Supplemental Material 3: Preprocessed Effect Sizes from Invididual Source Data

Author

2023-08-10

Table of Contents

I. Statement

All studies that provided processed individual sleep and memory measurement data by authors have undergone preprocessing or reanalysis to estimate correlation coefficients using standardized measurement methods selected for the meta-analysis. We are unable to disclose the source

data due to copyright restrictions associated with the original studies. Instead, we will directly report the preprocessed effect sizes and formulas used. Individuals or groups who are interested in any source dataset should contact the authors of the original studies directly.

In cases where meta-analysis authors reached out to the original study authors via email to obtain effect sizes, if the original study authors chose to provide processed individual datasets rather than reporting effect sizes directly, neither party requested or exchanged any information that could potentially expose the personal identities of individual participants. The data may have been sorted, merged or excluded based on the methods outlined in the original studies and the moderator selection in the meta-analysis. All data processing was performed within the Quarto document of R Studio version 2023.6.1.524 (Posit Team, 2023) using the R language (R Core Team, 2022) Not all effect sizes reported in this material will necessarily be used in the meta-analysis, contingent upon the inclusion criteria and moderators.

II. Formulas

Pearson Product-Moment Correlation Coefficient

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}} \tag{1}$$

Circular-Linear Correlation Coefficient

$$R = \sqrt{\frac{r_{12}^2 + r_{13}^2 + 2 \cdot r_{12} \cdot r_{13} \cdot r_{23}}{1 - r_{23}^2}} \tag{2}$$

where

$$r_{12} = \text{corr}(x, \cos\theta),\ r_{13} = \text{corr}(x, \sin\theta),\ \text{and}\ r_{23} = \text{corr}(\cos\theta, \sin\theta)$$

corr function refers to the Pearson's r formula in (1) (Mardia, 1976)

Declarative Memory Retention Rate

$$MRR(\%) = \frac{Recall_{\text{post.sleep}}}{Recall_{\text{pre.sleep}}} \times 100\% \tag{3}$$

III. Effect Sizes

Schreiner2021

Table 1: Schreiner 2021 Coupling and Memory Correlation Table (WIP)

Phase.Circlin.R	Phase.R.squared	Amplitude	Strength	SPcSO	SOcSP
0.5152	0.2654	0.1685	0.1275	0.0251	-0.1166

Table 2: Schreiner 2021 Coupling and Memory Correlation Table (TMR)

Phase.Circlin.R	Phase.R.squared	Amplitude	Strength	SPcSO	SOcSP
0.3868	0.1496	-0.2115	0.1638	-0.1982	-0.3942

Denis2021a

Table 3: Denis 2021 (TMR) CP Phase and Memory Circular Linear Correlation Table

	Circlin.R	R.squared
N2 Neutral	0.2393	0.0572
N2 Emotional	0.2107	0.0444
N2 Weighted	0.2282	0.0521
N3 Neutral	0.1469	0.0216
N3 Emotional	0.1270	0.0161
N3 Weighted	0.1403	0.0197

Table 4: Denis 2021 (TMR) SP Amplitude and Memory Pearson's r Correlation Table

	nREM2	nREM3
Neutral	-0.2098	-0.2458
Emotional	-0.1747	-0.2705
Weighted	-0.1984	-0.2802

Table 5: Denis 2021 (TMR) CP Strength and Memory Pearson's r Correlation Table

	nREM2	nREM3
Neutral	0.1797	0.1981
Emotional	0.1777	0.2963
Weighted	0.1901	0.2832

Table 6: Denis 2021 (TMR) CP Percentage and Memory Pearson's r Correlation Table

	nREM2	nREM3
Neutral	-0.0573	0.1915
Emotional	-0.3933	-0.0754
Weighted	-0.3074	0.0085

Hahn2020

Table 7: Hahn 2020 Child CP Phase and Memory Circular Linear Correlation Table

	Circlin.R	R.squared
Frontal	0.3191	0.1018
Central	0.2569	0.0660
Parietal and Occipital	0.3059	0.0936

Table 8: Hahn 2020 Adolescent CP Phase and Memory Circular Linear Correlation Table

	Circlin.R	R.squared
Frontal	0.4859	0.2361
Central	0.0971	0.0094
Parietal and Occipital	0.5138	0.2640

Table 9: Hahn 2020 SP Amplitude and Memory Pearson's r Correlation Table

	Child	Adolescent
Frontal	-0.1877	0.2143
Central	-0.2250	0.3446
Parietal and Occipital	-0.2796	0.2990

Table 10: Hahn 2020 CP Strength and Memory Pearson's r Correlation Table

	Child	Adolescent
Frontal	-0.0568	0.3792
Central	0.1827	-0.0797
Parietal and Occipital	-0.1048	-0.0129

Table 11: Hahn 2020 CP Percentage and Memory Pearson's r Correlation Table

	N2	N3
Child	0.0584	0.1432
Adolescent	-0.5107	-0.2487

Kurz2023

Table 12: Kurz 2023 CP Phase and Memory Circular Linear Correlation Table

	Circlin.R	R.squared
Slow Frontal	0.1322	0.0175
Slow Central	0.4461	0.1990
Slow Parietal	0.1708	0.0292
Fast Frontal	0.2731	0.0746
Fast Central	0.2777	0.0771
Fast Parietal	0.1865	0.0348

Table 13: Kurz 2023 SP Amplitude and Memory Pearson's r Correlation Table

	Fast.Spindle	Slow.Spindle
Frontal	0.4792	0.1308
Central	0.5582	0.1738
Parietal	0.5941	0.0830

Table 14: Kurz 2023 CP Strength and Memory Pearson's r Correlation Table

	Fast.Spindle	Slow.Spindle
Frontal	0.2768	-0.0574

	Fast.Spindle	Slow.Spindle
Central	0.3140	0.1543
Parietal	0.2721	0.1262

Donnelly2022

Table 15: Donnelly 2022 CP Phase and Memory Circular Linear Correlation Table

	Circlin.R	R.squared
Frontal	0.3509	0.1231
Central	0.3510	0.1232
Parietal and Occipital	0.6296	0.3964

Table 16: Donnelly 2022 SP Amplitude and Memory Pearson's r Correlation Table

	Frontal	Central	Parietal and Occipital
Correlation	0.5232	0.5343	0.3783

Table 17: Donnelly 2022 CP Strength and Memory Pearson's r Correlation Table

	Frontal	Central	Parietal and Occipital
Correlation	-0.2253	0.0043	0.0886

Denis2022

Table 18: Denis 2022 CP Phase and Memory Circular Linear Correlation Table

	Circlin.R	R.squared
Slow Frontal	0.4076	0.1661
Slow Central	0.3961	0.1569
Slow Parietal and Occipital	0.2586	0.0669
Fast Frontal	0.3818	0.1458
Fast Central	0.2439	0.0595
Fast Parietal and Occipital	0.1751	0.0307

Table 19: Denis 2022 SP Amplitude and Memory Pearson's r Correlation Table

	Fast.Spindle	Slow.Spindle
Frontal	-0.0145	-0.0222
Central	-0.0711	-0.0896
Parietal and Occipital	-0.1847	-0.2770

Table 20: Denis 2022 CP Strength and Memory Pearson's r Correlation Table

	Fast.Spindle	Slow.Spindle
Frontal	0.1690	-0.0882
Central	0.1577	-0.1101
Parietal and Occipital	0.1883	-0.0144

Table 21: Denis 2022 CP Percentage and Memory Pearson's r Correlation Table

	Fast.Spindle	Slow.Spindle
Frontal	-0.0619	0.0698
Central	0.0485	0.1087
Parietal and Occipital	0.0591	-0.1029

Mylonas2020

Table 22: Mylonas 2020 Coupling and Memory Correlation Table

Phase.Circlin.R	Phase.R.squared	Amplitude	Strength	SPcSO	SOcSP
0.3801	0.1445	-0.1982	0.0508	-0.0289	0.055

Hahn2022

Table 23: Hahn 2022 CP Phase and Memory Circular Linear Correlation Table

	Adolescent	Young.Adult
Frontal	0.4950	0.3067
Central	0.2770	0.2908
Parietal and Occipital	0.4205	0.3061

Mylonas2022

Table 24: Mylonas 2022 Coupling and Memory Correlation Table

Phase.Circlin.R	Phase.R.squared	Amplitude	Strength	SPcSO
0.3818	0.1458	0.3421	-0.0862	-0.1803

IV. References

1. Mardia, K. V. (1976). Linear-Circular Correlation Coefficients and Rhythmometry. *Biometrika,* 63(2), 403–405. https://doi.org/10.2307/2335637

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3. R Core Team (2022). R: A language and environment for statistical computing. *R Foundation for Statistical Computing, Vienna, Austria.* https://www.R-project.org/.