Supplemental Table 1. The Descriptive and inferential statistics for metrics of area estimation task.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Descriptive statistics | | | | Inferential statistics | | | | | | |
|  | MD | | GD | MV | GV | | MD-GD | MD-MV | MD-GV | GD-MV | GD-GV | MV-GV |
|  | M ± SD | | M ± SD | M ± SD | M ± SD | | p-value | p-value | p-value | p-value | p-value | p-value |
| Accuracy (%) | 26.09 | | 27.27 | 25.00 | 24.14 | | 0.931 | 0.934 | 0.749 | 0.866 | 0.687 | 0.810 |
| Response time(s) | 147.83±20.34 | | 132.86±19.66 | 91.16±45.85 | 108.75±51.40 | | 0.267 | 0.000\*\* | 0.000\*\* | 0.005\*\* | 0.062 | 0.337 |
| Average saccade duration(ms) | 79.95±13.97 | | 65.97±10.89 | 84.73±8.60 | 132.69±42.36 | | 0.007\*\* | 0.000\*\* | 0.000\*\* | 0.278 | 0.000\*\* | 0.000\*\* |
| Saccade frequency(time/s) | 7.53±1.48 | | 6.88±1.11 | 2.21±0.61 | 2.08±0.89 | | 0.462 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.868 |
| Average fixation duration(ms) | 254±28.54 | | 226.35±32.64 | 175.23±33.40 | 164.21±43.90 | | 0.059 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.464 |
| Fixation frequency(time/s) | 3.11±0.37 | | 3.28±0.56 | 3.43±0.34 | 2.59±0.73 | | 0.268 | 0.008\*\* | 0.039\* | 0.124 | 0.002\*\* | 0.000\*\* |
| Zoom-in/zoom-out count(time) | 6.26±1.57 | | 3.86±0.90 | 4.62±3.85 | 1.23±0.74 | | 0.004\*\* | 0.000\*\* | 0.530 | 0.000\*\* | 0.000\*\* | 0.001\*\* |
| Pan/rotate count(time) | 15.20±5.15 | | 15.99±5.40 | 14.96±13.53 | 23.81±21.60 | | 0.598 | 0.934 | 0.094 | 0.726 | 0.134 | 0.116 |
| M = mean, SD = standard deviation, \* p < 0.05 and \*\* p < 0.01. | | | | | | | | | | | | |

Supplemental Table 2. The Descriptive and inferential statistics for metrics of distance estimation task.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Descriptive statistics | | | | Inferential statistics | | | | | | |
|  | MD | | GD | MV | GV | | MD-GD | MD-MV | MD-GV | GD-MV | GD-GV | MV-GV |
|  | M ± SD | | M ± SD | M ± SD | M ± SD | | p-value | p-value | p-value | p-value | p-value | p-value |
| Accuracy (%) | 30.43 | | 18.18 | 28.57 | 48.28 | | 0.378 | 0.928 | 0.158 | 0.423 | 0.025\* | 0.130 |
| Response time(s) | 141.41±24.32 | | 156.00±26.30 | 132.02±58.30 | 138.89±73.14 | | 0.158 | 0.286 | 0.261 | 0.011\* | 0.010\*\* | 0.946 |
| Average saccade duration(ms) | 63.12±16.89 | | 62.09±14.93 | 84.11±9.58 | 145.18±62.19 | | 0.824 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.001\*\* |
| Saccade frequency(time/s) | 6.79±1.46 | | 5.52±1.03 | 1.99±0.68 | 1.93±0.84 | | 0.113 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.770 |
| Average fixation duration(ms) | 256.82±38.92 | | 245.68±36.16 | 183.69±42.07 | 176.10±38.38 | | 0.541 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.697 |
| Fixation frequency(time/s) | 2.89±0.50 | | 3.07±0.39 | 3.32±0.41 | 2.63±0.71 | | 0.312 | 0.003\*\* | 0.309 | 0.052 | 0.045\* | 0.000\*\* |
| Zoom-in/zoom-out count(time) | 7.37±1.24 | | 4.81±0.88 | 3.15±2.85 | 1.73±1.46 | | 0.004\*\* | 0.000\*\* | 0.011\* | 0.000\*\* | 0.000\*\* | 0.114 |
| Pan/rotate count(time) | 14.28±4.60 | | 24.41±6.10 | 6.50±5.48 | 18.5±14.04 | | 0.003\*\* | 0.000\*\* | 0.807 | 0.000\*\* | 0.006\*\* | 0.000\*\* |
| M = mean, SD = standard deviation, \* p < 0.05 and \*\* p < 0.01. | | | | | | | | | | | | |

Supplemental Table 3. The Descriptive and inferential statistics for metrics of attribute ranking task.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Descriptive statistics | | | | Inferential statistics | | | | | | |
|  | MD | | GD | MV | GV | | MD-GD | MD-MV | MD-GV | GD-MV | GD-GV | MV-GV |
|  | M ± SD | | M ± SD | M ± SD | M ± SD | | p-value | p-value | p-value | p-value | p-value | p-value |
| Accuracy (%) | 65.22 | | 43.48 | 53.57 | 48.28 | | 0.125 | 0.318 | 0.262 | 0.571 | 0.668 | 0.893 |
| Response time(s) | 71.54±14.04 | | 103.75±14.54 | 174.12±95.24 | 166.88±96.48 | | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.078 | 0.168 | 0.702 |
| Average saccade duration(ms) | 60.64±16.01 | | 50.72±11.35 | 87.69±9.38 | 149.5±62.33 | | 0.185 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.003\*\* |
| Saccade frequency(time/s) | 6.81±1.11 | | 7.21±1.08 | 2.09±0.66 | 1.72±0.85 | | 0.590 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.724 |
| Average fixation duration(ms) | 202.12±32.56 | | 252.81±25.91 | 181.51±33.99 | 171.87±44.66 | | 0.000\*\* | 0.103 | 0.021\* | 0.000\*\* | 0.000\*\* | 0.446 |
| Fixation frequency(time/s) | 3.48±0.23 | | 3.45±0.41 | 3.25±0.43 | 2.51±0.92 | | 0.619 | 0.055 | 0.000\*\* | 0.159 | 0.000\*\* | 0.002\*\* |
| Zoom-in/zoom-out count(time) | 8.92±1.94 | | 3.24±0.73 | 5.54±5.09 | 3.81±3.59 | | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.277 | 0.882 | 0.207 |
| Pan/rotate count(time) | 16.74±5.22 | | 19.72±5.77 | 20.27±17.78 | 29.77±21.66 | | 0.377 | 0.562 | 0.038\* | 0.139 | 0.242 | 0.007\*\* |
| M = mean, SD = standard deviation, \* p < 0.05 and \*\* p < 0.01. | | | | | | | | | | | | |

Supplemental Table 4. The Descriptive and inferential statistics for metrics of area ranking task.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Descriptive statistics | | | | Inferential statistics | | | | | | |
|  | MD | | GD | MV | GV | | MD-GD | MD-MV | MD-GV | GD-MV | GD-GV | MV-GV |
|  | M ± SD | | M ± SD | M ± SD | M ± SD | | p-value | p-value | p-value | p-value | p-value | p-value |
| Accuracy (%) | 60.87 | | 78.26 | 39.29 | 34.48 | | 0.148 | 0.130 | 0.052 | 0.004\*\* | 0.001\*\* | 0.646 |
| Response time(s) | 77.90±17.35 | | 65.51±16.12 | 156.90±69.99 | 143.10±63.73 | | 0.010\*\* | 0.000\*\* | 0.003\*\* | 0.000\*\* | 0.000\*\* | 0.446 |
| Average saccade duration(ms) | 58.93±13.49 | | 55.99±15.68 | 84.63±9.52 | 127.35±39.5 | | 0.709 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.004\*\* |
| Saccade frequency(time/s) | 6.38±1.18 | | 6.76±1.47 | 2.25±0.73 | 2.06±0.89 | | 0.612 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.917 |
| Average fixation duration(ms) | 238.57±30.91 | | 242.93±25.62 | 177.32±36.76 | 164.80±43.35 | | 0.612 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.470 |
| Fixation frequency(time/s) | 3.47±0.37 | | 3.50±0.23 | 3.31±0.35 | 2.75±0.77 | | 0.760 | 0.115 | 0.000\*\* | 0.059 | 0.000\*\* | 0.006\*\* |
| Zoom-in/zoom-out count(time) | 8.39±2.14 | | 3.95±0.69 | 4.31±3.51 | 1.46±0.92 | | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.609 | 0.000\*\* | 0.002\*\* |
| Pan/rotate count(time) | 15.18±4.91 | | 15.32±4.90 | 13.96±11.59 | 29.81±20.82 | | 0.466 | 0.225 | 0.007\*\* | 0.050\* | 0.053 | 0.000\*\* |
| M = mean, SD = standard deviation, \* p < 0.05 and \*\* p < 0.01. | | | | | | | | | | | | |

Supplemental Table 5. The Descriptive and inferential statistics for metrics of point-polygon association task.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Descriptive statistics | | | | Inferential statistics | | | | | | |
|  | MD | | GD | MV | GV | | MD-GD | MD-MV | MD-GV | GD-MV | GD-GV | MV-GV |
|  | M ± SD | | M ± SD | M ± SD | M ± SD | | p-value | p-value | p-value | p-value | p-value | p-value |
| Accuracy (%) | 69.57 | | 77.27 | 78.57 | 72.41 | | 0.588 | 0.480 | 0.760 | 0.879 | 0.811 | 0.691 |
| Response time(s) | 47.59±15.32 | | 52.58±15.81 | 127.91±61.97 | 133.06±83.85 | | 0.045\* | 0.000\*\* | 0.000\*\* | 0.001\*\* | 0.015\* | 0.326 |
| Average saccade duration(ms) | 63.55±12.37 | | 64.53±12.15 | 86.37±7.85 | 142.06±54.32 | | 0.860 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.001\*\* |
| Saccade frequency(time/s) | 5.74±0.96 | | 5.60±0.74 | 2.25±0.57 | 2.06±0.86 | | 0.764 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.959 |
| Average fixation duration(ms) | 230.65±24.21 | | 221.86±27.51 | 175.54±31.15 | 165.60±33.83 | | 0.446 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.383 |
| Fixation frequency(time/s) | 3.04±0.42 | | 3.10±0.43 | 3.36±0.28 | 2.67±0.80 | | 0.565 | 0.003\*\* | 0.162 | 0.016\* | 0.050\* | 0.000\*\* |
| Zoom-in/zoom-out count(time) | 6.58±1.41 | | 2.46±0.55 | 7.50±7.35 | 4.77±4.33 | | 0.000\*\* | 0.080 | 0.001\*\* | 0.001\*\* | 0.087 | 0.083 |
| Pan/rotate count(time) | 19.26±5.45 | | 24.17±5.78 | 28.65±22.14 | 48.58±36.65 | | 0.037\* | 0.277 | 0.000\*\* | 0.298 | 0.083 | 0.005\*\* |
| M = mean, SD = standard deviation, \* p < 0.05 and \*\* p < 0.01. | | | | | | | | | | | | |

Supplemental Table 6. The Descriptive and inferential statistics for metrics of polygon-polygon association task.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | Descriptive statistics | | | | Inferential statistics | | | | | | |
|  | MD | | GD | MV | GV | | MD-GD | MD-MV | MD-GV | GD-MV | GD-GV | MV-GV |
|  | M ± SD | | M ± SD | M ± SD | M ± SD | | p-value | p-value | p-value | p-value | p-value | p-value |
| Accuracy (%) | 91.30 | | 86.36 | 100.00 | 96.55 | | 0.605 | 0.142 | 0.552 | 0.064 | 0.279 | 0.304 |
| Response time(s) | 35.87±12.77 | | 31.42±12.83 | 47.05±19.20 | 68.74±34.16 | | 0.009\*\* | 0.174 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.006\*\* |
| Average saccade duration(ms) | 49.64±11.20 | | 54.19±10.01 | 85.26±11.18 | 136.04±54.67 | | 0.626 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.009\*\* |
| Saccade frequency(time/s) | 5.51±0.95 | | 4.82±0.95 | 2.21±0.70 | 1.99±0.81 | | 0.283 | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.878 |
| Average fixation duration(ms) | 212.39±21.88 | | 215.86±27.24 | 175.29±34.10 | 165.86±37.83 | | 0.776 | 0.001\*\* | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.289 |
| Fixation frequency(time/s) | 3.33±0.37 | | 3.59±0.43 | 3.39±0.41 | 2.85±0.77 | | 0.107 | 0.525 | 0.014\* | 0.314 | 0.000\*\* | 0.002\*\* |
| Zoom-in/zoom-out count(time) | 6.27±1.30 | | 2.93±0.58 | 3.19±2.27 | 1.77±1.63 | | 0.000\*\* | 0.000\*\* | 0.000\*\* | 0.681 | 0.017\* | 0.045\* |
| Pan/rotate count(time) | 16.74±5.17 | | 16.09±5.72 | 10.54±6.75 | 19.04±11.72 | | 0.911 | 0.006\*\* | 0.587 | 0.009\*\* | 0.511 | 0.001\*\* |
| M = mean, SD = standard deviation, \* p < 0.05 and \*\* p < 0.01. | | | | | | | | | | | | |