**Supplementary material**

Table 1

*Means (M) and standard deviation (SD) of performance rates in % across latency conditions*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | ***N*** | **-1500 ms** | **no cue** | **150 ms** | **300 ms** | **500 ms** | **800 ms** | **1200 ms** |
| **Blind** | 22 | 80.58 (13.93) | 72.90 (14.70) | 77.23 (13.31) | 78.03 (13.70) | 77.10 (12.60) | 77.44 (12.87) | 74.77 (14.15) |
| **Sighted** | 24 | 68.45 (8.54) | 64.76 (11.45) | 67.27 (9.47) | 64.60 (12,18) | 67.59 (10.60) | 69.61 (13.82) | 65.61 (10.51) |
| **All** | 46 | 74.25 (12.86) | 68.65 (13.59) | 72.04 (12.40) | 71.03 (14.47) | 72.14 (12.44) | 73.35 (13.80) | 69.99 (13.09) |

Table 2

*Means (M) and standard deviation (SD) of performance rates in % across load conditions*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | ***N*** | **2 itmes** | | **4 items** | | **6 items** | |
|  |  | **no cue** | **cue 150 ms** | **no cue** | **cue 150 ms** | **no cue** | **cue 150 ms** |
| **Blind** | 22 | 88.21 (15.14) | 90.95 (13.26) | 72.90 (14.70) | 77.23 (13.31) | 63.25 (8.37) | 66.04 (11.13) |
| **Sighted** | 24 | 78.85 (11.80) | 79.36 (12.35) | 64.76 (11.45) | 67.27 (9.47) | 62.69 (12.99) | 56.18 (10.37) |
| **All** | 46 | 83.32 (14.15) | 84.90 (13.93) | 68.65 (13.59) | 72.04 (12.40) | 62.96 (10.91) | 60.89 (11.73) |

Table 3

*Parameters of the post-hoc t-tests: differences in tCDA onset as a function of cue latency*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***df*** | ***t*** | ***p*** | ***d*** |
| **150 vs 300 ms** | 45 | -2.98 | .005\* | -0.44 |
| **300 vs 500 ms** | 45 | -5.78 | <.001\*\* | -0.85 |
| **500 vs 800 ms** | 45 | -7.20 | <.001\*\* | -1.06 |
| **800 vs 1200 ms** | 45 | -12.13 | <.001\*\* | -1.79 |

*Note.* Compared are inflection points latencies in lateralized potentials measured at F5/F6 and CP3/CP4. \**p*< .05, \*\**p*< .001

**Table 4***Onset of tCDA (identified with peak detection) at frontal and centroparietal electrodes as a function of cue latencies*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Blind** (*n*= 22) | | **Sighted** (*n*= 24) | | **All** (*N*=46) | |
|  | **F5/F6 (*SD*)** | **CP3/CP4 (*SD*)** | **F5/F6 (*SD*)** | **CP3/CP4 (*SD*)** | **F5/F6 (*SD*)** | **CP3/CP4 (*SD*)** |
| **150 ms** | 189.8 (242.2) | 266.7 (312.2) | 170.6 (234.3) | 143.0 (313.5) | 207.4 (252.9) | 380.0 (270.0) |
| **300 ms** | 421.7 (253.4) | 460.5 (351.5) | 373.8 (216.4) | 414.9 (281.5) | 465.6 (280.5) | 502.4 (406.9) |
| **500 ms** | 648.6 (390.0) | 680.3 (376.3) | 559.3 (409.2) | 615.8 (212.7) | 730.4 (360.7) | 739.4 (477.6) |
| **800 ms** | 956.9 (357.3) | 989.0 (404.0) | 858.6 (373.3) | 874.2 (440.3) | 1047.0 (323.8) | 1094.3 (343.8) |
| **1200 ms** | 1315.9 (317.2) | 1322.3 (349.8) | 1217.7 (366.3) | 1244.5 (413.3) | 1406.0 (238.1) | 1393.7 (269.0) |

*Note.* Data are given in ms. tCDA = tactile contralateral delay activity.

Table 5

*Results of the ANOVA on tCDA onsets (identified with peak detection)*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ANOVA** | ***df*** | ***F*** | ***p*** | *ηp2* |
| ***CUE LATENCY*** | 4,176 | 118.52 | < .001 | .73 |
| ***GROUP*** | 1,44 | 20.34 | < .001 | .32 |
| **Post-hoc *t*-test** | ***df*** | ***t*** | ***p*** | ***d*** |
| **150 vs 300 ms** | 45 | -4.63 | <.001 | -0.68 |
| **300 vs 500 ms** | 45 | -3.99 | <.001 | -0.59 |
| **500 vs 800 ms** | 45 | -4.75 | <.001 | -0.70 |
| **800 vs 1200 ms** | 45 | -5.29 | <.001 | -0.78 |

*Note.* Post-hoc *t*-tests compare tCDA onsets in lateralized potentials measured at F5/F6 and CP3/CP4

Table 6

*tCDAF (F5/F6) and tCDACP (CP3/CP4) amplitudes: Descriptives and t-tests against zero across all cue latencies*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Cue** | **tCDAF *(SD)*** | ***df*** | ***t*** | ***p*** | ***d*** | **tCDACP *(SD)*** | ***df*** | ***t*** | ***p*** | ***d*** |
| **Blind** | **-1500 ms** | -0.77 (3.74) | 21 | -0.96 | .346 | -0.21 | -1.65 (3.65) | 21 | -2.11 | .094 | -0.45 |
|  | **150 ms** | -1.46 (2.42) | 21 | -2.82 | .010\* | -0.60 | -1.41 (1.73) | 21 | -3.83 | .002\* | -0.82 |
|  | **300 ms** | 0.13 (4.89) | 21 | 0.12 | .903 | 0.03 | -0.73 (2.56) | 21 | -1.34 | .388 | -0.29 |
|  | **500 ms** | -1.93 (3.00) | 21 | -3.02 | .009\* | -0.64 | -1.44 (2.12) | 21 | -3.19 | .009\* | -0.68 |
|  | **800 ms** | -0.49 (3.03) | 21 | -0.75 | .460 | -0.16 | -1.00 (1.97) | 21 | -2.37 | .055 | -0.51 |
|  | **1200 ms** | -0.30 (2.77) | 21 | -0.51 | .616 | -0.11 | -1.72 (3.05) | 21 | -2.64 | .031\* | -0.56 |
| **Sighted** | **-1500 ms** | -1.67 (3.83) | 23 | -2.14 | .044\* | -0.44 | -1.30 (2.12) | 23 | -3.00 | .013\* | -0.61 |
|  | **150 ms** | -2.30 (3.34) | 23 | -3.40 | .006\* | -0.69 | -0.37 (1.89) | 23 | -0.96 | .346 | -0.20 |
|  | **300 ms** | -1.37 (2.23) | 23 | -3.01 | .013\* | -0.62 | -0.63 (1.62) | 23 | -1.89 | .071 | -0.39 |
|  | **500 ms** | -1.19 (3.29) | 23 | -1.78 | .092 | -0.36 | -1.45 (3.36) | 23 | -2.11 | .092 | -0.43 |
|  | **800 ms** | -1.38 (2.72) | 23 | -2.49 | .041\* | -0.51 | 0.04 (1.60) | 23 | 0.12 | .905 | 0.03 |
|  | **1200 ms** | -1.21 (3.53) | 23 | -1.68 | .214 | -0.34 | 0.37 (2.77) | 23 | 0.66 | .516 | 0.14 |
| **All** | **-1500 ms** | -1.24 (3.77) | 45 | -2.23 | .031\* | -0.33 | -1.46 (2.93) | 45 | -3.39 | .002\* | -0.50 |
|  | **150 ms** | -1.90 (2.94) | 45 | -4.38 | <.001\*\* | -0.65 | -0.87 (1.87) | 45 | -3.15 | .003\* | -0.47 |
|  | **300 ms** | -0.65 (3.77) | 45 | -1.17 | .247 | -0.17 | -0.68 (2.10) | 45 | -2.19 | .068 | -0.32 |
|  | **500 ms** | -1.54 (3.14) | 45 | -3.34 | .002\* | -0.49 | -1.44 (2.81) | 45 | -3.49 | .002\* | -0.51 |
|  | **800 ms** | -0.95 (2.88) | 45 | -2.25 | .059 | -0.33 | -0.46 (1.84) | 45 | -1.68 | .101 | -0.25 |
|  | **1200 ms** | -0.77 (3.19) | 45 | -1.65 | .213 | -0.24 | -0.63 (3.07) | 45 | -1.39 | .213 | -0.20 |

*Note*. Amplitudes are shown across the window 700-900 ms after onset of the relevant cue (or after S1 condition -1500ms) in **µV**. \**p* < .05, \*\**p*< .001

Table 7

*tCDA (F5/F6) and tCDA (CP3/CP4): Descriptives and t-tests against zero for the conditions with varying short term memory load*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **tCDAF *(SD)*** | ***df*** | ***T*** | ***P*** | ***d*** | **tCDACP *(SD)*** | ***df*** | ***t*** | ***p*** | ***d*** |
| **Blind** | **load 2** | -1.12 (2.35) | 21 | -2.24 | .036\* | -0.48 | -0.99 (1.25) | 21 | -3.71 | .003\* | -0.79 |
|  | **load 4** | -1.46 (2.42) | 21 | -2.82 | .010\* | -0.60 | -1.41 (1.73) | 21 | -3.83 | .002\* | -0.82 |
|  | **load 6** | -0.30 (3.45) | 21 | -0.40 | .727 | -0.09 | -0.84 (4.24) | 21 | -0.93 | .727 | -0.20 |
| **Sighted** | **load 2** | -0.56 (2.67) | 23 | -1.03 | .312 | -0.21 | 0.62 (1.66) | 23 | 1.82 | .162 | 0.37 |
|  | **load 4** | -2.30 (3.34) | 23 | -3.40 | .006\* | -0.69 | -0.37 (1.89) | 23 | -0.96 | .346 | -0.20 |
|  | **load 6** | -0.66 (3.91) | 23 | -0.83 | .832 | -0.17 | 0.29 (2.09) | 23 | 0.69 | .832 | 0.14 |
| **All** | **load 2** | -0.83 (2.51) | 45 | -2.25 | .059 | -0.33 | -0.15 (1.67) | 45 | -0.61 | .548 | -0.09 |
|  | **load 4** | -1.90 (2.94) | 45 | -4.38 | <.001\*\* | -0.65 | -0.87 (1.87) | 45 | -3.15 | .003\* | -0.47 |
|  | **load 6** | -0.49 (3.66) | 45 | -0.91 | .745 | -0.13 | -0.25 (3.31) | 45 | -0.51 | .745 | -0.08 |

*Note***.** Amplitudes are shown in the time frame of 700-900 ms after the auditory cue in **µV.**\**p* < .05, \*\**p*< .001

**Supplementary text - Differences between participants with congenital and acquired blindness**

In order to explore possible differences between participants who are congenitally blind and those who lost their sight later in life, further analyses were calculated comparing two groups of blind participants (*n*=11 congenital blindness; *n*=11 acquired blindness). These analyses were analogous to the calculations with all subjects described in the methods section, if not stated otherwise. We implemented the between-subject factor SUBGROUP comprising the two subgroups of participants who are congenitally blind and those who lost their sight later in life. We also did some correlation analyses to assess the influence of age, blindness onset, Braille experience, and disease duration on performance rates in the group of participants with blindness.

**Results**

**A.1. Performance**

**Latency.** Due to heteroscedasticity we used box-cox transformed performance rates to perform the ANOVAs. The two-way mixed ANOVA with the between-subjects factor SUBGROUP (congenital blindness, acquired blindness) and the within‑subject factor CUE LATENCY showed no main effect of SUBGROUP (*F*(1,20)=0.01, *p*=.94), or an interaction (*F*(1,20)=0.13, *p*=.99). Descriptive statistics are shown in Table 8.

**Table 8**

*Means (M) and standard deviation (SD) of performance rates in % across latency conditions for participants with congenital blindness (n=11)* *and participants with acquired blindness (n=11)*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **-1500 ms** | **no cue** | **150 ms** | **300 ms** | **500 ms** | **800 ms** | **1200 ms** |
| **Congenital** | 85.35 (10.77) | 77.05 (8.60) | 79.57 (10.21) | 77.16 (8.98) | 80.89 (5.30) | 77.00 (8.17) | 76.49 (9.49) |
| **Acquired** | 75.80 (15.53) | 68.75 (18.50) | 74.89 (16.00) | 78.91 (17.65) | 73.33 (16.55) | 77.87 (16.75) | 73.05 (17.99) |

**Load.** The three-way mixed ANOVA with between-subjects factor SUBGROUP and within-subjects factors LOAD and CUE showed no main effect of SUBGROUP (*F*(1,20)=1.77, *p*=.20), or an interaction with this factor (CUE\*SUBGROUP *F*(1,20)=1.84, *p*=.19); LOAD\*SUBGROUP *F*(2,40)=1.87, *p*=.17); CUE\*LOAD\*SUBGROUP *F*(1,20)=1.94, *p*=.18)). Descriptiv statistics can be found in Table 9.

Table 9

*Means (M) and standard deviation (SD) of performance rates in % across load conditions for participants with congenital blindness (n=11)* *and participants with acquired blindness (n=11)*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2 items** | |  | **4 items** | | **6 items** | |
|  | **no cue** | **cue 150 ms** |  | **no cue** | **cue 150 ms** | **no cue** | **cue 150 ms** |
| **Congenital** | 93.48 (4.36) | 95.88 (4.16) |  | 77.05 (8.60) | 79.57 (10.21) | 64.23 (8.37) | 66.95 (10.21) |
| **Acquired** | 82.93 (20.02) | 86.01 (17.28) |  | 68.75 (18.50) | 74.89 (16.00) | 62.27 (8.65) | 65.13 (12.42) |

Thus, in all experimental conditions were no significant differences regarding performance rates between participants who are congenitally blind and those who lost their sight later in life.

**Influencing factors**

We did not find significant correlations between age, blindness onset, years of Braille experience, or disease duration with performance rates in the group of participants with blindness, as assessed with Spearman’s correlation (age: *r*=‑.36, *p*=.09; blindness onset: *r*=‑,.22, *p*=.32; Braille experience: *r*=-.01, *p*=.96; disease duration: *r*=.01, *p*=.96). However, we observed the trend that participants with a late onset (≥13 years) reached performance rates comparable to those of sighted participants. Future studies could examine possible effects of blindness onset more formally.

**A.2. Characteristics of tCDA**

**Time course.** The three-way mixed ANOVA on tCDA inflection-point latencies as a function of the factors SUBGROUP, CUE LATENCY, and ELECTRODE did not reveal a main effect of SUBGROUP (*F*(1,20)=0.73, *p*=.40), or an interaction with this factor (LATENCY\*SUBGROUP *F*(3,51)=2.60, *p*=.07); ELECTRODE\*SUBGROUP *F*(1,20)=0.28, *p*=.17); LATENCY\*ELECTRODE\*SUBGROUP *F*(4,80)=1.40, *p*=.24)). There was no homogeneity of covariances, as assessed by Box’s test (*p*=.001). Descriptive statistics can be found in Table 10.

Table 10

*Means (M) and standard deviation (SD) of inflection points (in ms) across latency conditions for participants with congenital blindness and participants with acquired blindness*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Congenital** (*n* = 11) | | | **Acquired** (*n* = 11) | | |
|  | **F5/6** (*SD*) | **CP3/4** (*SD*) | **MF/CP** (*SD*) | **F5/6** (*SD*) | **CP3/4** (*SD*) | **MF/CP** (*SD*) |
| **150 ms** | 433.5 (341.1) | 311.9 (203.2) | 372.7 (223.2) | 415.7 (238.3) | 360.3 (244.4) | 388.0 (164.8) |
| **300 ms** | 380.3 (145.8) | 528.1 (284.9) | 454.2 (163.4) | 577.6 (310.9) | 528.6 (322.9) | 553.1 (155.9) |
| **500 ms** | 811.8 (320.4) | 769.3 (243.9) | 790.6 (205.1) | 724.2 (302.7) | 931.2 (357.9) | 827.7 (263.2) |
| **800 ms** | 1070.2 (214.8) | 1208.7 (288.4) | 1139.5 (212.7) | 1012.8 (302.8) | 975.5 (221.0) | 994.1 (245.3) |
| **1200 ms** | 1734.6 (175.6) | 1559.9 (208.3) | 1647.3 (170.8) | 1566.0 (213.8) | 1328.3 (150.7) | 1447.2 (123.5) |

**Load effects.** The three-way mixed ANOVA on the amplitude of tCDA as a function of the factors SUBGROUP, LOAD, and ELECTRODE did not show a main effect of the factor SUBGROUP (*F*(1,20)=0.21, *p*=.66), or an interaction with this factor (LOAD\*SUBGROUP *F*(1,27)=1.36, *p*=.27); ELECTRODE\*SUBGROUP *F*(1,20)=.005, *p*=.95); ELECTRODE\*LOAD\*SUBGROUP *F*(2,40)=0.02, *p*=.97)). Descriptive statistics can be found in Table 11.

Table 11

*tCDA (F5/F6) and tCDA (CP3/CP4): Descriptives for the conditions with varying memory load for participants with congenital blindness(n=11) and participants with acquired blindness(n=11)*

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **tCDAF *(SD)*** | **tCDACP *(SD)*** |
| **Congenital** | **load 2** | -0.68 (2.28) | -0.48 (0.84) |
|  | **load 4** | -0.99 (2.42) | -0.93 (1.66) |
|  | **load 6** | -0.74 (2.25) | -1.41 (3.03) |
| **Acquired** | **load 2** | -1.57 (2.44) | -1.49 (1.41) |
|  | **load 4** | -1.91 (2.44) | -1.90 (1.74) |
|  | **load 6** | 0.15 (4.42) | -0.27 (5.27) |

*Note***.** Amplitudes are shown in the time frame of 700-900 ms after the auditory cue in **µV.**

**Topography.** The three-way mixed ANOVA with the factors SUBGROUP, ELECTRODE, and CUE LATENCY did not show a main effect of the factor SUBGROUP (*F*(1,20)=2.20, *p*=.15), or an interaction with this factor (CUE LATENCY\*SUBGROUP *F*(2,47)=0.38, *p*=.72); ELECTRODE\*SUBGROUP *F*(1,20)=0.60, *p*=.45); ELECTRODE\*CUE LATENCY\*SUBGROUP *F*(5,100)=1.27, *p*=.28)). Table 12 shows the descriptive statistics.

**Table 12**

*tCDAF (F5/F6) and tCDACP (CP3/CP4) amplitudes: Descriptives across all cue latencies for participants with congenital blindness (n=11) and participants with acquired blindness(n=11)*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Cue** | **tCDAF *(SD)*** | **tCDACP *(SD)*** |
| **Congenital** | **-1500 ms** | -0.49 (3.88) | -0.64 (3.93) |
|  | **150 ms** | -0.99 (2.42) | -0.93 (1.66) |
|  | **300 ms** | 1.18 (6.68) | 0.04 (2.88) |
|  | **500 ms** | -1.84 (1.83) | -1.25 (2.37) |
|  | **800 ms** | 0.01 (3.81) | -1.07 (2.08) |
|  | **1200 ms** | 1.07 (2.13) | -1.86 (3.78) |
| **Acquired** | **-1500 ms** | -1.04 (3.76) | -2.65 (3.22) |
|  | **150 ms** | -1.91 (2.44) | -1.90 (1.74) |
|  | **300 ms** | -0.92 (1.76) | -1.50 (2.05) |
|  | **500 ms** | -2.02 (3.94) | -1.64 (1.94) |
|  | **800 ms** | -0.98 (2.05) | -0.92 (1.96) |
|  | **1200 ms** | -1.67 (2.73) | -1.58 (2.29) |

*Note***.** Amplitudes are shown in the time frame of 700-900 ms after onset of the relevant cue (or after S1 condition -1500ms) in **µV.**

There were no significant differences between the two subgroups of participants with blindness regarding tCDA characteristics, i.e. time course, load effects, and topography.