic, meanhr)

Feature: ▼

Condition: ▼

MEAN_HR - Comparison

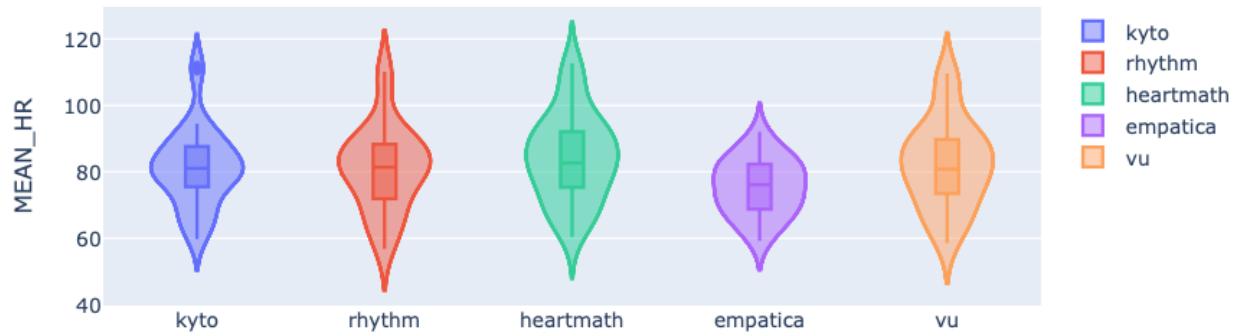


fig6_arithmetic_rmssd.png

Comment: manuscript Fig. 6 (arithmetic, rmssd)

Feature:

Condition:

RMSSD - Comparison



fig6_biking_meanhr.png

Comment: manuscript Fig. 6 (biking, mean hr)

Feature:

Condition:

MEAN_HR - Comparison

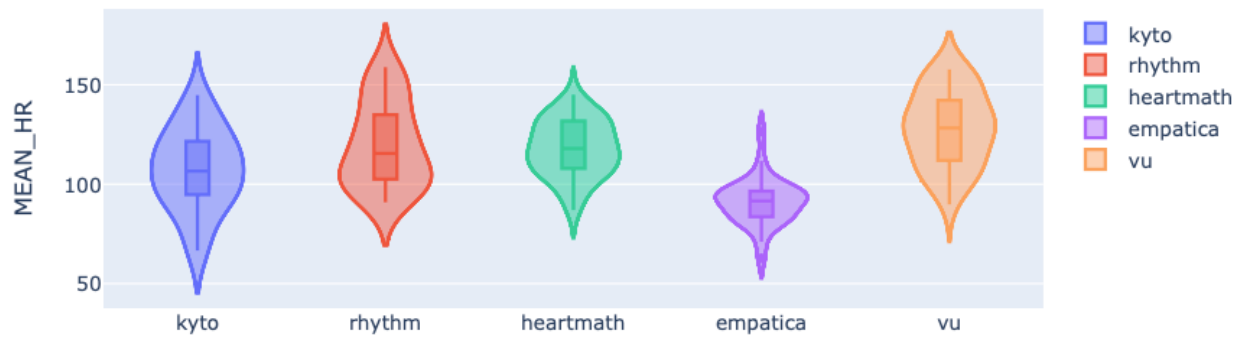


fig6_biking_rmssd.png

Comment: manuscript Fig. 6 (biking, rmssd)

Feature: Condition:

RMSSD - Comparison



fig6_sitting_meanhr.png

Comment: manuscript Fig. 6 (sitting, mean hr)

Feature: mean_hr

Condition: sitting



MEAN_HR - Comparison

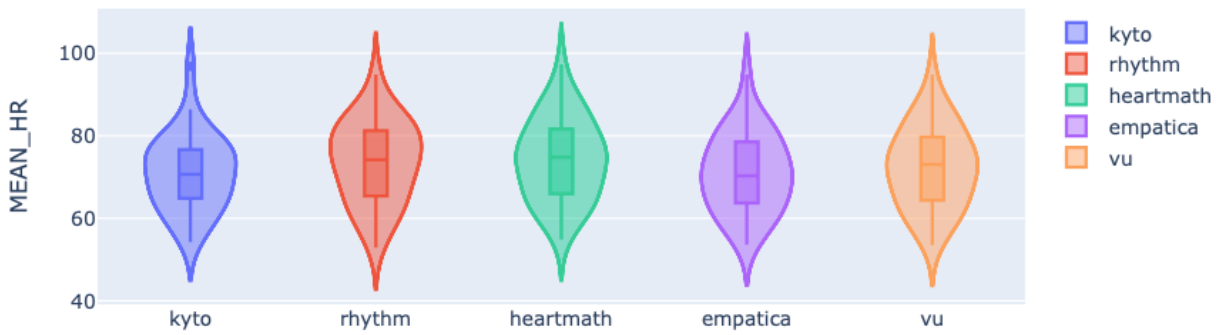
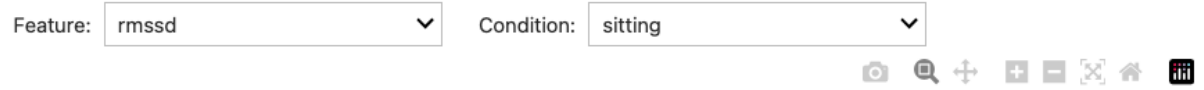


fig6_sitting_rmssd.png

Comment: manuscript Fig. 6 (sitting, rmssd)



RMSSD - Comparison



fig7_meanhr.png

Comment: manuscript Fig. 7 (mean hr)

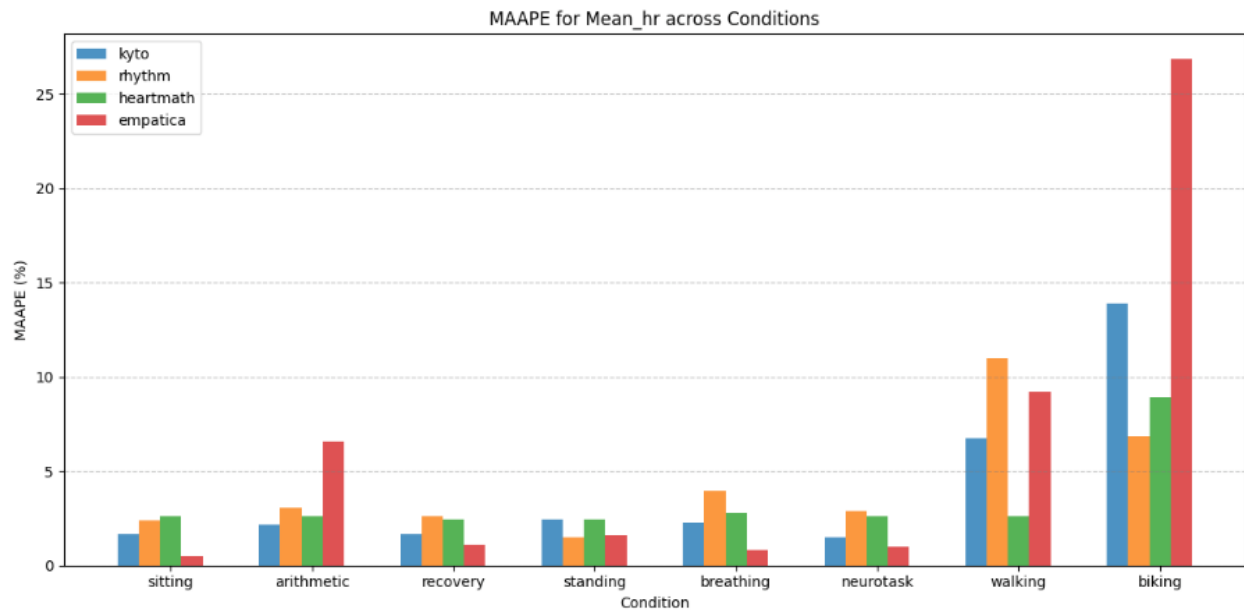


fig7_rmssd.png

Comment: manuscript Fig. 7 (rmssd)

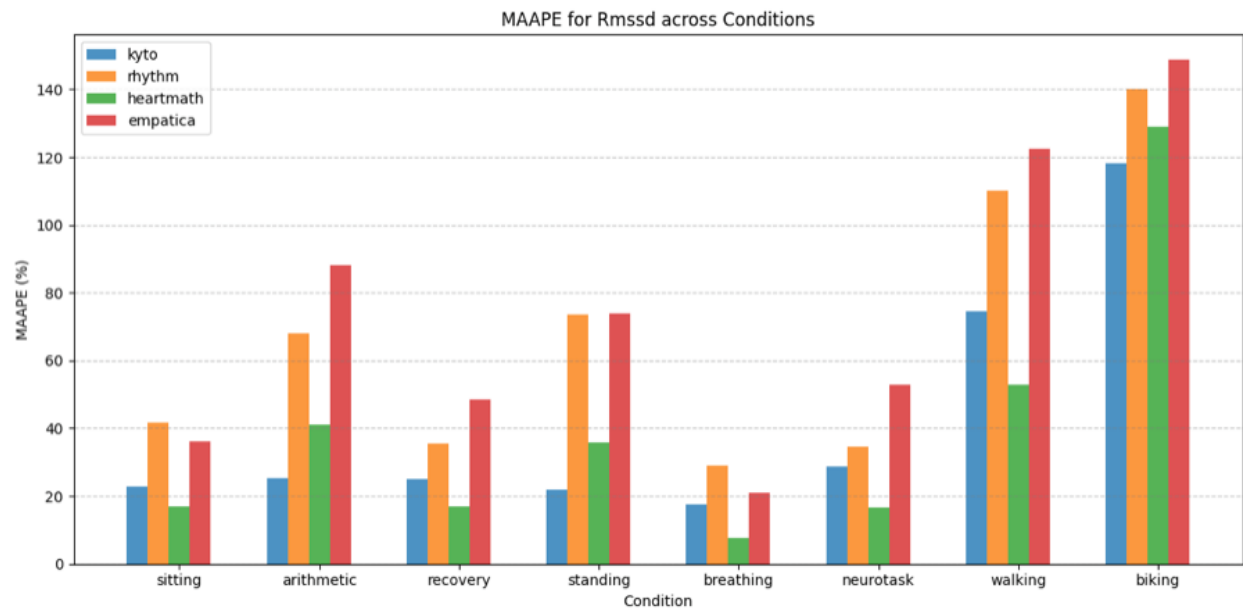


fig8_meanhr.png

Comment: manuscript Fig. 8 (mean hr)

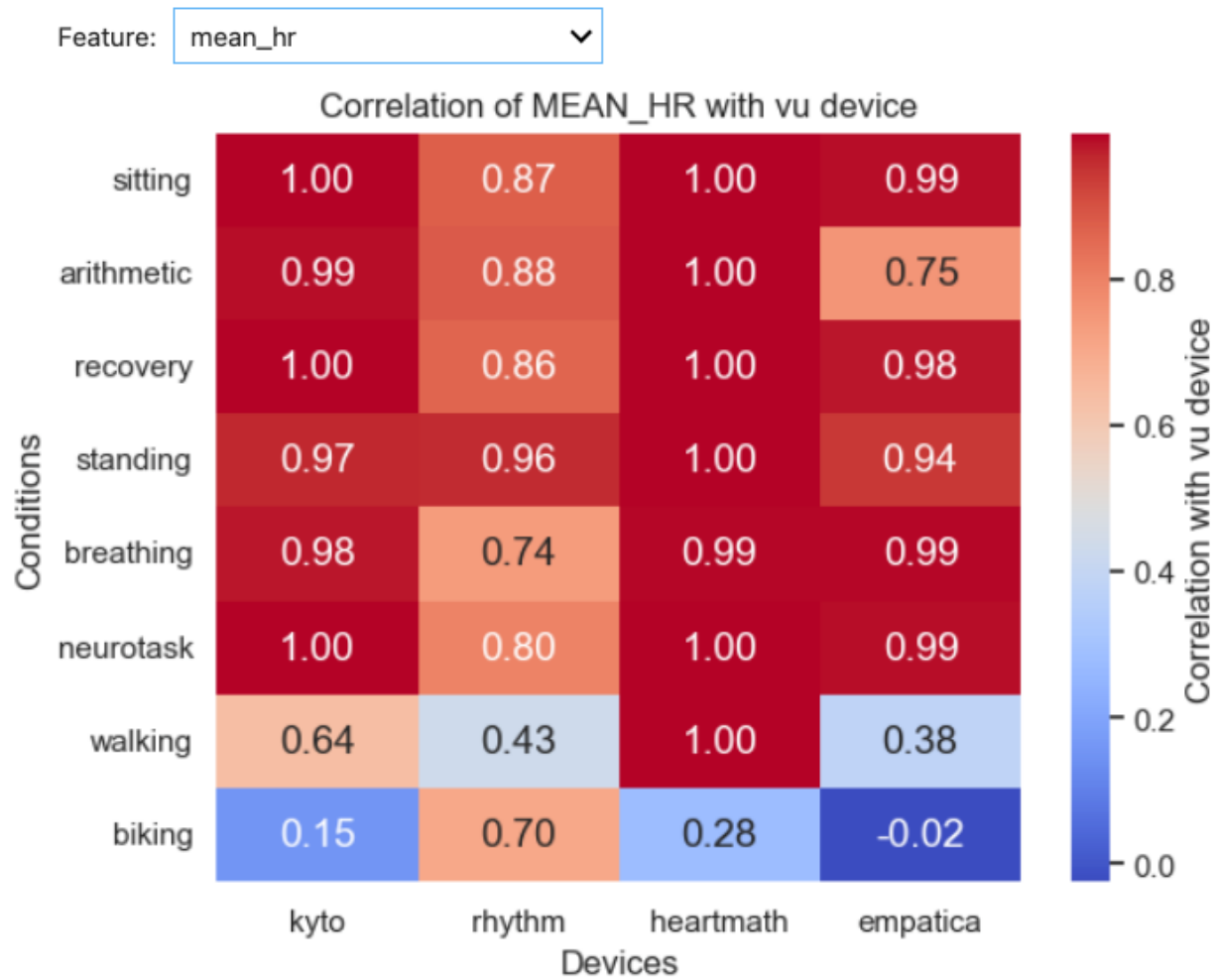


fig8_rmssd.png

Comment: manuscript Fig. 8 (rmssd)

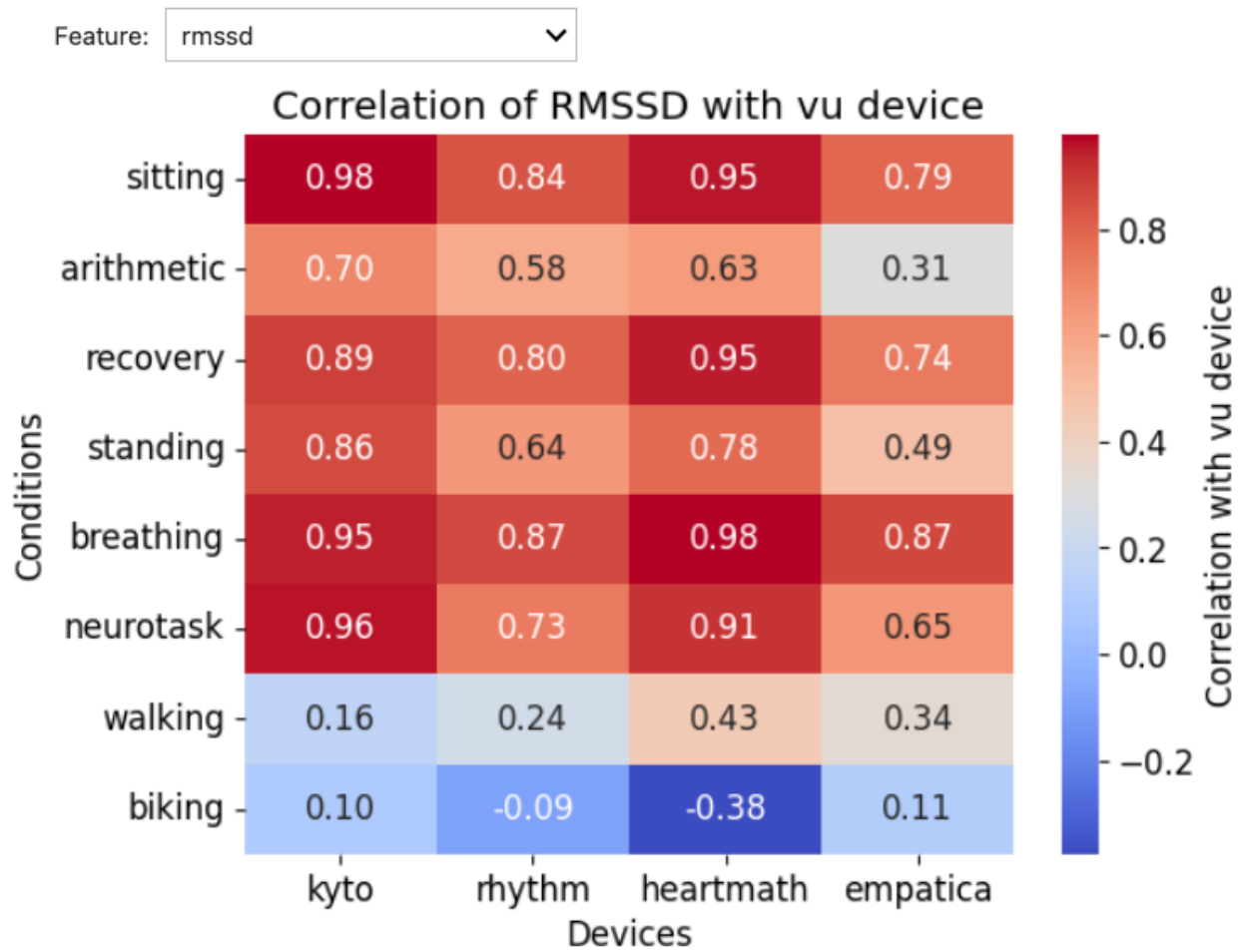


fig9_arithmetic_meanhr.png

Comment: manuscript Fig. 9 (arithmetic, meanhr)

Feature: ▼

Condition: ▼

Bland-Altman Plot for Mean_hr - Arithmetic

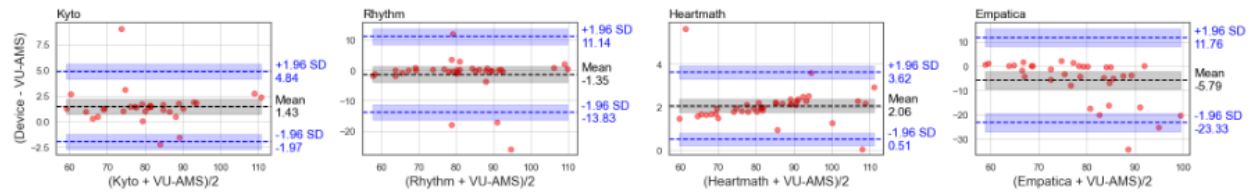


fig9_arithmetic_rmssd.png

Comment: manuscript Fig. 9 (arithmetic, rmssd)

Feature:

Condition:

Bland-Altman Plot for Rmssd - Arithmetic

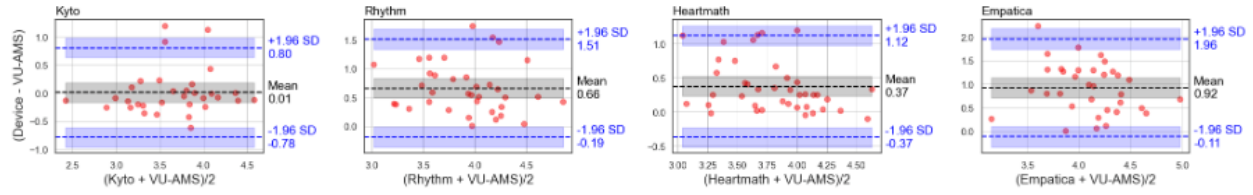


fig9_biking_meanhr.png

Comment: manuscript Fig. 9 (biking, mean hr)

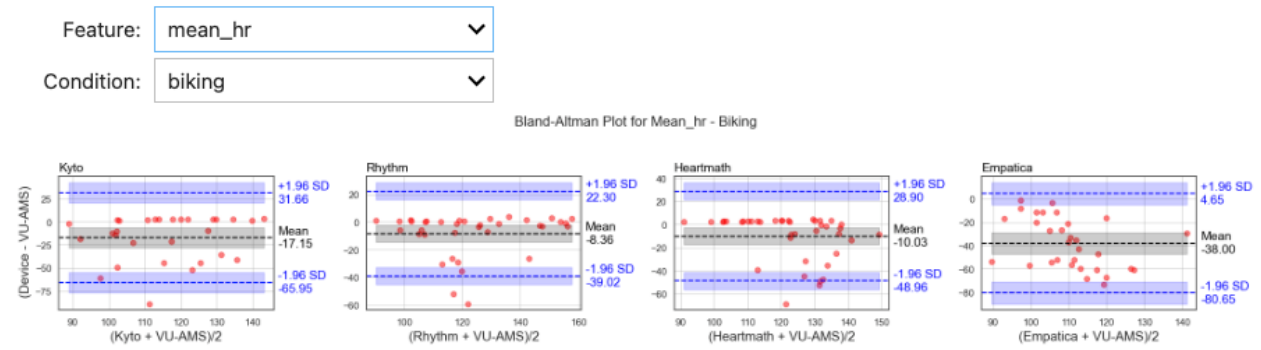


fig9_biking_rmssd.png

Comment: manuscript Fig. 9 (biking, rmssd)

Feature:

Condition:

Bland-Altman Plot for Rmssd - Biking

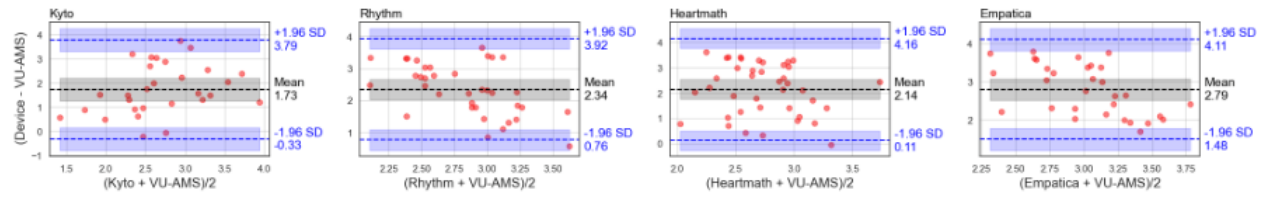


fig9_sitting_meanhr.png

Comment: manuscript Fig. 9 (sitting, mean hr)

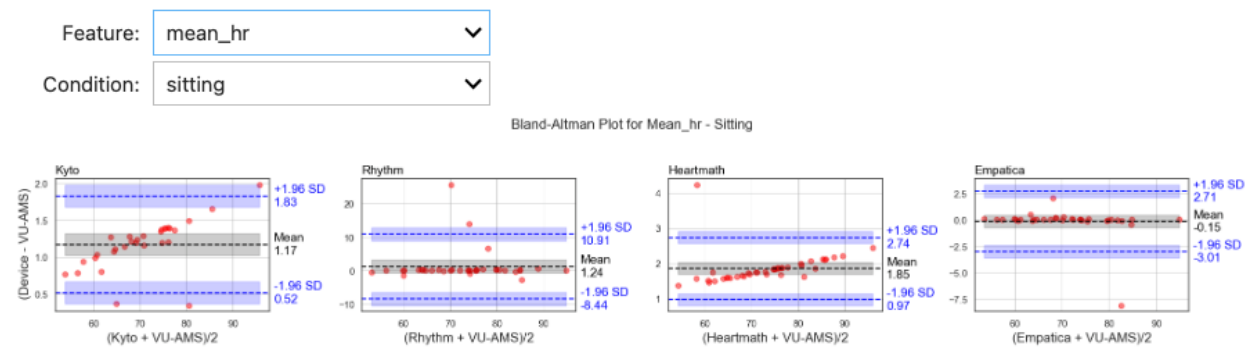


fig9_sitting_rmssd.png

Comment: manuscript Fig. 9 (sitting, rmssd)

Feature:

Condition:

Bland-Altman Plot for Rmssd - Sitting

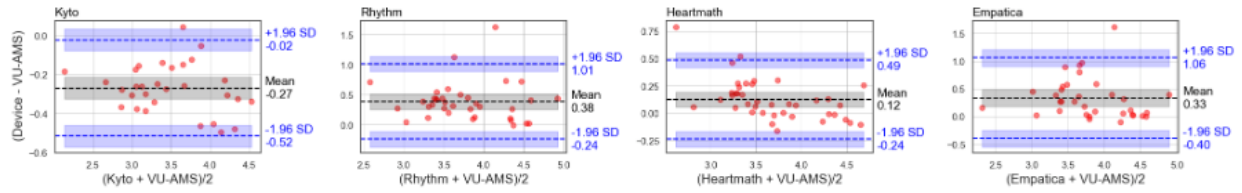


table1.png

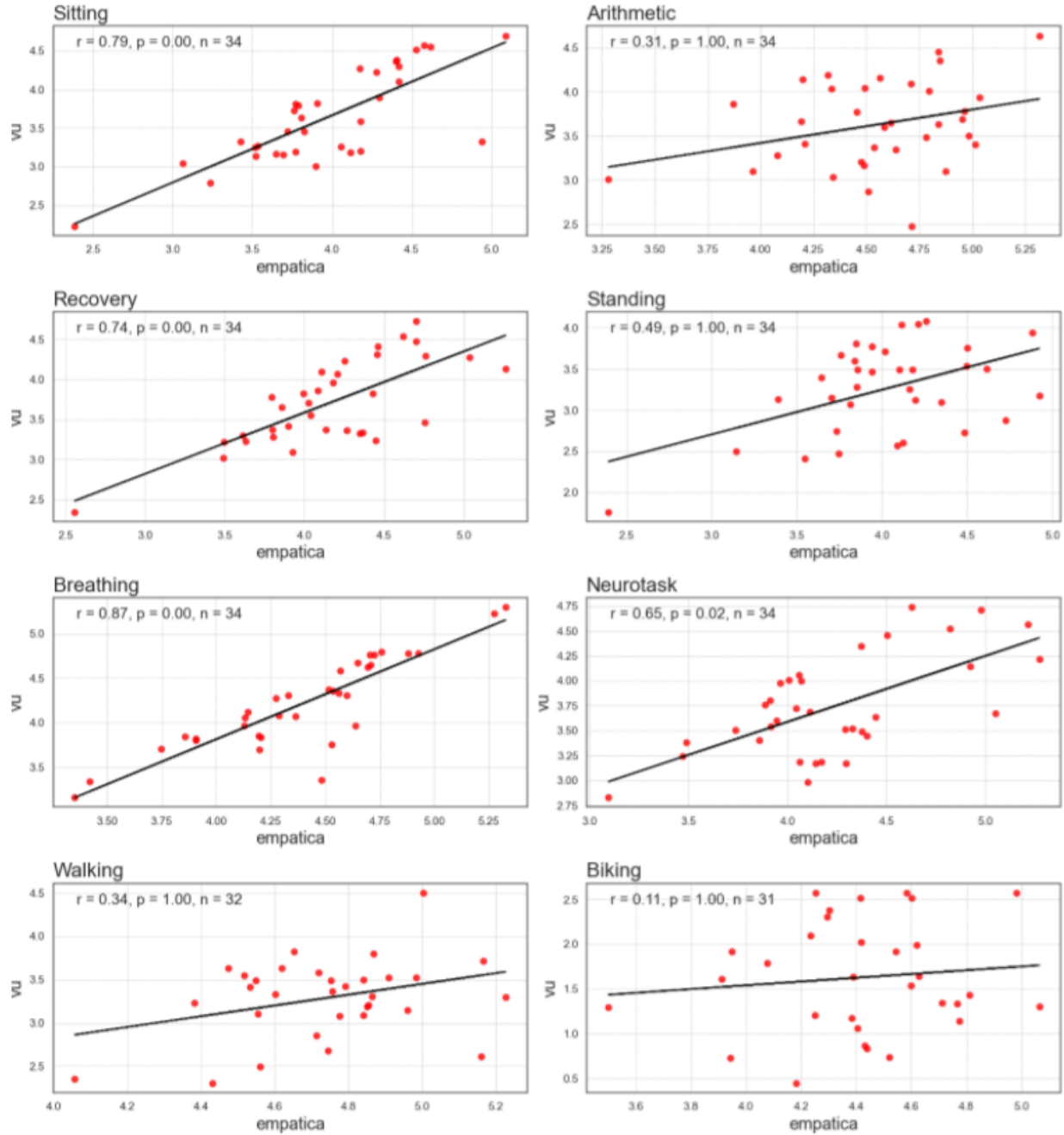
Comment: manuscript Table 1

	Condition	sitting	arithmetic	recovery	standing	breathing	neurotask	walking	biking
	Device								
Artifacts (Mean & SD)	kyto	0.0 (0.0)	0.03 (0.18)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
	rhythm	5.25 (16.43)	2.42 (3.95)	4.19 (10.63)	2.33 (5.99)	3.17 (6.05)	7.69 (19.36)	32.5 (21.92)	13.33 (12.81)
	heartmath	0.85 (3.96)	3.08 (5.38)	0.32 (0.88)	0.25 (1.04)	0.82 (1.73)	0.85 (3.17)	1.3 (2.48)	16.12 (27.27)
	empatica	7.15 (15.76)	42.44 (31.15)	11.18 (18.37)	16.29 (28.04)	9.65 (14.65)	25.62 (41.48)	82.03 (22.38)	84.9 (42.54)
	vu	0.08 (0.35)	0.05 (0.22)	0.12 (0.56)	0.0 (0.0)	0.18 (0.38)	0.1 (0.37)	0.0 (0.0)	0.12 (0.56)
Detected Beats (Mean & SD)	kyto	337.97 (80.29)	212.61 (44.53)	191.94 (48.17)	217.17 (59.75)	181.38 (56.01)	547.48 (157.42)	156.06 (76.51)	237.07 (100.98)
	rhythm	310.47 (66.15)	150.31 (60.23)	180.0 (37.67)	185.11 (47.7)	150.94 (43.61)	528.03 (120.33)	140.14 (63.35)	222.22 (75.98)
	heartmath	358.2 (47.98)	237.58 (35.44)	210.72 (27.87)	238.5 (31.57)	201.8 (27.23)	618.3 (91.04)	243.9 (30.88)	282.62 (65.54)
	empatica	350.38 (45.41)	215.12 (22.64)	205.68 (25.5)	230.15 (29.02)	200.47 (24.9)	591.41 (83.28)	219.81 (16.6)	256.1 (28.29)
	vu	359.12 (47.71)	244.45 (37.95)	211.65 (28.13)	239.72 (32.23)	203.75 (26.06)	620.28 (90.65)	247.85 (31.86)	381.02 (53.92)
Mean IBI Detection Rate	kyto	97.24	89.3	92.7	93.43	92.04	90.47	64.92	63.95
	rhythm	86.27	61.3	84.99	77.16	73.94	84.5	56.6	58.39
	heartmath	99.74	97.19	99.56	99.49	99.04	99.68	98.41	74.17
	empatica	99.22	89.16	98.52	97.96	99.75	96.92	88.98	66.59
	vu	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

sfig4_empatica.png

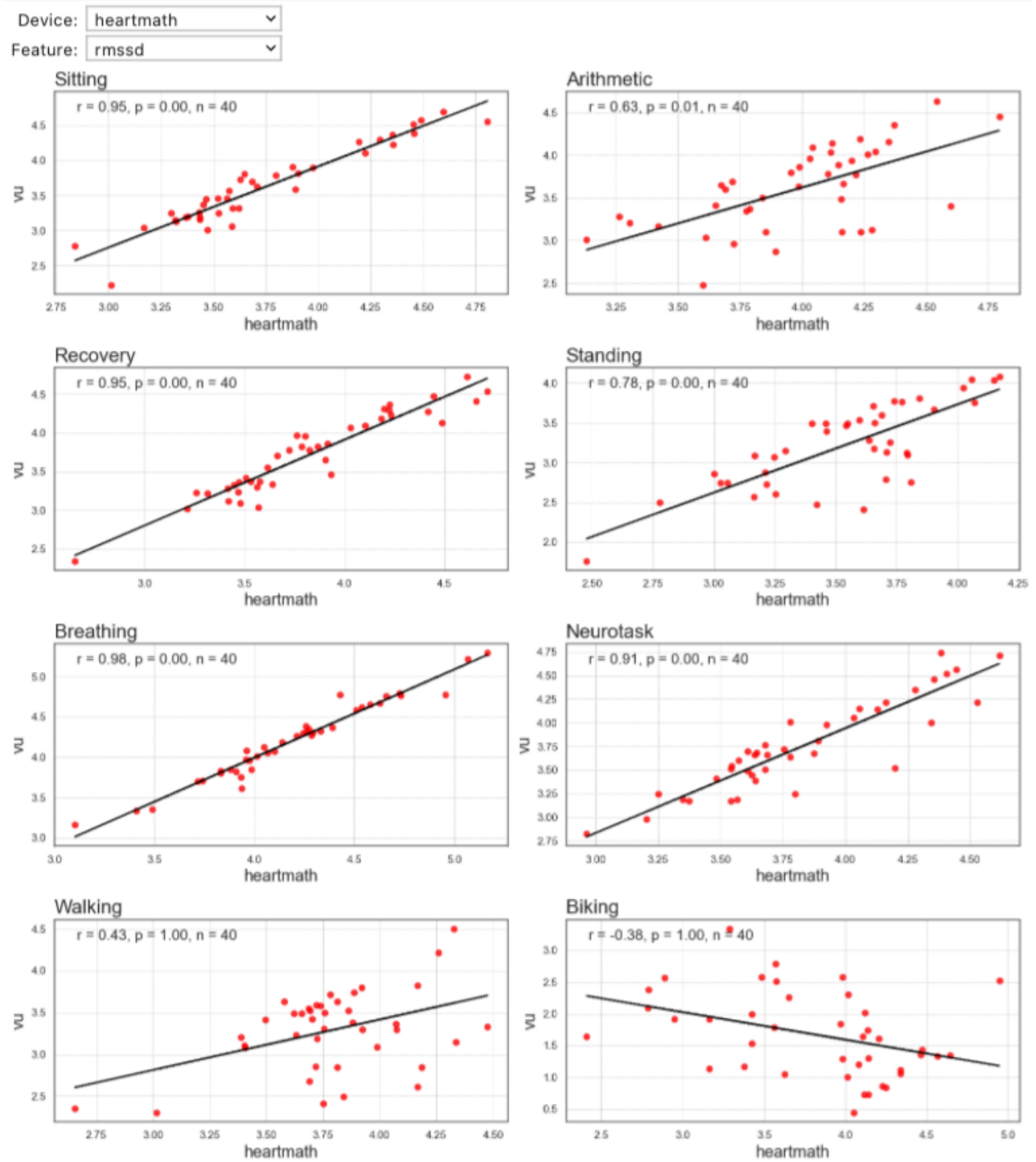
Comment: supplement Fig. 4 (empatica)

Device: 
Feature: 



sfig4_heartmath.png

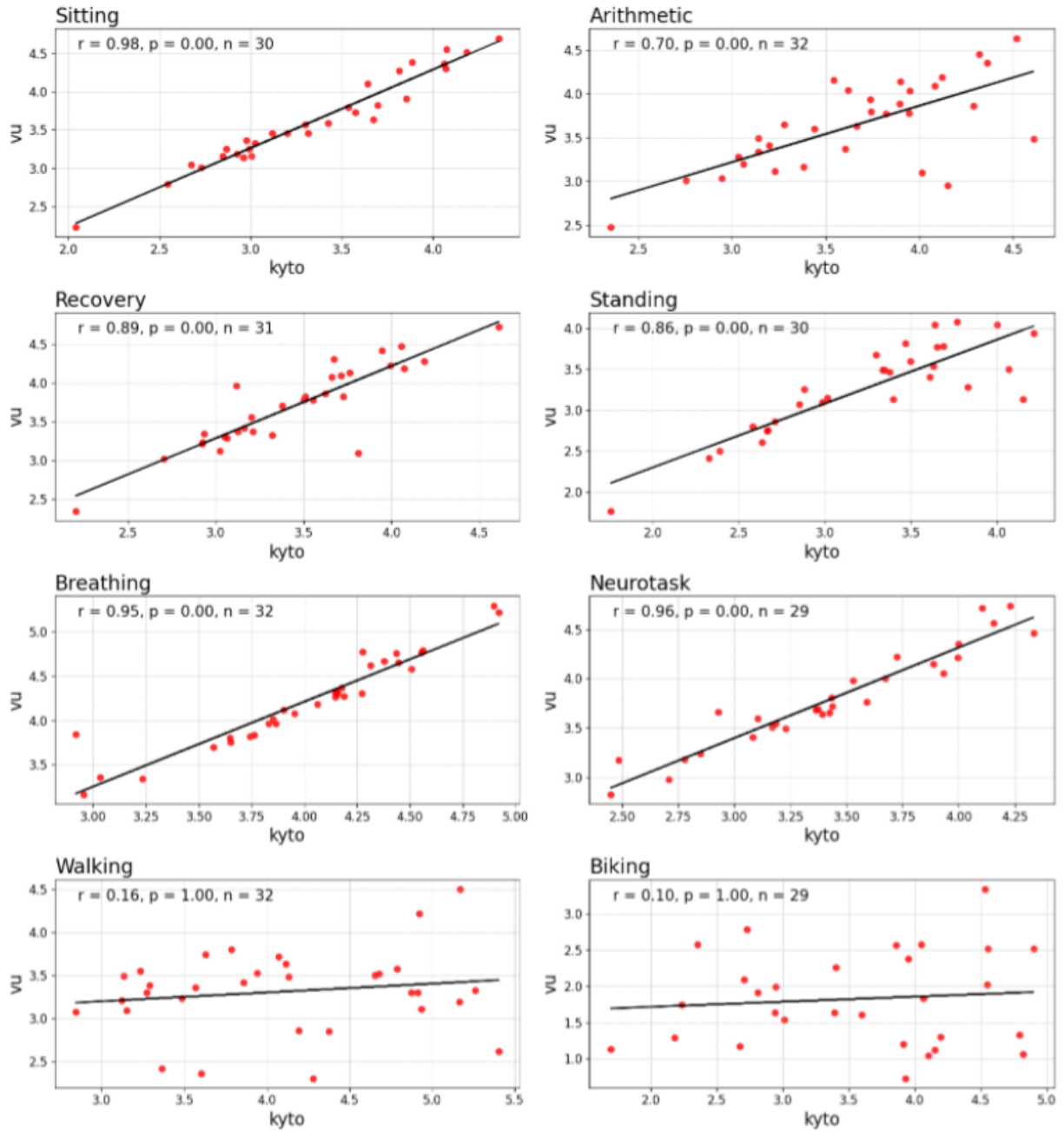
Comment: supplement Fig. 4 (heartmath)



sfig4_kyto.png

Comment: supplement Fig. 4 (kyto)

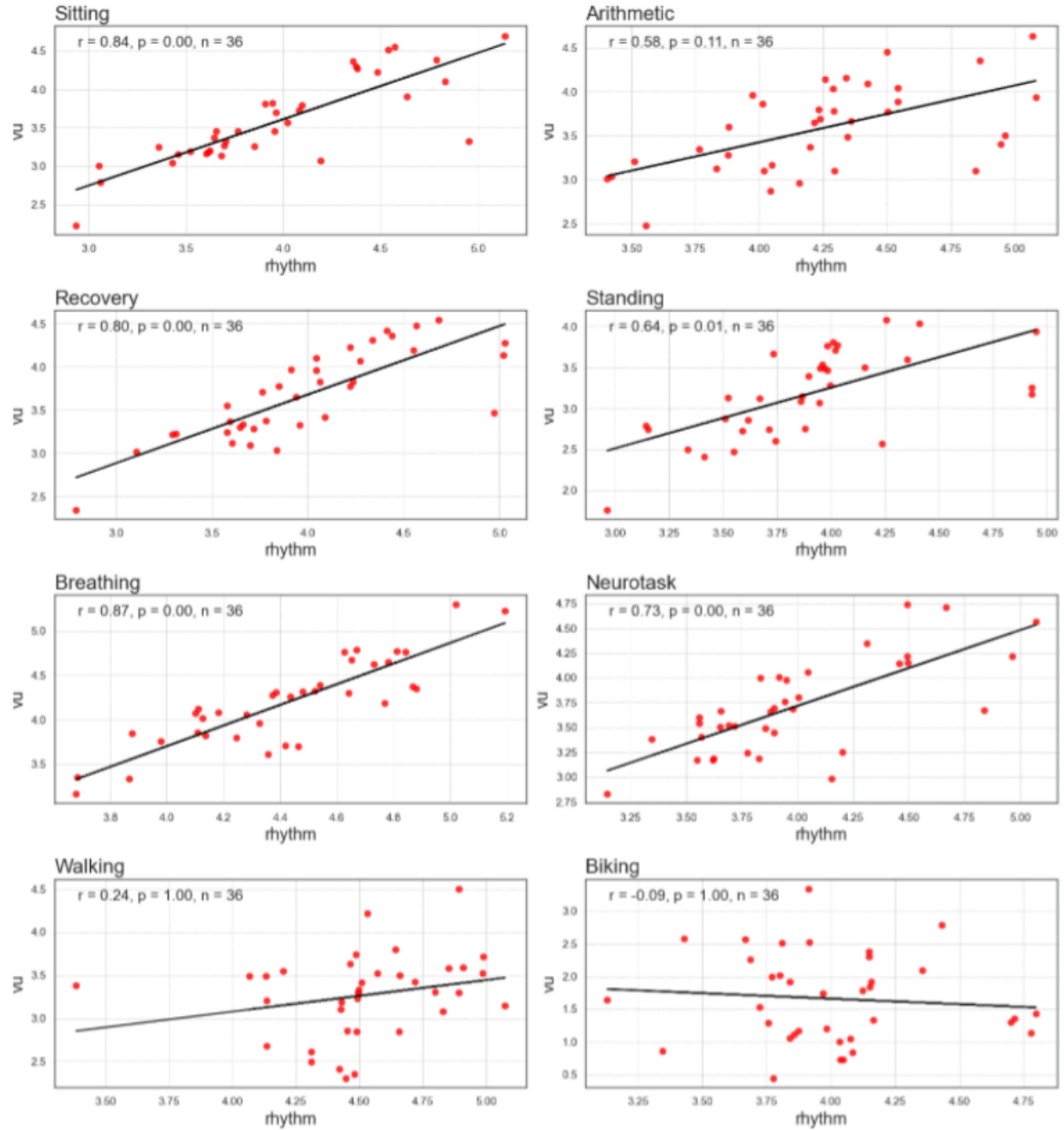
Device:
Feature:



sfig4_rhythm.png

Comment: supplement Fig. 4 (rhythm)

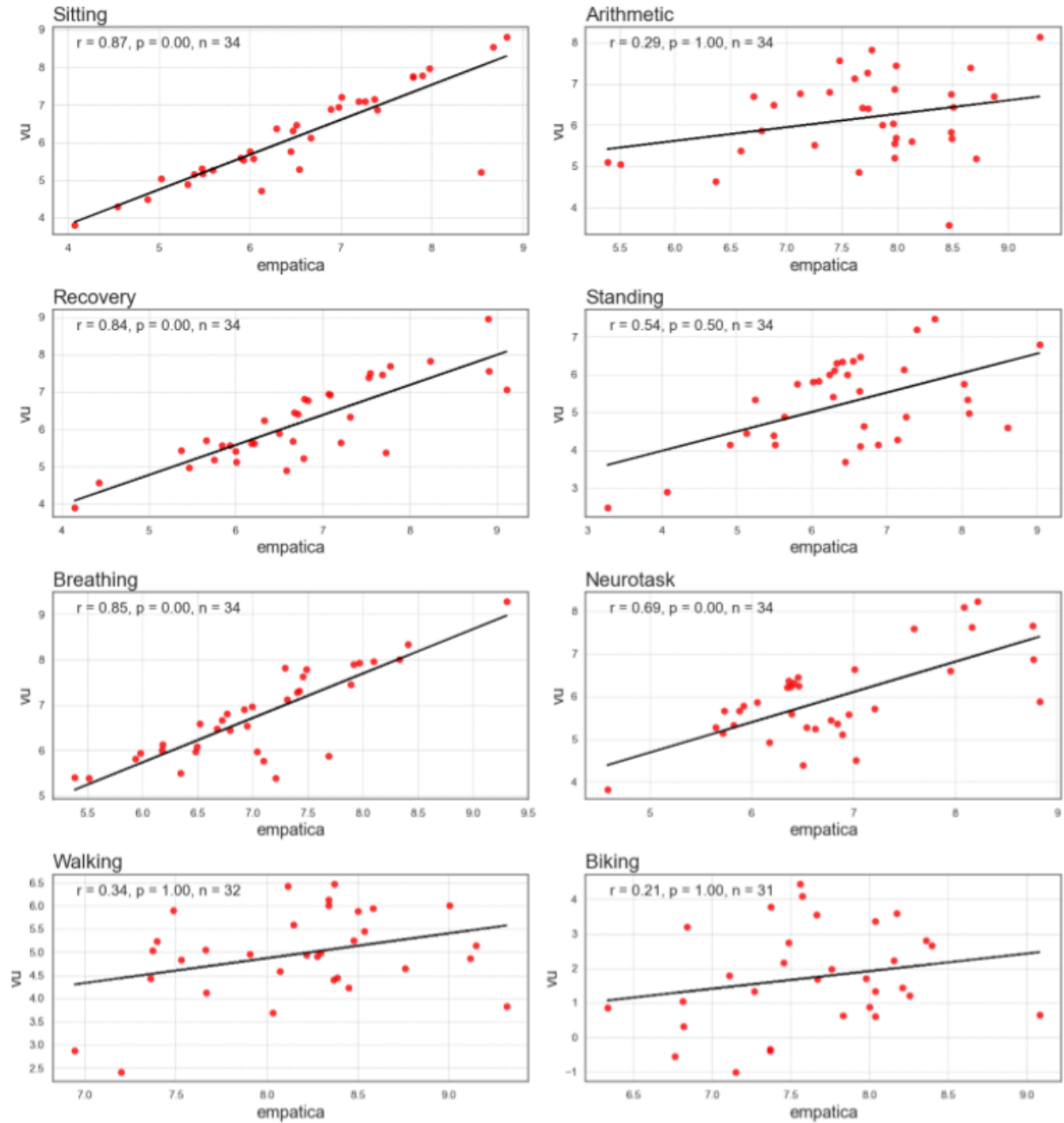
Device:
Feature:



sfig5_empatica.png

Comment: supplement Fig. 5 (empatica)

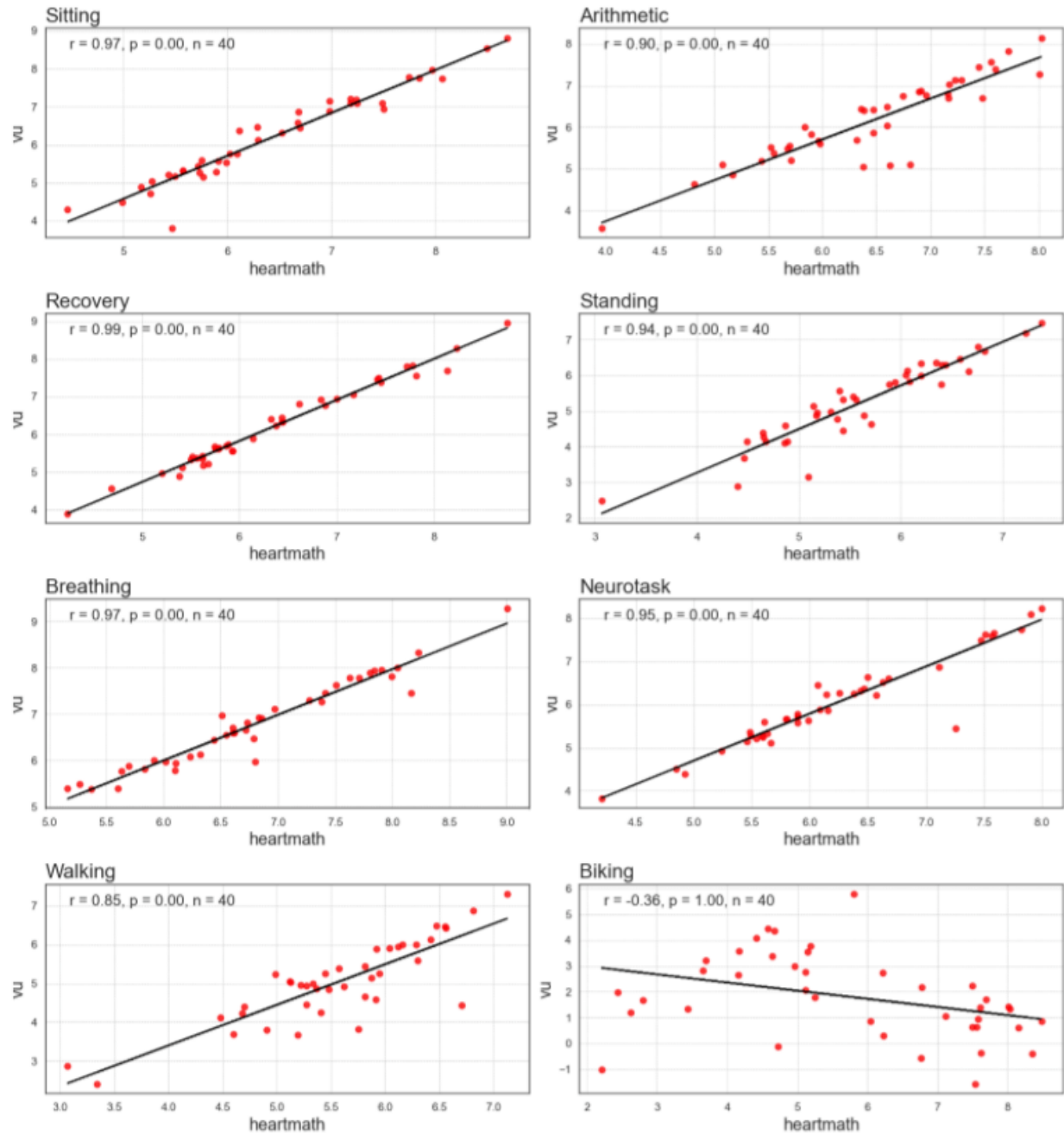
Device:
Feature:



sfig5_heartmath.png

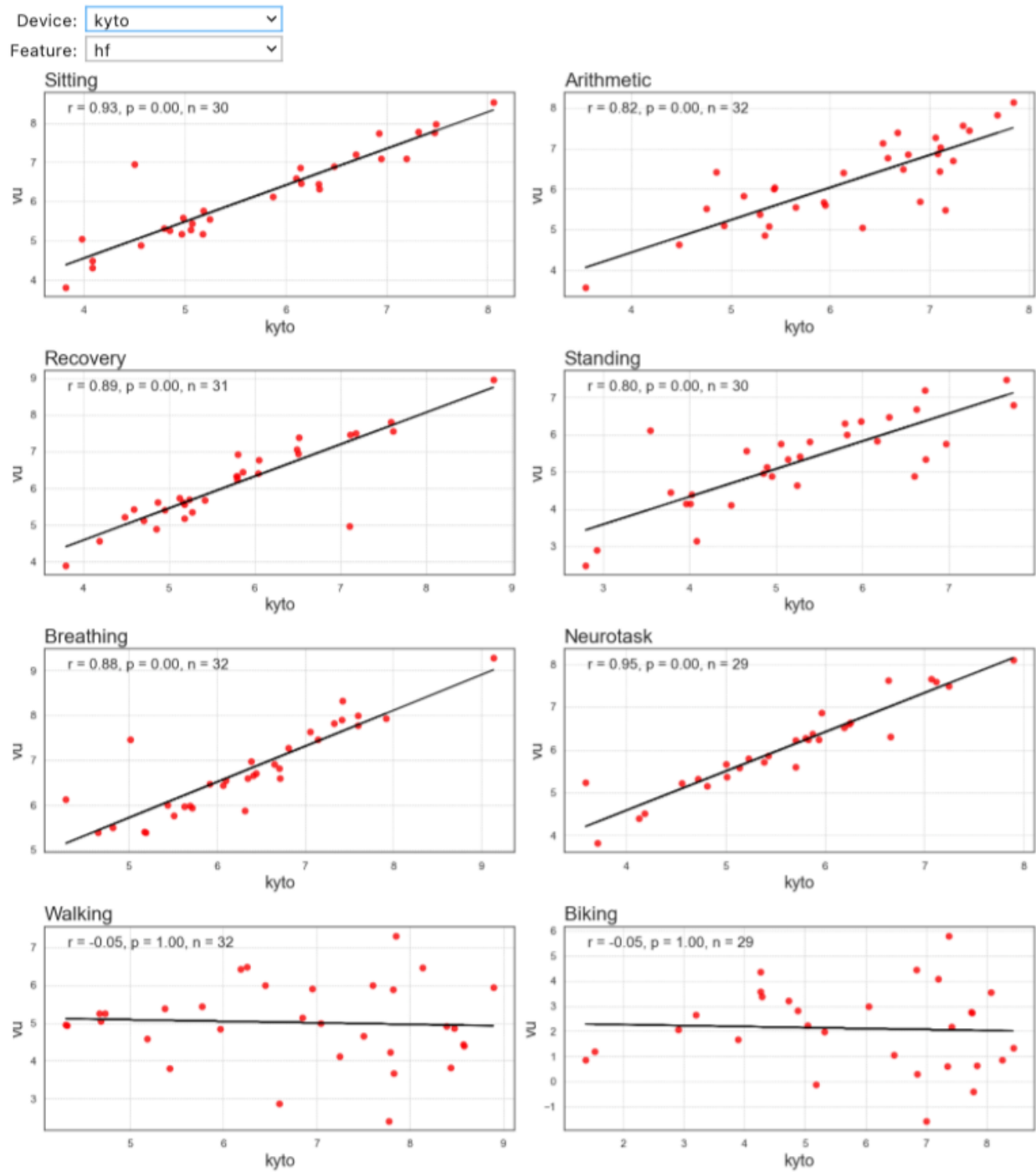
Comment: supplement Fig. 5 (heartmath)

Device: heartmath
Feature: hf



sfig5_kyto.png

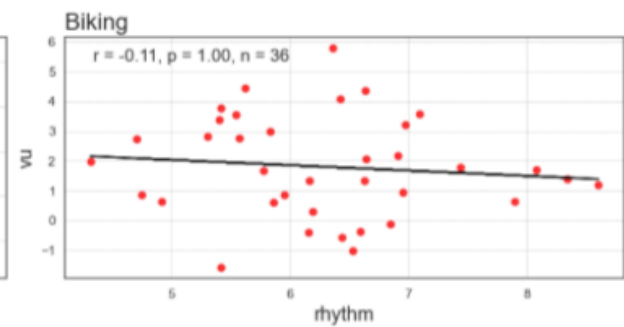
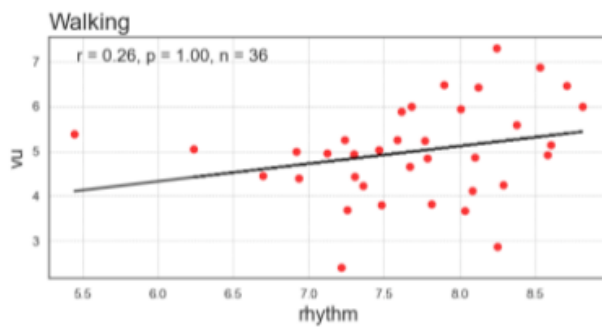
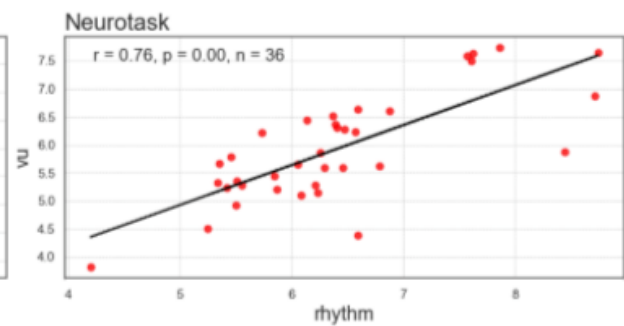
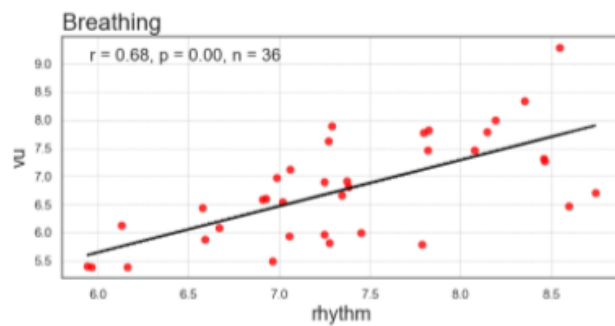
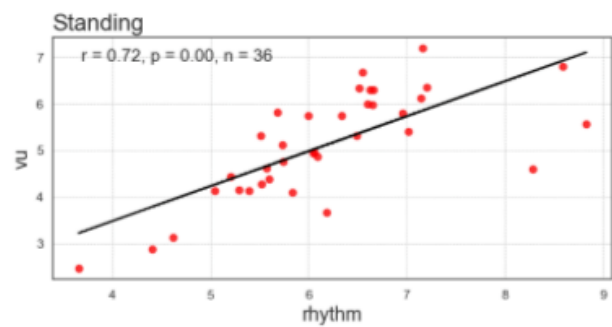
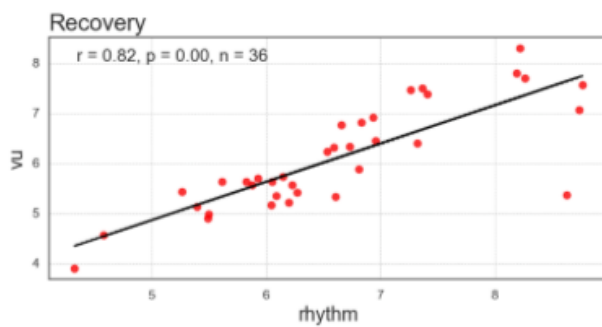
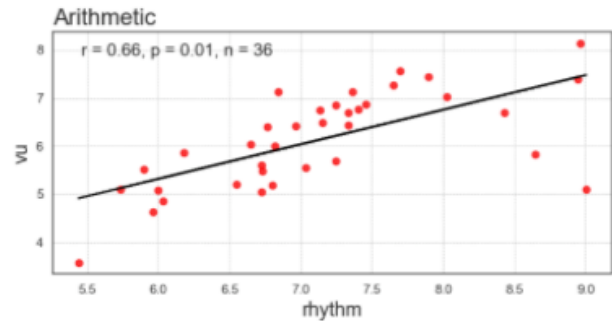
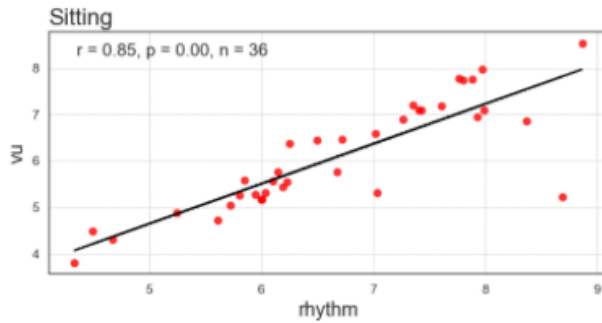
Comment: supplement Fig. 5 (kyto)



sfig5_rhythm.png

Comment: supplement Fig. 5 (rhythm)

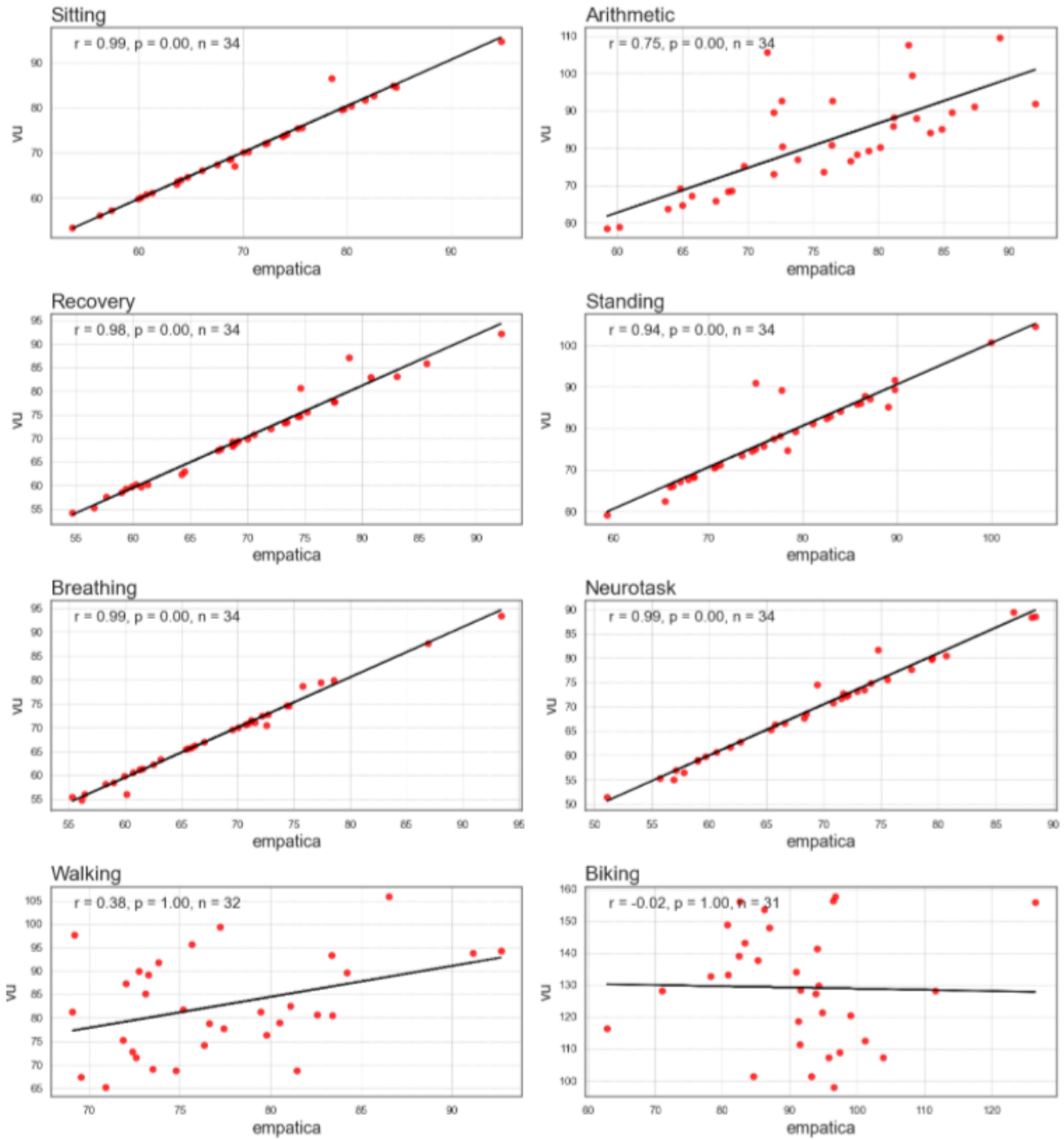
Device:
Feature:



sfig6_empatica.png

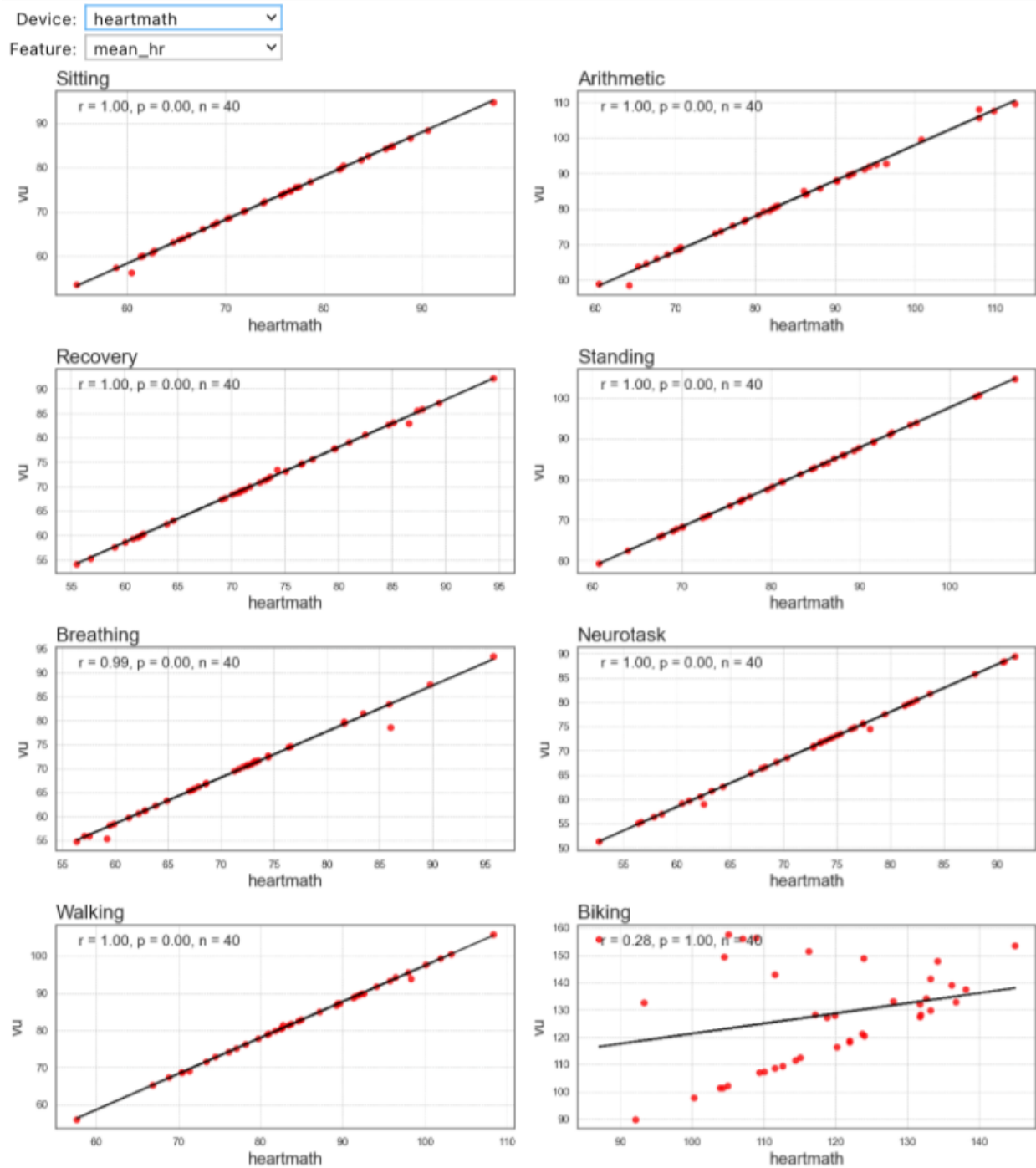
Comment: supplement Fig. 6 (empatica)

Device:
Feature:



sfig6_heartmath.png

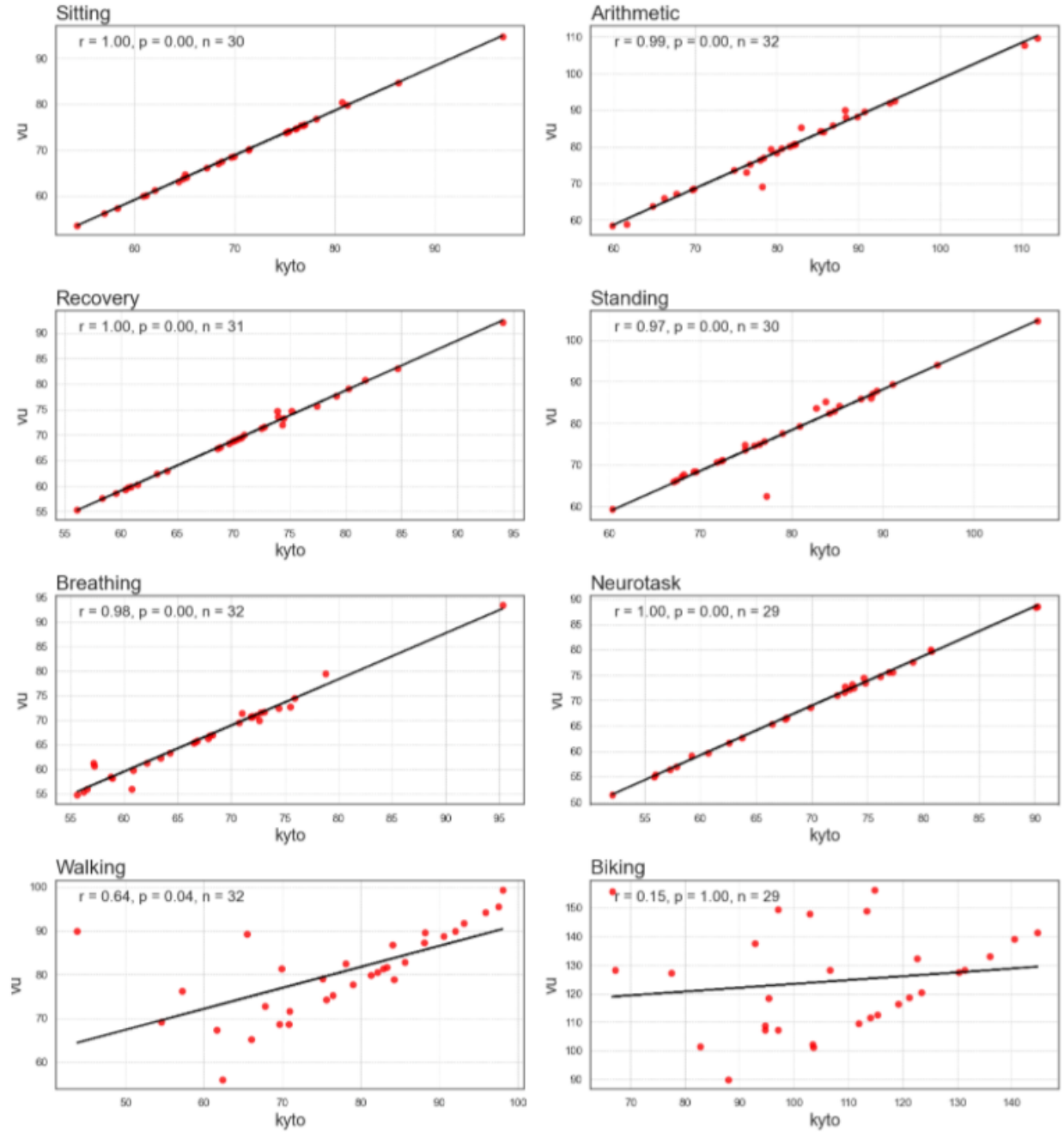
Comment: supplement Fig. 6 (heartmath)



sfig6_kyto.png

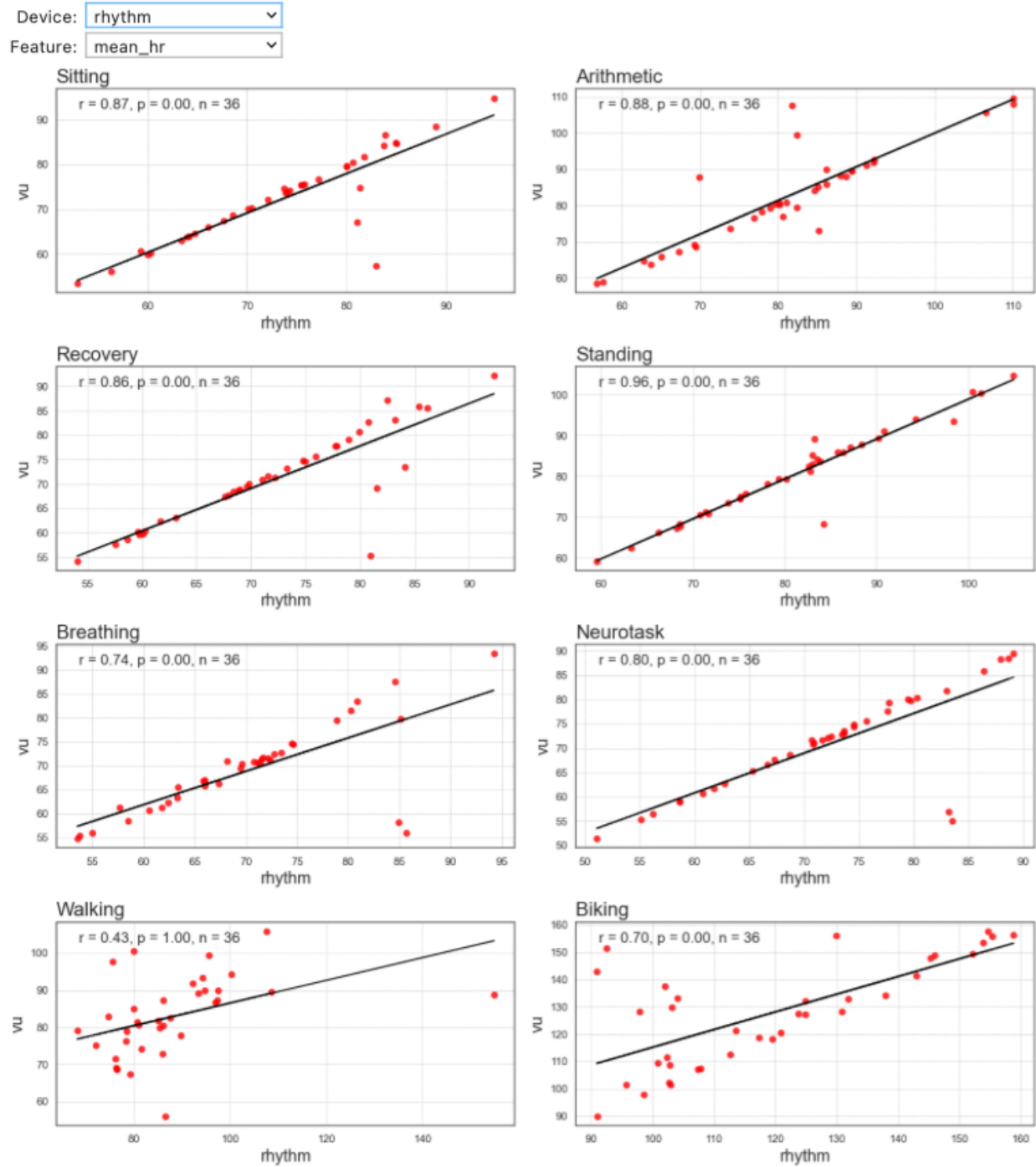
Comment: supplement Fig. 6 (kyto)

Device:
Feature:



sfig6_rhythm.png

Comment: supplement Fig. 6 (rhythm)

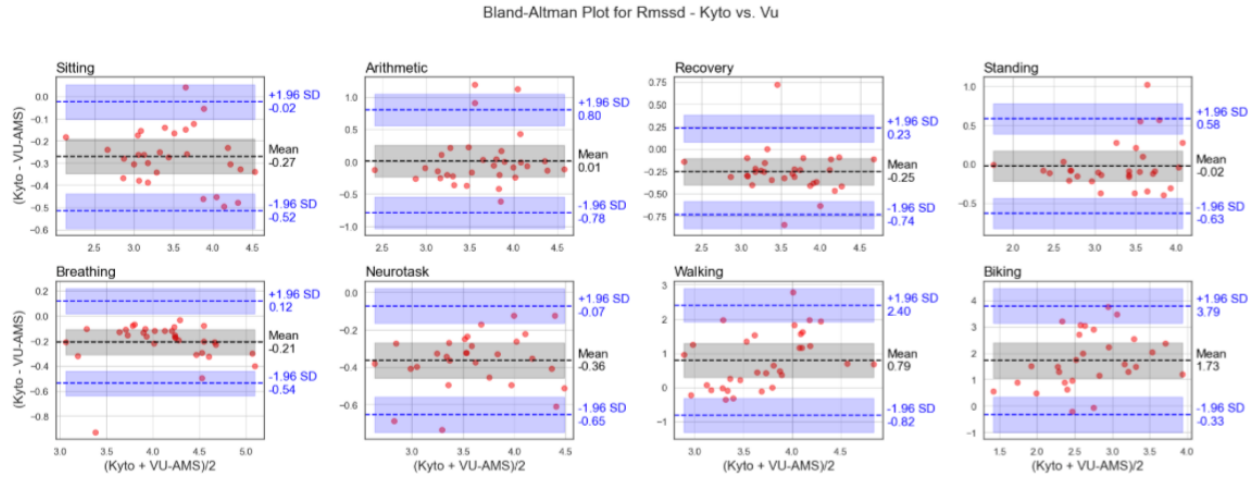


sfig7_kyto.png

Comment: supplement Fig. 7 (kyto)

Feature: 

Device: 



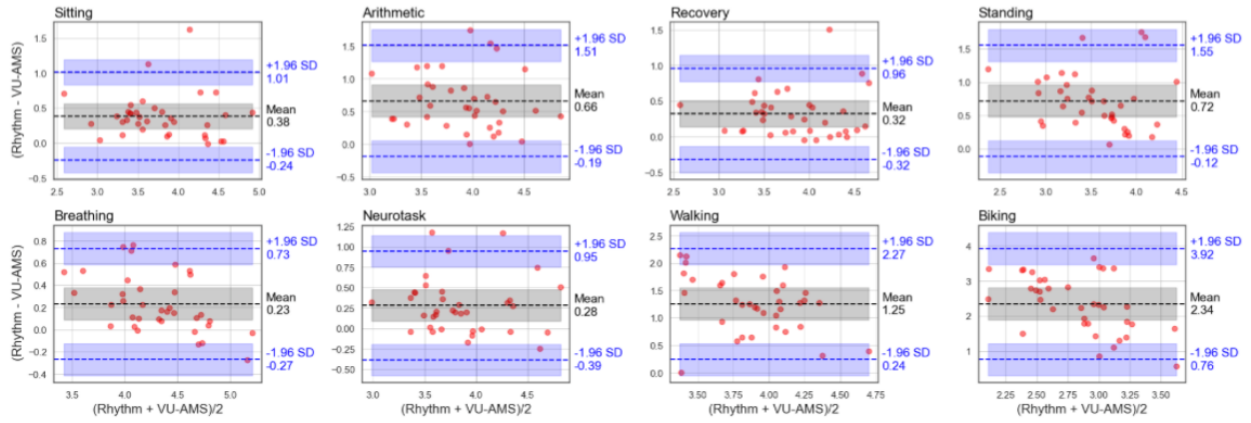
sfig7_rhythm.png

Comment: supplement Fig. 7 (rhythm)

Feature:

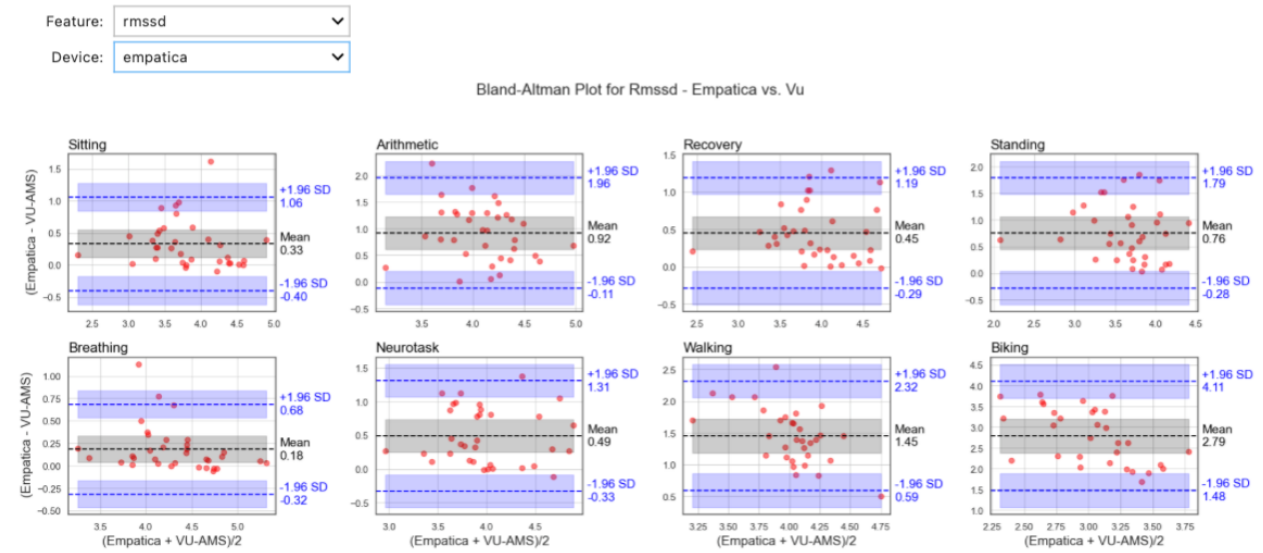
Device:

Bland-Altman Plot for Rmssd - Rhythm vs. Vu



sfig8_empatica.png

Comment: supplement Fig. 8 (empatica)



sfig8_heartmath.png

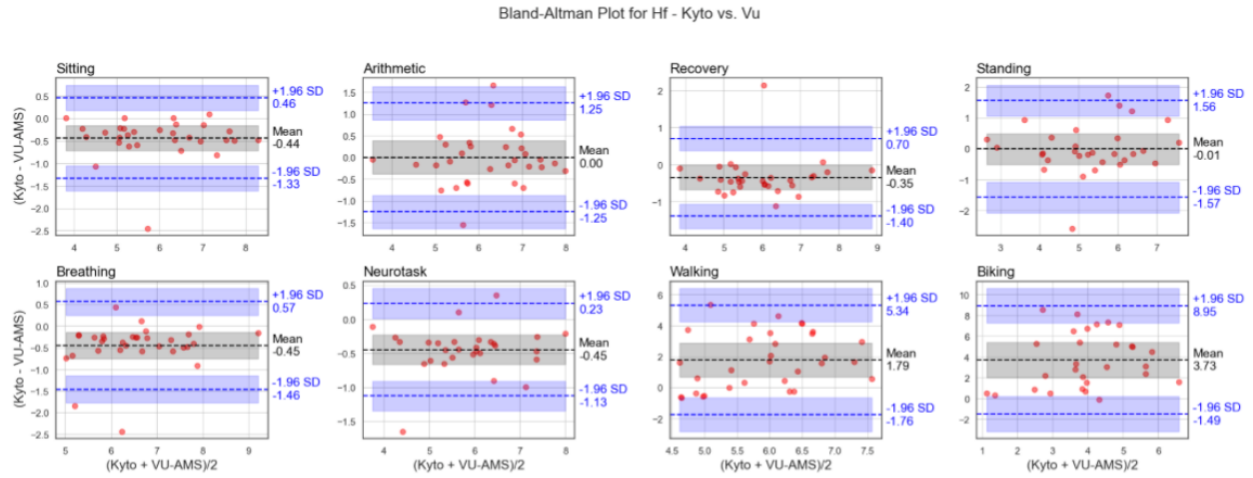
Comment: supplement Fig. 8 (heartmath)



sfig9_kyto.png

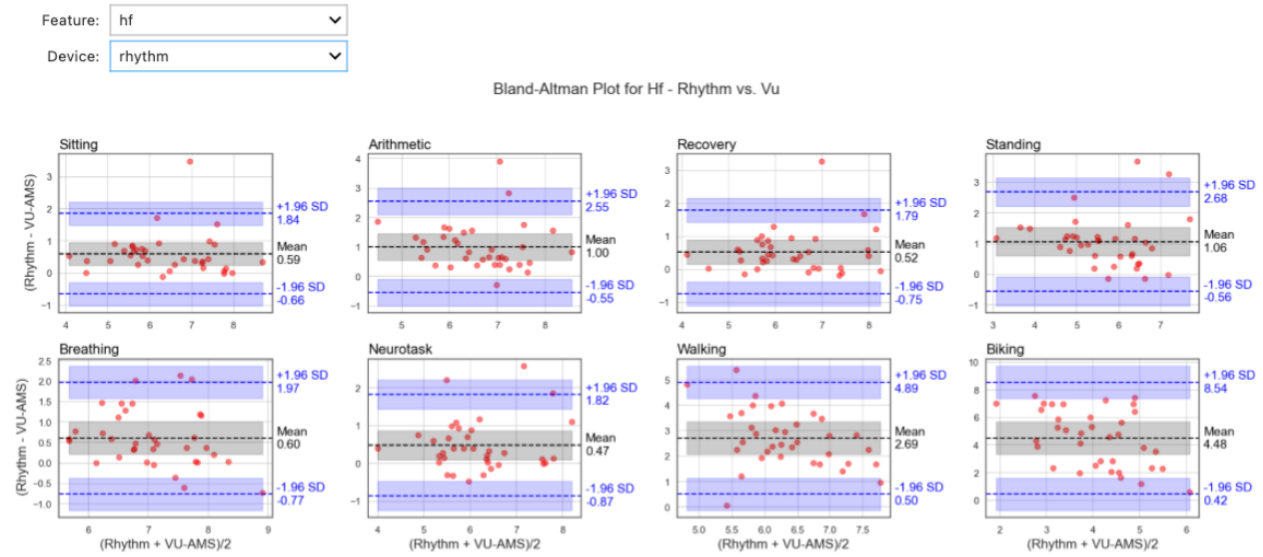
Comment: supplement Fig. 9 (kyto)

Feature: hf
Device: kyto



sfig9_rhythm.png

Comment: supplement Fig. 9 (rhythm)



stable3.png

Comment: supplement Table 3

	Feature	rmssd				hf				mean_hr			
		max	mean	min	std	max	mean	min	std	max	mean	min	std
vice	Condition												
cyto	sitting	78.39	32.85	7.71	17.94	3168.19	591.52	45.52	713.65	96.78	71.04	54.27	9.21
	arithmetic	100.40	44.01	10.50	22.57	2544.40	753.12	34.49	640.14	112.01	81.20	59.79	11.90
	recovery	100.54	35.34	9.06	18.67	6567.18	678.57	44.77	1215.85	94.02	70.62	56.12	8.44
	standing	67.54	30.19	5.78	16.47	2308.54	420.55	16.41	568.46	106.97	79.04	60.33	10.12
	breathing	137.10	62.09	18.49	28.90	9263.71	1031.19	72.89	1643.21	95.34	67.63	55.63	8.38
	neurotask	76.15	35.06	11.57	17.74	2674.07	468.08	36.23	557.36	90.26	70.22	52.07	9.85
	walking	222.23	78.76	17.16	57.91	7291.74	1874.55	74.70	1942.69	98.08	77.22	43.85	13.20
	biking	134.46	48.95	5.45	37.70	4610.31	1123.17	3.97	1282.91	144.78	107.21	66.62	20.30
thm	sitting	170.30	61.39	18.85	35.97	7116.78	1451.24	75.96	1636.15	94.82	73.58	52.91	9.83
	arithmetic	161.16	76.78	30.11	35.05	8142.19	1935.32	230.46	2140.04	110.08	81.18	56.81	12.80
	recovery	152.69	62.01	16.32	34.24	6400.95	1359.97	75.70	1726.66	92.27	72.26	54.08	9.54
	standing	140.94	54.87	19.37	29.59	6845.13	927.09	38.80	1452.69	104.93	80.98	59.52	10.90
	breathing	179.91	88.73	39.65	32.33	6265.72	2105.33	380.73	1594.40	94.24	70.37	53.52	9.68
	neurotask	159.28	60.23	23.23	32.02	6288.64	1084.75	66.62	1536.37	89.15	72.35	51.08	9.93
	walking	159.61	96.36	29.53	28.54	6720.58	2662.34	232.22	1610.94	154.83	87.89	68.32	15.05
	biking	121.21	58.64	22.90	23.87	5449.82	916.83	74.97	1178.92	158.84	119.44	90.90	21.07
lath	sitting	122.39	47.15	17.11	24.41	5926.04	1068.50	87.12	1282.54	97.25	74.09	54.88	9.81
	arithmetic	120.81	57.12	22.94	20.36	3048.47	915.64	52.52	750.74	112.57	84.36	60.40	13.08
	recovery	111.62	50.38	14.17	23.63	6311.22	990.44	69.24	1246.73	94.45	72.78	55.52	9.79
	standing	64.84	36.67	11.91	12.73	1606.03	389.65	21.48	346.60	107.36	82.30	60.71	11.19
	breathing	175.45	72.38	22.24	33.40	8135.12	1377.38	174.46	1479.35	95.75	70.95	56.35	9.28
	neurotask	101.10	49.43	19.37	20.38	2964.09	762.17	67.33	762.68	91.70	72.54	52.70	10.07
	walking	87.91	46.64	14.23	15.06	1245.82	350.81	21.54	261.40	108.34	85.10	57.63	11.15
	biking	140.45	52.33	11.13	27.44	4821.37	1019.79	9.13	1289.96	145.02	117.90	87.00	13.87
tica	sitting	162.54	60.49	10.84	32.32	6810.90	1326.19	58.80	1664.08	94.81	70.88	53.62	9.44
	arithmetic	203.90	101.86	26.60	36.44	10716.60	2974.98	219.25	2225.93	92.01	75.44	59.19	8.42
	recovery	193.28	72.29	12.88	36.54	9108.55	1594.20	63.22	2176.88	92.17	69.73	54.69	8.83
	standing	137.22	61.70	10.94	28.48	8445.89	1256.57	26.34	1725.90	104.65	78.09	59.26	10.10
	breathing	205.90	89.13	28.54	39.30	11019.14	1715.02	218.01	1963.20	93.41	68.17	55.33	8.56
	neurotask	194.60	77.77	22.08	41.99	6815.21	1519.06	98.05	1837.40	88.45	69.26	51.10	9.59
	walking	186.18	117.92	57.85	28.57	11157.30	4156.52	1035.84	2462.03	92.71	77.30	69.09	6.09
	biking	158.44	87.29	33.13	27.54	8760.03	2466.11	562.85	1584.09	126.48	91.15	62.83	11.70
vu	sitting	110.01	43.54	9.26	25.58	6735.54	989.04	45.10	1368.33	94.80	72.23	53.50	9.70
	arithmetic	103.42	41.28	11.93	20.19	3438.02	736.88	35.88	719.04	109.64	82.29	58.57	13.10
	recovery	112.71	46.70	10.44	24.06	7683.33	956.63	49.33	1389.80	92.17	71.05	54.21	9.54
	standing	59.15	28.43	5.84	13.99	1750.36	329.88	12.01	362.86	104.66	80.33	59.24	10.94
	breathing	199.58	75.04	23.63	38.83	10751.61	1424.60	218.12	1804.85	93.42	69.04	54.75	8.94
	neurotask	114.43	47.64	16.91	24.89	3736.28	726.60	45.35	885.89	89.44	70.69	51.37	9.87
	walking	90.16	29.90	10.00	15.06	1483.03	254.35	11.11	288.26	105.87	82.95	55.97	10.83
	biking	28.19	6.70	1.56	5.17	326.97	22.23	0.21	53.52	157.70	127.93	89.84	18.57

stable4.png

Comment: supplement Table 4

	Device	Feature	Condition	MAAPE	CI Lower	CI Upper
0	kyto	rmssd	sitting	22.78	19.56	26.01
1	kyto	rmssd	arithmetic	25.39	14.69	36.08
2	kyto	rmssd	recovery	25.05	19.53	30.56
3	kyto	rmssd	standing	21.96	13.73	30.19
4	kyto	rmssd	breathing	17.51	13.76	21.26
...	...	...	...	...	...	...
91	empatica	mean_hr	standing	1.58	0.28	2.88
92	empatica	mean_hr	breathing	0.80	0.28	1.33
93	empatica	mean_hr	neurotask	1.01	0.35	1.67
94	empatica	mean_hr	walking	9.22	6.37	12.07
95	empatica	mean_hr	biking	26.83	21.96	31.69

stable5.png

Comment: supplement Table 5

	Device	Feature	Condition	Bias with 95% CI	SD	Lower LoA with 95% CI	Upper LoA with 95% CI
0	kyto	rmssd	sitting	-0.27 [-0.32, -0.22]	0.125720	-0.52 [-0.56, -0.47]	-0.02 [-0.07, 0.02]
1	kyto	rmssd	arithmetic	0.01 [-0.14, 0.16]	0.405462	-0.78 [-0.93, -0.64]	0.80 [0.66, 0.95]
2	kyto	rmssd	recovery	-0.25 [-0.34, -0.16]	0.246820	-0.74 [-0.82, -0.65]	0.23 [0.14, 0.32]
3	kyto	rmssd	standing	-0.02 [-0.14, 0.09]	0.309610	-0.63 [-0.74, -0.52]	0.58 [0.47, 0.69]
4	kyto	rmssd	breathing	-0.21 [-0.27, -0.15]	0.167777	-0.54 [-0.60, -0.48]	0.12 [0.06, 0.18]
...	...	...	...	...	...	...	...
91	empatica	mean_hr	standing	-0.63 [-1.87, 0.61]	3.555297	-7.59 [-8.79, -6.40]	6.34 [5.15, 7.54]
92	empatica	mean_hr	breathing	0.06 [-0.32, 0.44]	1.088580	-2.07 [-2.44, -1.70]	2.20 [1.83, 2.56]
93	empatica	mean_hr	neurotask	-0.44 [-1.00, 0.12]	1.603270	-3.58 [-4.12, -3.04]	2.70 [2.16, 3.24]
94	empatica	mean_hr	walking	-5.38 [-8.95, -1.81]	9.899159	-24.78 [-28.21, -21.35]	14.02 [10.59, 17.45]
95	empatica	mean_hr	biking	-38.00 [-45.98, -30.02]	21.761497	-80.65 [-88.32, -72.99]	4.65 [-3.01, 12.31]

96 rows × 7 columns

Acknowledgements

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About this document

This document was created using R Markdown using the `codecheck` R package. `make codecheck.pdf` will regenerate the report file.

```
sessionInfo()
```

```
## R version 4.4.2 (2024-10-31)
## Platform: aarch64-apple-darwin24.1.0
## Running under: macOS Sequoia 15.1.1
##
## Matrix products: default
## BLAS: /opt/homebrew/Cellar/openblas/0.3.28/lib/libopenblas-r0.3.28.dylib
## LAPACK: /opt/homebrew/Cellar/r/4.4.2_2/lib/R/lib/libRlapack.dylib; LAPACK version 3.12.0
##
## locale:
## [1] en_GB.UTF-8/en_GB.UTF-8/en_GB.UTF-8/C/en_GB.UTF-8/en_GB.UTF-8
##
## time zone: Europe/London
## tzcode source: internal
##
## attached base packages:
## [1] stats      graphics  grDevices  utils      datasets
## [6] methods    base
##
## other attached packages:
## [1] readr_2.1.5      tibble_3.2.1      xtable_1.8-4
## [4] yaml_2.3.10      rprojroot_2.0.4   knitr_1.49
## [7] codecheck_0.11.4 parsedate_1.3.1   R.cache_0.16.0
## [10] gh_1.4.1
##
## loaded via a namespace (and not attached):
## [1] xfun_0.49      rdflib_0.2.9      tzdb_0.4.0
## [4] vctrs_0.6.5    tools_4.4.2       generics_0.1.3
## [7] curl_6.0.1     parallel_4.4.2    fansi_1.0.6
## [10] pkgconfig_2.0.3 pdftools_3.4.1    R.oo_1.27.0
## [13] redland_1.0.17-18 assertthat_0.2.1  lifecycle_1.0.4
```

```

## [16] compiler_4.4.2      atom4R_0.3-3      stringr_1.5.1
## [19] keyring_1.3.2       htmltools_0.5.8.1 pillar_1.9.0
## [22] crayon_1.5.3        whisker_0.4.1     tidyr_1.3.1
## [25] R.utils_2.12.3      cachem_1.1.0      zen4R_0.10
## [28] tidyselect_1.2.1    zip_2.3.1         digest_0.6.37
## [31] stringi_1.8.4       dplyr_1.1.4       purrr_1.0.2
## [34] fastmap_1.2.0       cli_3.6.3         magrittr_2.0.3
## [37] XML_3.99-0.17       crul_1.5.0        utf8_1.2.4
## [40] osfr_0.2.9          withr_3.0.2       bit64_4.5.2
## [43] roxygen2_7.3.2      rmarkdown_2.29    httr_1.4.7
## [46] bit_4.5.0.1         qpdf_1.3.4        askpass_1.2.1
## [49] R.methodsS3_1.8.2   hms_1.1.3         memoise_2.0.1
## [52] evaluate_1.0.1      rlang_1.1.4       Rcpp_1.0.13-1
## [55] glue_1.8.0          httpcode_0.3.0    xml2_1.3.6
## [58] fauxpas_0.5.2       rorcid_0.7.0      vroom_1.6.5
## [61] jsonlite_1.8.9      plyr_1.8.9        R6_2.5.1
## [64] fs_1.6.5

```