## Supporting Information

Supplement 1. Overall characteristics for the users based on their game level for each development group for all 3 tenacity groups.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Typical development** | | | |  |  | **Developmental disabilities** | | | |  |  | **Total** | | | |  |
| **(n=1661)** | | | |  |  | **(n=280)** | | | |  |  | **(n=1941)** | | | |  |
|  | FALSE | Neutral | TRUE | p-value |  |  | FALSE | Neutral | TRUE | p-value |  |  | FALSE | Neutral | TRUE | p-value |  |
| (n=268) | (n=705) | (n=688) |  |  | (n=44) | (n=120) | (n=116) |  |  | (n=312) | (n=825) | (n=804) |  |
| **Survey** |  | | | | | | | | | | | | | | | | |
| Gender |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Male n, (%) | 140 (52.2) | 339 (48.1) | 370  (53.7) | 0.13 |  |  | 30 (68.1) | 79 (65.8) | 83 (71.5) | 0.13 |  |  | 170 (54.5) | 418 (50.7) | 453 (56.3) | 0.0752 |  |
| Female n (%) | 128 (47.7) | 366 (51.9) | 318  (46.2) |  | 14 (31.9) | 41 (34.2) | 33 (28.5) |  | 142 (45.5) | 407 (49.3) | 351 (43.7) |
| age (month) | 45.97 (16.14) | 51.24 (17.49) | 46.45 (14.53) | <0.000 | \*\*\* |  | 69.32 (38.22) | 70.16 (33.68) | 57.37 (26.6) | 0.005 | \*\* |  | 49.27 (22.26) | 53.99 (21.7) | 48.03 (17.25) | <0.000 | \*\*\* |
| using period (day) | 191.5 [107.75, 325.0] | 162.0 [89.00, 262.5] | 195.0 [110.00, 308.5] | <0.000 | \*\*\* |  | 178.5 [77.75, 255.0] | 151 [93.00, 233.0] | 171 [72.25, 265.5] | 0.211 |  |  | 189 [94.0, 321.0] | 159  [87.0, 255.0] | 189 [106.0, 255.0] | 0.0001 | \*\* |
| Time taken playing 1–10 episodes (day) | 75.5  [31.0, 189.50] | 52.0 [25.0, 125.50] | 61.0  [28.0, 159.25] | 0.036 | \* |  | 69 [23.75, 208.0] | 34.5 [10.00, 116.0] | 48 [12.50, 146.0] | 0.022 | \* |  | 70 [30,0. 182.0] | 50 [23.0, 120.0] | 58 [26.0, 155.0] | <0.000 | \*\*\* |
| The number of episodes user played | 20.82 (12.18) | 23.58 (15.68) | 22.72 (15.45) | 0.036 | \* |  | 29.20 (18.74) | 32.64 (21.14) | 34.07 (22.87) | 0.423 |  |  | 22 (13.72) | 24.21 (17.15) | 25.06 (17.01) | 0.0212 | \* |
| **Game Driven Index** |  | | | | | | | | | | | | | | | | |
| **Game Level** |  | | | | | | | | | | | | | | | | |
| level A (%) | 130  (48.7) | 343 (48.4) | 338  (49.1) | 0.995 |  |  | 24 (54.5) | 51 (42.5) | 48 (41.4) | 0.599 |  |  | 155 (49.5) | 394  (47.8) | 385  (47.9) | 0.963 |  |
| level B (%) | 77  (28.6) | 208 (29.4) | 202  (29.4) |  | 8 (18.2) | 33 (27.5) | 32 (27.6) |  | 85 (27.2) | 241  (29.2) | 234  (29.1) |
| level C (%) | 61  (22.7) | 157 (22.2) | 148  (21.5) |  | 12 (27.3) | 36  (30) | 36  (31) |  | 73 (23.3) | 190  (23.0) | 184  (22.9) |
| **Score from episode 1 to 3** |  | | | | | | | | | |  |  |  |  |  |  |  |
| Inference | 8.57  [7.52, 10.27] | 9.16 [8.46, 10.3] | 7.86  [6.76, 8.98] | <0.000 | \*\*\* |  | 9.29 [7.85, 10.3] | 9.28 [8.99, 10.32] | 7.29 [6.44, 8.88] | <0.000 | \*\*\* |  | 8.78 [7.54, 10.28] | 9.18 [8.53, 10.3] | 7.78 [6.69, 8.98] | <0.000 | \*\*\* |
| Discrimination | 9.29  [8.45, 10.15] | 9.9  [9.41, 10.49] | 9.11  [8.31, 9.78] | <0.000 | \*\*\* |  | 9.7 [8.72, 10.58] | 9.99 [9.11, 10.57] | 8.91 [8.26, 9.82] | <0.000 | \*\*\* |  | 9.37 [8.47, 10.21] | 9.91 [9.38, 10.51] | 9.08 [8.3, 9.78] | <0.000 | \*\*\* |
| Memory | 9.02 [7.87, 10.47] | 9.72 [8.58, 10.53] | 8.48  [7.5, 9.62] | <0.000 | \*\*\* |  | 9.16 [7.59, 10.22] | 9.54 [8.15, 10.47] | 7.9 [6.76, 9.22] | <0.000 | \*\*\* |  | 9.04 [7.85, 10.46] | 9.7 [8.54, 10.53] | 8.42 [7.4, 9.59] | <0.000 | \*\*\* |
| Numerical | 9.02  [8.17, 9.7] | 9.43 [8.62, 10.13] | 8.37  [7.6, 9.06] | <0.000 | \*\*\* |  | 9.39 [8.52, 10.2] | 9.49 [8.82, 10.1] | 8.42 [7.52, 9.22] | <0.000 | \*\*\* |  | 9.07 [8.24, 9.78] | 9.44 [8.65, 10.13] | 8.38 [7.59, 9.06] | <0.000 | \*\*\* |
| Organizing | 8.2  [6.68, 9.4] | 9.16 [8.13, 10.19] | 7.58 [6.07, 8.73] | <0.000 | \*\*\* |  | 8.45 [6.53, 9.93] | 9.2 [7.73, 10.21] | 7.11 [5.43, 8.47] | <0.000 | \*\*\* |  | 8.21 [6.67, 9.42] | 9.17 [8.06, 10.19] | 7.46 [5.96, 8.69] | <0.000 | \*\*\* |
| Space Perceptual | 8.02  [6.99, 8.79] | 8.63 [7.95, 9.42] | 7.23 [6.49, 8.1] | <0.000 | \*\*\* |  | 8.55 [7.35, 9.6] | 8.88 [8.21, 9.63] | 7.26 [6.12, 8.04] | <0.000 | \*\*\* |  | 8.1 [7.01, 8.99] | 8.65 [7.97, 9.44] | 7.23 [6.43, 8.09] | <0.000 | \*\*\* |
| Velocity Perceptual | 9.03 [8.29, 9.51] | 9.4  [8.66, 10.15] | 8.66 [8.22, 9.41] | <0.000 | \*\*\* |  | 9.25 [8.21, 9.51] | 9.31 [8.65, 9.51] | 8.54 [7.74, 9.21] | <0.000 | \*\*\* |  | 9.04 [8.28, 9.51] | 9.39 [8.66, 10.13] | 8.64 [8.15, 9.4] | <0.000 | \*\*\* |

- Data include mean (standard deviation), number (%), or median [interquartile range] scores.

- Chi-square test was performed for categorical variables, and ANOVA test were performed for continuous variables, except *‘Time interval playing 1st and 10th episodes’, ‘using period’, ‘Score from episode 1 to 3’* for which the Kruskal-Wallis test was performed.

- Significance level: p<0.05

Supplement 2. Comparison in relation to two tenacity groups and score gap between 10and primary episodes in the typical development group.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **A level** | | |  | **B level** | | |  | **C level** | | |  |
| **(n=468)** | | |  | **(n=279)** | | |  | **(n=209)** | | |  |
| Normal | FALSE | TRUE | p-value |  | FALSE | TRUE | p-value |  | FALSE | TRUE | p-value |  |
| (n=130) | (n=338) |  | (n=77) | (n=202) |  | (n=61) | (n=148) |  |
| **Score gap, mean (SD)** |  |  |  |  |  |  |  |  |  |  |  |  |
| Inference | 1.01 (2.08) | 1.91 (2.15) | <0.000 | \*\*\* | 0.65 (2.25) | 1.26 (1.95) | 0.0695 | . | 0.55 (2.49) | 1.08 (2.23) | 0.1639 |  |
| Discrimination | 0.5 (1.89) | 0.63 (1.67) | 0.3704 |  | 0.41 (1.79) | 0.53 (1.71) | 0.2504 |  | 0.74 (1.97) | 0.66 (1.67) | 0.7709 |  |
| Memory | 0.13 (2.44) | 0.3 (2.33) | 0.2353 |  | 1.28 (2.2) | 1.96 (2.08) | 0.0322 | \* | 1.8 (2.03) | 1.87 (2.19) | 0.3666 |  |
| Numerical | 0.35 (1.7) | 0.75 (1.95) | 0.0038 | \*\* | 1.49 (1.29) | 1.55 (1.73) | 0.2092 |  | 1.31 (1.5) | 2.4 (1.24) | <0.000 | \*\*\* |
| Organizing | 0.6 (1.97) | 1.01 (2.18) | 0.013 | \* | 1.06 (2.27) | 1.64 (2.29) | 0.017 | \* | -0.66 (2.16) | 0.04 (2.07) | 0.0382 | \* |
| Space Perceptual | -1.79 (3.11) | -1.47 (2.88) | 0.4901 |  | -0.6 (3.08) | -0.51 (2.84) | 0.1808 |  | -0.89 (2.72) | -0.14 (2.64) | 0.1509 |  |
| Velocity Perceptual | -0.62 (2.22) | -0.61 (2.06) | 0.3788 |  | -2.17 (2.63) | -2.31 (2.2) | 0.3994 |  | -2.31 (2.45) | -2.01 (2.18) | 0.1856 |  |

- Two-independent t tests were used after checking normality, Mann-Whitney test was performed otherwise.

- Significance level p < 0.05

Supplement 3. Comparison in relation to the tenacity group and score gap between 10and primary episodes in developmental disabilities group.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **A level** | | |  | **B level** | | |  | **C level** | | |  |
| **(n=72)** | | |  | **(n=40)** | | |  | **(n=120)** | | |  |
| Disabilities | FALSE | TRUE | p-value |  | FALSE | TRUE | p-value |  | FALSE | TRUE | p-value |  |
| (n=24) | (n=48) |  | (n=8) | (n=32) |  | (n=12) | (n=36) |  |
| **Score gap, mean (SD)** |  |  |  |  |  |  |  |  |  |  |  |  |
| Inference | 1.44 (2.07) | 2.19 (1.83) | 0.024 | \* | -0.55 (1.54) | 1.63 (1.96) | 0.006 | \*\* | 1.23 (1.31) | 1.62 (1.9) | 0.4371 |  |
| Discrimination | 1.08 (1.64) | 0.13 (1.98) | 0.0422 | \* | 0.13 (1.81) | -0.47 (2.02) | 0.526 |  | -0.28 (1.53) | 0.97 (1.2) | 0.0108 | \* |
| Memory | 0.72 (2.56) | 0.35 (2.36) | 0.5698 |  | 0.21 (2.83) | 1.4 (2.06) | 0.3213 |  | 1.93 (2.15) | 1.82 (2.09) | 0.8894 |  |
| Numerical | 0.28 (1.7) | 0.37 (2.11) | 0.8557 |  | -1.11 (1.69) | 1.02 (1.96) | 0.004 | \*\* | 1.47 (1.36) | 2.07 (1.31) | 0.216 |  |
| Organizing | -0.26 (2.79) | 0.84 (2.19) | 0.0227 | \* | 1.31 (3.07) | 2.34 (2.84) | 0.4679 |  | -0.56 (1.71) | 1.18 (1.87) | 0.0094 | \*\* |
| Space Perceptual | -0.56 (3.28) | -0.56 (2.65) | 0.9946 |  | -2.77 (3.16) | -0.44 (2.66) | 0.1044 |  | -0.39 (1.79) | 1.23 (2.84) | 0.0385 | \* |
| Velocity Perceptual | -0.25 (2.66) | -0.35 (2.15) | 0.8717 |  | -1.86 (2.1) | -1.44 (2.63) | 0.6765 |  | -1.82 (2.76) | -2.58 (2.24) | 0.4228 |  |

- Two-independent t tests were used after checking normality, Mann-Whitney test was performed otherwise.

- Significance level p < 0.05

Supplement 4. Comparison in relation to 3 tenacity groups and score gap between 10and primary episodes in typical developments group.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **A level** | | | |  | **B level** | | | | |  | | **C level** | | | | |  | |
| **(n=811)** | | | |  | **(n=487)** | | | | |  | | **(n=363)** | | | | |  | |
| Normal | FALSE | Neutral | TRUE | p-value |  | FALSE | Neutral | TRUE | p-value |  | | FALSE | | Neutral | TRUE | p-value |  | |
| (n=130) | (n=343) | (n=338) |  | (n=77) | (n=208) | (n=202) |  | | (n=61) | | (n=157) | (n=148) |  | |
| **Score gap, mean (SD)** |  |  |  |  |  |  |  |  |  |  | |  | |  |  |  |  | |
| Inference | 1.01 (2.08) | 0.56 (1.45) | 1.91 (2.15) | <0.000 | \*\*\* | 0.65 (2.25) | 0.73 (1.6) | 1.26 (1.95) | <0.000 | \*\*\* | | 0.55 (2.49) | | -0.26 (1.97) | 1.08 (2.23) | <0.000 | \*\*\* | |
| Discrimination | 0.5 (1.89) | 0.07 (1.27) | 0.63 (1.67) | <0.000 | \*\*\* | 0.41 (1.79) | -0.05 (1.46) | 0.53 (1.71) | <0.000 | \*\*\* | | 0.74 (1.97) | | 0.05 (1.47) | 0.66 (1.67) | <0.000 | \*\*\* | |
| Memory | 0.13 (2.44) | -0.01 (2.25) | 0.3  (2.33) | <0.000 | \*\*\* | 1.28  (2.2) | 1.41 (1.92) | 1.96 (2.08) | <0.000 | \*\*\* | | 1.8  (2.03) | | 1.78 (2.07) | 1.87 (2.19) | 0.0029 | \*\* | |
| Numerical | 0.35 (1.7) | -0.02 (1.67) | 0.75 (1.95) | <0.000 | \*\*\* | 1.49 (1.29) | 1.13 (1.36) | 1.55 (1.73) | <0.000 | \*\*\* | | 1.31  (1.5) | | 1.62 (1.16) | 2.4  (1.24) | <0.000 | \*\*\* | |
| Organizing | 0.6 (1.97) | -0.23 (1.68) | 1.01 (2.18) | <0.000 | \*\*\* | 1.06 (2.27) | 0.65 (1.97) | 1.64 (2.29) | <0.000 | \*\*\* | | -0.66 (2.16) | | -1.14 (1.95) | 0.04 (2.07) | <0.000 | \*\*\* | |
| Space Perceptual | -1.79 (3.11) | -2.31 (2.78) | -1.47 (2.88) | <0.000 | \*\*\* | -0.6 (3.08) | -0.82 (2.84) | -0.51 (2.84) | <0.000 | \*\*\* | | -0.89 (2.72) | | -0.37 (2.06) | -0.14 (2.64) | <0.000 | \*\*\* | |
| Velocity Perceptual | -0.62 (2.22) | -0.88 (2.03) | -0.61 (2.06) | <0.000 | \*\*\* | -2.17 (2.63) | -2.59 (1.91) | -2.31  (2.2) | <0.000 | \*\*\* | | -2.31 (2.45) | | -2.14 (2.35) | -2.01 (2.18) | <0.000 | \*\*\* | |

- Data include mean (standard deviation) and ANCOVA test was performed and the day interval taken to play from episode 1 to 10 was considered a covariate

- Significance level p < 0.05

Supplement 5. Comparison in relation to 3 tenacity groups and score gap between 10 and primary episodes in developmental disabilities group.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **A level** | | | |  | **B level** | | | |  | **C level** | | | |  |
| **(n=123)** | | | |  | **(n=73)** | | | |  | **(n=84)** | | | |  |
| Disabilities | FALSE | Neutral | TRUE | p-value |  | FALSE | Neutral | TRUE | p-value |  | FALSE | Neutral | TRUE | p-value |  |
| (n=24) | (n=51) | (n=48) |  | (n=8) | (n=33) | (n=32) |  | (n=12) | (n=36) | (n=36) |  |
| **Episode gap, mean (sd)** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Inference | 1.44 (2.07) | 0.49 (1.74) | 2.19 (1.83) | <0.000 | \*\*\* | -0.55 (1.54) | 0.03 (1.43) | 1.63 (1.96) | <0.000 | \*\*\* | 1.23 (1.31) | -0.3 (2.54) | 1.62  (1.9) | <0.000 | \*\*\* |
| Discrimination | 1.08 (1.64) | -0.12 (1.08) | 0.13 (1.98) | <0.000 | \*\*\* | 0.13 (1.81) | -0.05 (1.45) | -0.47 (2.02) | <0.000 | \*\*\* | -0.28 (1.53) | 0.45 (1.69) | 0.97  (1.2) | <0.000 | \*\*\* |
| Memory | 0.72 (2.56) | -0.36 (2.15) | 0.35 (2.36) | <0.000 | \*\*\* | 0.21 (2.83) | 0.92 (2.13) | 1.4  (2.06) | <0.000 | \*\*\* | 1.93 (2.15) | 1.3  (2.34) | 1.82 (2.09) | <0.000 | \*\*\* |
| Numerical | 0.28  (1.7) | -0.27 (1.58) | 0.37 (2.11) | <0.000 | \*\*\* | -1.11 (1.69) | 0.84 (1.25) | 1.02 (1.96) | <0.000 | \*\*\* | 1.47 (1.36) | 1.13 (1.12) | 2.07 (1.31) | <0.000 | \*\*\* |
| Organizing | -0.26 (2.79) | -0.25 (1.48) | 0.84 (2.19) | <0.000 | \*\*\* | 1.31 (3.07) | 1.07 (2.08) | 2.34 (2.84) | <0.000 | \*\*\* | -0.56 (1.71) | -0.82 (1.98) | 1.18 (1.87) | <0.000 | \*\*\* |
| Space Perceptual | -0.56 (3.28) | -1.51 (2.52) | -0.56 (2.65) | <0.000 | \*\*\* | -2.77 (3.16) | -0.8 (2.15) | -0.44 (2.66) | <0.000 | \*\*\* | -0.39 (1.79) | -0.82 (2.75) | 1.23 (2.84) | <0.000 | \*\*\* |
| Velocity Perceptual | -0.25 (2.66) | -1.02 (2.2) | -0.35 (2.15) | <0.000 | \*\*\* | -1.86 (2.1) | -2.3 (1.96) | -1.44 (2.63) | <0.000 | \*\*\* | -1.82 (2.76) | -2.7 (2.36) | -2.58 (2.24) | <0.000 | \*\*\* |

- Data include mean (standard deviation) and ANCOVA test was performed and the day interval taken to play from episode 1 to 10 was considered a covariate.

- Significance level p < 0.05