Supplemental Material

Association between Long-Term Air Pollution, Chronic Traffic Noise, and Resting-State Functional Connectivity in the 1000BRAINS Study

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Table S2. Estimates of the associations between an interquartile range increase in mean air pollution exposure or an 10 dB(A) increase in mean noise level and network segregation, intra-network FC and internetwork FC for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual) with increasing model adjustment.

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Table S4. Estimates of the associations between a 10 dB(A) increase in mean noise level with different thresholds and network segregation for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual). All models were adjusted for age at fMRI, sex, BMI, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure, alcohol consumption, individual SES, neighborhood SES and PM$_{2.5}$ absorbance. Noise variables were partially bound continuous variables with a lower cut-off value of 50 dB(A) and 45 dB(A) for $L_{den}$, 45 dB(A) and 35 dB(A) for $L_{night}$ with all noise values lower than the defined threshold being set to the threshold value.
Table S5. Estimates of the associations between a 10 dB(A) increase in mean indoor or outdoor noise level and network segregation for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual) in 522 participants. All models were adjusted for age at fMRI, sex, BMI, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure, alcohol consumption, individual SES, neighborhood SES and PM$_{2.5}$ absorbance. Noise variables were partially bound continuous variables with a lower cut-off value of 50 dB(A) for outdoor $L_{den}$, 45 dB(A) for $L_{night}$ and indoor $L_{den}$, 20 dB(A) and 10 dB(A) for $L_{night}$ with all noise values lower than the defined threshold being set to the threshold value.

Table S6. Estimates of the associations between an interquartile range increase in mean air pollution exposure or a 10 dB(A) increase in mean noise level and network segregation, intranetwork FC and internetwork FC for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual) adjusted using inverse probability weights. Air pollution models were further adjusted for 24-h outdoor noise and noise models were adjusted for PM$_{2.5}$ absorbance.

Table S7. Estimates of the associations between air pollution, noise from 2006-2008 and altered network segregation, intranetwork FC and internetwork FC in seven established networks (default, dorsal and ventral attention, frontoparietal, limbic, Sensorimotor, and visual) from 2011-2015. Models were adjusted for age at fMRI, sex, body mass index, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure and alcohol consumption, individual and neighborhood SES. Air pollution models were further adjusted for 24-h outdoor noise and noise models were adjusted for PM$_{2.5}$ absorbance.

Figure S1. Timeline of exposure and outcome assessments: Marked fields display when the specific elements of the study were conducted.

Figure S2. Directed Acyclic Graph: The graph displays the possible relationship between air pollution exposure (AP Exposure) and functional brain connectivity (Functional_Connectivity). An arrow between two variables represents a possible cause-effect relationship. Variable that are “upstream” from the exposure (air pollution) and outcome (functional connectivity) are colored in red. Variables in blue are “upstream” from the outcome (functional connectivity). Variables in grey are unobserved.
Figure S3. **Categorization of Confidence Intervals for Summarization Plot:** Confidence limits resulting from the analysis of associations between air pollution, noise and FC Metrics (network segregation, intra- and internetwork FC) were categorized into ten categories. For this, the direction of the effect size and the quality of estimation (width of confidence interval) were considered. First, for each estimate, confidence intervals were divided into eight equally sized segments. Depending on the location of the zero value in segments, these eight segments plus two categories for confidence limits completely above or below the zero value, formed ten categories. Although, confidence limits in category eight display higher effect estimates than confidence limits in category nine, confidence limits in category eight are wider and display more uncertainty. Subsequently, each category was assigned a color and/or texture displaying possible decrease (confidence interval mostly below zero) to increase (confidence interval mostly above zero). Furthermore, to avoid graphically overestimating effects, confidence limits with effect estimates very close to zero (category 4 to 7) were grouped into one category (white).

Figure S4. **Derivation of Study Population Flowchart.**

Figure S5. **Adjustments Sets for the Segregation Index:** Associations between an interquartile range (IQR) increase in mean air pollution exposure or a 10 dB(A) increase in mean noise level and network segregation for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual). Model 1 was adjusted for sex and age at time of fMRI scan. Model 2 was further adjusted for BMI, smoking status, physical activity, alcohol consumption and diet. In Model 3 we further adjusted Model 2 for individual SES and neighborhood SES. In Model 2 and 3 air pollution models were further adjusted for 24-h outdoor noise and noise models were adjusted for PM2.5 absorbance. Estimates are shown for an IQR increase of 2.0 μg/m³ for PM10, of 1.4 μg/m³ for PM2.5, of 0.3 10⁻⁵/m for PM2.5abs, of 613 n/mL for PMAM and of 5.2 μg/m³ for NO₂.

Figure S6. **Sensitivity Analyses – Noise Thresholds:** Associations between a 10 dB(A) increase in mean noise level with different thresholds and network segregation for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual). All models were adjusted for age at fMRI, sex, BMI, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure, alcohol consumption, individual SES, neighborhood SES and PM2.5 absorbance. Noise variables were partially bound continuous variables with a lower cut-off value of 50 dB(A) and 45 dB(A) for L-den, 45 dB(A) and 35 dB(A) for L-night with all noise values lower than the defined threshold being set to the threshold value.

Figure S7. **Sensitivity Analyses – Indoor vs. Outdoor Noise:** Associations between a 10 dB(A) increase in mean indoor or outdoor noise level with different thresholds and network segregation for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual) in 522 participants. All models were adjusted for age at fMRI, sex, BMI, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure, alcohol consumption, individual SES, neighborhood SES and PM2.5 absorbance. Noise variables were partially bound continuous variables with a lower cut-off value of 50 dB(A) for outdoor L-den, 45 dB(A) for L-night and indoor L-den, 20 dB(A) and 10 dB(A) for L-night with all noise values lower than the defined threshold being set to the threshold value.
**Figure S8. Sensitivity Analyses – Inverse Probability Weighting:** Associations between an interquartile range (IQR) increase in mean air pollution exposure or a 10 dB(A) increase in mean noise level and network segregation for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual) adjusted using inverse probability weights. Air pollution models were further adjusted for 24-h outdoor noise and noise models were adjusted for PM$_{2.5}$ absorbance. Estimates are shown for an IQR increase of 2.0 μg/m$^3$ for PM$_{10}$, of 1.4 μg/m$^3$ for PM$_{2.5}$, of 0.3 10$^{-5}$/m for PM$_{2.5abs}$, of 613 n/mL for PM$_{AM}$ and of 5.2 μg/m$^3$ for NO$_2$.

**Figure S9. Sensitivity Analyses - Exposure from HNR- FU1:** Associations between air pollution, noise from 2006-2008 and altered network segregation, intra- and internetwork FC in seven established networks (default, dorsal and ventral attention, frontoparietal, limbic, Sensorimotor, and visual) from 2011-2015. All models were adjusted for age at fMRI, sex, body mass index, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure and alcohol consumption, individual and neighborhood SES. Air pollution models were further adjusted for 24-h outdoor noise and noise models were adjusted for PM$_{2.5}$ absorbance. Estimates are shown for an IQR increase of 2.0 μg/m$^3$ for PM$_{10}$, of 1.4 μg/m$^3$ for PM$_{2.5}$, of 0.3 10$^{-5}$/m for PM$_{2.5abs}$, of 613 n/mL for PM$_{AM}$ and of 5.2 μg/m$^3$ for NO$_2$.

**R-Code to Categorize Confidence Limits for Summarization Plot**
Table S1: Comparison of sociodemographic and exposure characteristics for all participants that participated at the 10-year HNR follow-up examination (n=3,087), the 1000BRAINS participants included (n=574) in the analyses, and the 1000BRAINS participants excluded from current analyses (n=111), with variables collected at HNR baseline examination (2000-2003), except for age at MRI.

| Variables                        | Excluded (n=111) | Included (n=574) | Participants of 10 y-Examination (n=3,087) |
|----------------------------------|------------------|------------------|-------------------------------------------|
|                                  | Mean ± SD or Median [IQR] or n (%) | Mean ± SD or Median [IQR] or n (%) | Mean ± SD or Median [IQR] or n (%) |
| Age at HNR Baseline (years)      | 57.2 ± 7.4       | 56.1 ± 6.6       | 58.4 ± 7.3                                 |
| Age at fMRT (years)              | 68.8 ± 7.7       | 67.4 ± 6.6       |                                            |
| Gender                           |                  |                  |                                            |
| Female                           | 52 (46.8%)       | 253 (44.1%)      | 1,580 (51.2%)                              |
| Male                             | 59 (53.2%)       | 321 (55.9%)      | 1,507 (48.8%)                              |
| BMI (kg/m²)                      | 27.8 ± 4.39      | 27.1 ± 3.99      | 27.5 ± 4.36                                |
| Missing                          | 1 (0.9%)         | 0 (0%)           | 13 (0.4%)                                  |
| Physical Activity                |                  |                  |                                            |
| Yes                              | 62 (55.9%)       | 368 (64.1%)      | 1,833 (59.4%)                              |
| No                               | 49 (44.1%)       | 206 (35.9%)      | 1,254 (40.6%)                              |
| Nutrition Index                  | 12.6 ± 2.61      | 12.2 ± 3.10      | 12.7 ± 3.12                                |
| Missing                          | 4 (3.6%)         | 0 (0%)           | 42 (1.4%)                                  |
| Environmental Tobacco Smoke Exposure |                |                  |                                            |
| Yes                              | 40 (36.0%)       | 216 (37.6%)      | 1,085 (35.1%)                              |
| No                               | 71 (64.0%)       | 358 (62.4%)      | 2,002 (64.9%)                              |
| Missing                          | 0 (0%)           | 0 (0%)           | 3 (0.1%)                                   |
| Smoking Status                   |                  |                  |                                            |
| Never smoker                     | 54 (48.6%)       | 240 (41.8%)      | 1,348 (43.7%)                              |
| Ex-smoker                        | 36 (32.4%)       | 220 (38.3%)      | 1,127 (36.5%)                              |
| Current smoker                   | 21 (18.9%)       | 114 (19.9%)      | 612 (19.8%)                                |
| Cumulative Smoking (pack-years)  | 19.9 [27.8]      | 18.0 [24.1]      | 19.3 [28.0]                                |
| Alcohol consumption              |                  |                  |                                            |
| Never                            | 46 (41.4%)       | 209 (36.4%)      | 1,418 (45.9%)                              |
| 1-3 drinks/week                  | 13 (11.7%)       | 95 (16.6%)       | 486 (15.7%)                                |
Table S1 (Continued):

|                 | BMI >3-6 drinks/week | BMI >6-14 drinks/week | BMI >14 drinks/week | BMI Missing |
|-----------------|----------------------|-----------------------|---------------------|------------|
|                 | 11 (9.9%)            | 85 (14.8%)            | 344 (11.1%)         |            |
|                 |                      |                       |                     |            |
| Education       |                      |                       |                     |            |
| ≤ 10 years      | 8 (7.2%)             | 29 (5.1%)             | 266 (8.6%)          |            |
| 11-13 years     | 65 (58.6%)           | 290 (50.5%)           | 1,698 (55.0%)       |            |
| 14-17 years     | 22 (19.8%)           | 153 (26.7%)           | 725 (23.5%)         |            |
| ≥ 18 years      | 16 (14.4%)           | 102 (17.8%)           | 394 (12.8%)         |            |
|                 | 0 (0%)               | 0 (0%)                | 4 (0.1%)            |            |
| Neighborhood Unemployment (%) | 12.7 ± 3.34 | 12.0 ± 3.27 | 12.3 ± 3.37 |
| Coronary Heart Disease |            |                      |                     |            |
| Yes             | 3 (2.7%)             | 3 (0.5%)              | 147 (4.8%)          |            |
| No              | 108 (97.3%)          | 571 (99.5%)           | 2,940 (95.2%)       |            |
| Diabetes        |                      |                       |                     |            |
| Yes             | 8 (7.2%)             | 49 (8.5%)             | 318 (10.3%)         |            |
| No              | 103 (92.8%)          | 525 (91.5%)           | 2,769 (89.7%)       |            |

Abbreviations: BMI, body mass index; fMRI, functional magnetic resonance imaging; HNR, Heinz-Nixdorf Recall; IQR, interquartile range; MRI magnetic resonance imaging; SD, standard deviation
Table S2: Estimates of the associations between an interquartile range increase in mean air pollution exposure or an 10 dB(A) increase in mean noise level and network segregation, intra-network FC and internetwork FC for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual) with increasing model adjustment.

| Model     | Network          | Segregation Index      | Intra-network FC       | Internetwork FC      |
|-----------|------------------|------------------------|------------------------|----------------------|
| PM$_{10}$ |                  |                        |                        |                      |
| Crude$^a$ | Default          | -0.0012 (-0.0156, 0.0132) | 0.0057 (-0.0025, 0.0140) | 0.0039 (-0.0031, 0.0109) |
| Model1$^b$ | Default         | -0.0020 (-0.0165, 0.0125) | 0.0044 (-0.0038, 0.0126) | 0.0034 (-0.0036, 0.0104) |
| Model2$^c$ | Default         | 0.0024 (-0.0124, 0.0172)  | 0.0059 (-0.0026, 0.0143) | 0.0025 (-0.0048, 0.0097) |
| Model3$^d$ | Default         | 0.0038 (-0.0129, 0.0205)  | 0.0043 (-0.0051, 0.0138) | 0.0010 (-0.0071, 0.0092) |
| Crude$^a$ | Dorsal Attention | -0.0122 (-0.0263, 0.0018) | -0.0025 (-0.0138, 0.0087) | 0.0042 (-0.0023, 0.0107) |
| Model1$^b$ | Dorsal Attention | -0.0120 (-0.0260, 0.0020) | -0.0026 (-0.0139, 0.0087) | 0.0039 (-0.0027, 0.0104) |
| Model2$^c$ | Dorsal Attention | -0.0097 (-0.0241, 0.0047) | -0.0020 (-0.0137, 0.0097) | 0.0029 (-0.0038, 0.0096) |
| Model3$^d$ | Dorsal Attention | -0.0079 (-0.0241, 0.0083) | -0.0031 (-0.0161, 0.0100) | 0.0013 (-0.0063, 0.0088) |
| Crude$^a$ | Frontoparietal   | -0.0098 (-0.0225, 0.0029) | -0.0006 (-0.0096, 0.0085) | 0.0040 (-0.0028, 0.0108) |
| Model1$^b$ | Frontoparietal   | -0.0091 (-0.0218, 0.0036) | -0.0009 (-0.0100, 0.0082) | 0.0034 (-0.0034, 0.0103) |
| Model2$^c$ | Frontoparietal   | -0.0062 (-0.0192, 0.0068) | -0.0007 (-0.0100, 0.0087) | 0.0025 (-0.0046, 0.0095) |
| Model3$^d$ | Frontoparietal   | 0.0010 (-0.0136, 0.0157)  | -0.0001 (-0.0106, 0.0104) | 0.0003 (-0.0076, 0.0082) |
| Crude$^a$ | Limbic           | -0.0074 (-0.0249, 0.0102) | -0.0007 (-0.0144, 0.0131) | 0.0024 (-0.0038, 0.0085) |
| Model1$^b$ | Limbic           | -0.0040 (-0.0215, 0.0134) | 0.0011 (-0.0127, 0.0149)  | 0.0017 (-0.0045, 0.008)  |
| Model2$^c$ | Limbic           | -0.0056 (-0.0235, 0.0123) | -0.0010 (-0.0151, 0.0132) | 0.0013 (-0.0051, 0.0077) |
| Model3$^d$ | Limbic           | 0.0016 (-0.0185, 0.0217)  | 0.0016 (-0.0144, 0.0176)  | -0.0019 (-0.0091, 0.0053) |
| Crude$^a$ | Sensorimotor     | -0.0135 (-0.0270, 0.0001) | -0.0099 (-0.0245, 0.0047) | 0.0045 (-0.0023, 0.0112) |
| Model1$^b$ | Sensorimotor     | -0.0122 (-0.0256, 0.0012) | -0.0095 (-0.0241, 0.0052) | 0.0041 (-0.0027, 0.0109) |
| Model2$^c$ | Sensorimotor     | -0.0094 (-0.0231, 0.0044) | -0.0081 (-0.0231, 0.0069) | 0.0033 (-0.0037, 0.0103) |
| Model3$^d$ | Sensorimotor     | -0.0071 (-0.0226, 0.0084) | -0.0092 (-0.0261, 0.0077) | 0.0012 (-0.0066, 0.0091) |
| Crude$^a$ | Ventral Attention | -0.0072 (-0.0206, 0.0061) | -0.0057 (-0.0170, 0.0056) | 0.0031 (-0.0036, 0.0099) |
| Model1$^b$ | Ventral Attention | -0.0078 (-0.0211, 0.0055) | -0.0067 (-0.0181, 0.0047) | 0.0027 (-0.0041, 0.0095) |
| Model2$^c$ | Ventral Attention | -0.0070 (-0.0206, 0.0067)  | -0.0081 (-0.0198, 0.0036) | 0.0018 (-0.0053, 0.0088) |
| Model3$^d$ | Ventral Attention | -0.0070 (-0.0224, 0.0084)  | -0.0124 (-0.0256, 0.0007) | -0.0002 (-0.0081, 0.0077) |
| Crude$^a$ | Visual           | -0.0031 (-0.0194, 0.0131)  | 0.0082 (-0.0125, 0.0288)  | 0.0067 (0.0003, 0.0131)  |
| Model1$^b$ | Visual           | -0.0019 (-0.0181, 0.0143)  | 0.0085 (-0.0122, 0.0292)  | 0.0061 (-0.0003, 0.0125) |
| Model | Region | PM$_{2.5}$ |
|-------|--------|------------|
| Model2 | Visual | 0.0024 (-0.0141, 0.0189) |
| Model3 | Visual | 0.0090 (-0.0095, 0.0275) |

PM$_{2.5}$

| Model | Region | PM$_{2.5}$ |
|-------|--------|------------|
| Crude | Default | -0.0031 (-0.0204, 0.0142) |
| Model1 | Default | -0.0037 (-0.0210, 0.0136) |
| Model2 | Default | 0.0028 (-0.0152, 0.0207) |
| Model3 | Default | 0.0059 (-0.0152, 0.0270) |
| Crude | Dorsal Attention | -0.0094 (-0.0262, 0.0074) |
| Model1 | Dorsal Attention | -0.0094 (-0.0262, 0.0074) |
| Model2 | Dorsal Attention | -0.0055 (-0.0230, 0.0120) |
| Model3 | Dorsal Attention | -0.0024 (-0.0229, 0.0180) |
| Crude | Frontoparietal | -0.0138 (-0.0290, 0.0014) |
| Model1 | Frontoparietal | -0.0133 (-0.0285, 0.0019) |
| Model2 | Frontoparietal | -0.0100 (-0.0258, 0.0058) |
| Model3 | Frontoparietal | 0.0002 (-0.0183, 0.0187) |
| Crude | Limbic | -0.0151 (-0.0361, 0.0060) |
| Model1 | Limbic | -0.0122 (-0.0330, 0.0087) |
| Model2 | Limbic | -0.0148 (-0.0365, 0.0069) |
| Model3 | Limbic | -0.0066 (-0.0320, 0.0188) |
| Crude | Sensorimotor | -0.0184 (-0.0346, -0.0022) |
| Model1 | Sensorimotor | -0.0174 (-0.0335, -0.0014) |
| Model2 | Sensorimotor | -0.0137 (-0.0303, 0.0030) |
| Model3 | Sensorimotor | -0.0111 (-0.0307, 0.0085) |
| Crude | Ventral Attention | -0.0084 (-0.0244, 0.0076) |
| Model1 | Ventral Attention | -0.0091 (-0.0250, 0.0069) |
| Model2 | Ventral Attention | -0.0072 (-0.0238, 0.0093) |
| Model3 | Ventral Attention | -0.0065 (-0.0260, 0.0129) |
| Crude | Visual | -0.0053 (-0.0247, 0.0142) |
| Model1 | Visual | -0.0045 (-0.0238, 0.0149) |
| Model2 | Visual | 0.0017 (-0.0182, 0.0217) |
| Model3 | Visual | 0.0127 (-0.0106, 0.0361) |
Table S2: (Continued):

|                  | PM2.5abs          |                  |                  |                  |                  |
|------------------|-------------------|------------------|------------------|------------------|------------------|
| Crude            | Default           | -0.0075 (-0.0207, 0.0058) | 0.0054 (-0.0022, 0.0129) | 0.0060 (-0.0004, 0.0124) |
| Model1           | Default           | -0.0080 (-0.0213, 0.0052) | 0.0046 (-0.0029, 0.0121) | 0.0058 (-0.0006, 0.0122) |
| Model2           | Default           | -0.0029 (-0.0173, 0.0115) | 0.0064 (-0.0018, 0.0146) | 0.0047 (-0.0023, 0.0116) |
| Model3           | Default           | -0.0025 (-0.0186, 0.0137) | 0.0052 (-0.0039, 0.0144) | 0.0038 (-0.0040, 0.0117) |
| Crude            | Dorsal Attention  | -0.0125 (-0.0254, 0.0004) | -0.0001 (-0.0015, 0.0102) | 0.0061 (0.0002, 0.0121) |
| Model1           | Dorsal Attention  | -0.0125 (-0.0254, 0.0003) | -0.0002 (-0.0010, 0.0101) | 0.006 (0.0000, 0.0119) |
| Model2           | Dorsal Attention  | -0.0096 (-0.0236, 0.0044) | 0.0003 (-0.0011, 0.0117) | 0.0049 (-0.0016, 0.0114) |
| Model3           | Dorsal Attention  | -0.0083 (-0.0240, 0.0073) | -0.0006 (-0.0013, 0.0121) | 0.0038 (-0.0034, 0.0111) |
| Crude            | Frontoparietal    | -0.0148 (-0.0264, -0.0032) | 0.0005 (-0.0079, 0.0088) | 0.0064 (0.0002, 0.0127) |
| Model1           | Frontoparietal    | -0.0146 (-0.0262, -0.0030) | 0.0002 (-0.0081, 0.0085) | 0.0061 (-0.0001, 0.0124) |
| Model2           | Frontoparietal    | -0.0101 (-0.0227, 0.0026) | 0.0011 (-0.0080, 0.0101) | 0.0048 (-0.0020, 0.0116) |
| Model3           | Frontoparietal    | -0.0039 (-0.0181, 0.0102) | 0.0023 (-0.0078, 0.0125) | 0.0035 (-0.0041, 0.0111) |
| Crude            | Limbic            | -0.0082 (-0.0244, 0.0079) | 0.0033 (-0.0093, 0.0160) | 0.0052 (-0.0005, 0.0108) |
| Model1           | Limbic            | -0.0065 (-0.0225, 0.0095) | 0.0044 (-0.0083, 0.0170) | 0.0049 (-0.0008, 0.0106) |
| Model2           | Limbic            | -0.0080 (-0.0254, 0.0093) | 0.0026 (-0.0111, 0.0164) | 0.0046 (-0.0016, 0.0108) |
| Model3           | Limbic            | -0.0015 (-0.0210, 0.0179) | 0.0061 (-0.0093, 0.0216) | 0.0024 (-0.0046, 0.0093) |
| Crude            | Sensorimotor      | -0.0132 (-0.0256, -0.0007) | -0.0063 (-0.0197, 0.0071) | 0.0064 (0.0002, 0.0126) |
| Model1           | Sensorimotor      | -0.0127 (-0.0250, -0.0004) | -0.0063 (-0.0197, 0.0072) | 0.0063 (0.0001, 0.0125) |
| Model2           | Sensorimotor      | -0.0083 (-0.0217, 0.0051) | -0.0034 (-0.0180, 0.0112) | 0.0054 (-0.0014, 0.0122) |
| Model3           | Sensorimotor      | -0.0057 (-0.0207, 0.0094) | -0.0031 (-0.0194, 0.0132) | 0.0041 (-0.0035, 0.0117) |
| Crude            | Ventral Attention | -0.0110 (-0.0232, 0.0012) | -0.0024 (-0.0128, 0.0080) | 0.0059 (-0.0003, 0.0121) |
| Model1           | Ventral Attention | -0.0116 (-0.0237, 0.0006) | -0.0030 (-0.0135, 0.0074) | 0.0057 (-0.0005, 0.0120) |
| Model2           | Ventral Attention | -0.0123 (-0.0255, 0.0009) | -0.0054 (-0.0167, 0.0060) | 0.0051 (-0.0017, 0.0119) |
| Model3           | Ventral Attention | -0.0133 (-0.0281, 0.0016) | -0.0085 (-0.0213, 0.0043) | 0.0041 (-0.0035, 0.0117) |
| Crude            | Visual            | -0.0150 (-0.0299, -0.0001) | -0.0014 (-0.0204, 0.0176) | 0.0083 (0.0024, 0.0141) |
| Model1           | Visual            | -0.0146 (-0.0294, 0.0001) | -0.0016 (-0.0206, 0.0174) | 0.008 (0.0021, 0.0138) |
| Model2           | Visual            | -0.0061 (-0.0221, 0.0099) | 0.0087 (-0.0118, 0.0292) | 0.0070 (0.0006, 0.0134) |
| Model3           | Visual            | -0.0014 (-0.0193, 0.0165) | 0.0101 (-0.0128, 0.0329) | 0.0063 (-0.0009, 0.0134) |

|                  | PMAM              |                  |                  |                  |                  |
| Crude            | Default           | -0.0145 (-0.0328, 0.0037) | 0.0003 (-0.0101, 0.0108) | 0.0065 (-0.0024, 0.0153) |
Table S2: (Continued):

| Model  | Region            | Effect Size | 95% CI       | p-value     |
|--------|-------------------|-------------|--------------|-------------|
| Model1 | Default           | -0.0148     | (-0.0331, 0.0035) | 0.0008 (-0.0096, 0.0112) | 0.0067 (-0.0021, 0.0156) |
| Model2 | Default           | -0.0096     | (-0.0285, 0.0093) | 0.0015 (-0.0092, 0.0123) | 0.0047 (-0.0045, 0.0139) |
| Model3 | Default           | -0.0089     | (-0.0295, 0.0116) | -0.0007 (-0.0123, 0.0110) | 0.0034 (-0.0066, 0.0134) |
| Crude  | Dorsal Attention  | 0.0025      | (-0.0153, 0.0204) | 0.0104 (-0.0038, 0.0246) | 0.0049 (-0.0033, 0.0131) |
| Model1 | Dorsal Attention  | 0.0012      | (-0.0165, 0.0189) | 0.0100 (-0.0043, 0.0242) | 0.0052 (-0.0030, 0.0134) |
| Model2 | Dorsal Attention  | 0.0057      | (-0.0127, 0.0241) | 0.0111 (-0.0037, 0.0260) | 0.0034 (-0.0052, 0.0119) |
| Model3 | Dorsal Attention  | 0.0081      | (-0.0118, 0.0280) | 0.0102 (-0.0059, 0.0262) | 0.0016 (-0.0076, 0.0109) |
| Crude  | Frontoparietal    | -0.0131     | (-0.0292, 0.0030) | 0.0018 (-0.0097, 0.0132) | 0.0063 (-0.0023, 0.0150) |
| Model1 | Frontoparietal    | -0.0137     | (-0.0297, 0.0024) | 0.0017 (-0.0098, 0.0132) | 0.0065 (-0.0021, 0.0152) |
| Model2 | Frontoparietal    | -0.0120     | (-0.0286, 0.0046) | 0.0002 (-0.0117, 0.0121) | 0.0048 (-0.0042, 0.0137) |
| Model3 | Frontoparietal    | -0.0045     | (-0.0226, 0.0135) | 0.0019 (-0.0110, 0.0149) | 0.0031 (-0.0066, 0.0128) |
| Crude  | Limbic            | -0.0189     | (-0.0411, 0.0034) | -0.0057 (-0.0231, 0.0118) | 0.0035 (-0.0043, 0.0114) |
| Model1 | Limbic            | -0.0188     | (-0.0408, 0.0032) | -0.0050 (-0.0224, 0.0124) | 0.0038 (-0.0040, 0.0117) |
| Model2 | Limbic            | -0.0210     | (-0.0438, 0.0018) | -0.0093 (-0.0273, 0.0088) | 0.0028 (-0.0054, 0.0109) |
| Model3 | Limbic            | -0.0151     | (-0.0398, 0.0097) | -0.0077 (-0.0274, 0.0119) | 0.0001 (-0.0088, 0.0089) |
| Crude  | Sensorimotor      | -0.0192     | (-0.0364, -0.0021) | -0.0137 (-0.0322, 0.0048) | 0.0047 (-0.0039, 0.0133) |
| Model1 | Sensorimotor      | -0.0203     | (-0.0373, -0.0034) | -0.0145 (-0.0329, 0.0040) | 0.0049 (-0.0036, 0.0135) |
| Model2 | Sensorimotor      | -0.0167     | (-0.0342, 0.0008) | -0.0133 (-0.0324, 0.0059) | 0.0036 (-0.0054, 0.0125) |
| Model3 | Sensorimotor      | -0.0141     | (-0.0332, 0.0049) | -0.0140 (-0.0347, 0.0068) | 0.0017 (-0.0080, 0.0114) |
| Crude  | Ventral Attention | -0.0189     | (-0.0357, -0.0020) | -0.0115 (-0.0259, 0.0028) | 0.0040 (-0.0045, 0.0126) |
| Model1 | Ventral Attention | -0.0202     | (-0.0369, -0.0034) | -0.0122 (-0.0266, 0.0021) | 0.0043 (-0.0043, 0.0128) |
| Model2 | Ventral Attention | -0.0182     | (-0.0355, -0.0008) | -0.0142 (-0.0292, 0.0007) | 0.0023 (-0.0067, 0.0112) |
| Model3 | Ventral Attention | -0.0184     | (-0.0372, 0.0005) | -0.0176 (-0.0338, 0.0014) | 0.0006 (-0.0091, 0.0103) |
| Crude  | Visual            | -0.0086     | (-0.0293, 0.0120) | 0.0037 (-0.0225, 0.0299) | 0.0056 (-0.0025, 0.0137) |
| Model1 | Visual            | -0.0102     | (-0.0306, 0.0103) | 0.0030 (-0.0232, 0.0292) | 0.0058 (-0.0023, 0.0140) |
| Model2 | Visual            | -0.0049     | (-0.0259, 0.0161) | 0.0065 (-0.0240, 0.0335) | 0.0038 (-0.0046, 0.0122) |
| Model3 | Visual            | 0.0025      | (-0.0203, 0.0253) | 0.0101 (-0.0190, 0.0392) | 0.0018 (-0.0074, 0.0110) |

NO₂

| Model  | Region            | Effect Size | 95% CI       | p-value     |
|--------|-------------------|-------------|--------------|-------------|
| Crude  | Default           | -0.0117     | (-0.0270, 0.0036) | 0.0029 (-0.0059, 0.0117) | 0.0066 (-0.0008, 0.0140) |
| Model1 | Default           | -0.0124     | (-0.0277, 0.0029) | 0.0017 (-0.0071, 0.0104) | 0.0061 (-0.0013, 0.0136) |
| Model2 | Default           | -0.0068     | (-0.0234, 0.0098) | 0.0024 (-0.0071, 0.0118) | 0.0043 (-0.0037, 0.0124) |
| Model     | Region          | Default | Dorsal Attention | Ventral Attention | Frontoparietal | Sensorimotor | Limbic | Visual | Dist_men <100m vs. >200m |
|-----------|-----------------|---------|------------------|-------------------|----------------|--------------|--------|--------|--------------------------|
| Model3    | Default         | -0.0064 (-0.0242, 0.0114) | 0.0009 (-0.0092, 0.0109) | 0.0034 (-0.0052, 0.0121) |
| Crude     | Dorsal Attention| -0.0183 (-0.0332, -0.0035) | -0.0095 (-0.0214, 0.0024) | 0.0029 (-0.0039, 0.0098) |
| Model1    | Dorsal Attention| -0.0181 (-0.0329, -0.0033) | -0.0095 (-0.0215, 0.0024) | 0.0026 (-0.0043, 0.0095) |
| Model2    | Dorsal Attention| -0.0163 (-0.0324, -0.0001) | -0.0114 (-0.0244, 0.0017) | 0.0005 (-0.0070, 0.0080) |
| Model3    | Dorsal Attention| -0.0163 (-0.0335, 0.0008) | -0.0139 (-0.0278, -0.0001) | -0.0010 (-0.0091, 0.0070) |
| Crude     | Frontoparietal  | -0.0104 (-0.0239, 0.0030) | 0.0013 (-0.0083, 0.0109) | 0.0054 (-0.0018, 0.0126) |
| Model1    | Frontoparietal  | -0.0098 (-0.0233, 0.0037) | 0.0010 (-0.0086, 0.0107) | 0.0049 (-0.0024, 0.0121) |
| Model2    | Frontoparietal  | -0.0038 (-0.0184, 0.0108) | 0.0005 (-0.0100, 0.0109) | 0.0022 (-0.0057, 0.0100) |
| Model3    | Frontoparietal  | 0.0029 (-0.0127, 0.0184)  | 0.0018 (-0.0093, 0.0130) | 0.0007 (-0.0077, 0.0091) |
| Crude     | Limbic          | -0.0118 (-0.0304, 0.0068) | -0.0019 (-0.0165, 0.0127) | 0.0019 (-0.0047, 0.0085) |
| Model1    | Limbic          | -0.0088 (-0.0273, 0.0098) | -0.0003 (-0.0150, 0.0143) | 0.0013 (-0.0053, 0.0079) |
| Model2    | Limbic          | -0.0113 (-0.0313, 0.0088) | -0.0036 (-0.0195, 0.0122) | 0.0001 (-0.0071, 0.0073) |
| Model3    | Limbic          | -0.0060 (-0.0274, 0.0154) | -0.0020 (-0.0190, 0.0150) | -0.0024 (-0.0101, 0.0052) |
| Crude     | Sensorimotor    | -0.0137 (-0.0281, 0.0007) | -0.0148 (-0.0303, 0.0007) | 0.0030 (-0.0041, 0.0102) |
| Model1    | Sensorimotor    | -0.0125 (-0.0267, 0.0018) | -0.0144 (-0.0300, 0.0011) | 0.0027 (-0.0045, 0.0099) |
| Model2    | Sensorimotor    | -0.0060 (-0.0214, 0.0094) | -0.0101 (-0.0269, 0.0067) | 0.0011 (-0.0068, 0.0089) |
| Model3    | Sensorimotor    | -0.0027 (-0.0192, 0.0138) | -0.0098 (-0.0277, 0.0082) | -0.0006 (-0.0090, 0.0078) |
| Crude     | Ventral Attention| -0.0076 (-0.0218, 0.0066) | -0.0008 (-0.0128, 0.0113) | 0.0043 (-0.0029, 0.0114) |
| Model1    | Ventral Attention| -0.0080 (-0.0221, 0.0061) | -0.0016 (-0.0137, 0.0104) | 0.0038 (-0.0034, 0.0110) |
| Model2    | Ventral Attention| -0.0081 (-0.0234, 0.0072) | -0.0044 (-0.0176, 0.0087) | 0.0024 (-0.0055, 0.0102) |
| Model3    | Ventral Attention| -0.0069 (-0.0233, 0.0095) | -0.0058 (-0.0198, 0.0083) | 0.0011 (-0.0073, 0.0095) |
| Crude     | Visual          | -0.0147 (-0.0320, 0.0025) | -0.0045 (-0.0265, 0.0174) | 0.0049 (-0.0019, 0.0117) |
| Model1    | Visual          | -0.0137 (-0.0308, 0.0034) | -0.0043 (-0.0262, 0.0177) | 0.0044 (-0.0024, 0.0112) |
| Model2    | Visual          | -0.0044 (-0.0229, 0.0141) | 0.0058 (-0.0179, 0.0295)  | 0.0028 (-0.0047, 0.0102) |
| Model3    | Visual          | 0.0011 (-0.0186, 0.0208)  | 0.0080 (-0.0171, 0.0322)  | 0.0011 (-0.0068, 0.0090) |
Table S2: (Continued):

| Dist_{trafroad} | 100-200m vs. >200m |
|-----------------|---------------------|
| Crude a | Default | -0.0362 ( -0.0977 , 0.0253 ) | -0.0219 ( -0.0572 , 0.0134 ) | 0.0056 ( -0.0243 , 0.0354 ) |
| Model1 b | Dorsal Attention | -0.0334 ( -0.095 , 0.0281 ) | -0.0214 ( -0.0564 , 0.0135 ) | 0.0050 ( -0.0248 , 0.0348 ) |
| Model2 c | Dorsal Attention | -0.0321 ( -0.0943 , 0.0301 ) | -0.0271 ( -0.0625 , 0.0082 ) | 0.0011 ( -0.0292 , 0.0314 ) |
| Model3 d | Default | -0.0334 ( -0.0962 , 0.0293 ) | -0.0300 ( -0.0655 , 0.0055 ) | 0.0001 ( -0.0304 , 0.0306 ) |
| Crude a | Dorsal Attention | -0.0033 ( -0.0904 , 0.0297 ) | -0.0045 ( -0.0526 , 0.0436 ) | 0.0140 ( -0.0136 , 0.0417 ) |
| Model1 b | Dorsal Attention | -0.0274 ( -0.0871 , 0.0323 ) | -0.0031 ( -0.0513 , 0.0451 ) | 0.0140 ( -0.0137 , 0.0417 ) |
| Model2 c | Dorsal Attention | -0.0205 ( -0.0812 , 0.0402 ) | -0.0037 ( -0.0529 , 0.0455 ) | 0.0108 ( -0.0174 , 0.0389 ) |
Table S2: (Continued):

|                | Model3 | Crude | Model2 | Crude | Model1 | Crude | Model1 | Crude | Model3 | Crude |
|----------------|--------|-------|--------|-------|--------|-------|--------|-------|--------|-------|
| Dorsal Attention | -0.0201 (-0.081 , 0.0408) | 0.0028 (-0.0516 , 0.0572) | 0.0057 (-0.0485 , 0.0599) | 0.0131 (-0.0417 , 0.0680) | 0.0152 (-0.0398 , 0.0703) | -0.0525 (-0.1274 , 0.2225) | -0.0522 (-0.1265 , 0.2221) | -0.0462 (-0.1215 , 0.291) | -0.0434 (-0.1190 , 0.323) | -0.0264 (-0.0844 , 0.0316) | -0.0228 (-0.0801 , 0.0346) | -0.0133 (-0.0713 , 0.0446) | -0.0126 (-0.0710 , 0.0458) | -0.0409 (-0.0979 , 0.0161) | -0.0369 (-0.0936 , 0.0198) | -0.0341 (-0.0916 , 0.0233) | -0.0378 (-0.0957 , 0.0200) | -0.0225 (-0.0914 , 0.0465) | -0.0187 (-0.0870 , 0.0497) | -0.0069 (-0.0758 , 0.0621) | -0.0074 (-0.0767 , 0.0618) |
|                |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |        |       |        |       |        |       |
| Ventral Attention |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
|                |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
| Frontoparietal |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
|                |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
| Sensorimotor |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
|                |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
| Limbic |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
|                |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
| Visual |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
|                |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
| Default |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
|                |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
| L_{den} |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |        |       |       |        |       |        |       |        |
Table S2: (Continued):

| Model  | Region          | Parameter | Estimate 1 | Standard Error 1 | Estimate 2 | Standard Error 2 | Estimate 3 | Standard Error 3 | Estimate 4 | Standard Error 4 | Estimate 5 | Standard Error 5 |
|--------|-----------------|-----------|------------|------------------|------------|------------------|------------|------------------|------------|------------------|------------|------------------|
| Model1 | Frontoparietal  | Crude     | -0.0218    | (-0.0386, -0.0051) | -0.0037    | (-0.0158, 0.0083) | 0.0061     | (-0.0029, 0.0152) |
| Model2 | Frontoparietal  | Crude     | -0.0168    | (-0.0348, 0.0012) | -0.0045    | (-0.0174, 0.0084) | 0.0033     | (-0.0064, 0.0129) |
| Model3 | Frontoparietal  | Crude     | -0.0202    | (-0.0373, -0.0032) | -0.0031    | (-0.0155, 0.0092) | 0.0060     | (-0.0032, 0.0153) |
| Crude  | Limbic          | Model1    | 0.0004     | (-0.0229, 0.0238) | 0.0035     | (-0.0148, 0.0218) | 0.0028     | (-0.0054, 0.0110) |
| Model1 | Limbic          | Model2    | 0.0018     | (-0.0214, 0.0249) | 0.0044     | (-0.0139, 0.0226) | 0.0026     | (-0.0056, 0.0108) |
| Model2 | Limbic          | Model3    | 0.0051     | (-0.0196, 0.0299) | 0.0012     | (-0.0184, 0.0208) | -0.0003    | (-0.0091, 0.0086) |
| Crude  | Limbic          | Model3    | 0.0020     | (-0.0217, 0.0256) | 0.0036     | (-0.0151, 0.0223) | 0.0019     | (-0.0065, 0.0103) |
| Model1 | Limbic          | Sensorimotor | -0.0161  | (-0.0341, 0.0019) | -0.0121    | (-0.0315, 0.0073) | 0.0044     | (-0.0046, 0.0134) |
| Model2 | Limbic          | Sensorimotor | -0.0159  | (-0.0337, 0.0018) | -0.0123    | (-0.0316, 0.0071) | 0.0043     | (-0.0047, 0.0133) |
| Model3 | Limbic          | Sensorimotor | -0.0100  | (-0.0290, 0.0091) | -0.0099    | (-0.0307, 0.0109) | 0.0008     | (-0.0088, 0.0105) |
| Model1 | Sensorimotor    | Ventral Attention | 0.0009  | (-0.0169, 0.0187) | 0.0065     | (-0.0085, 0.0216) | 0.0037     | (-0.0053, 0.0127) |
| Model2 | Sensorimotor    | Ventral Attention | 0.0003  | (-0.0174, 0.0179) | 0.0060     | (-0.0091, 0.0211) | 0.0035     | (-0.0054, 0.0125) |
| Model3 | Sensorimotor    | Ventral Attention | 0.0081  | (-0.0107, 0.0270) | 0.0085     | (-0.0078, 0.0247) | 0.0002     | (-0.0094, 0.0099) |
| Model1 | Sensorimotor    | Ventral Attention | 0.0013  | (-0.0168, 0.0194) | 0.0064     | (-0.0091, 0.0218) | 0.0034     | (-0.0058, 0.0126) |
| Crude  | Visual          | Model1    | -0.0315    | (-0.0530, -0.0100) | -0.0323    | (-0.0597, -0.0049) | 0.0048     | (-0.0037, 0.0133) |
| Model1 | Visual          | Model2    | -0.0315    | (-0.0527, -0.0102) | -0.0329    | (-0.0602, -0.0056) | 0.0046     | (-0.0039, 0.0131) |
| Model2 | Visual          | Model3    | -0.0281    | (-0.0509, -0.0053) | -0.0385    | (-0.0677, -0.0093) | 0.0003     | (-0.0088, 0.0094) |
| Model3 | Visual          | Model1    | -0.0275    | (-0.0491, -0.0058) | -0.0292    | (-0.0569, -0.0015) | 0.0041     | (-0.0046, 0.0128) |

L_{right}
Table S2: (Continued):

|       | Model3 | Crude | Model1 | Model2 | Model3 |
|-------|--------|-------|--------|--------|--------|
|       | Frontoparietal |       |        |        |        |
|       | -0.0264 (-0.0492, -0.0036) | -0.0048 (-0.0213, 0.0117) | 0.0073 (-0.0051, 0.0196) |       |       |
|       | Limbic |       |        |        |        |
|       | -0.0016 (-0.0329, 0.0296) | 0.0036 (-0.0209, 0.0281) | 0.0033 (-0.0077, 0.0143) |       |       |
|       | Limbic |       |        |        |        |
|       | -0.0004 (-0.0313, 0.0306) | 0.0045 (-0.0200, 0.0289) | 0.0032 (-0.0078, 0.0141) |       |       |
|       | Limbic |       |        |        |        |
|       | 0.0034 (-0.0296, 0.0364) | 0.0003 (-0.0258, 0.0264) | -0.0005 (-0.0123, 0.0113) |       |       |
|       | Limbic |       |        |        |        |
|       | -0.0005 (-0.0321, 0.0311) | 0.0033 (-0.0217, 0.0283) | 0.0024 (-0.0088, 0.0136) |       |       |
|       | Sensorimotor |       |        |        |        |
|       | -0.0174 (-0.0415, 0.0067) | -0.0131 (-0.0391, 0.0129) | 0.0044 (-0.0076, 0.0164) |       |       |
|       | Sensorimotor |       |        |        |        |
|       | -0.0173 (-0.0411, 0.0065) | -0.0133 (-0.0392, 0.0127) | 0.0043 (-0.0077, 0.0164) |       |       |
|       | Sensorimotor |       |        |        |        |
|       | -0.0095 (-0.0348, 0.0159) | -0.0102 (-0.0379, 0.0175) | -0.0003 (-0.0132, 0.0126) |       |       |
|       | Sensorimotor |       |        |        |        |
|       | -0.0146 (-0.0389, 0.0097) | -0.0080 (-0.0344, 0.0185) | 0.0045 (-0.0078, 0.0168) |       |       |
|       | Ventral Attention |       |        |        |        |
|       | 0.0030 (-0.0208, 0.0267) | 0.0080 (-0.0122, 0.0281) | 0.0036 (-0.0084, 0.0157) |       |       |
|       | Ventral Attention |       |        |        |        |
|       | 0.0023 (-0.0213, 0.0259) | 0.0073 (-0.0128, 0.0275) | 0.0035 (-0.0085, 0.0156) |       |       |
|       | Ventral Attention |       |        |        |        |
|       | 0.0127 (-0.0124, 0.0378) | 0.0105 (-0.0111, 0.0322) | -0.0009 (-0.0137, 0.0120) |       |       |
|       | Ventral Attention |       |        |        |        |
|       | 0.0039 (-0.0203, 0.0280) | 0.0081 (-0.0125, 0.0287) | 0.0034 (-0.0089, 0.0157) |       |       |
|       | Visual |       |        |        |        |
|       | -0.0447 (-0.0734, -0.016) | -0.0473 (-0.0839, -0.0107) | 0.0056 (-0.0058, 0.0170) |       |       |
|       | Visual |       |        |        |        |
|       | -0.0449 (-0.0733, -0.0165) | -0.0476 (-0.0841, -0.0112) | 0.0055 (-0.0059, 0.0168) |       |       |
|       | Visual |       |        |        |        |
|       | -0.0406 (-0.0710, -0.0103) | -0.0549 (-0.0937, -0.0160) | -0.0002 (-0.0124, 0.0120) |       |       |
|       | Visual |       |        |        |        |
|       | -0.0396 (-0.0685, -0.0107) | -0.0423 (-0.0793, -0.0053) | 0.0048 (-0.0068, 0.0165) |       |       |

* The Crude model with no adjustment.
* Model1 with adjustment for sex and age at time of brain scan.
* In addition to the variables in Model1, Model2 was adjusted for BMI, smoking status, physical activity, alcohol consumption and diet. While noise models were additionally adjusted for PM2.5abs, air pollution models were additionally adjusted for L_den.
* In addition to the variables in Model2, Model3 was further adjusted for individual SES and neighborhood SES.

Note: Estimates are shown for an IQR increase of 2.0 μg/m³ for PM₁₀, of 1.4 μg/m³ for PM₂.₅, of 0.3 10⁻⁵/m for PM₂.₅abs, of 613 n/mL for PM_AM, of 5.2 μg/m³ for NO₂ and an 10 dB(A) increase of L_den and L_night.

Abbreviations: BMI, body mass index; dB(A), A-weighted decibels; Disttrafroad, distance from home address to the nearest high-traffic roads; FC, functional connectivity; fMRI, functional magnetic resonance imaging; IQR, interquartile range; L_den, outdoor 24-hour weighted noise; L_night, outdoor nighttime noise; fMRI,
Table S3: Estimates of the associations between age and altered network segregation, intra- and internetwork FC in seven established networks. The models were adjusted for sex, body mass index, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure and alcohol consumption, individual and neighborhood SES. Estimates for a 1-year age increase are shown.

| Network            | Segregation Index | Intra-network FC | Internetwork FC |
|--------------------|-------------------|------------------|-----------------|
| Default            | -0.0006 (-0.0027, 0.0016) | 0.0018 ( 0.0006, 0.0030 ) | 0.0010 (-0.0001, 0.0020 ) |
| Dorsal Attention   | -0.0034 (-0.0055, -0.0013) | -0.0012 (-0.0029, 0.0005) | 0.0009 (-0.0001, 0.0018) |
| Frontoparietal     | -0.0017 (-0.0036, 0.0002)  | 0.0002 (-0.0012, 0.0015)  | 0.0009 (-0.0001, 0.0019)  |
| Limbic             | -0.0017 (-0.0043, 0.0009)  | 0.0006 (-0.0015, 0.0027)  | 0.0011 ( 0.0002, 0.0020 ) |
| Sensorimotor       | -0.0036 (-0.0056, -0.0016) | -0.0025 (-0.0047, -0.0003) | 0.0009 (-0.0001, 0.0019) |
| Ventral Attention  | -0.0031 (-0.0051, -0.0011) | -0.0008 (-0.0025, 0.0009)  | 0.0010 ( 0.0000, 0.0021 ) |
| Visual             | -0.0034 (-0.0058, -0.0010) | -0.0009 (-0.0040, 0.0021)  | 0.0009 (-0.0001, 0.0018)  |

Abbreviations: FC, functional connectivity; SES, socioeconomic status
Table S4: Estimates of the associations between a 10 dB(A) increase in mean noise level with different thresholds and network segregation for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual). All models were adjusted for age at fMRI, sex, BMI, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure, alcohol consumption, individual SES, neighborhood SES and PM$_{2.5}$ absorbance. Noise variables were partially bound continuous variables with a lower cut-off value of 50 dB(A) and 45 dB(A) for $L_{\text{den}}$, 45 dB(A) and 35 dB(A) for $L_{\text{night}}$ with all noise values lower than the defined threshold being set to the threshold value.

| Network          | Exposure          |        |        |        |        |        |
|------------------|-------------------|--------|--------|--------|--------|--------|
|                  | $L_{\text{den50}}$ | $L_{\text{den45}}$ | $L_{\text{night45}}$ | $L_{\text{night35}}$ |        |        |
| Default          | -0.0117 (-0.0312, 0.0077) | -0.0116 (-0.0278, 0.0046) | -0.0135 (-0.0395, 0.0125) | -0.0127 (-0.0292, 0.0038) |        |        |
| Dorsal Attention | -0.0144 (-0.0332, 0.0044) | -0.0095 (-0.0252, 0.0062) | -0.0159 (-0.0411, 0.0092) | -0.0078 (-0.0238, 0.0082) |        |        |
| Frontoparietal   | -0.0196 (-0.0365, -0.0027) | -0.0158 (-0.0299, -0.0017) | -0.0257 (-0.0483, -0.0031) | -0.0158 (-0.0301, -0.0014) |        |        |
| Limbic           | 0.0033 (-0.0201, 0.0267) | 0.0036 (-0.0160, 0.0231) | 0.0012 (-0.0301, 0.0325) | 0.0023 (-0.0176, 0.0222) |        |        |
| Sensorimotor     | -0.0137 (-0.0317, 0.0044) | -0.0117 (-0.0268, 0.0033) | -0.0144 (-0.0385, 0.0097) | -0.0124 (-0.0277, 0.0029) |        |        |
| Ventral Attention| 0.0013 (-0.0166, 0.0192) | 0.0002 (-0.0148, 0.0151) | 0.0037 (-0.0203, 0.0276) | -0.0007 (-0.0159, 0.0145) |        |        |
| Visual           | -0.0270 (-0.0484, -0.0055) | -0.0228 (-0.0407, -0.0049) | -0.0391 (-0.0677, -0.0104) | -0.0251 (-0.0433, -0.0069) |        |        |

Abbreviations: BMI, body mass index; dB(A), A-weighted decibels; FC, functional connectivity; fMRI, functional magnetic resonance imaging; $L_{\text{den50}}$, outdoor 24-hour weighted noise with threshold of 50 dB(A); $L_{\text{den45}}$, outdoor 24-hour weighted noise with threshold of 45 dB(A); $L_{\text{night45}}$ outdoor nighttime noise with threshold of 45 dB(A); $L_{\text{night35}}$ outdoor nighttime noise with threshold of 35 dB(A); PM$_{2.5}$abs, PM$_{2.5}$ absorbance, soot; SES, socioeconomic status.
Table S5: Estimates of the associations between a 10 dB(A) increase in mean indoor or outdoor noise level and network segregation for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual) in 522 participants. All models were adjusted for age at fMRI, sex, BMI, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure, alcohol consumption, individual SES, neighborhood SES and PM$_{2.5}$ absorbance. Noise variables were partially bound continuous variables with a lower cut-off value of 50 dB(A) for outdoor $L_{\text{den}}$, 45 dB(A) for $L_{\text{night}}$ and indoor $L_{\text{den}}$, 20 dB(A) and 10 dB(A) for $L_{\text{night}}$ with all noise values lower than the defined threshold being set to the threshold value.

| Network           | L$_{\text{den}}$       | ln-L$_{\text{den}}$ | L$_{\text{night}}$   | ln-L$_{\text{night}}$ |
|-------------------|-------------------------|---------------------|----------------------|------------------------|
| Default           | -0.0095 (-0.0305, 0.0114) | 0.0000 (-0.0113, 0.0114) | -0.0083 (-0.0363, 0.0196) | 0.0022 (-0.0080, 0.0125) |
| Dorsal Attention  | -0.0066 (-0.0267, 0.0136) | 0.0058 (-0.0051, 0.0167) | -0.0047 (-0.0316, 0.0223) | 0.0063 (-0.0035, 0.0161) |
| Frontoparietal    | -0.0110 (-0.0290, 0.0071) | -0.0094 (-0.0191, 0.0004) | -0.0144 (-0.0385, 0.0096) | -0.0076 (-0.0164, 0.0012) |
| Limbic            | 0.0004 (-0.0248, 0.0255)  | 0.0057 (-0.0079, 0.0193)  | -0.0040 (-0.0375, 0.0296)  | 0.0062 (-0.0061, 0.0185)  |
| Sensorimotor     | -0.0105 (-0.0297, 0.0086) | -0.0002 (-0.0106, 0.0102) | -0.0097 (-0.0353, 0.0158) | 0.0066 (-0.0087, 0.0100) |
| Ventral Attention | 0.0052 (-0.0141, 0.0245)  | -0.0036 (-0.0141, 0.0068) | 0.0095 (-0.0163, 0.0352) | -0.0018 (-0.0112, 0.0077) |
| Visual            | -0.0212 (-0.0444, 0.0021) | -0.0094 (-0.0220, 0.0033) | -0.0310 (-0.0621,-0.0000) | -0.0070 (-0.0183, 0.0044) |

Abbreviations: BMI, body mass index; dB(A), A-weighted decibels; FC, functional connectivity; fMRI, functional magnetic resonance imaging; $L_{\text{den50}}$, outdoor 24-hour weighted noise with threshold 50 dB(A); $L_{\text{night45}}$, outdoor nighttime noise with threshold 45 dB(A); ln-$L_{\text{den20}}$, indoor 24-hour weighted noise with threshold 20 dB(A); ln-$L_{\text{night10}}$, indoor nighttime noise with threshold 10 dB(A); PM$_{2.5abs}$, PM$_{2.5}$ absorbance, soot; SES, socioeconomic status
Table S6: Estimates of the associations between an interquartile range increase in mean air pollution exposure or a 10 dB(A) increase in mean noise level and network segregation, intra-network FC and internetwork FC for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual) adjusted using inverse probability weights. Air pollution models were further adjusted for 24-h outdoor noise and noise models were adjusted for PM$_{2.5}$ absorbance.

| Network        | Segregation Index | Intra-network FC | Internetwork FC |
|----------------|------------------|------------------|-----------------|
| **PM$_{10}$**   |                  |                  |                 |
| Default         | -0.0017 (-0.0167, 0.0132) | 0.0048 (-0.0037, 0.0132) | 0.0041 (-0.0029, 0.0110) |
| Dorsal Attention| -0.0156 (-0.0305, -0.0008) | 0.0027 (-0.0066, 0.0120) | 0.0018 (-0.0052, 0.0088) |
| Frontoparietal  | 0.0047 (-0.0090, 0.0184) | 0.0026 (-0.0115, 0.0167) | -0.0015 (-0.0079, 0.0049) |
| Limbic          | 0.0031 (-0.0152, 0.0213) | 0.0070 (-0.0221, 0.0081) | 0.0027 (-0.0041, 0.0095) |
| Sensorimotor    | -0.0074 (-0.0213, 0.0066) | -0.0099 (-0.0222, 0.0024) | 0.0016 (-0.0052, 0.0085) |
| Ventral Attention| -0.0081 (-0.0223, 0.0060) | 0.0099 (-0.0222, 0.0004) | 0.0016 (-0.0052, 0.0085) |
| Visual          | -0.0037 (-0.0208, 0.0134) | 0.0101 (-0.0132, 0.0335) | 0.0104 (0.0040, 0.0168) |
| **PM$_{2.5}$**   |                  |                  |                 |
| Default         | -0.0047 (-0.0229, 0.0135) | 0.0041 (-0.0061, 0.0143) | 0.0050 (-0.0039, 0.0139) |
| Dorsal Attention| -0.0103 (-0.0285, 0.0080) | -0.0035 (-0.0184, 0.0113) | 0.0030 (-0.0053, 0.0113) |
| Frontoparietal  | -0.0017 (-0.0182, 0.0148) | 0.0029 (-0.0087, 0.0144) | 0.0047 (-0.0040, 0.0133) |
| Limbic          | -0.0023 (-0.0243, 0.0197) | -0.0007 (-0.0175, 0.0161) | -0.0010 (-0.0089, 0.0070) |
| Sensorimotor    | -0.0125 (-0.0298, 0.0047) | -0.0104 (-0.0289, 0.0080) | 0.0040 (-0.0047, 0.0127) |
| Ventral Attention| -0.0125 (-0.0296, 0.0046) | -0.0128 (-0.0275, 0.0019) | 0.0019 (-0.0067, 0.0105) |
| Visual          | 0.0059 (-0.0146, 0.0265) | 0.0324 (0.0060, 0.0588) | 0.0089 (0.0007, 0.0172) |
| **PM$_{2.5abs}$**|                  |                  |                 |
| Default         | -0.0127 (-0.0253, 0.0000) | 0.0005 (-0.0065, 0.0076) | 0.0050 (-0.0009, 0.0109) |
| Dorsal Attention| -0.0163 (-0.0287, -0.0040) | -0.0095 (-0.0199, 0.0009) | 0.0028 (-0.0028, 0.0084) |
| Frontoparietal  | -0.0106 (-0.0222, 0.0010) | -0.0010 (-0.0088, 0.0068) | 0.0038 (-0.0021, 0.0096) |
| Limbic          | -0.0027 (-0.0176, 0.0123) | 0.0016 (-0.0101, 0.0132) | 0.0015 (-0.0039, 0.0069) |
| Sensorimotor    | -0.0045 (-0.0166, 0.0076) | -0.0028 (-0.0163, 0.0108) | 0.0032 (-0.0026, 0.0091) |
| Ventral Attention| -0.0175 (-0.0295, -0.0056) | -0.0097 (-0.0203, 0.0008) | 0.0038 (-0.0020, 0.0097) |
| Visual          | -0.0143 (-0.0287, 0.0001) | 0.0072 (-0.0118, 0.0262) | 0.0106 (0.0051, 0.0161) |
| **PM$_{AM}$**    |                  |                  |                 |
| Default         | -0.0141 (-0.0330, 0.0049) | -0.0009 (-0.0114, 0.0096) | 0.0058 (-0.0034, 0.0150) |
| Dorsal Attention| 0.0115 (-0.0072, 0.0303) | 0.0154 (0.0005, 0.0304) | 0.0039 (-0.0046, 0.0124) |
Table S6: (Continued):

|                      | NO<sub>2</sub>       | Dist<sub>trafroad</sub> <100m vs. >200m | Dist<sub>trafroad</sub> 100-200m vs. >200m |
|----------------------|-----------------------|----------------------------------------|----------------------------------------|
|                      | Frontoparietal        | Limbic                                 | Sensorimotor                           |
|                      |                       |                                        |                                        |
| Frontoparietal       | -0.0034 (-0.0206, 0.0138) | 0.0067 (-0.0053, 0.0187) | 0.0058 (-0.0032, 0.0147) |
| Limbic               | -0.0126 (-0.0357, 0.0104) | -0.0017 (-0.0196, 0.0162) | 0.0030 (-0.0051, 0.0112) |
| Sensorimotor         | -0.0184 (-0.0363, -0.0005) | -0.0135 (-0.0328, 0.0059) | 0.0033 (-0.0057, 0.0123) |
| Ventral Attention    | -0.0184 (-0.0366, -0.0002) | -0.0153 (-0.0303, -0.0004) | 0.0020 (-0.0068, 0.0109) |
| Visual               | 0.0058 (-0.0156, 0.0272) | 0.0153 (-0.0114, 0.0420) | 0.0036 (-0.0050, 0.0121) |
|                      | Default               | Dorsal Attention                       |                                         |
|                      |                       |                                        |                                        |
| Default              | -0.0095 (-0.0261, 0.0072) | -0.0019 (-0.0111, 0.0073) | 0.0032 (-0.0047, 0.0110) |
| Dorsal Attention     | -0.0181 (-0.0342, -0.0020) | -0.0188 (-0.0319, -0.0058) | -0.0025 (-0.0099, 0.0048) |
| Frontoparietal       | -0.0002 (-0.0149, 0.0145) | -0.0007 (-0.0111, 0.0097) | -0.0002 (-0.0078, 0.0075) |
| Limbic               | 0.0016 (-0.0185, 0.0218) | -0.0003 (-0.0159, 0.0153) | -0.0036 (-0.0107, 0.0036) |
| Sensorimotor         | -0.0007 (-0.0165, 0.0151) | -0.0065 (-0.0238, 0.0109) | -0.0013 (-0.0090, 0.0064) |
| Ventral Attention    | -0.0106 (-0.0261, 0.0050) | -0.0064 (-0.0200, 0.0072) | 0.0011 (-0.0066, 0.0088) |
| Visual               | -0.0076 (-0.0263, 0.0110) | -0.0014 (-0.0251, 0.0222) | 0.0029 (-0.0043, 0.0100) |

|                      | 0.0072 (-0.0242, 0.0386) | 0.0384 (0.0164, 0.0605) | 0.0207 (0.0020, 0.0394) |
|                      | 0.0029 (-0.0580, 0.0162) | 0.0336 (0.0026, 0.0646) | 0.0407 (0.0233, 0.0581) |
|                      | 0.0024 (-0.0269, 0.0318) | 0.0429 (0.0101, 0.0756) | 0.0292 (0.0108, 0.0477) |
|                      | -0.0164 (-0.0486, 0.0158) | 0.0475 (0.0208, 0.0743) | 0.0389 (0.0199, 0.0579) |
|                      | -0.1002 (-0.1479, -0.0525) | 0.0083 (-0.0425, 0.0590) | 0.0409 (0.0227, 0.0591) |

|                      | 0.00223 (-0.0516, 0.0069) | -0.0269 (-0.0473, -0.0065) | 0.0001 (-0.0180, 0.0181) |
|                      | 0.0021 (-0.0267, 0.0309) | 0.0001 (-0.0233, 0.0236) | 0.0020 (-0.0144, 0.0185) |
|                      | 0.0142 (-0.0153, 0.0438) | 0.0032 (-0.0175, 0.0240) | -0.0011 (-0.0187, 0.0164) |
|                      | -0.0556 (-0.0905, -0.0207) | -0.0167 (-0.0458, 0.0125) | 0.0101 (-0.0063, 0.0264) |
|                      | -0.0004 (-0.0280, 0.0272) | 0.0012 (-0.0297, 0.0320) | 0.0061 (-0.0113, 0.0235) |
|                      | -0.0307 (-0.0610, -0.0005) | -0.0254 (-0.0505, -0.0002) | -0.0016 (-0.0195, 0.0163) |
|                      | -0.0048 (-0.0496, 0.0400) | 0.0259 (-0.0218, 0.0736) | 0.0025 (-0.0146, 0.0196) |
Table S6: (Continued):

| L_{den}                  | Default   | Dorsal Attention | Frontoparietal | Limbic | Sensorimotor | Ventral Attention | Visual |
|--------------------------|-----------|------------------|----------------|--------|--------------|-------------------|--------|
|                          | -0.0067 (-0.0271, 0.0137) | -0.0020 (-0.0132, 0.0092) | 0.0005 (-0.0090, 0.0100) |
|                          | 0.0020 (-0.0136, 0.0176) | 0.0027 (-0.0061, 0.0115) | 0.0026 (-0.0066, 0.0119) |
|                          | 0.0005 (-0.0090, 0.0100) | -0.0006 (-0.0132, 0.0092) | 0.0002 (-0.0132, 0.0092) |

| L_{night}                | Default   | Dorsal Attention | Frontoparietal | Limbic | Sensorimotor | Ventral Attention | Visual |
|--------------------------|-----------|------------------|----------------|--------|--------------|-------------------|--------|
|                          | -0.0073 (-0.0348, 0.0201) | -0.0025 (-0.0176, 0.0126) | 0.0001 (-0.0128, 0.0129) |
|                          | -0.0052 (-0.0314, 0.0210) | 0.0042 (-0.0168, 0.0253) | 0.0031 (-0.0087, 0.0150) |
|                          | -0.0201 (-0.0437, 0.0036) | -0.0058 (-0.0226, 0.0111) | 0.0032 (-0.0093, 0.0156) |
|                          | 0.0086 (-0.0241, 0.0413) | 0.0021 (-0.0235, 0.0277) | -0.0009 (-0.0124, 0.0106) |
|                          | -0.0064 (-0.0320, 0.0192) | -0.0062 (-0.0337, 0.0213) | 0.0002 (-0.0122, 0.0126) |
|                          | -0.0012 (-0.0218, 0.0375) | 0.0124 (-0.0091, 0.0339) | -0.0001 (-0.0126, 0.0124) |
|                          | -0.0313 (-0.0619, 0.0007) | -0.0434 (-0.0824, -0.0044) | -0.0003 (-0.0121, 0.0116) |

Note: Estimates are shown for an IQR increase of 2.0 μg/m³ for PM₁₀, of 1.4 μg/m³ for PM₂.₅, of 0.3 10⁻⁵/m for PM₂.₅abs, of 613 n/mL for PMAM, of 5.2 μg/m³ for NO₂ and an 10 dB(A) increase of L_{den} and L_{night}.

Abbreviations: BMI, body mass index; dB(A), A-weighted decibels; Dist_{trafroad}, distance from home address to the nearest high-traffic roads; FC, functional connectivity; fMRI, functional magnetic resonance imaging; IQR, interquartile range; L_{den}, outdoor 24-hour weighted noise; L_{night}, outdoor nighttime noise; fMRI, functional magnetic resonance imaging; NO₂, nitrogen dioxide; PM₁₀, particulate matter with diameter ≤10 µm; PM₂.₅, particulate matter with diameter ≤2.5 µm; PM₂.₅abs, PM₂.₅ absorbance, soot; PNAM, accumulation mode particle number concentration
Table S7: Estimates of the associations between air pollution, noise from 2006-2008 and altered network segregation, intra-network FC and internetwork FC in seven established networks (default, dorsal and ventral attention, frontoparietal, limbic, Sensorimotor, and visual) from 2011-2015. Models were adjusted for age at fMRI, sex, body mass index, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure and alcohol consumption, individual and neighborhood SES. Air pollution models were further adjusted for 24-h outdoor noise and noise models were adjusted for PM2.5 absorbance.

| Network          | Segregation Index | Intra-network FC | Internetwork FC |
|------------------|-------------------|------------------|-----------------|
| PM10             |                   |                  |                 |
| Default          | 0.0035 (-0.0136, 0.0206) | 0.0041 (-0.0056, 0.0138) | 0.0010 (-0.0074, 0.0094) |
| Dorsal Attention | -0.0083 (-0.0249, 0.0083) | -0.0032 (-0.0166, 0.0101) | 0.0011 (-0.0066, 0.0089) |
| Frontoparietal   | 0.0017 (-0.0134, 0.0167) | 0.0001 (-0.0107, 0.0108) | 0.0003 (-0.0079, 0.0084) |
| Limbic           | 0.0005 (-0.0200, 0.0210) | 0.0003 (-0.0161, 0.0168) | -0.0021 (-0.0095, 0.0053) |
| Sensorimotor     | -0.0054 (-0.0213, 0.0104) | -0.0084 (-0.0254, 0.0086) | 0.0008 (-0.0073, 0.0089) |
| Ventral Attention| -0.0061 (-0.0218, 0.0097) | -0.0124 (-0.0258, 0.0100) | -0.0003 (-0.0084, 0.0078) |
| Visual           | 0.0112 (-0.0078, 0.0302) | 0.0129 (-0.0114, 0.0373) | 0.0029 (-0.0048, 0.0105) |
| PM2.5            |                   |                  |                 |
| Default          | 0.0068 (-0.0148, 0.0284) | 0.0030 (-0.0092, 0.0153) | -0.0008 (-0.0114, 0.0098) |
| Dorsal Attention | -0.0024 (-0.0235, 0.0186) | -0.0015 (-0.0184, 0.0153) | -0.0008 (-0.0106, 0.0090) |
| Frontoparietal   | 0.0012 (-0.0178, 0.0202) | -0.0016 (-0.0152, 0.0119) | -0.0004 (-0.0107, 0.0099) |
| Limbic           | -0.0081 (-0.0341, 0.0178) | -0.0072 (-0.0280, 0.0136) | -0.0041 (-0.0134, 0.0053) |
| Sensorimotor     | -0.0090 (-0.0290, 0.0111) | -0.0178 (-0.0393, 0.0037) | -0.0014 (-0.0116, 0.0089) |
| Ventral Attention| -0.0052 (-0.0251, 0.0148) | -0.0164 (-0.0334, 0.0005) | -0.0027 (-0.0129, 0.0076) |
| Visual           | 0.0162 (-0.0078, 0.0402) | 0.0174 (-0.0134, 0.0481) | 0.0008 (-0.0089, 0.0104) |
| PM2.5abs         |                   |                  |                 |
| Default          | -0.0041 (-0.0203, 0.0122) | 0.0052 (-0.0041, 0.0144) | 0.0045 (-0.0034, 0.0125) |
| Dorsal Attention | -0.0092 (-0.0251, 0.0066) | -0.0001 (-0.0128, 0.0126) | 0.0043 (-0.0031, 0.0117) |
| Frontoparietal   | -0.0055 (-0.0197, 0.0088) | 0.0022 (-0.0080, 0.0124) | 0.0042 (-0.0036, 0.0119) |
| Limbic           | -0.0035 (-0.0231, 0.0160) | 0.0053 (-0.0104, 0.0209) | 0.0027 (-0.0043, 0.0098) |
| Sensorimotor     | -0.0043 (-0.0194, 0.0108) | -0.0010 (-0.0172, 0.0152) | 0.0046 (-0.0031, 0.0123) |
| Ventral Attention| -0.0120 (-0.0270, 0.0030) | -0.0072 (-0.0200, 0.0056) | 0.0045 (-0.0032, 0.0122) |
| Visual           | -0.0014 (-0.0195, 0.0167) | 0.0074 (-0.0157, 0.0306) | 0.0061 (-0.0012, 0.0134) |
| Table S7: (Continued): |
|------------------------|
| **PM<sub>AM</sub>** |
| Default | -0.0036 (-0.0246 , 0.0174 ) | 0.0012 (-0.0108 , 0.0131 ) | 0.0037 (-0.0066 , 0.0139 ) |
| Dorsal Attention | 0.0084 (-0.0120 , 0.0289 ) | 0.0115 (-0.0048 , 0.0279 ) | 0.0027 (-0.0069 , 0.0122 ) |
| Frontoparietal | -0.0008 (-0.0193 , 0.0177 ) | 0.0033 (-0.0098 , 0.0165 ) | 0.0028 (-0.0072 , 0.0128 ) |
| Limbic | -0.0127 (-0.0380 , 0.0125 ) | -0.0049 (-0.0251 , 0.0154 ) | 0.0008 (-0.0083 , 0.0099 ) |
| Sensorimotor | -0.0110 (-0.0305 , 0.0085 ) | -0.0113 (-0.0322 , 0.0096 ) | 0.0017 (-0.0082 , 0.0117 ) |
| Ventral Attention | -0.0164 (-0.0357 , 0.0029 ) | -0.0169 (-0.0333 , -0.0004 ) | 0.0004 (-0.0095 , 0.0104 ) |
| Visual | 0.0038 (-0.0196 , 0.0272 ) | 0.0135 (-0.0165 , 0.0434 ) | 0.0017 (-0.0078 , 0.0111 ) |
| **NO<sub>2</sub>** |
| Default | -0.0073 (-0.0253 , 0.0107 ) | 0.0012 (-0.0090 , 0.0115 ) | 0.0043 (-0.0045 , 0.0131 ) |
| Dorsal Attention | -0.0169 (-0.0344 , 0.0005 ) | -0.0136 (-0.0276 , 0.0004 ) | -0.0008 (-0.0089 , 0.0074 ) |
| Frontoparietal | 0.0019 (-0.0139 , 0.0178 ) | 0.0025 (-0.0088 , 0.0138 ) | 0.0016 (-0.0070 , 0.0102 ) |
| Limbic | -0.0052 (-0.0268 , 0.0165 ) | -0.0014 (-0.0187 , 0.0160 ) | -0.0021 (-0.0099 , 0.0057 ) |
| Sensorimotor | -0.0019 (-0.0186 , 0.0148 ) | -0.0079 (-0.0258 , 0.0101 ) | -0.0001 (-0.0086 , 0.0085 ) |
| Ventral Attention | -0.0066 (-0.0232 , 0.0100 ) | -0.0054 (-0.0195 , 0.0088 ) | 0.0014 (-0.0071 , 0.0099 ) |
| Visual | 0.0022 (-0.0178 , 0.0222 ) | 0.0077 (-0.0180 , 0.0334 ) | 0.0010 (-0.0070 , 0.0091 ) |
| **Dist<sub>trafroad</sub> <100m vs. >200m** |
| Default | -0.0710 (-0.1515 , 0.0094 ) | 0.0192 (-0.0266 , 0.0650 ) | 0.0390 (-0.0004 , 0.0784 ) |
| Dorsal Attention | -0.0110 (-0.0897 , 0.0676 ) | 0.0111 (-0.0518 , 0.0741 ) | 0.0209 (-0.0156 , 0.0575 ) |
| Frontoparietal | -0.0154 (-0.0862 , 0.0555 ) | 0.0383 (-0.0123 , 0.0889 ) | 0.0323 (-0.0060 , 0.0707 ) |
| Limbic | -0.0025 (-0.0993 , 0.0943 ) | 0.0421 (-0.0355 , 0.1197 ) | 0.0407 ( 0.0059 , 0.0754 ) |
| Sensorimotor | 0.0029 (-0.0720 , 0.0778 ) | 0.0485 (-0.0319 , 0.1289 ) | 0.0276 (-0.0106 , 0.0658 ) |
| Ventral Attention | -0.0256 (-0.1001 , 0.0489 ) | 0.0470 (-0.0164 , 0.1104 ) | 0.0433 ( 0.0052 , 0.0814 ) |
| Visual | -0.1171 (-0.2064 , -0.0279 ) | -0.0308 (-0.1460 , 0.0843 ) | 0.0345 (-0.0016 , 0.0706 ) |
| **Dist<sub>trafroad</sub> 100-200m vs. >200m** |
| Default | -0.0260 (-0.0906 , 0.0387 ) | -0.0263 (-0.0631 , 0.0105 ) | -0.0045 (-0.0362 , 0.0271 ) |
| Dorsal Attention | -0.0060 (-0.0692 , 0.0572 ) | 0.0109 (-0.0397 , 0.0615 ) | 0.0066 (-0.0227 , 0.0360 ) |
| Frontoparietal | 0.0382 (-0.0188 , 0.0951 ) | 0.0201 (-0.0205 , 0.0608 ) | -0.0003 (-0.0311 , 0.0305 ) |
| Limbic | -0.0577 (-0.1354 , 0.0201 ) | -0.0407 (-0.1031 , 0.0216 ) | 0.0049 (-0.0231 , 0.0328 ) |
| Sensorimotor | -0.0037 (-0.0639 , 0.0565 ) | 0.0022 (-0.0624 , 0.0668 ) | 0.0073 (-0.0234 , 0.0380 ) |
Table S7: (Continued):

|                      | Ventral Attention | Visual | Dorsal Attention | Frontoparietal | Limbic | Sensorimotor | Ventral Attention | Visual | Limbic | Default | Dorsal Attention | Frontoparietal | Limbic | Sensorimotor | Ventral Attention | Visual | Limbic | Default |
|----------------------|-------------------|--------|------------------|---------------|--------|--------------|-------------------|--------|--------|---------|------------------|---------------|--------|--------------|-------------------|--------|--------|---------|
| **L_{den}**          |                   |        |                  |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| Default              | -0.0110 ( -0.0309 , 0.0090 ) | 0.0017 ( -0.0096 , 0.0131 ) | 0.0042 ( -0.0055 , 0.0140 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| Dorsal Attention     | -0.0141 ( -0.0335 , 0.0052 ) | 0.0053 ( -0.0152 , 0.0158 ) | 0.0050 ( -0.0040 , 0.0140 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| Frontoparietal       | -0.0217 ( -0.0391 , -0.0043 ) | -0.0039 ( -0.0165 , 0.0088 ) | 0.0060 ( -0.0035 , 0.0155 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| Limbic               | 0.0029 ( -0.0211 , 0.0269 ) | 0.0035 ( -0.0157 , 0.0227 ) | 0.0015 ( -0.0071 , 0.0101 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| Sensorimotor         | -0.0117 ( -0.0302 , 0.0068 ) | -0.0066 ( -0.0265 , 0.0133 ) | 0.0040 ( -0.0055 , 0.0134 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| Ventral Attention    | 0.0036 ( -0.0148 , 0.0220 ) | -0.0079 ( -0.0077 , 0.0235 ) | 0.0030 ( -0.0064 , 0.0124 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| **Visual**           | -0.0282 ( -0.0503 , -0.0060 ) | -0.0293 ( -0.0578 , -0.0009 ) | 0.0040 ( -0.0049 , 0.0129 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| **L_{night}**        |                   |        |                  |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| Default              | -0.0127 ( -0.0395 , 0.0140 ) | 0.0019 ( -0.0133 , 0.0172 ) | 0.0047 ( -0.0084 , 0.0177 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| Dorsal Attention     | -0.0158 ( -0.0418 , 0.0101 ) | 0.0019 ( -0.0189 , 0.0226 ) | 0.0061 ( -0.0060 , 0.0182 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| Frontoparietal       | -0.0287 ( -0.0521 , -0.0054 ) | -0.0062 ( -0.0231 , 0.0107 ) | 0.0071 ( -0.0056 , 0.0199 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| Limbic               | 0.0001 ( -0.0321 , 0.0323 ) | 0.0024 ( -0.0233 , 0.0282 ) | 0.0016 ( -0.0100 , 0.0131 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| Sensorimotor         | -0.0115 ( -0.0363 , 0.0134 ) | -0.0059 ( -0.0326 , 0.0208 ) | 0.0038 ( -0.0088 , 0.0164 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| Ventral Attention    | 0.0079 ( -0.0168 , 0.0325 ) | 0.0108 ( -0.0101 , 0.0317 ) | 0.0028 ( -0.0098 , 0.0154 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |
| **Visual**           | -0.0400 ( -0.0696 , -0.0104 ) | -0.0429 ( -0.0810 , -0.0049 ) | 0.0043 ( -0.0076 , 0.0163 ) |               |        |              |                   |        |        |         |                   |               |        |              |                   |        |        |         |

Note: Estimates are shown for an IQR increase of 2.0 μg/m³ for PM_{10}, of 1.4 μg/m³ for PM_{2.5}, of 0.3 10⁻⁵/m for PM_{2.5abs}, of 613 n/mL for PMAM, of 5.2 μg/m³ for NO₂ and an 10 dB(A) increase of L_{den} and L_{night}.

Abbreviations: BMI, body mass index; dB(A), A-weighted decibels; Dist_{trafroad}, distance from home address to the nearest high-traffic roads; FC, functional connectivity; fMRI, functional magnetic resonance imaging; IQR, interquartile range; L_{den}, outdoor 24-hour weighted noise; L_{night}, outdoor nighttime noise; fMRI, functional magnetic resonance imaging; NO₂, nitrogen dioxide; PM_{10}, particulate matter with diameter ≤10 µm; PM_{2.5}, particulate matter with diameter ≤2.5 µm; PM_{2.5abs}, PM_{2.5} absorbance, soot; PNAM, accumulation mode particle number concentration; SES, socioeconomic status
Figure S1: Timeline of exposure and outcome assessments: Marked fields display when the specific elements of the study were conducted.

Abbreviations: HNR; Heinz-Nixdorf Recall, FU; Follow-up examination, CTM; Chemistry transport modeling, LUR; Land use regression modeling

Figure S2: Directed Acyclic Graph: The graph displays the possible relationship between air pollution exposure (AP Exposure) and functional brain connectivity (Functional_Connectivity). An arrow between two variables represents a possible cause-effect relationship. Variable that are “upstream” from the exposure (air pollution) and outcome (functional connectivity) are colored in red. Variables in blue are “upstream” from the outcome (functional connectivity). Variables in grey are unobserved.
Figure S3: Categorization of Confidence Intervals for Summarization Plot: Confidence limits resulting from the analysis of associations between air pollution, noise and FC Metrics (network segregation, intra- and internetwork FC) were categorized into ten categories. For this, the direction of the effect size and the quality of estimation (width of confidence interval) were considered. First, for each estimate, confidence intervals were divided into eight equally sized segments. Depending on the location of the zero value in segments, these eight segments plus two categories for confidence limits completely above or below the zero value, formed ten categories. Although, confidence limits in category eight display higher effect estimates than confidence limits in category nine, confidence limits in category eight are wider and display more uncertainty. Subsequently, each category was assigned a color and/or texture displaying possible decrease (confidence interval mostly below zero) to increase (confidence interval mostly above zero). Furthermore, to avoid graphically overestimating effects, confidence limits with effect estimates very close to zero (category 4 to 7) were grouped into one category (white).
Figure S4: Derivation of Study Population Flowchart
Figure S5: Adjustments Sets for the Segregation Index: Associations between an interquartile range (IQR) increase in mean air pollution exposure or a 10 dB(A) increase in mean noise level and network segregation for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual). Model 1 was adjusted for sex and age at time of fMRI scan. Model 2 was further adjusted for BMI, smoking status, physical activity, alcohol consumption and diet. In Model 3 we further adjusted Model 2 for individual SES and neighborhood SES. In Model 2 and 3 air pollution models were further adjusted for 24-h outdoor noise and noise models were adjusted for PM2.5 absorbance. Estimates are shown for an IQR increase of 2.0 μg/m³ for PM₁₀, of 1.4 μg/m³ for PM₂.₅, of 0.3 10⁻⁵/m for PM₂.₅abs, of 613 n/mL for PMAM and of 5.2 μg/m³ for NO₂.

Abbreviations: BMI, body mass index; dB(A), A-weighted decibels; Disttrafroad, distance from home address to the nearest high-traffic roads; FC, functional connectivity; fMRI, functional magnetic resonance imaging; L_den, outdoor 24-hour weighted noise; L_night, outdoor nighttime noise; fMRI, functional magnetic resonance imaging; NO₂, nitrogen dioxide; PM₁₀, particulate matter with diameter ≤10 μm; PM₂.₅, particulate matter with diameter ≤2.5 μm; PM₂.₅abs, PM₂.₅ absorbance, soot; PNAM, accumulation mode particle number concentration; SES, socioeconomic status
Figure S6: Sensitivity Analyses – Noise Thresholds: Associations between a 10 dB(A) increase in mean noise level with different thresholds and network segregation for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual). All models were adjusted for age at fMRI, sex, BMI, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure, alcohol consumption, individual SES, neighborhood SES and PM$_{2.5}$ absorbance. Noise variables were partially bound continuous variables with a lower cut-off value of 50 dB(A) and 45 dB(A) for $L_{\text{den}}$, 45 dB(A) and 35 dB(A) for $L_{\text{night}}$ with all noise values lower than the defined threshold being set to the threshold value.

Abbreviations: BMI, body mass index; dB(A), A-weighted decibels; FC, functional connectivity; fMRI, functional magnetic resonance imaging; $L_{\text{den50}}$, outdoor 24-hour weighted noise with threshold of 50 dB(A); $L_{\text{den45}}$, outdoor 24-hour weighted noise with threshold of 45 dB(A); $L_{\text{night45}}$ outdoor nighttime noise with threshold of 45 dB(A); $L_{\text{night35}}$ outdoor nighttime noise with threshold of 35 dB(A); PM$_{2.5\text{abs}}$, PM$_{2.5}$ absorbance, soot; SES, socioeconomic status
Figure S7: Sensitivity Analyses – Indoor vs. Outdoor Noise: Associations between a 10 dB(A) increase in mean indoor or outdoor noise level with different thresholds and network segregation for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual) in 522 participants. All models were adjusted for age at fMRI, sex, BMI, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure, alcohol consumption, individual SES, neighborhood SES and PM$_{2.5}$ absorbance. Noise variables were partially bound continuous variables with a lower cut-off value of 50 dB(A) for outdoor $L_{den}$, 45 dB(A) for $L_{night}$ and indoor $L_{den}$, 20 dB(A) and 10 dB(A) for $L_{night}$ with all noise values lower than the defined threshold being set to the threshold value.

Abbreviations: BMI, body mass index; dB(A), A-weighted decibels; FC, functional connectivity; fMRI, functional magnetic resonance imaging; $L_{den50}$, outdoor 24-hour weighted noise with threshold 50 dB(A); $L_{night45}$, outdoor nighttime noise with threshold 45 dB(A); $In-L_{den20}$, indoor 24-hour weighted noise with threshold 20 dB(A); $In-L_{night10}$, indoor nighttime noise with threshold 10 dB(A); PM$_{2.5abs}$, PM$_{2.5}$ absorbance, soot; SES, socioeconomic status
Figure S8: Sensitivity Analyses – Inverse Probability Weighting: Associations between an interquartile range (IQR) increase in mean air pollution exposure or a 10 dB(A) increase in mean noise level and network segregation for seven established brain networks (default, dorsal and ventral attention, frontoparietal, limbic, sensorimotor, and visual) adjusted using inverse probability weights. Air pollution models were further adjusted for 24-h outdoor noise and noise models were adjusted for PM_{2.5} absorbance. Estimates are shown for an IQR increase of 2.0 \mu g/m^3 for PM_{10}, of 1.4 \mu g/m^3 for PM_{2.5}, of 0.3 \times 10^{-5}/m for PM_{2.5abs}, of 613 n/mL for PM_{AM} and of 5.2 \mu g/m^3 for NO_2.

Abbreviations: BMI, body mass index; dB(A), A-weighted decibels; Dist_{trafroad}, distance from home address to the nearest high-traffic roads; FC, functional connectivity; fMRI, functional magnetic resonance imaging; L_{den}, outdoor 24-hour weighted noise; L_{night}, outdoor nighttime noise; fMRI, functional magnetic resonance imaging; NO_2, nitrogen dioxide; PM_{10}, particulate matter with diameter \leq 10 \mu m; PM_{2.5}, particulate matter with diameter \leq 2.5 \mu m; PM_{2.5abs}, PM_{2.5} absorbance, soot; PN_{AM}, accumulation mode particle number concentration
**Figure S9: Sensitivity Analyses - Exposure from HNR-FU1:** Associations between air pollution, noise from 2006-2008 and altered network segregation, intra- and internetwork FC in seven established networks (default, dorsal and ventral attention, frontoparietal, limbic, Sensorimotor, and visual) from 2011-2015. All models were adjusted for age at fMRI, sex, body mass index, diet, physical activity, smoking status, cumulative smoking, environmental tobacco smoke exposure and alcohol consumption, individual and neighborhood SES. Air pollution models were further adjusted for 24-h outdoor noise and noise models were adjusted for PM$_{2.5}$ absorbance. Estimates are shown for an IQR increase of 2.0 μg/m$^3$ for PM$_{10}$, of 1.4 μg/m$^3$ for PM$_{2.5}$, of 0.3 $10^{-5}$/m for PM$_{2.5}$abs, of 613 n/mL for PM$_{AM}$ and of 5.2 μg/m$^3$ for NO$_2$.

**Abbreviations:** BMI, body mass index; dB(A), A-weighted decibels; Dist$_{trafroad}$, distance from home address to the nearest high-traffic roads; FC, functional connectivity; fMRI, functional magnetic resonance imaging; L$_{den}$, outdoor 24-hour weighted noise; L$_{night}$, outdoor nighttime noise; fMRI, functional magnetic resonance imaging; NO$_2$, nitrogen dioxide; PM$_{10}$, particulate matter with diameter ≤10 μm; PM$_{2.5}$, particulate matter with diameter ≤2.5 μm; PM$_{2.5}$abs, PM$_{2.5}$ absorbance, soot; PN$_{AM}$, accumulation mode particle number concentration; SES, socioeconomic status.
R-Code to Categorize Confidence Limits for Summarization Plot

```r
#-------------------------------------------#
#         Summarization Plot
#   categorization of confidence limits
#-------------------------------------------#

#This code creates a categorical variable (CI_category)
#that classifies the confidence intervals into ten categories.

library(kimisc)

results<-read.xlsx(file = "\04_model_results_table_all.xlsx",sheetIndex = 1)

results<-results[which(results$exposure_unit=="pIQR"),] # only IQR

part1 <- abs(results$upper_CI-results$beta)/4
part2 <- abs(results$beta- results$lower_CI)/4

# Create indicator variables

zero<- rep(NA, dim(results)[1])
for(i in 1:dim(results)[1]){
  zero[i]<-in.interval.lo(0, results$lower_CI[i], results$upper_CI[i])
}

intervall_up1<- rep(NA, dim(results)[1])
for(i in 1:dim(results)[1]){
  intervall_up1[i]<-in.interval.lo(0, results$upper_CI[i]-part1[i], results$upper_CI[i])
}

intervall_up2<- rep(NA, dim(results)[1])
for(i in 1:dim(results)[1]){
  intervall_up2[i]<-in.interval.lo(0, results$upper_CI[i]-2*part1[i], results$upper_CI[i]-part1[i])
}

intervall_up3<- rep(NA, dim(results)[1])
for(i in 1:dim(results)[1]){
  intervall_up3[i]<-in.interval.lo(0, results$upper_CI[i]-3*part1[i], results$upper_CI[i]-2*part1[i])
}

intervall_up4<- rep(NA, dim(results)[1])
for(i in 1:dim(results)[1]){
  intervall_up4[i]<-in.interval.lo(0, results$beta[i], results$upper_CI[i]-3*part1[i])
}

intervall_up5<- rep(NA, dim(results)[1])
for(i in 1:dim(results)[1]){
  intervall_up5[i]<-in.interval.lo(0, results$beta[i]-1*part2[i], results$beta[i])
}

intervall_up6<- rep(NA, dim(results)[1])
for(i in 1:dim(results)[1]){
  intervall_up6[i]<-in.interval.lo(0, results$upper_CI[i]-3*part1[i], results$beta[i])
}
```

intervall_up6[i]<-in.interval.lo(0, results$beta[i]-2*part2[i],
results$beta[i]-1*part2[i])

intervall_up7<- rep(NA, dim(results)[1])
for(i in 1:dim(results)[1]){
    intervall_up7[i]<-in.interval.lo(0, results$beta[i]-3*part2[i],
results$beta[i]-2*part2[i])
}

intervall_up8<- rep(NA, dim(results)[1])
for(i in 1:dim(results)[1]){
    intervall_up8[i]<-in.interval.lo(0, results$lower_CI[i], results$beta[i]-
3*part2[i])
}

CI_category<- rep(NA, dim(results)[1])
CI_category[which(zero==F & results$beta <0)] <- 1
CI_category[which(intervall_up1==T)] <- 2
CI_category[which(intervall_up2==T)] <- 3
CI_category[which(intervall_up3==T)] <- 4
CI_category[which(intervall_up4==T)] <- 5
CI_category[which(intervall_up5==T)] <- 6
CI_category[which(intervall_up6==T)] <- 7
CI_category[which(intervall_up7==T)] <- 8
CI_category[which(intervall_up8==T)] <- 9
CI_category[which(zero==F & results$beta >0)] <- 10

results2 <- cbind(results, CI_category)

table(results2$CI_category)