Game description

Participants must collect stars while not touching neon circles, which are constantly in motion. In order to collect a star participants should move the mouse' cursor until the star is reached. The game has 13 levels, which progressively increase in terms of difficulty; it becomes increasingly more difficult to reach all the starts needed to complete a game level. The game claims the level 13th is a training for fighter pilots, and participants are challenged to do it in less than 10s. The game is available online: http://loveisgames.com/action/1979/star-reaction

Objective game performance

Table 1. Maximum level achieved out of 13 levels

	Maximum level achieved	
	M	SD
Study 1	7,58	1,09
Study 2	7,88	1,13

Figure 1. Time in seconds required to complete each of the game levels in Study 1

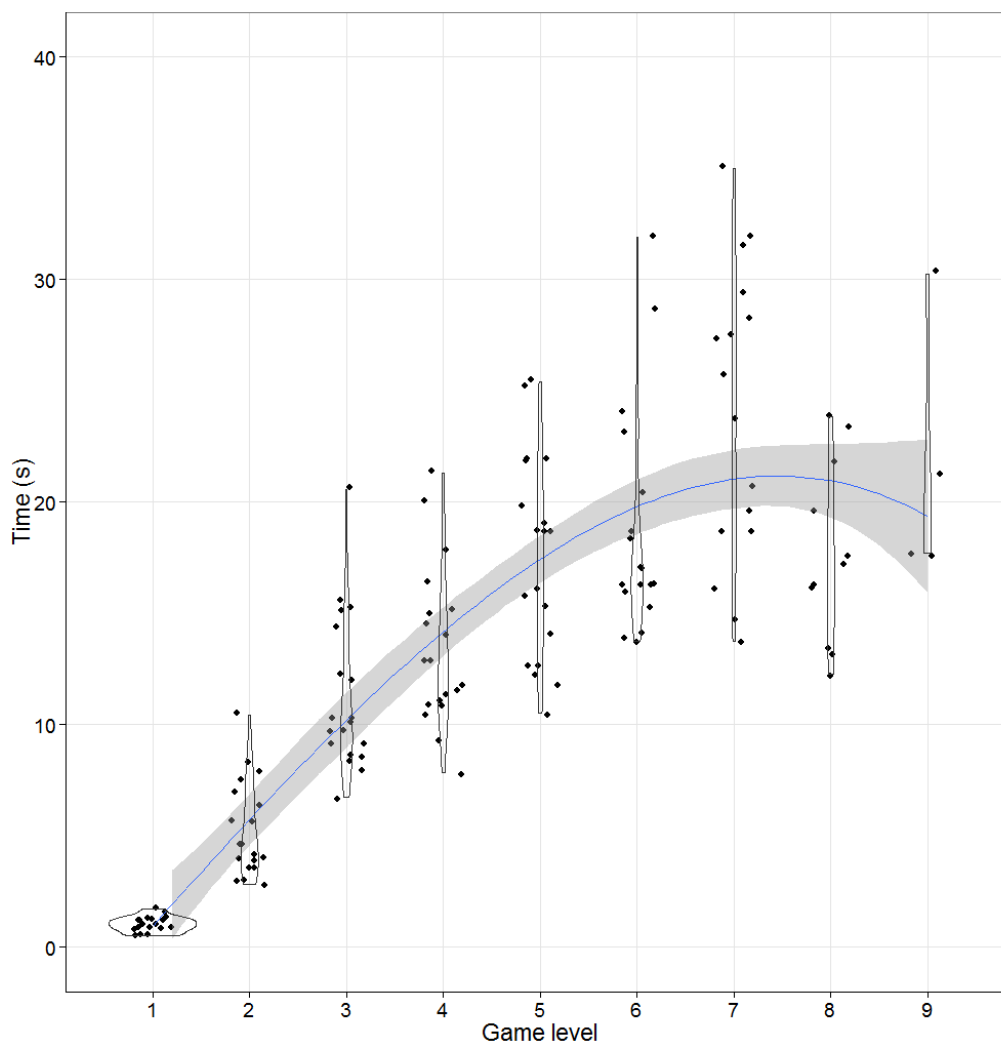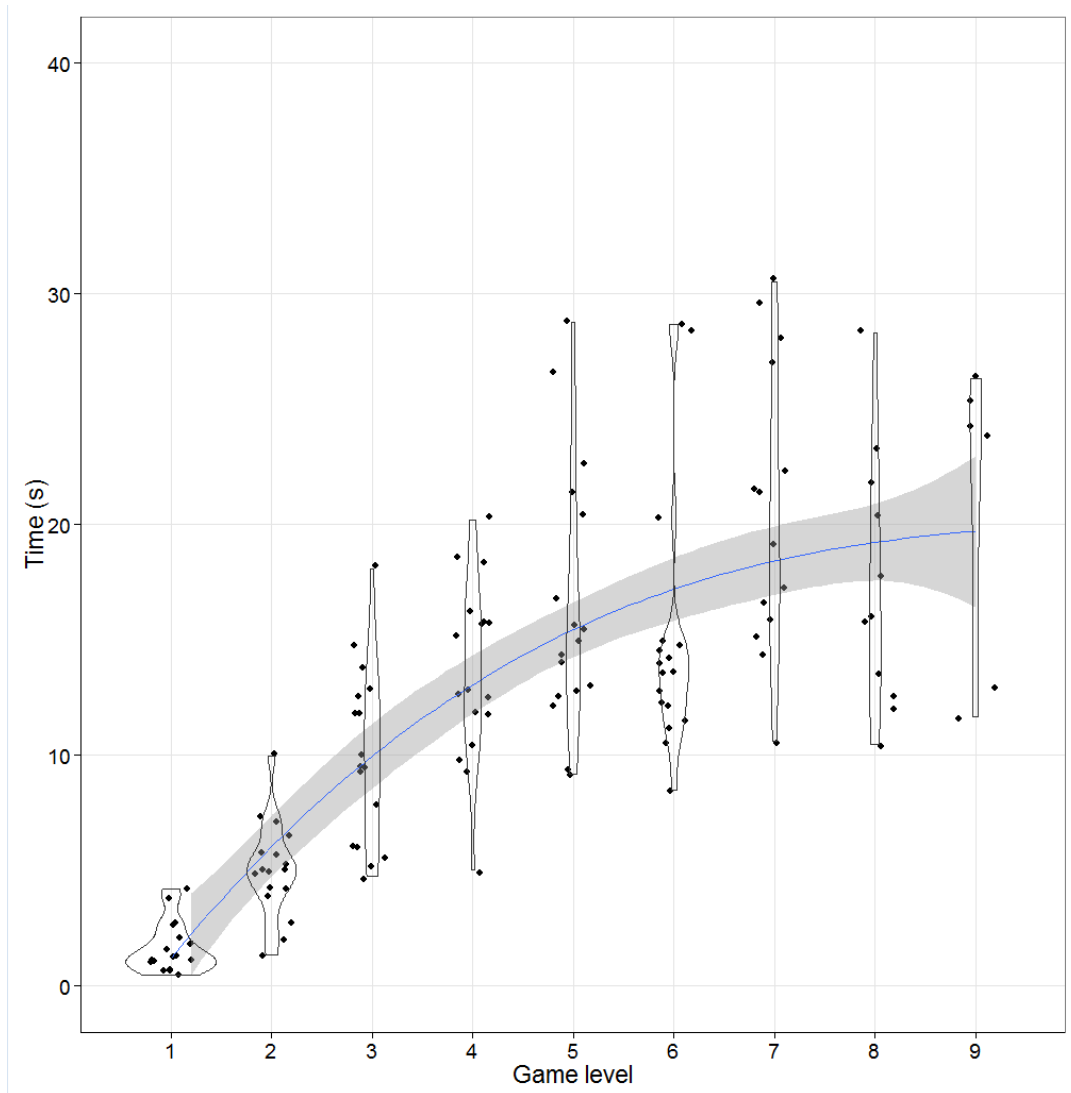*Figure 2. Time in seconds required to complete each of the game levels in Study 2*

Questionnaires

Study 1: Short questionnaire/ Results

Figure 3. Self-perceived skills

I think that my skills to perform this part of the experiment -when considering the game

demands- were: low (1) - high (9)

The results of a Repeated measures ANOVA revealed a significant main effect of Condition $F_{(2, 36)}=23,78$, $p < 0,001$, $\eta_p^2 = 0,57$. Post hoc tests (corrected for multiple comparisons using the Tukey's honestly significant difference (HSD) procedure) showed significantly higher scores in the Flow condition when compared with Boredom ($M = 5,79$ vs. $M = 7,16$, $p = 0,007$) and Frustration ($M = 5,79$ vs. $M = 4,26$, $p = 0,003$).

Study 2: Questionnaires/ Results

Table 2. Flow questionnaire adapted from Engeser & Rheinberg (2008)

	Not at all			Partly			Very Much
	1	**2**	**3**	**4**	**5**	**6**	**7**
I felt just the right amount of challenge	☐	☐	☐	☐	☐	☐	☐
My thoughts ran fluidly and smoothly	☐	☐	☐	☐	☐	☐	☐

|							
I didn't notice time passing	☐	☐	☐	☐	☐	☐	☐
I had no difficulty concentrating	☐	☐	☐	☐	☐	☐	☐
My mind was completely clear	☐	☐	☐	☐	☐	☐	☐
I was totally absorbed in what I was doing	☐	☐	☐	☐	☐	☐	☐
The right movements occurred of their own accord	☐	☐	☐	☐	☐	☐	☐
I know what I had to do each step of the way	☐	☐	☐	☐	☐	☐	☐
I felt that I had everything under control	☐	☐	☐	☐	☐	☐	☐
I was completely lost in thought	☐	☐	☐	☐	☐	☐	☐
It was difficult to focus my attention on the game	☐	☐	☐	☐	☐	☐	☐
I found it easy to monitor the auditory target and press the button	☐	☐	☐	☐	☐	☐	☐

Figure 4. Average total scores for the Flow questionnaire Engeser & Rheinberg (2008) per condition
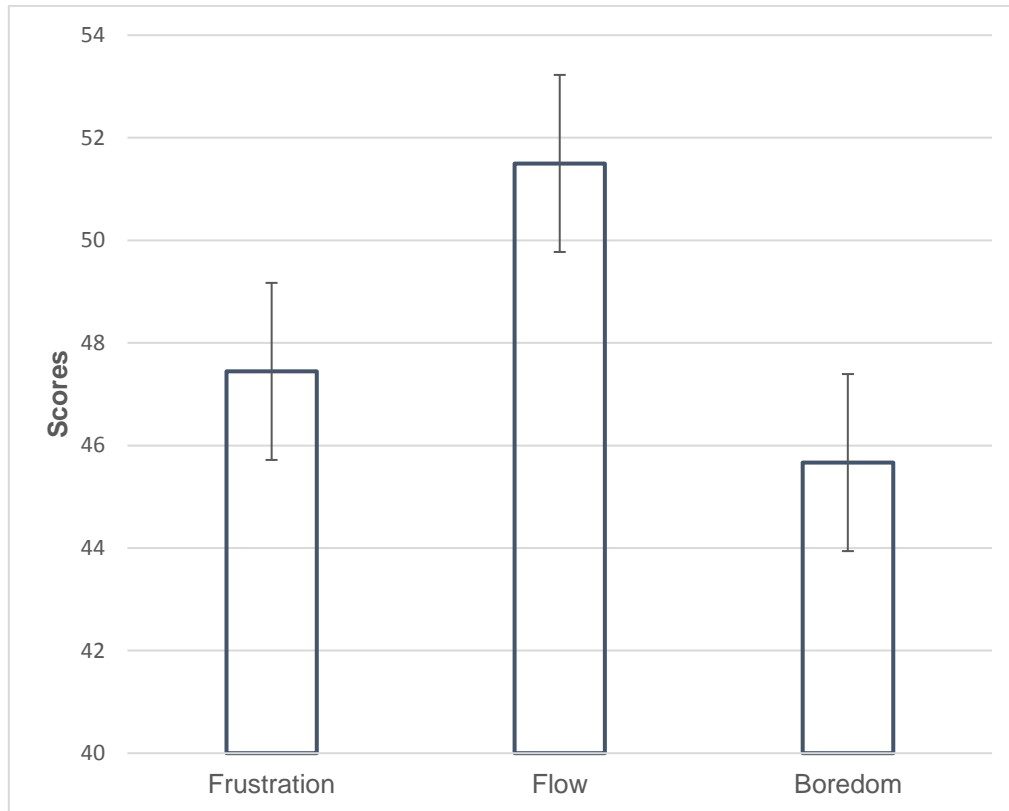
The results of a Repeated measures ANOVA revealed a significant main effect of Condition F(2, 38)=4,62, p = 0,016, η_p^2= 0,20. Post hoc tests (corrected for multiple comparisons using the Tukey's honestly significant difference (HSD) procedure) showed higher scores in the Flow condition when compared with Boredom (M = 51,6 vs. M = 45,5, p = 0,018) and when compared with Frustration (M = 51,6 vs. M = 46,7, p = 0,064).

Table 3. Flow questionnaire from Sherry et al. (2006)

	Strongly Disagree					Strongly Agree	
	1	**2**	**3**	**4**	**5**	**6**	**7**
I found this game difficult to play	☐	☐	☐	☐	☐	☐	☐
I felt like I was part of the game	☐	☐	☐	☐	☐	☐	☐
The game was very tedious to play	☐	☐	☐	☐	☐	☐	☐
I felt absorbed by this game	☐	☐	☐	☐	☐	☐	☐
I lost interest in playing this game pretty quickly	☐	☐	☐	☐	☐	☐	☐
This game was very irritating to play	☐	☐	☐	☐	☐	☐	☐
I felt anxious when playing the video game	☐	☐	☐	☐	☐	☐	☐
This game felt very repetitive	☐	☐	☐	☐	☐	☐	☐
This game was too complicated for me to play	☐	☐	☐	☐	☐	☐	☐
I was caught up in the game	☐	☐	☐	☐	☐	☐	☐
This game was very monotonous	☐	☐	☐	☐	☐	☐	☐
This game held my attention	☐	☐	☐	☐	☐	☐	☐

Figure 5. Average scores for the Flow questionnaire Sherry et al. (2006) per condition
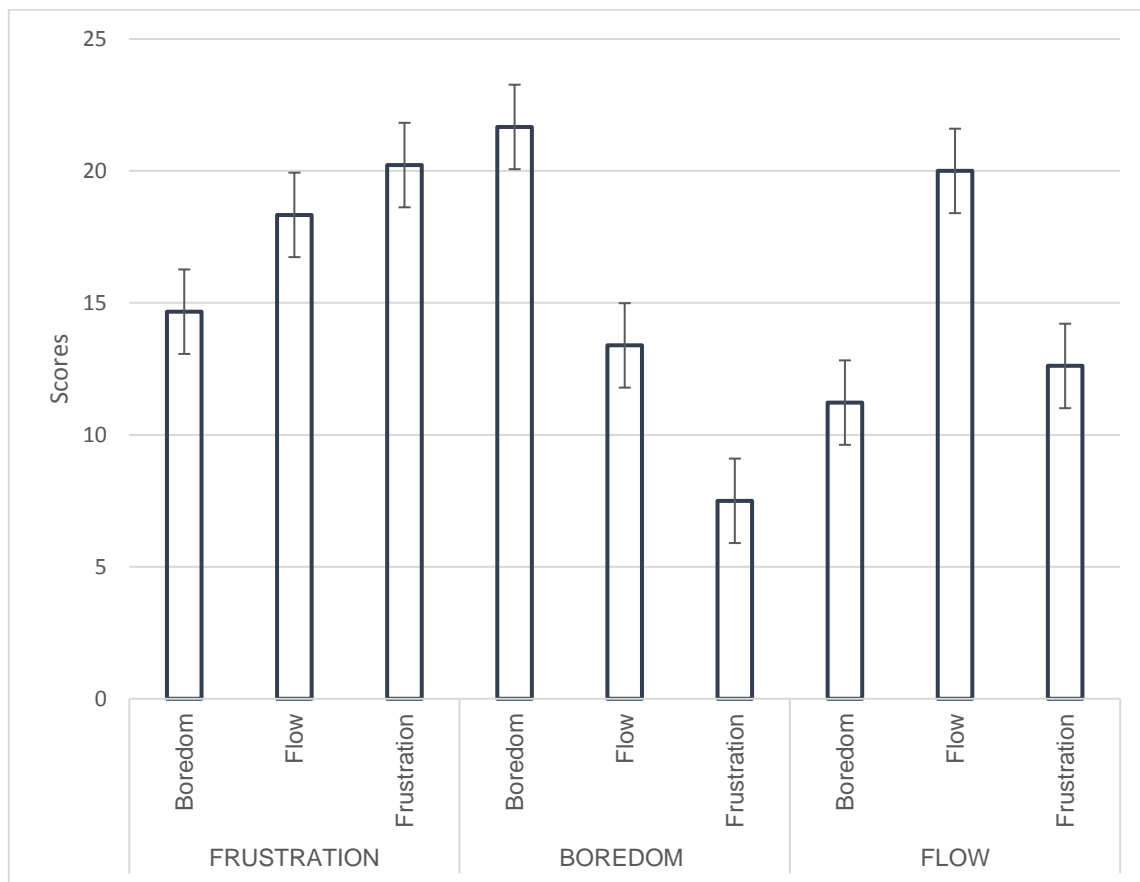
Here the results for all the conditions are depicted. When considering the Flow condition, the results of a Repeated measures ANOVA revealed a significant main effect Score per sub-scale (Boredom vs. Frustration vs. Flow) $F_{(2, 34)}=23,13$, $p < 0,001$, $\eta_p^2= 0,58$. Post hoc tests (corrected for multiple comparisons using the Tukey's honestly significant difference (HSD) procedure) showed significantly higher scores in the Flow condition when compared with Boredom ($M = 19,89$ vs. $M = 11,22$, $p < 0,001$) and when compared with Frustration ($M = 19,89$ vs. $M = 12,61$, $p < 0,001$). Likewise a significant main effect of Score per sub-scale was found in the conditions of Boredom $F_{(2, 34)}=41,74$, $p < 0,001$, $\eta_p^2= 0,71$ and Frustration $F_{(2, 34)}=7,99$, $p= 0,001$ $\eta_p^2= 0,32$, with higher scores for the sub-scale of boredom in the Boredom condition and for the sub-scale of frustration in the Frustration condition.

Scalp maps omissions/errors

Figure 6. Laplacian transformed data - Scalp maps corresponding to the first 360ms following incorrect trials