**Supplementary Table 1. Matrix of correlation coefficients of all variables in all participants.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Mean±SD** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** |
| **1 Locomotion methods** | 0.5±0.5 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **2 OI navigation legibility** | 0.5±0.5 | 0.00 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **3 Gender** | 0.5±0.5 | 0.00 | 0.00 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **4 Age group** | 46±22.8 | 0.00 | 0.00 | 0.00 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **5 Education level** | 3±1 | 0.00 | 0.00 | -0.09 | -0.55\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **6 Digital experience** | 4±1.9 | 0.00 | 0.00 | -0.17\* | -0.79\*\*\* | 0.56\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **7 Egocentric scale** | 5±1.2 | 0.00 | 0.00 | -0.12 | 0.39\*\*\* | -0.36\*\*\* | -0.18\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **8 Allocentric scale** | 4±1.2 | 0.00 | 0.00 | -0.05 | 0.32\*\*\* | -0.34\*\*\* | -0.14 | 0.73\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **9 Cardinal directions scale** | 3±1.7 | 0.00 | 0.00 | -0.17\* | -0.16\* | 0.11 | 0.32\*\*\* | 0.47\*\*\* | 0.31\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **10 Use of navigation** | 4±1.8 | 0.00 | 0.00 | -0.17\* | -0.74\*\*\* | 0.62\*\*\* | 0.77\*\*\* | -0.17\* | -0.20\*\* | 0.34\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| **11 Possession of navigation** | 3±1.6 | 0.00 | 0.00 | -0.22\*\* | -0.62\*\*\* | 0.47\*\*\* | 0.60\*\*\* | -0.04 | -0.11 | 0.36\*\*\* | 0.80\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |
| **12 Rotation ability** | 17±3.7 | 0.00 | 0.00 | -0.34\*\*\* | -0.26\*\*\* | 0.10 | 0.20\*\* | -0.20\*\* | -0.18\* | -0.13 | 0.19\*\* | 0.12 | 1 |  |  |  |  |  |  |  |  |  |  |
| **13 Wayfinding time** | 147.3±81.59s | 0.14 | 0.07 | 0.11 | **0.71\*\*\*** | **-0.35\*\*\*** | **-0.66\*\*\*** | 0.13 | **0.25\*\*\*** | **-0.2\*\*** | **-0.63\*\*\*** | **-0.5\*\*\*** | **-0.28\*\*\*** | 1 |  |  |  |  |  |  |  |  |  |
| **14 Number of hesitation** | 10±7.5 | **0.19\*\*** | -0.01 | 0.03 | **0.41\*\*\*** | **-0.24\*\*\*** | **-0.5\*\*\*** | -0.06 | 0.13 | **-0.27\*\*\*** | **-0.42\*\*\*** | **-0.36\*\*\*** | -0.04 | 0.75\*\*\* | 1 |  |  |  |  |  |  |  |  |
| **15 Number of turn errors** | 1±1.4 | 0.10 | 0.13 | **0.19\*\*** | **0.22\*\*** | -0.12 | **-0.3\*\*\*** | -0.06 | 0.03 | **-0.27\*\*\*** | **-0.39\*\*\*** | **-0.27\*\*\*** | 0.05 | 0.35\*\*\* | 0.39\*\*\* | 1 |  |  |  |  |  |  |  |
| **16 Mobile navigation usage number** | 25±13.2 | 0.01 | 0.06 | 0.04 | **0.34\*\*\*** | **-0.17\*** | **-0.35\*\*\*** | -0.04 | **0.15\*** | **-0.2\*\*** | **-0.38\*\*\*** | **-0.36\*\*\*** | -0.03 | 0.61\*\*\* | 0.57\*\*\* | 0.31\*\*\* | 1 |  |  |  |  |  |  |
| **17 Mobile navigation usage duration** | 65.2±42.52s | 0.03 | 0.14 | -0.02 | **0.67\*\*\*** | **-0.31\*\*\*** | **-0.49\*\*\*** | **0.22\*\*** | **0.23\*\*** | -0.03 | **-0.56\*\*\*** | **-0.40\*\*\*** | **-0.40\*\*\*** | 0.76\*\*\* | 0.27\*\*\* | 0.08 | 0.34\*\*\* | 1 |  |  |  |  |  |
| **18 Mobile navigation usage duration proportion** | 44.9±18.95% | -0.10 | 0.11 | -0.11 | 0.16\* | -0.01 | 0.03 | **0.20\*\*** | 0.06 | **0.21\*\*** | -0.09 | 0.00 | **-0.32\*\*\*** | -0.03 | -0.50\*\*\* | -0.29\*\*\* | -0.28\*\*\* | 0.60\*\*\* | 1 |  |  |  |  |
| **19 Regression number** | 7±5.3 | -0.01 | 0.07 | -0.01 | **-0.3\*\*\*** | 0.04 | **0.25\*\*\*** | **-0.15\*** | 0.01 | **-0.16\*** | 0.07 | **0.17\*** | **0.19\*\*** | -0.03 | 0.16\* | 0.30\*\*\* | 0.19\*\* | -0.15\* | -0.23\*\* | 1 |  |  |  |
| **20 Average regression angle** | 72.7±22.32° | **-0.19\*\*** | 0.08 | 0.06 | -0.02 | -0.09 | -0.05 | 0.00 | 0.04 | -0.04 | -0.12 | 0.04 | -0.05 | 0.09 | 0.06 | 0.27\*\*\* | 0.01 | 0.01 | -0.09 | 0.34\*\*\* | 1 |  |  |
| **21 Time of cognitive map drawing** | 172.2±82.52s | 0.00 | -0.02 | -0.06 | 0.05 | 0.19\*\* | -0.01 | 0.02 | -0.06 | 0.02 | 0.03 | -0.05 | 0.03 | 0.26\*\*\* | 0.27\*\*\* | -0.05 | 0.14\* | 0.09 | -0.13 | -0.04 | -0.13 | 1 |  |
| **22 Accuracy of cognitive map drawing** | 60.5±20.91% | **0.26\*\*\*** | **0.25\*\*\*** | -0.14 | **-0.63\*\*\*** | **0.32\*\*\*** | **0.56\*\*\*** | -0.09 | -0.07 | **0.17\*** | **0.56\*\*\*** | **0.43\*\*\*** | **0.27\*\*\*** | -0.42\*\*\* | -0.22\*\* | -0.26\*\*\* | -0.2\*\* | -0.38\*\*\* | -0.09 | 0.28\*\*\* | -0.11 | 0.10 | 1 |

The variables Locomotion methods, OI navigation legibility, Gender and Education level were all nominal variables represented by numerical values in the correlation analysis. Specifically, in Locomotion methods, 0 and 1 represented discontinuous teleportation and continuous teleportation, respectively. In OI navigation legibility, 0 and 1 represented unenhanced legibility and enhanced legibility, respectively. In Gender, 0 and 1 represented male and female, respectively. In Education level, 1, 2, 3, and 4 represented primary school and below, junior high school, senior high school, and undergraduate or associate degree, respectively.

The significance levels were indicated as \*p<.05, \*\*p<.01, and \*\*\*p<.001.

**Supplementary Table 2. Matrix of correlation coefficients of all variables in older adults.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Mean±SD** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** |
| **1 Locomotion methods** | 0.5±0.5 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **2 OI navigation legibility** | 0.5±0.5 | 0.00 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **3 Gender** | 0.5±0.5 | 0.00 | 0.00 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **4 Age group** | 68±5.5 | 0.00 | 0.00 | -0.19 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **5 Education level** | 3±1 | 0.00 | 0.00 | -0.33\*\*\* | 0.17 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **6 Digital experience** | 2±1.2 | 0.00 | 0.00 | -0.13 | -0.08 | 0.40\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **7 Egocentric scale** | 5±0.8 | 0.00 | 0.00 | 0.00 | -0.12 | -0.01 | 0.32\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **8 Allocentric scale** | 5±0.8 | 0.00 | 0.00 | 0.05 | -0.07 | -0.14 | 0.13 | 0.58\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **9 Cardinal directions scale** | 3±2.1 | 0.00 | 0.00 | 0.02 | 0.06 | 0.11 | 0.29\*\* | 0.58\*\*\* | 0.20 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **10 Use of navigation** | 3±1.5 | 0.00 | 0.00 | -0.37\*\*\* | 0.09 | 0.38\*\*\* | 0.48\*\*\* | 0.35\*\*\* | -0.02 | 0.37\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| **11 Possession of navigation** | 2±1.1 | 0.00 | 0.00 | -0.32\*\* | 0.04 | 0.35\*\*\* | 0.37\*\*\* | 0.31\*\* | -0.19 | 0.26\* | 0.84\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |
| **12 Rotation ability** | 16±3.4 | 0.00 | 0.00 | -0.20 | 0.23\* | 0.01 | -0.17 | -0.54\*\*\* | -0.21\* | -0.48\*\*\* | -0.11 | -0.18 | 1 |  |  |  |  |  |  |  |  |  |  |
| **13 Wayfinding time** | 196.7±81.92s | **0.20\*** | 0.11 | -0.04 | **0.31\*\*** | 0.06 | **-0.33\*\*** | **-0.43\*\*\*** | -0.10 | -0.18 | **-0.41\*\*\*** | **-0.41\*\*\*** | 0.01 | 1 |  |  |  |  |  |  |  |  |  |
| **14 Number of hesitation** | 13±7.9 | **0.21\*** | -0.05 | -0.16 | **0.26\*** | -0.05 | **-0.48\*\*\*** | **-0.36\*\*\*** | 0.04 | **-0.25\*** | **-0.37\*\*\*** | **-0.42\*\*\*** | 0.15 | 0.75\*\*\* | 1 |  |  |  |  |  |  |  |  |
| **15 Number of turn errors** | 2±1.6 | 0.05 | 0.08 | **0.27\*\*** | -0.01 | 0.03 | **-0.32\*\*** | **-0.27\*\*** | -0.05 | **-0.33\*\*** | **-0.43\*\*\*** | **-0.33\*\*\*** | 0.19 | 0.33\*\* | 0.29\*\* | 1 |  |  |  |  |  |  |  |
| **16 Mobile navigation usage number** | 29±15.9 | 0.11 | 0.07 | -0.05 | 0.04 | 0.00 | **-0.28\*\*** | **-0.52\*\*\*** | -0.02 | **-0.22\*** | **-0.36\*\*\*** | **-0.43\*\*\*** | **0.30\*\*** | 0.65\*\*\* | 0.63\*\*\* | 0.37\*\*\* | 1 |  |  |  |  |  |  |
| **17 Mobile navigation usage duration** | 91.2±42.2s | 0.11 | **0.23\*** | -0.02 | **0.29\*\*** | 0.05 | 0.10 | -0.16 | -0.16 | 0.06 | -0.20 | -0.14 | -0.24\* | 0.64\*\*\* | 0.16 | -0.02 | 0.16 | 1 |  |  |  |  |  |
| **18 Mobile navigation usage duration proportion** | 47.8±16.81% | -0.02 | 0.16 | 0.04 | 0.04 | 0.07 | **0.45\*\*\*** | **0.28\*\*** | -0.12 | **0.28\*\*** | 0.15 | **0.25\*** | **-0.41\*\*\*** | -0.2\* | -0.59\*\*\* | -0.34\*\*\* | -0.54\*\*\* | 0.59\*\*\* | 1 |  |  |  |  |
| **19 Regression number** | 6±4.7 | 0.03 | 0.04 | 0.04 | -0.02 | -0.16 | -0.10 | **-0.21\*** | 0.12 | **-0.33\*\*** | **-0.41\*\*\*** | **-0.31\*\*** | **0.24\*** | 0.18 | 0.25\* | 0.49\*\*\* | 0.39\*\*\* | 0.07 | -0.18 | 1 |  |  |  |
| **20 Average regression angle** | 68.3±28.54° | **-0.32\*\*** | 0.04 | 0.20 | **-0.21\*** | -0.12 | -0.08 | -0.04 | 0.11 | -0.14 | **-0.36\*\*\*** | **-0.26\*** | -0.13 | 0.06 | -0.03 | 0.38\*\*\* | -0.01 | -0.02 | -0.08 | 0.40\*\*\* | 1 |  |  |
| **21 Time of cognitive map drawing** | 172.7±83.9s | -0.01 | 0.01 | **-0.46\*\*\*** | **0.23\*** | **0.29\*\*** | -0.18 | -0.12 | **-0.25\*** | 0.08 | -0.01 | 0.02 | 0.14 | 0.31\*\* | 0.31\*\* | -0.04 | 0.13 | 0.06 | -0.20 | -0.09 | -0.08 | 1 |  |
| **22 Accuracy of cognitive map drawing** | 47.3±16.69% | **0.43\*\*\*** | **0.40\*\*\*** | **-0.26\*\*** | 0.02 | -0.01 | -0.03 | 0.02 | 0.00 | 0.04 | 0.19 | 0.08 | 0.18 | 0.02 | 0.05 | -0.08 | 0.03 | 0.05 | -0.01 | -0.01 | -0.12 | 0.06 | 1 |

The variables Locomotion methods, OI navigation legibility, Gender and Education level were all nominal variables represented by numerical values in the correlation analysis. Specifically, in Locomotion methods, 0 and 1 represented discontinuous teleportation and continuous teleportation, respectively. In OI navigation legibility, 0 and 1 represented unenhanced legibility and enhanced legibility, respectively. In Gender, 0 and 1 represented male and female, respectively. In Education level, 1, 2, 3, and 4 represented primary school and below, junior high school, senior high school, and undergraduate or associate degree, respectively.

The significance levels were indicated as \*p<.05, \*\*p<.01, and \*\*\*p<.001.

**Supplementary Table 3. Matrix of correlation coefficients of all variables in younger adults.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **Mean±SD** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** |
| **1 Locomotion methods** | 0.5±0.5 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **2 OI navigation legibility** | 0.5±0.5 | 0.00 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **3 Gender** | 0.5±0.5 | 0.00 | 0.00 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **4 Age group** | 23±2.4 | 0.00 | 0.00 | 0.38\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **5 Education level** | 4±0.4 | 0.00 | 0.00 | 0.38\*\*\* | 0.83\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **6 Digital experience** | 5±1.2 | 0.00 | 0.00 | -0.41\*\*\* | -0.25\* | -0.33\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **7 Egocentric scale** | 4±1.3 | 0.00 | 0.00 | -0.22\* | -0.27\*\* | -0.41\*\*\* | 0.25\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **8 Allocentric scale** | 4±1.3 | 0.00 | 0.00 | -0.12 | -0.23\* | -0.33\*\* | 0.31\*\* | 0.72\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **9 Cardinal directions scale** | 3±1.3 | 0.00 | 0.00 | -0.49\*\*\* | -0.22\* | -0.34\*\*\* | 0.37\*\*\* | 0.76\*\*\* | 0.67\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **10 Use of navigation** | 5±0.7 | 0.00 | 0.00 | -0.11 | 0.22\* | -0.04 | 0.33\*\*\* | 0.29\*\* | 0.35\*\*\* | 0.30\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |  |
| **11 Possession of navigation** | 4±1.4 | 0.00 | 0.00 | -0.25\* | -0.19 | -0.22\* | 0.11 | 0.33\*\*\* | 0.33\*\* | 0.48\*\*\* | 0.44\*\*\* | 1 |  |  |  |  |  |  |  |  |  |  |  |
| **12 Rotation ability** | 18±3.8 | 0.00 | 0.00 | -0.49\*\*\* | -0.33\*\*\* | -0.30\*\* | 0.13 | 0.16 | -0.04 | 0.22\* | 0.13 | 0.03 | 1 |  |  |  |  |  |  |  |  |  |  |
| **13 Wayfinding time** | 97.8±41.63s | 0.16 | 0.09 | **0.34\*\*\*** | **0.31\*\*** | **0.21\*** | **-0.21\*** | -0.13 | 0.09 | -0.04 | 0.14 | 0.10 | -0.28\*\* | 1 |  |  |  |  |  |  |  |  |  |
| **14 Number of hesitation** | 7±5.9 | 0.20 | 0.05 | **0.29\*\*** | **0.21\*** | 0.04 | -0.20 | **-0.21\*** | -0.04 | -0.19 | 0.19 | 0.08 | -0.04 | 0.72\*\*\* | 1 |  |  |  |  |  |  |  |  |
| **15 Number of turn errors** | 1±1.1 | 0.17 | **0.20\*** | 0.11 | 0.01 | -0.02 | -0.05 | -0.12 | -0.08 | -0.05 | -0.10 | 0.02 | 0.02 | 0.23\* | 0.42\*\*\* | 1 |  |  |  |  |  |  |  |
| **16 Mobile navigation usage number** | 20±7.3 | -0.14 | 0.05 | **0.21\*** | **0.37\*\*\*** | **0.23\*** | 0.04 | 0.06 | 0.11 | 0.01 | **0.33\*\*** | 0.08 | -0.27\*\* | 0.43\*\*\* | 0.26\* | -0.04 | 1 |  |  |  |  |  |  |
| **17 Mobile navigation usage duration** | 39.2±22.05s | -0.03 | 0.13 | -0.04 | **0.22\*** | **0.35\*\*\*** | 0.00 | -0.03 | 0.10 | 0.17 | 0.04 | 0.16 | -0.37\*\*\* | 0.48\*\*\* | -0.12 | -0.20 | 0.22\* | 1 |  |  |  |  |  |
| **18 Mobile navigation usage duration proportion** | 41.9±20.53% | -0.16 | 0.07 | **-0.24\*** | 0.00 | **0.23\*** | 0.08 | 0.08 | 0.06 | **0.22\*** | -0.13 | 0.06 | -0.20 | -0.19 | -0.68\*\*\* | -0.37\*\*\* | -0.16 | 0.74\*\*\* | 1 |  |  |  |  |
| **19 Regression number** | 9±5.7 | -0.08 | 0.13 | -0.08 | -0.20 | **-0.28\*\*** | **0.23\*** | 0.14 | 0.16 | 0.03 | 0.19 | **0.32\*\*** | -0.04 | 0.35\*\*\* | 0.42\*\*\* | 0.20 | 0.17 | 0.06 | -0.24\* | 1 |  |  |  |
| **20 Average regression angle** | 77.0±12.20° | -0.06 | 0.13 | -0.10 | 0.00 | -0.11 | -0.07 | 0.03 | 0.01 | 0.12 | **0.20\*** | **0.32\*\*** | 0.02 | 0.20 | 0.21\* | 0.10 | 0.05 | 0.04 | -0.11 | 0.30\*\* | 1 |  |  |
| **21 Time of cognitive map drawing** | 171.6±81.55s | 0.02 | -0.05 | **0.34\*\*\*** | **0.25\*** | **0.21\*** | 0.17 | 0.12 | 0.05 | -0.07 | 0.19 | -0.12 | -0.07 | 0.39\*\*\* | 0.25\* | -0.07 | 0.18 | 0.17 | -0.08 | 0.04 | -0.18 | 1 |  |
| **22 Accuracy of cognitive map drawing** | 73.7±15.75% | **0.23\*** | **0.25\*** | -0.08 | **-0.34\*\*\*** | **-0.37\*\*\*** | **0.30\*\*** | **0.43\*\*\*** | **0.34\*\*\*** | 0.18 | 0.04 | 0.04 | 0.10 | 0.03 | 0.00 | -0.27\*\* | -0.02 | 0.07 | 0.03 | 0.33\*\* | -0.16 | 0.23\* | 1 |

The variables Locomotion methods, OI navigation legibility, Gender and Education level were all nominal variables represented by numerical values in the correlation analysis. Specifically, in Locomotion methods, 0 and 1 represented discontinuous teleportation and continuous teleportation, respectively. In OI navigation legibility, 0 and 1 represented unenhanced legibility and enhanced legibility, respectively. In Gender, 0 and 1 represented male and female, respectively. In Education level, 1, 2, 3, and 4 represented primary school and below, junior high school, senior high school, and undergraduate or associate degree, respectively.

The significance levels were indicated as \*p<.05, \*\*p<.01, and \*\*\*p<.001.