Supplemental Materials

Package version Info:

R version 4.0.2 (2020-06-22)

Platform: x86_64-w64-mingw32/x64 (64-bit)

Running under: Windows 10 x64 (build 18363)

Matrix products: default

locale:

[1] LC_COLLATE=English_Belgium.1252 LC_CTYPE=English_Belgium.1252 LC_MONETARY=English_Belgium.1252 LC_NUMERIC=C LC_TIME=English_Belgium.1252

attached base packages:

[1] stats graphics grDevices utils datasets methods base

other attached packages:

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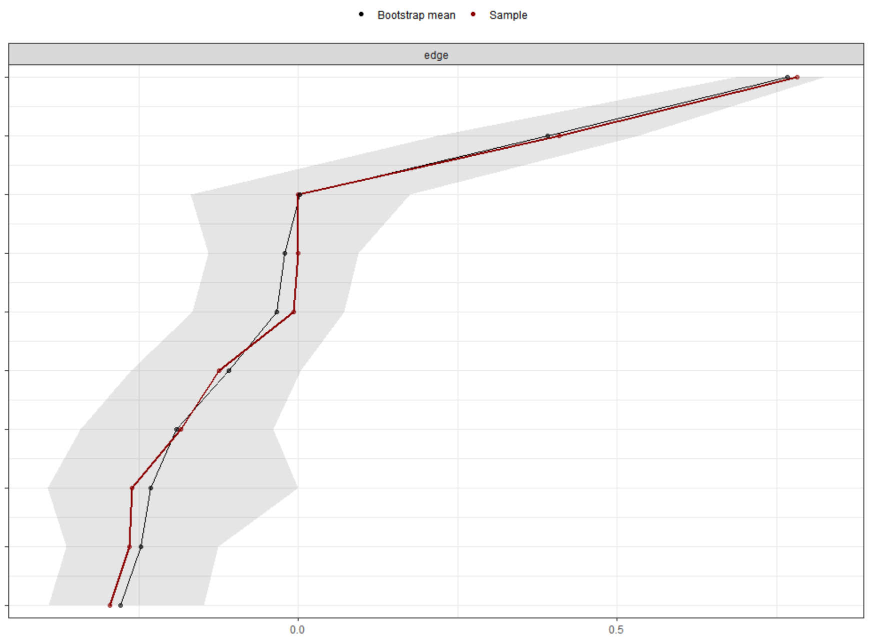
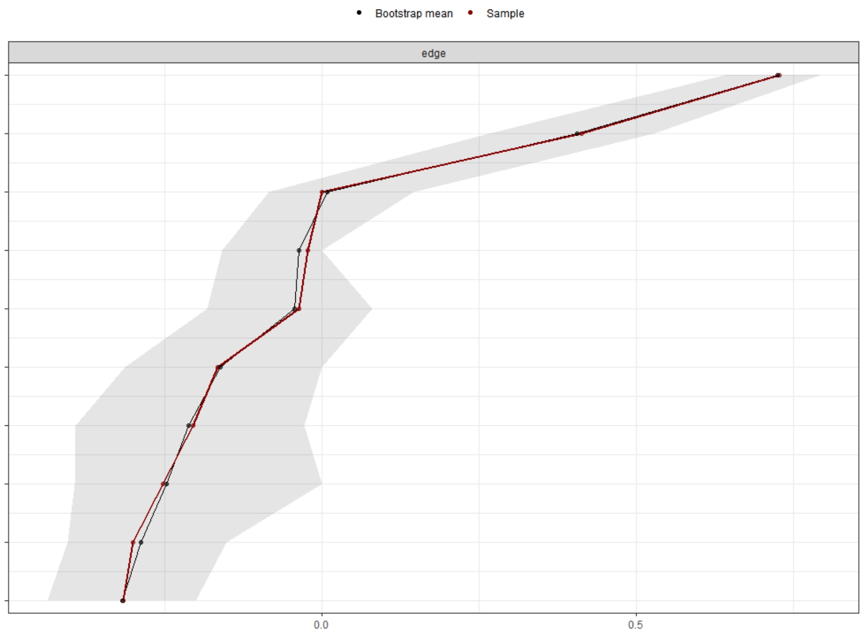
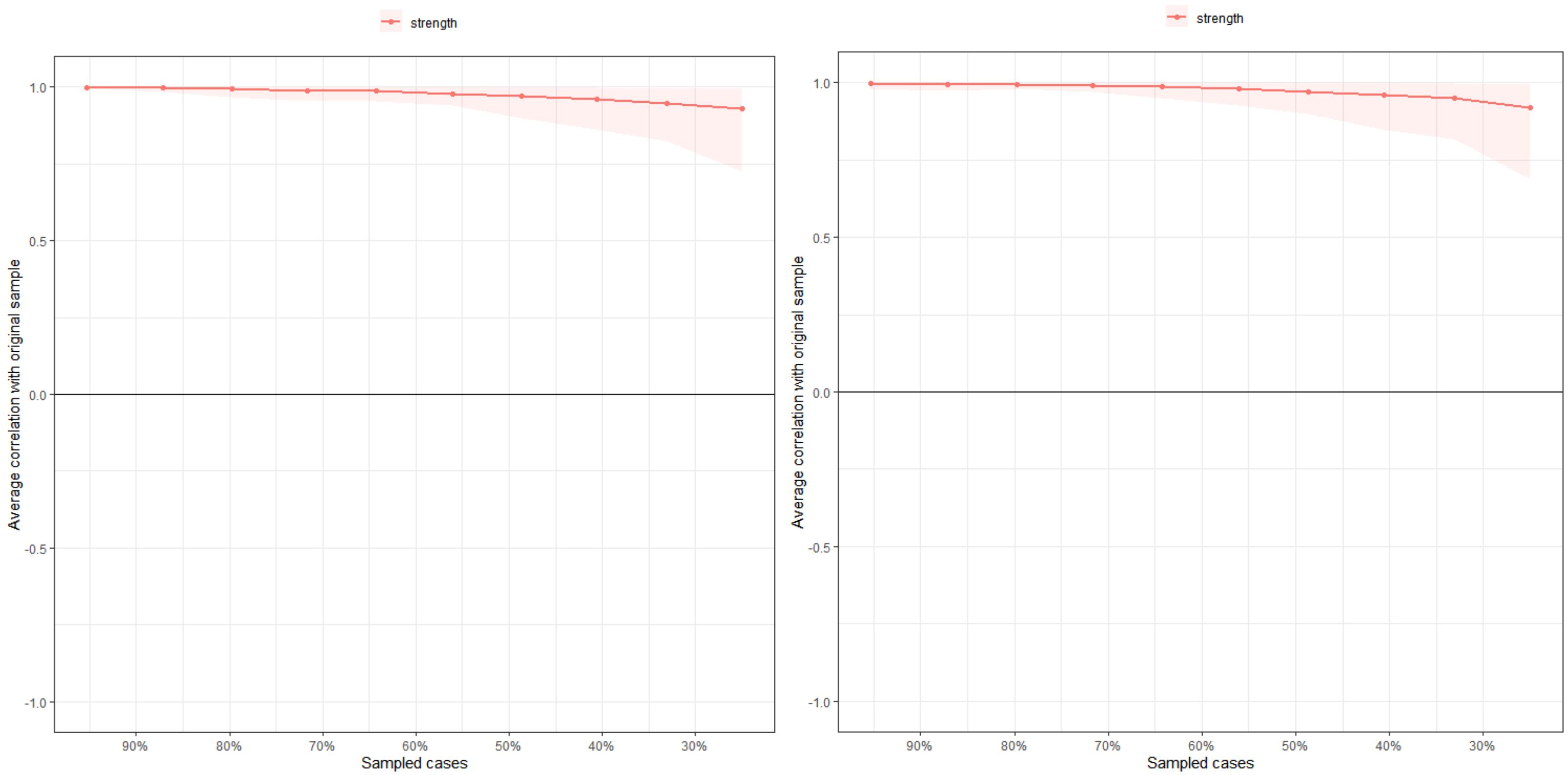
Supplemental Figures

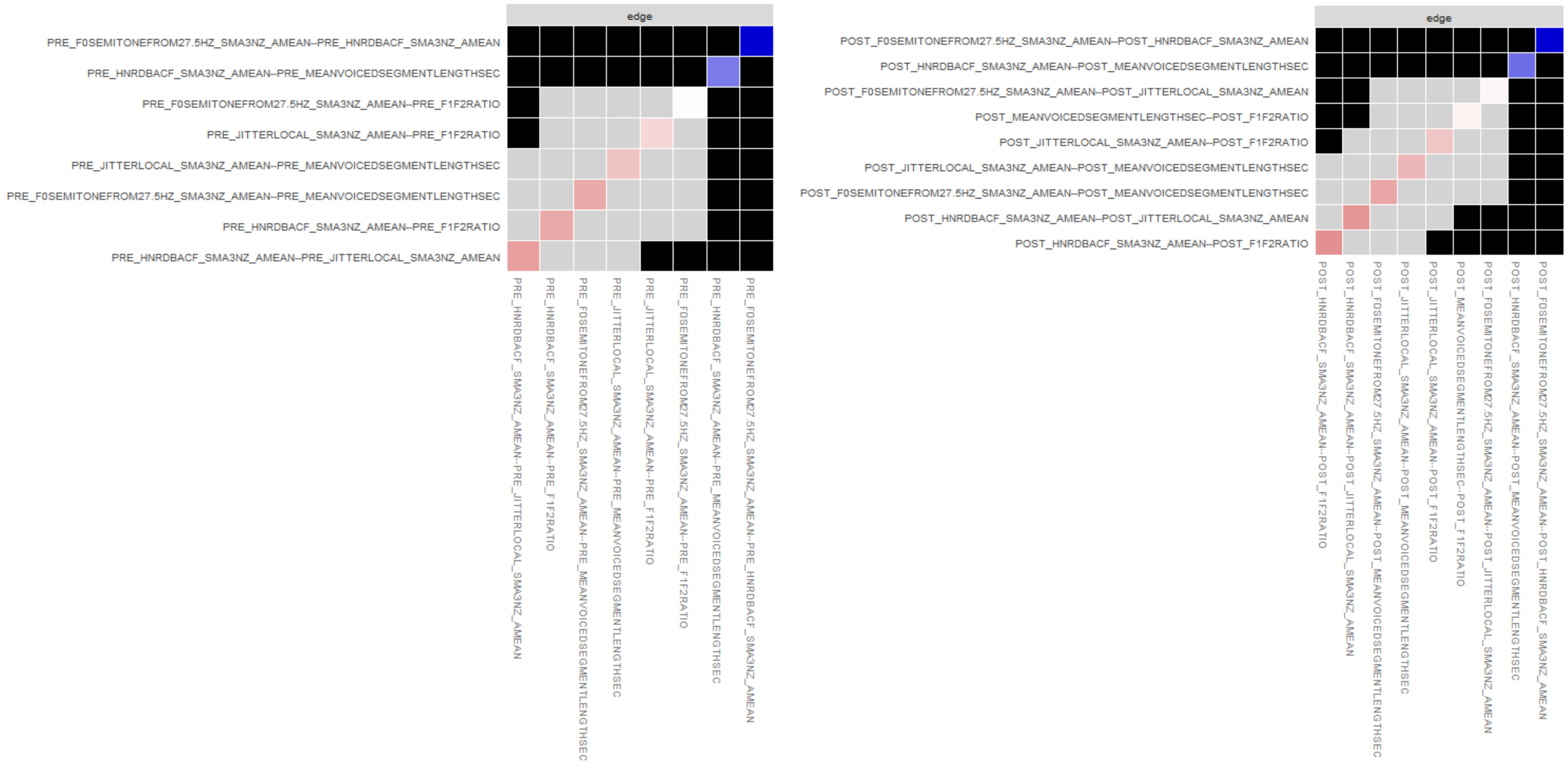




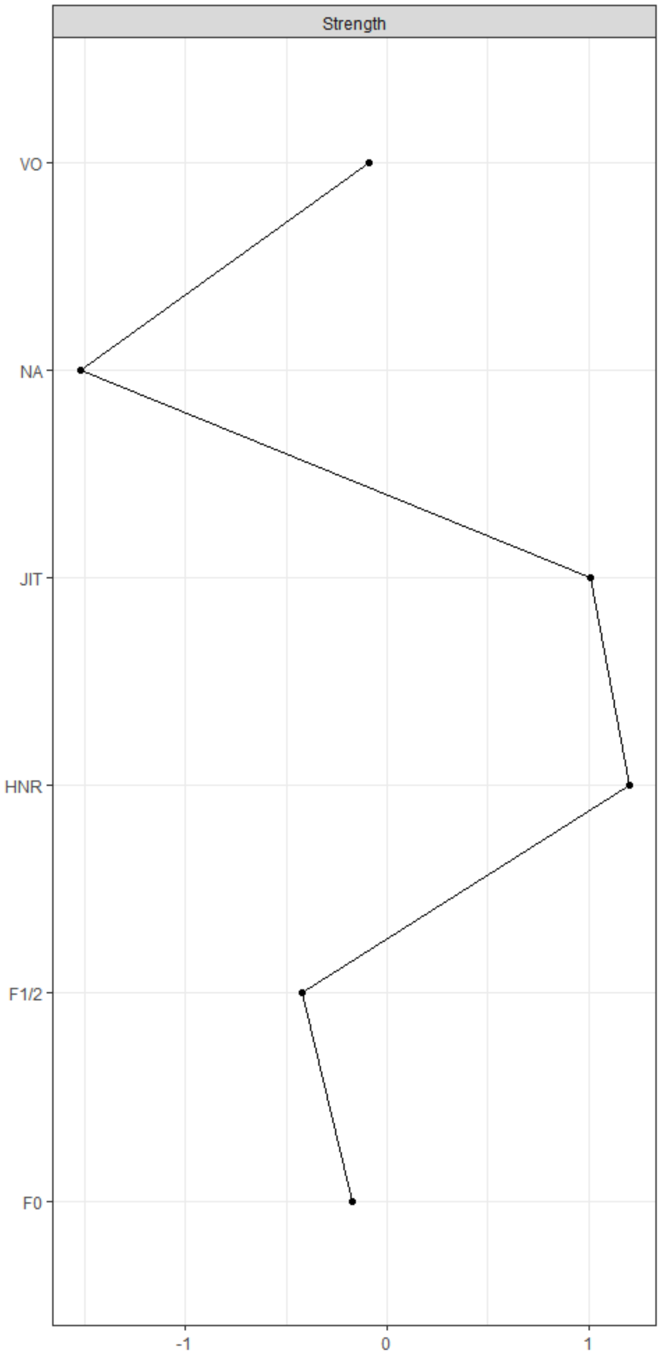
Supplemental Figure 1. Edge accuracy for the Resting state (left) and Stress (right) network models.



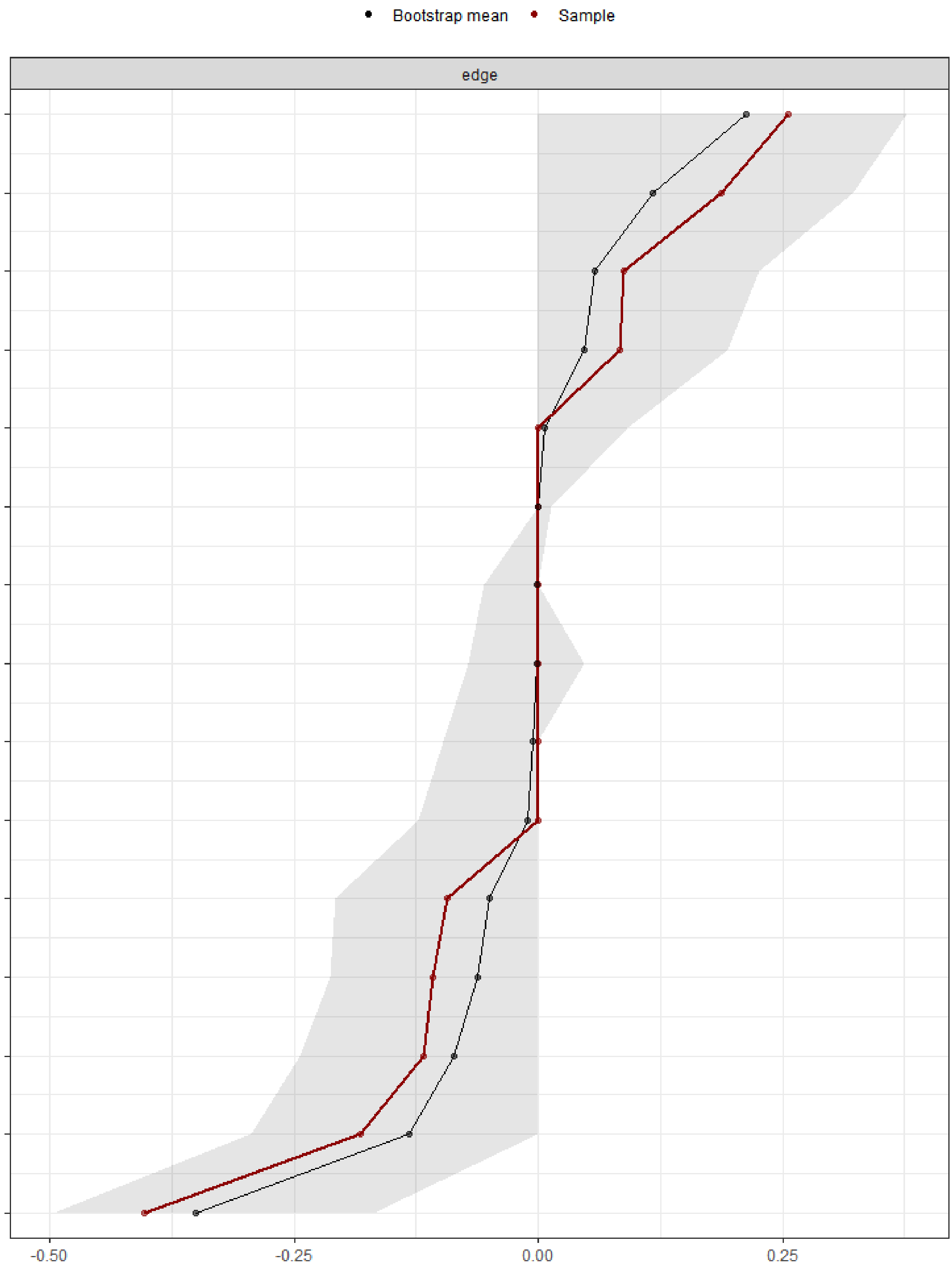
Supplemental Figure 2. Stability of Strength centrality for the Resting state (left) and Stress (right) network models. Note that for both networks, good correlation stability was obtained (.75).



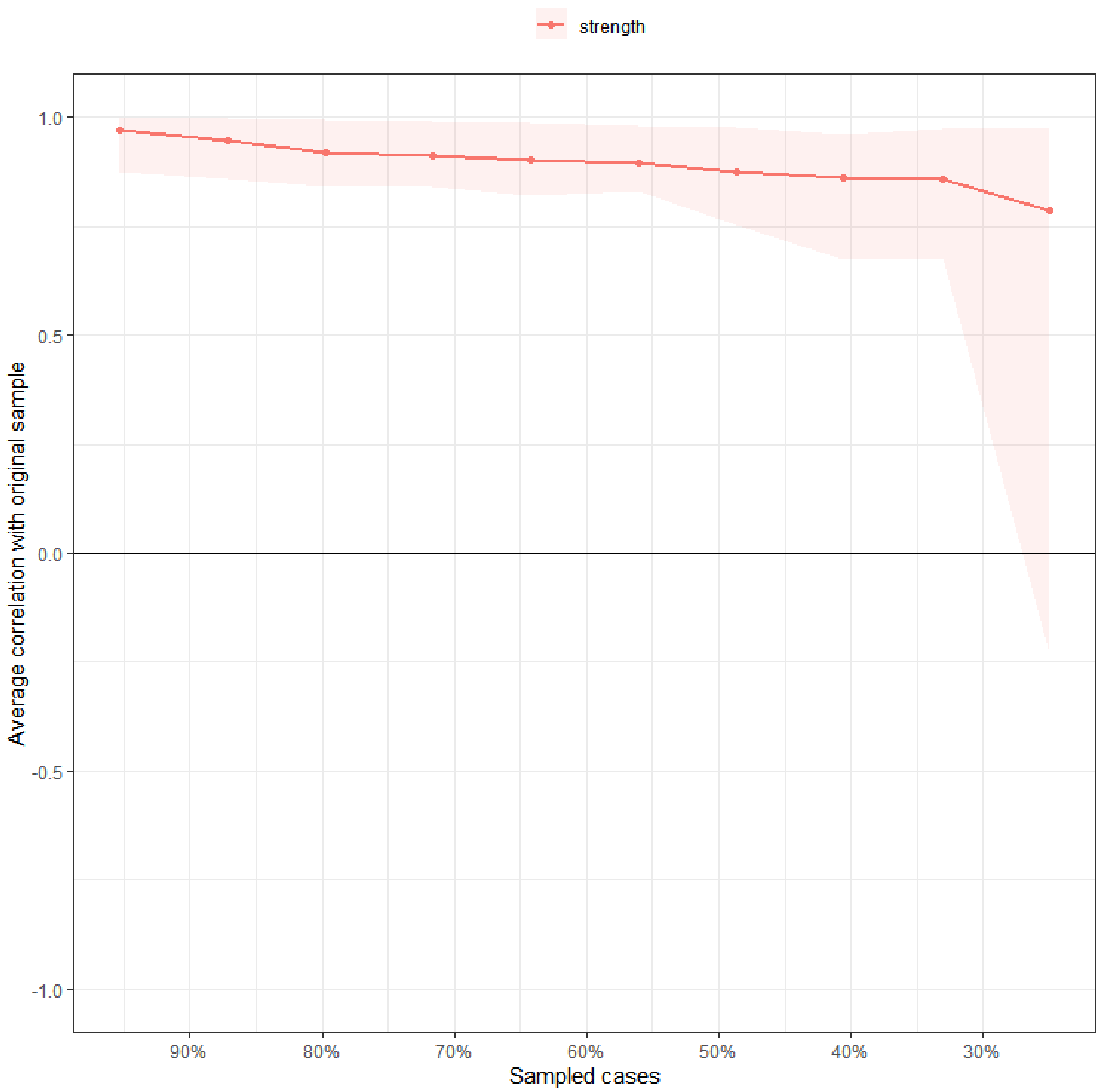
Supplemental Figure 3. Significant edge differences for the Resting state (left) and Stress (right) network models.



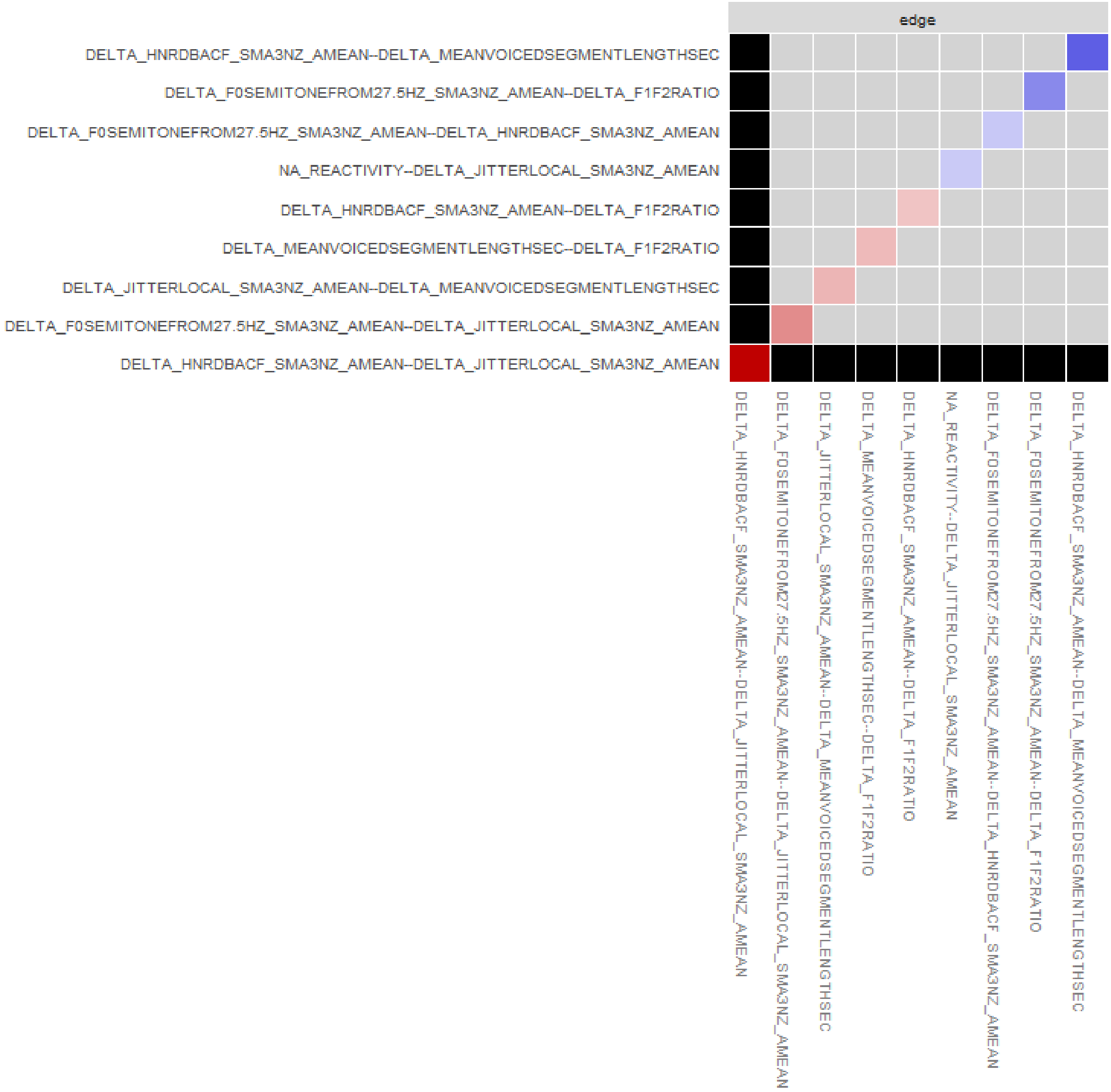
Supplemental Figure 4. Strength centrality for the Stress Reactivity network.



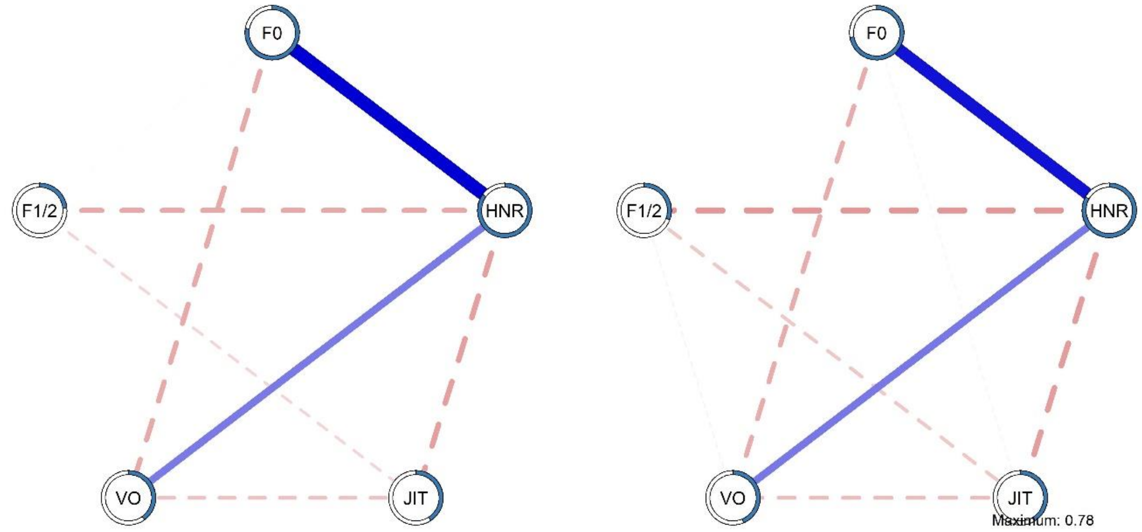
Supplemental Figure 5. Edge accuracy for the Stress Reactivity Network.



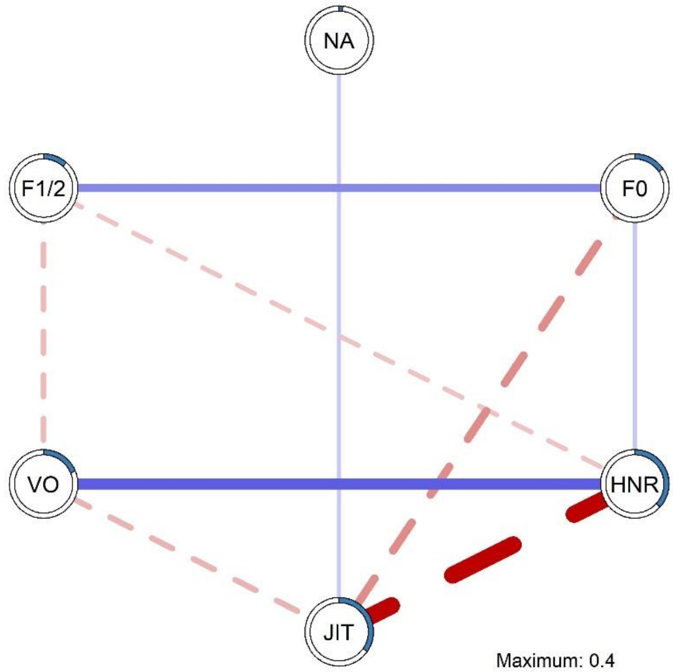
Supplemental Figure 6. Stability of Strength centrality for the Stress Reactivity Network. Note that the correlation stability was adequate (.28).



Supplemental Figure 7. Significant edge differences for the Stress Reactivity Network



Supplemental Figure 8. Circular layout plots for the Resting state (left) and Stress (right) network models.



Supplemental Figure 9. Circular layout plots for the Stress Reactivity Network

Supplemental Tables

Supplemental Table 1. Node predictability for Resting state and Stress network

Node	R^2 Resting state network	R^2 Stress network
F0	.78	.72
HNR	.85	.83
JIT	.41	.42
VO	.40	.44
F1/2	.24	.31

Supplemental Table 2. Node predictability for Stress Reactivity Network

Node	R^2
NA	.02
F0	.16
HNR	.37
JIT	.35
VO	.19
F1/2	.12

Supplemental Table 3. Descriptive Statistics for Speech Parameters at Resting state

	F0	HNR	JIT	V0	F1/2	RATE
Median	26.33	2.59	.0526	.1721	.3582	2.897
Mean	27.82	3.14	.0558	.1761	.3633	2.921
SE. Mean	.37	.19	.0013	.0026	.0022	.030
CI. Mean 0.95	.73	.37	.0025	.0051	.0043	.059
Std. Dev.	4.47	2.29	.0452	.0316	.0265	.361

Supplemental Table 4. Descriptive Statistics for Speech Parameters at Post-Stressor state

	F0	HNR	JIT	V0	F1/2	RATE
Median	26.68	2.73	.0521	.178	.361	2.712
Mean	27.88	3.23	.0546	.180	.364	2.755
SE. Mean	.37	.19	.0012	.0015	.002	.027
CI. Mean 0.95	.74	.37	.0024	.0049	.005	.053
Std. Dev.	4.54	2.28	.0148	.0304	.029	.329

Supplemental Table 5. Descriptive Statistics for Delta scores of Parameters

	NA	F0	HNR	JIT	V0	F1/2	RATE
Median	3.83	-.010	.027	-.0004	.0057	.0005	-.145
Mean	6.45	.055	.090	-.0012	.0040	.0004	-.166
SE. Mean	.88	.068	.049	.0009	.0016	.0009	.015
CI. Mean 0.95	1.73	.134	.096	.0017	.0031	.0018	.049
Std. Dev.	10.67	.827	.590	.0104	.0188	.0108	3.303

Supplemental Table 6. Edge Weight Matrix Pre-Stressor network

	F0	HNR	JIT	VO	F1/2
F0	0.00	0.78	0.00	-0.26	-0.01
HNR	0.78	0.00	-0.30	0.41	-0.27
JIT	0.00	-0.30	0.00	-0.18	-0.12
VO	-0.26	0.41	-0.18	0.00	0.00
F1/2	-0.01	-0.27	-0.12	0.00	0.00

Supplemental Table 7. Edge Weight Matrix Post-Stressor network

	F0	HNR	JIT	VO	F1/2
F0	0.00	0.73	-0.02	-0.25	0.00
HNR	0.73	0.00	-0.30	0.41	-0.32
JIT	-0.02	-0.30	0.00	-0.21	-0.17
VO	-0.25	0.41	-0.21	0.00	-0.04
F1/2	0.00	-0.32	-0.17	-0.04	0.00

Supplemental Table 8. Edge Weight Matrix Stress Reactivity network

	NA	F0	HNR	JIT	V0	F1/2
NA	0.00	0.00	0.00	0.08	0.00	0.00
F0	0.00	0.00	0.09	-0.18	0.00	0.19
HNR	0.00	0.09	0.00	-0.40	0.26	-0.09
JIT	0.08	-0.18	-0.40	0.00	-0.12	0.00
VO	0.00	0.00	0.26	-0.12	0.00	-0.11
F1/2	0.00	0.19	-0.09	0.00	-0.11	0.00

Feature calculation:

We used OpenSmile 2.3.0 (Eyben et l., 2010) with the GeMAPS configuration (Eyben et al., 2015) to extract the used speech features. Here we will describe the calculation of every feature with reference to the GeMAPS configuration paper (Eyben, F., Scherer, K., Schuller, B., Sundberg, J., André, E., Busso, C., Devillers, L., Epps, J., Laukka, P., Narayanan, S., & Truong, K. (2015). The Geneva Minimalistic Acoustic Parameter Set (GeMAPS) for Voice Research and Affective Computing. *IEEE Transactions on Affective Computing*, *7*(2), 190–202. https://doi.org/10.1109/TAFFC.2015.2457417).

F0

F0 variable name in GeMAPS configuration output: F0SEMITONEFROM27.5HZ_SMA3NZ_AMEAN
In the GeMAPS paper the calculation is described on page 198 as:
"The fundamental frequency (F0) is computed via subharmonic summation (SHS) in the spectral domain as described by [60]. Spectral smoothing, spectral peak enhancement, and auditory weighting are applied as in [60]. 15 harmonics are considered, i.e., the spectrum is octave shift-added 15 times, and a compression factor of 0.85 is used at each shifting ([60]). F0 ¼ 0 is defined for unvoiced regions. The voicing probability is determined by the ratio of the harmonic summation spectrum peak belonging to an F0 candidate and the average amplitude of all harmonic summation spectrum bins, scaled to a range ½0; 1_. A maximum of 6 F0 candidates in the range of 55-1000 Hz are selected. Online Viterbi post-smoothing is applied to select the most likely F0 path through all possible candidates. A voicing probability threshold of 0:7 is then applied to discern voiced from unvoiced frames. After Viterbi smoothing the F0 range of 55–1000 Hz is enforced by setting all voiced frames outside the range to unvoiced frames (F0 ¼ 0). The final F0 value is converted from its linear Hz scale to a logarithmic scale – a semitone frequency scale starting at 27.5 Hz (semitone 0). However, as 0 is reserved for unvoiced frames, every value below semitone 1 (29.136 Hz) is clipped to 1.

HNR

HNR variable name in GeMAPS configuration output: HNRDBACF_SMA3NZ_AMEAN

In the GeMAPS paper the calculation is described on page 199 as:

"The HNR gives the energy ratio of the harmonic signal parts to the noise signal parts in dB. It is estimated from the short-time autocorrelation function (ACF) (60 ms window) as the logarithmic ratio of the ACF amplitude at F0 and the total frame energy, expressed in dB, as given by [61]:

$$HNR_{acf,log} = 10 \log_{10} \left(\frac{ACF_{T_0}}{ACF_0 - ACF_{T_0}} \right) \mathrm{dB}.$$

where ACFT0 is the amplitude of the autocorrelation peak at the fundamental period (derived from the SHS-based F0 extraction algorithm described above) and ACF0 is the zeroth ACF coefficient (equivalent to the quadratic frame energy). The logarithmic HNR value is floored to _100 dB to avoid highly negative and varying values for low-energy noise.

Jitter

Jitter variable name in GeMAPS configuration output: JITTERLOCAL_SMA3NZ_AMEAN

In the GeMAPS paper the calculation is described on page 198 as:

“Jitter, is computed as the average (over one 60 ms frame) of the absolute local (period to period) jitter Jppðn0Þ scaled by the average fundamental period length. For two consecutive pitch periods, with the length of the first period n0 _ 1 being T0ðn0 _ 1Þ and the length of the second period n0 being T0ðn0Þ, the absolute period to period jitter, also referred to as absolute local jitter, is given as follows [61]:

$$J_{pp}(n') = |T_0(n') - T_0(n'-1)| \text{ for } n' > 1. \qquad (1)$$

This definition yields one value for Jpp for every pitch period, starting with the second one. To obtain a single jitter value per frame for N0 local pitch periods n0 ¼ 1 . . .N0 within one analysis frame, the average local jitter Jpp is given by:

$$\overline{J_{pp}} = \frac{1}{N'-1} \sum_{n'=2}^{N'} |T_0(n') - T_0(n'-1)|. \qquad (2)$$

In order to make the jitter value independent of the underlying pitch period length, it is scaled by the average pitch period length. This yields the average relative jitter, used as the jitter measure in our parameter set:

$$\overline{J_{pp,rel}} = \frac{\frac{1}{N'-1} \sum_{n'=2}^{N'} |T_0(n') - T_0(n'-1)|}{\frac{1}{N'} \sum_{n'=1}^{N'} T_0(n')}. \qquad (3)$$

Voiced (mean voiced segment length)

Mean voiced segment length variable name in GeMAPS configuration output: MEANVOICEDSEGMENTLENGTHSEC

In the GeMAPS paper the calculation is described on page 193 as:

“the mean length and the standard deviation of continuously voiced regions (F0 > 0),”

F1/2

This feature is feature is computed by calculating the ratio between Formant 1 and Formant 2. These variables are found in the GeMAPS configuration output under the names:

F1FREQUENCY_SMA3NZ_AMEAN & F2FREQUENCY_SMA3NZ_AMEAN

In the GeMAPS paper the calculation is described on page 199 as:

“Both formant bandwidth and formant centre frequency are computed from the roots of Linear Predictor (LP) [67] coefficient polynomial. The algorithm follows the implementation of [11].”

Relevant references from GeMAPS configuration paper with according numbers:
[11] P. Boersma, “Praat, a system for doing phonetics by computer,” Glot Int., vol. 5, nos. 9/10, pp. 341–345, 2001.

[60] D. J. Hermes, “Measurement of pitch by subharmonic summation,” J. Acoust. Soc. Amer., vol. 83, no. 1, pp. 257–264, 1988.
[61] B. Schuller, Intelligent Audio Analysis (Signals and Communication Technology). New York, Ny, USA: Springer, 2013.
[67] J. Makhoul, “Linear prediction: A tutorial review,” Proc. IEEE, vol. 63, no. 5, pp. 561–580, Apr. 1975.

Other supplemental materials

Read-out-loud Text:

"Papa en Marloes staan op het station. Ze wachten op de trein. Eerst hebben ze een kaartje gekocht. Er stond een hele lange rij, dus dat duurde wel even. Nu wachten ze tot de trein eraan komt. Het is al vijf over drie, dus het duurt nog vier minuten. Er staan nog veel meer mensen te wachten. Marloes kijkt naar links, in de verte ziet ze de trein al aankomen." From: van de Weijer and Slis (1991)

Van de Weijer, J., Slis, I. (1991). Nasaliteitsmeting met de Nasometer. Logopedie en Foniatrie, 63, 97-101.

This text is 70 words and has been developed as a phonetically balanced text that matches the sound frequencies as they occur in the Dutch language as validated by van den Broecke and described in van de Weijer (1990) and van de Weijer & Slis (1991). During both moments (pre- and post-stressor) they articulated this text only once. We used the OpenSmile toolbox that computes mean values for each fragment per variable (for more information see: Eyben et al., 2010 and Eyben et al., 2015) resulting in the use of one datapoint per variable per recording.

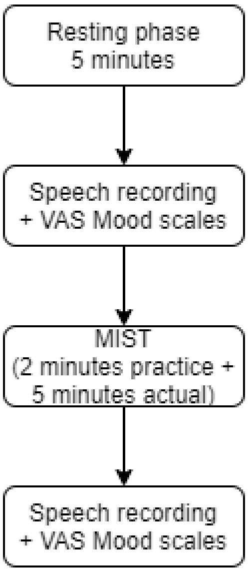
The voiced to voiceless ratio is as follows:

Pre-stress: Mean = 2.103, SD = .533

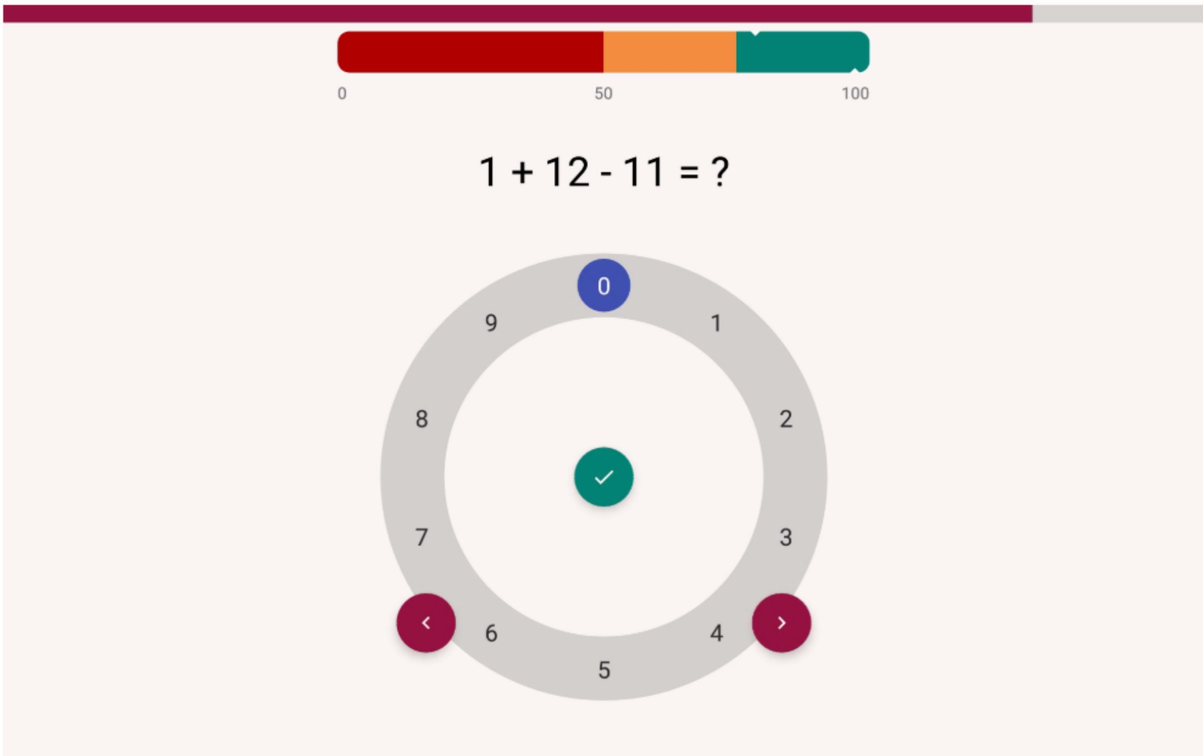
Post-stress: Mean = 2.071, SD = .549

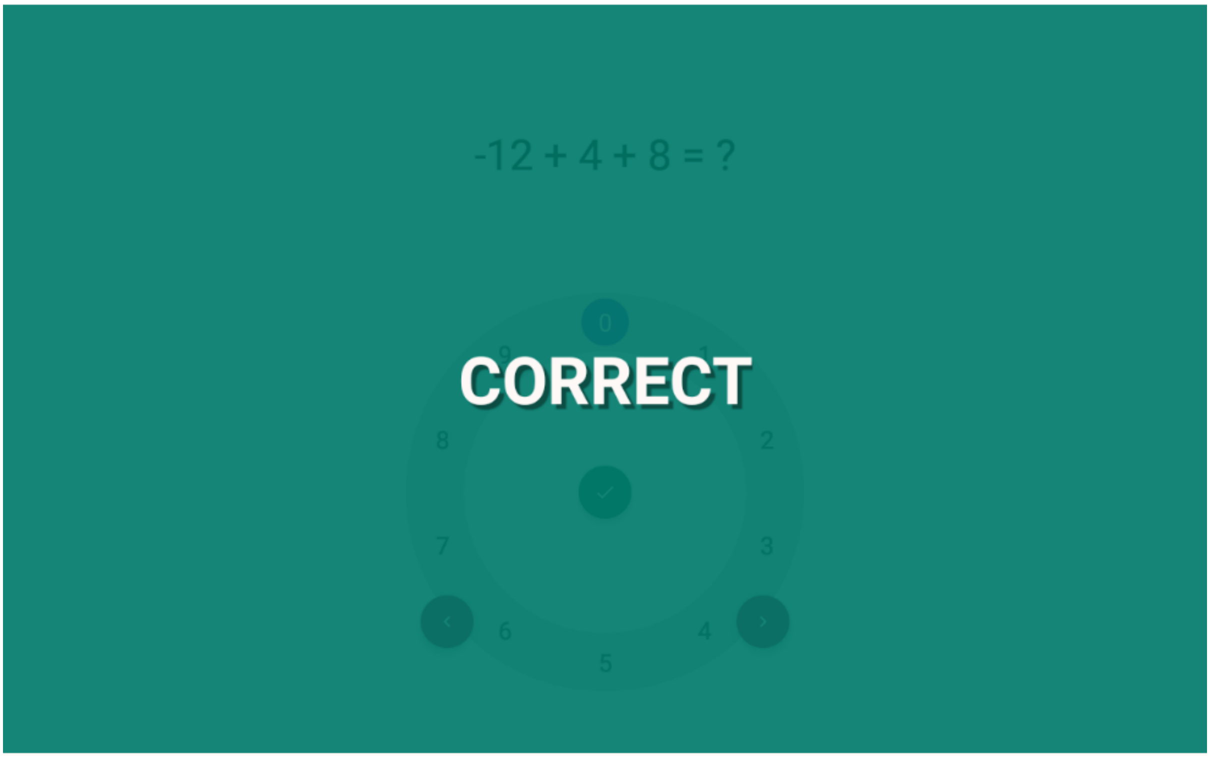
Distributions were similar between the two moments. Data with regards to each individual participants number of voiced and unvoiced frames has been added to OSF.

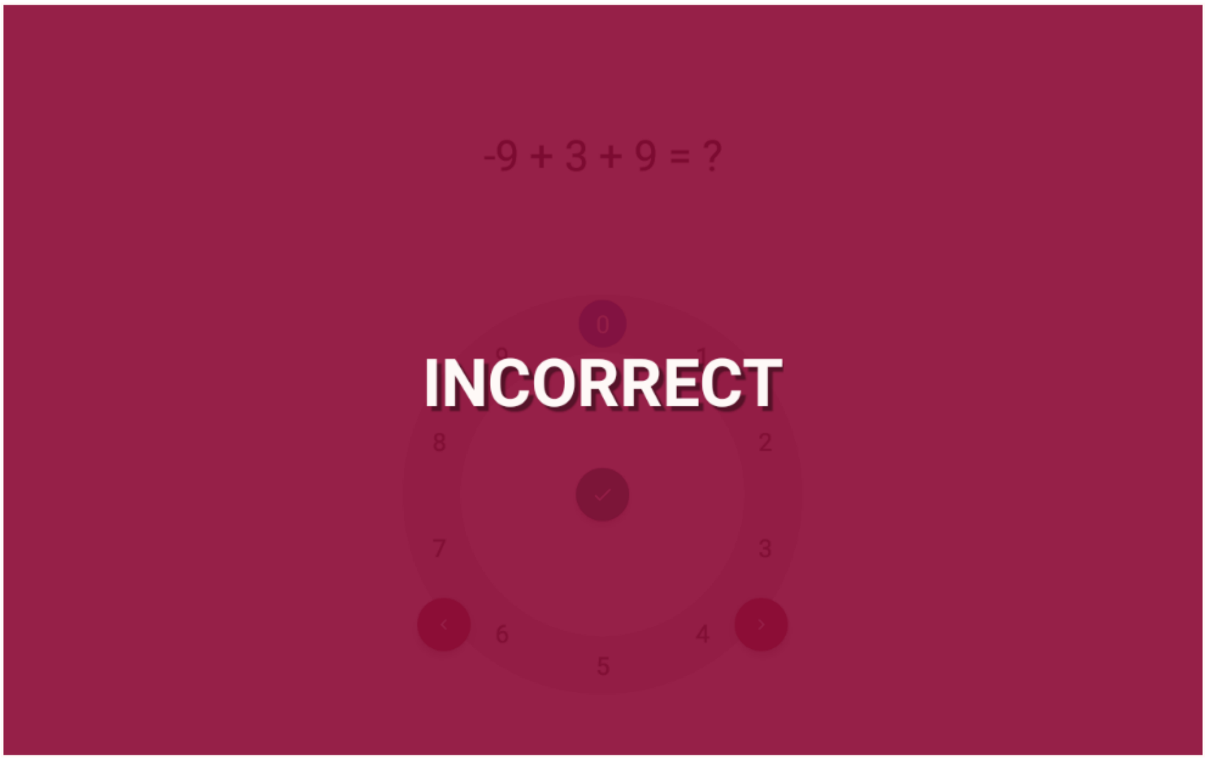
Study Flowchart



Screenshots



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2
7
3
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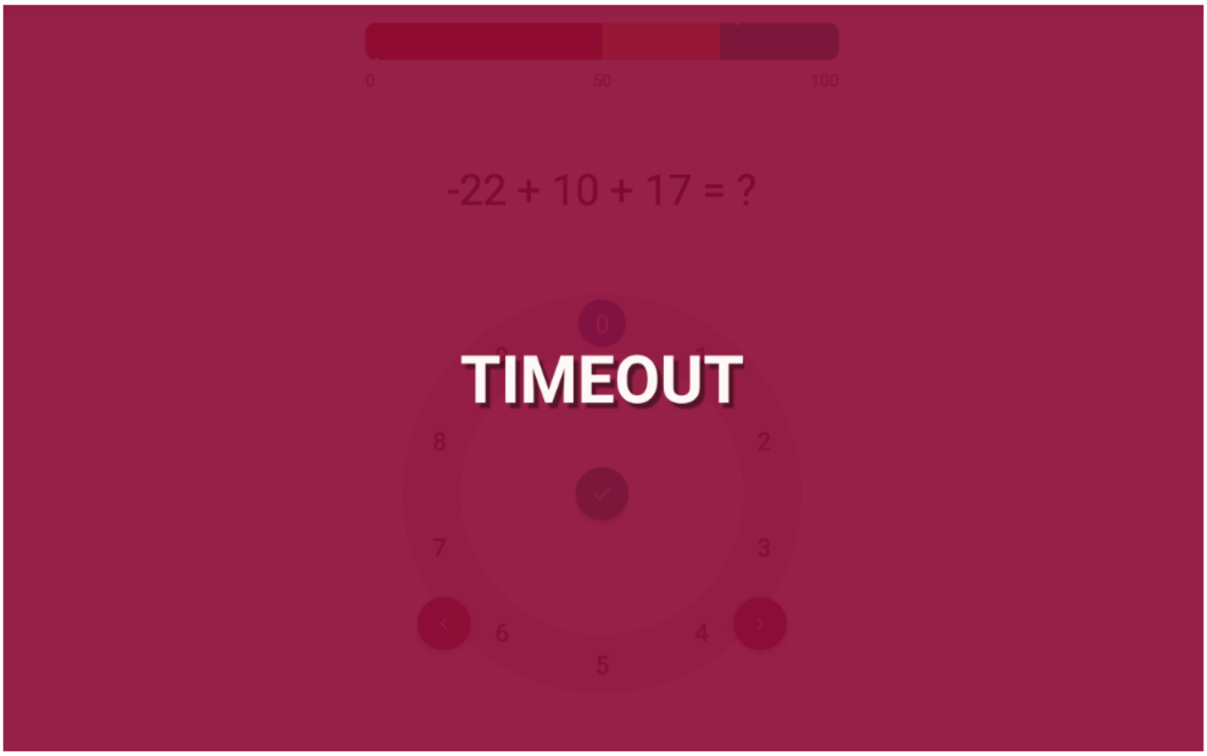
5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5