# Supplemental material

## 1 Perform a meta analysis

To perform the meta-analysi several steps must be followed. First the choice of the model: this analysis is based on either one of the following statistical models [Borenstein et al., 2009]:

- *the fixed-effect model*: the true effect size (ES) (i.e the ES that would be observed with an infinitely large sample size) is the same for all the studies in the analysis. The differences between the actually observed ESs are due to sampling errors;
- *the random-effects model*: the true ES could vary from study to study. The differences between the observed ESs are due to sampling errors but also to the various designs of the studies (for instance the number of participants or the implementation).

In the present case, although the studies included into the meta-analysis met the same criteria, they remained different from each other on various points, so the random effects model was more appropriate than the fixed-effect model.

### 1.1 Compute the effect size of each study

First, the scores presented in the articles were extracted and the ES of each study as defined in Morris [2008] was computed as in eq. (1):

$$\mathsf{ES} = c_p \left[ \frac{(M_{\mathsf{post},T} - M_{\mathsf{pre},T}) - (M_{\mathsf{post},C} - M_{\mathsf{pre},C})}{\mathsf{SD}_{\mathsf{pre}}} \right]. \tag{1}$$

An ES is exactly equivalent to a z-score of a standard normal distribution, it is computed as mean pre- to post-treatment score change in the Neurofeedback (NFB) group ($M_{\mathsf{pre},T}$, $M_{\mathsf{post},T}$) minus the mean pre- to post- treatment score change in the control group ($M_{\mathsf{pre},C}$, $M_{\mathsf{post},C}$), divided by the pooled pretest standard deviation ($SD_{\mathsf{pre}}$) defined as eq. (2):

$$\mathsf{SD}_{\mathsf{pre}} = \sqrt{\frac{(n_T - 1)\mathsf{SD}^2_{\mathsf{pre},T} + (n_C - 1)\mathsf{SD}^2_{\mathsf{pre},C}}{n_T + n_C - 2}}, \tag{2}$$

where $\mathsf{SD}_{t,G}$ indicates the standard deviation for group $G$ at time $t$ and $n_G$ defines the sample size of each group; $c_p$ is a bias adjustment typically used for small sample sizes and defined as eq. (3):

$$\mathsf{cp} = 1 - \frac{3}{4(n_T + n_C - 2) - 1}. \tag{3}$$

The means (first statistical moments) correspond to the mean average score over all scores given by raters to assess the Attention deficit/hyperactivity disorder (ADHD) symptoms. The standard deviations of the means correspond to the squared root of the second statistical moment, the variance. The variance measures how far a set of numbers are spread out from their average value.

## 1.2 Compute the variance of each effect size

Then, the variance of each ES was computed as described in eq. (4) [Morris, 2008]:

$$\sigma^2(\mathsf{ES}) = c_p^2 \left(\frac{n_T + n_C - 2}{n_T + n_C - 4}\right) \left[\frac{2(1-\rho)(n_T + n_C)}{n_T n_C} + \mathsf{ES}^2\right] - \mathsf{ES}^2. \tag{4}$$

To compute the variance of the ES, the pooled within-group Pearson correlation $\rho$ (i.e the pre-post correlation) was required as described in eq. (5) [James et al., 2013]:

$$\rho = \frac{\sum_{i=1}^{n}(\mathsf{pre}_i - \mu_{\mathsf{pre}})(\mathsf{post}_i - \mu_{\mathsf{post}})}{\sqrt{\sum_{i=1}^{n}(\mathsf{pre}_i - \mu_{\mathsf{pre}})^2}\sqrt{\sum_{i=1}^{n}(\mathsf{post}_i - \mu_{\mathsf{post}})^2}}, \tag{5}$$

where $n$ is the number of patients included in a study, $pre_i$, $post_i$ are score values for patient $i$ at pre- and post-test respectively, and $\mu_{pre}$, $\mu_{post}$ the mean scores over all patients. It is a measure of linear correlation between two variables. A value of 1 means that there is a positive correlation whereas a value of -1 means a negative correlation. When $\rho = 0$, there is no linear correlation [James et al., 2013]. In our case, this correlation was not known and the raw data were not available so we took an approximation: Balk et al. [2012] found that a value of 0.5 yields values closer to those computed with the right value of the correlation.

Once variances were obtained with eq. (4), we could compute the standard error and the 95% confidence interval of each ES.

## 1.3 Compute the weight of each study

To compute the summary effect (Se) a weight must be assigned to each study. To obtain them several steps must be followed. At first, the fixed-effects model weight $w_{fixed}$ of each study $k$ was computed as defined in Borenstein et al. [2009] described in eq. (6):

$$w_{\mathsf{fixed}_k} = \frac{1}{\sigma^2(\mathsf{ES}_k)}. \tag{6}$$

Nevertheless, we chose to use the random effects model, so the weights associated to this model are different. To compute them, the between-studies variance $\tau^2$ is required. It was calculated in three steps described in eq. (7), eq. (8) and eq. (9) [Borenstein et al., 2009]:

$$Q = \sum_{k=1}^{K} (w_{\mathsf{fixed}_k} \mathsf{ES}_k^2), \tag{7}$$

$$C = \sum_{k=1}^{K} (w_{\mathsf{fixed}_k} - \frac{\sum_{k=1}^{K} (w_{\mathsf{fixed}_k})^2}{\sum_{k=1}^{K} (w_{\mathsf{fixed}_k})}, \tag{8}$$

with $K$ the total number of included studies.

$$\tau^2 = \frac{Q - \mathsf{df}}{C}, \tag{9}$$

with $\mathsf{df} = K - 1$ the degrees of freedom.

The random-effects model takes into account the differences between the studies, so the weights are equal to the inverse of the addition between the within-study variance (the variance of the ES) and the between-studies variance as presented in eq. (10):

$$w_k = \frac{1}{\sigma^2(\mathsf{ES}_k) + \tau^2}. \tag{10}$$

## 1.4 Compute the summary effect

Eventually, the weighted average of the $K$ ES was computed to obtain the Se as described in eq. (11) [Borenstein et al., 2009]:

$$\mathsf{Se} = \frac{\sum_{k=1}^{K} w_k \mathsf{ES}_k}{\sum_{k=1}^{K} w_k}. \tag{11}$$

Once the Se is obtained, we can compute its variance, its standard error, its 95% confidence interval, its p-value, and $I^2$ estimating effects size's between studies heterogeneity.

# 2 Scales used for replication

Table 1: Clinical scales used to update Cortese et al. [2016] with our choices and the two new articles.

| Study | Outcome | Score Names - Parents ratings | Score Names - Teachers ratings |
|---|---|---|---|
| Arnold et al. | Total | SNAP IV | SNAP IV |
| | Inattention | SNAP IV | SNAP IV |
| | Hyperactivity | SNAP IV | SNAP IV |
| Bakhshayesh et al. | Total | German ADHD-RS | German ADHD-RS |
| | Inattention | German ADHD-RS | German ADHD-RS |
| | Hyperactivity | German ADHD-RS | German ADHD-RS |
| Baumeister et al. | Total | DISYPS | - |
| Beauregard and Levesque | Total | CPRS | - |
| | Inattention | CPRS | - |
| | Hyperactivity | CPRS | - |
| Bink et al. | Total | ADHD-RS self report | - |
| | Inattention | ADHD-RS self report | - |
| | Hyperactivity | ADHD-RS self report | - |
| Christiansen et al. | Total | Conners-3 Parents | Conners-3 Teachers |
| Gevensleben et al. | Total | German ADHD-RS | German ADHD-RS |
| | Inattention | German ADHD-RS | German ADHD-RS |
| | Hyperactivity | German ADHD-RS | German ADHD-RS |
| Heinrich et al. | Total | German ADHD-RS | - |
| Holtmann et al. | Total | German ADHD-RS | - |
| | Inattention | German ADHD-RS | - |
| | Hyperactivity | German ADHD-RS | - |
| Linden et al. | Total | IOWA Conners | - |
| | Inattention | IOWA Conners | - |
| Maurizio et al. | Total | CPRS | CTRS |
| | Inattention | CPRS | CTRS |
| | Hyperactivity | CPRS | CTRS |
| Steiner et al. | Total | Conners Rating Scales Revised | Conners Rating Scales Revised |
| | Inattention | Conners Rating Scales Revised | Conners Rating Scales Revised |
| | Hyperactivity | Conners Rating Scales Revised | Conners Rating Scales Revised |
| Steiner et al. | Total | Conners-3 Parents | Conners-3 Teachers |
| | Inattention | Conners-3 Parents | Conners-3 Teachers |
| | Hyperactivity | Conners-3 Parents | Conners-3 Teachers |
| Strehl et al. | Total | German ADHD-RS | German ADHD-RS |
| | Inattention | German ADHD-RS | German ADHD-RS |
| | Hyperactivity | German ADHD-RS | German ADHD-RS |
| van Dongen-Boomsma et al. | Total | ADHD RS | ADHD RS |
| | Inattention | ADHD RS | ADHD RS |
| | Hyperactivity | ADHD RS | ADHD RS |

SNAP: Wanson, Nolan and Pelham Questionnaire, ADHD-RS: ADHD Rating Scale, CPRS: Conners Parent Rating Scale, CTRS: Conners Teacher Rating Scale, BOSS Classroom Observation: Behavioral Observation of Students in Schools, DISYPS: Diagnostic System of Mental Disorders in Children and Adolescents

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