Choosing to choose or not

Supplemental

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This supplemental includes the following sections;

S1 – A full report regarding the pre-determined filters and their rationales (S1.a) as well as the filtered results of Experiment 1a (S1.b), Experiment 1b (S1.c), Experiment 2 (S1.d), and Experiment 3 although different filters were used in this experiment (S1.e.).

S2 - A full report of the Meta-analysis that compared Actual-Choice to Simulated-Choice experiments.

S3 – A full report of the subjective experience's comparisons from Experiment 3.

S4 –The correlation matrixes of the subjective experience probes across all experiments

S5 – Descriptive statistics of additional measurements that were not reported in the main text.

S1.a. Pre-determined filters

The following filters were implemented to ensure that we analyze only data of participants that fully understood the instructions and dedicated sufficient attention to the experiment. We decided to apply these filters prior to conducting the experiments, and they also served to determine the experiments' stopping rules, as stated in the main text.

First, for the *post-experiment debriefing* filter, the experimenter verified that participants understood the instructions immediately after the experiment was ended. Second, as a *pre-determined criterion*, we excluded from the analysis all participants that reported, in at least one condition, an impossible gain of less than 50 points (as each condition included 50 rounds with at least 1 point earned on each round). Third, an *impossible pattern of answers* filter was employed in Exp. 1a that included both the points and money probes. This filter excluded participants that reported gains that were impossible under the experimental design (i.e., gains of less than 50 or more than 250 points when 1-5 points could be earned on each round and 50 rounds were completed, or gains of 100 points and less than 100 or more than 500 Agorot when it was known that each point is worth 1-5 Agorot). Forth, *participants who counted points* were excluded because focusing on counting might tamper with or prevent the experience of the process of choice. This was done separately for the first and second blocks. However, to verify that this filter was not responsible for the reported results, we ran the analyses with participants that counted points as well, and when the pattern of results differed as a function of this filter, we clearly indicate it in the following text. Finally, to verify that our results are not driven by *outliers*, we produced a separate boxplot for each condition and before each *t*-test the observations which fell outside the fence were filtered (observed values above/below 1.5 * interquartile range; Tukey, 1977).

S1.b. Filtered results of Exp. 1a

Filters. Two participants (2.18%) were excluded after applying the post-experiment debriefing filter, 14 participants (15.26%) were excluded by the pre-determined criterion

filter and 31 participants (33.79%) were excluded due to the impossible pattern of answers filter. Overall, there were 62 valid participants for the filtered analysis.

Preference for choice. Among participants that did not count points during any part of the experiment (n=29), 86.21% ($CI_{95\%}$ 72.86-99.56) preferred choosing for themselves over letting the computer choose for them, significantly higher than the point of indifference (50%; z=3.9, p<.001). Among all valid participants (n=62), 79.03% ($CI_{95\%}$ 68.61-89.45) preferred choosing for themselves (z=4.57, p<.001).

Subjective experience. The pattern of the filtered subjective experience measures was identical to the unfiltered results from the main text (see Table S1 for the descriptive statistics and *t*-tests results)

Predicting PFC. Each of the Difference Variables that reflect the difference in participants' subjective experience in the CP and OC conditions was used as an input variable in a logistic regression with PFC as its output. The sole significant predictor was the difference in enjoyment, $\chi^2_{(1)}$=5.84, p=.02, R^2=.25 (difference in points - $\chi^2_{(1)}$=.13, p=.72; difference in money - $\chi^2_{(1)}$=.02, p=.9). A shift from 1 enjoyment point below to one point above the mean of Enjoyment Difference (M=1.72; Gelman & Hill, 2006) corresponds to an increase of 13.27% in the probability to decide to choose for oneself.

S1.c. Filtered results of Exp. 1b

Filters. One participant (1.75%) was excluded from the analysis because he failed to answer the subjective experience questions and 10 participants (17.54%) were excluded due to the impossible pattern of answers filter, resulting in 46 valid participants.

Preference for choice. Among participants who did not count points in any part of the experiment (n=30), 86.67% ($CI_{95\%}$ 73.76-99.58) preferred choosing for themselves in

the third part of the experiment (z=4.02, p<.001). Among all valid participants (n=46), 86.96% ($CI_{95\%}$ 76.84-97.07) preferred choosing for themselves (z=5.01, p<.001).

Subjective experience. Again, the pattern of for the filtered subjective experience was identical to the unfiltered results from the main text (see Table S1).

Predicting PFC. The difference in Enjoyment and in Points served as an input variable in two logistic regressions with PFC as their output variable, and only the difference in enjoyment predicted participants' PFC ($\chi^2_{(1)}$=7.51, p=.006, R^2=.32; Points difference - $\chi^2_{(1)}$=.54, p=.46).. Shifting from 1 point below to one point above the mean of Enjoyment Difference (M=2) corresponds to an increase of 8.45% in the probability to decide to choose for oneself.

S1.d. Filtered results of Exp. 2

Filters. First, 88 participants (34.65%) were excluded from the analysis due to the impossible pattern of answers filter (Exp. 1a – 33 participants, Exp. 2b – 47 participants, Exp 2c. – 8 participants). Then, thirty-two participants (12.6%) were omitted due to the application of the Belief filter (rating lower than 5 on the 1-9 belief scale; Exp. 2a – 18 participants, Exp 2b – 12 participants, Exp 2c – 2 participants). Applying these filters resulted in 134 valid participants for the reported analysis (49, 40, and 45 participants in the first, second, and third experiments, respectively).

Preference for choice. Among all valid participants (n=134), 71.64% ($CI_{95\%}$ 63.91-79.37; z=5.01, p<.001) preferred choosing for themselves over letting the computer choose for them (Exp.2a – 67.35% [$CI_{95\%}$ 53.74-80.96]; Exp.2b – 75% [$CI_{95\%}$ 60.98-89.02]; Exp.2c –73.33% [$CI_{95\%}$ 59.9-86.77]) .

Subjective experience. Once more, the pattern of for the filtered subjective experience was identical to the unfiltered results from the main text (see Table S1) (see Table S1).

Predicting PFC. Each of the Difference Variables was used as an input variable in a logistic regression with PFC as the output variable. The difference in predicted enjoyment was reliably associated with participants' decision to choose for themselves ($\chi^2_{(1)}$=4.97, p=.03, R^2=.03). A change of one point below to one point above the mean of difference in enjoyment (M=1.58) corresponded to a change of 7.51% in the probability to decide to choose for oneself. Interestingly, the difference in predicted points to-be-gained also reliably predicted participants' desire to choose ($\chi^2_{(1)}$=6.45, p=.01, R^2=.04). A change of ten points below to ten points above the mean of difference in predicted points to-be-gained *(*M=4.93) corresponded to an increase of 8.83% in the probability to decide to choose for oneself.

Simultaneously regressing PFC on predicted Enjoyment, the predicted Points to-be-gained, and their interaction, explained a larger portion of the variance in participants' decision to choose for themselves ($\chi^2_{(3)}$=9.44, p=.02, R^2=.06). However, none of the factors significantly predicted PFC on its own (Enjoyment, z=1.63, p=.1, Coef.=.15; Points, z=1.39, p=.17, Coef.=.02, Interaction, z=.23, p=.82, Coef.<.01).

S1.e. Filtered results of Experiment 3

Filters. Thirteen participants (11.02%) were excluded from the analysis as they erred on more than one n-back question in at least one of the within-subject conditions. Applying this filter left us 105 valid participants.

Preference for choice. Among participants who did not count points in any part of the experiment, 69.7% preferred choosing for themselves in the DUAL-TASK condition, 60% preferred choosing for themselves in the SINGLE-TASK condition, and only 45.45% preferred choosing for themselves in the Random condition (95% CI are presented in Figure S1). The DUAL-TASK condition differed from the point of indifference (50%; z=2.26, p=.02) and from the Random condition (z=1.99, p=.046). No other reliable differences between conditions or between the point of indifference were found.

We also compared the Preference-based choice condition (Dual-task and Single-task combined) to the Random condition. Among participants in the Preference-based condition that did not count points on any part of the experiment, 64.71% preferred choosing for themselves (Figure S1), significantly different from chance level (z=2.43, p=.02) and marginally different from the Random Choice condition. (z=1.84, p=.07).

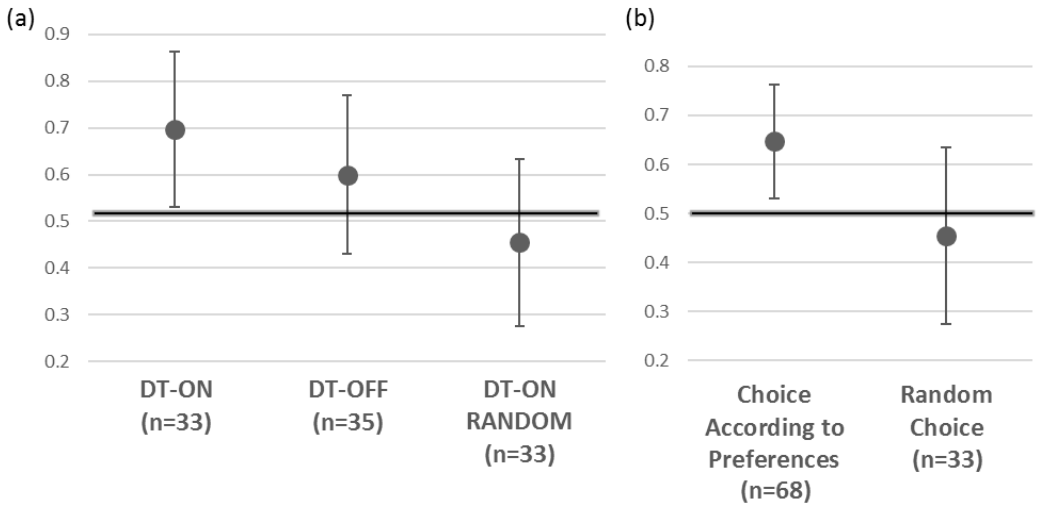

Figure S1. Means and 95% confidence intervals of the probability to choose pending on the experimental condition of Experiment 3 (a) and on the nature of choice in Experiment 3 (b), in the filtered data of Experiment 3.

Subjective experience. As predicted, and parallel to the unfiltered results from the main text, there was no consistent difference between the OC and CP conditions in any of the subjective experience measures (i.e., enjoyment, interest, sense of control, and the difficulty to perform the 1-back task; see Table S1).

Predicting PFC. Three logistic regressions were conducted with each Difference Variable, the between-subjects condition, and their interaction as the input variables (Figure S2). Entering the difference in Enjoyment to the regression yielded a significant model ($\chi^2_{(5)}$=17.05, p=.004, R^2=.12) when the enjoyment coefficient was the only one that approached the significance level (z=1.78, p=.08, Coef.=.69, $CI_{95\%}$ -.07-1.44). Entering the difference in Interest or Boredom to the regression yielded significant models as well (Interest - $\chi^2_{(5)}$=29.41, p<.001, R^2=.21; Boredom - $\chi^2_{(5)}$=26.38, p<.001, R^2=.19). However, here the coefficients of Interest/Boredom approached significance level *alongside* the between-subjects conditions, and specifically, the difference between the Random condition to the Dual- and Single-task conditions (Figure S2).

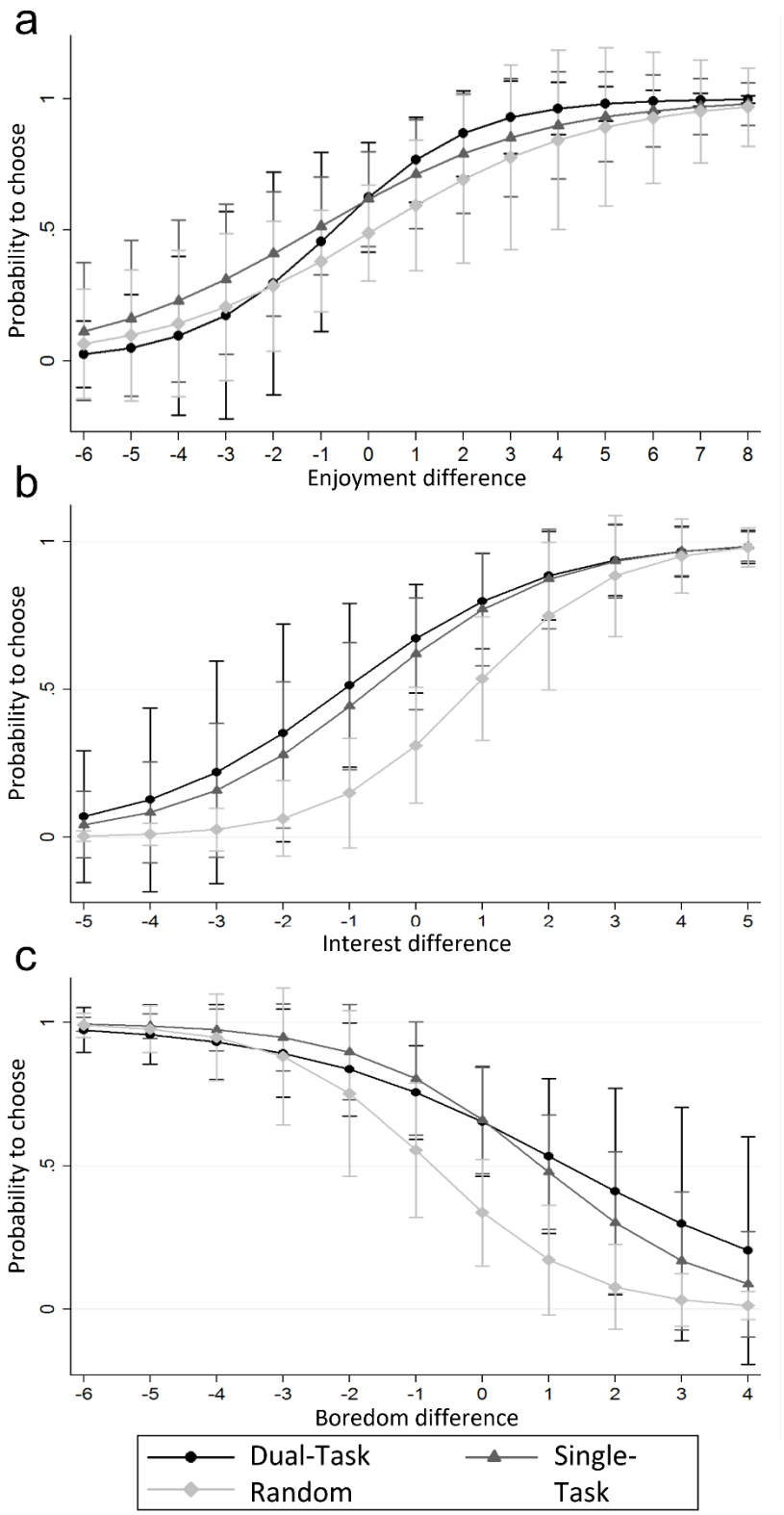

Figure S2. Adjusted prediction of the probability to choose for oneself (1) or let the computer choose (0) with 95% confidence intervals, pending on the Difference in Enjoyment (a), Interest (b) or Boredom (c) and the Experimental condition (in the filtered data of Experiment 3).

Table S1. Descriptive and inference statistic results of the *filtered* subjective experience measures across all experiments. The first line of each measure presents the mean and standard deviation for each condition, and the second line shows the hypothesis test result of the comparison between these conditions. Most hypothesis tests were *t*-test – between-subjects tests that compared the OC and CP conditions in each block (i.e., participants that completed the OC condition in block 1 to those that completed the CP condition in block 1), and within-subject tests for the comparison of block 1 to block 2 within participants.

Note that in Exp. 3 the Single-task and Dual-task conditions that were identical during the part of the experiment in which the subjective experiences measures were collected (before the PFC question), were combined to one Preference-based choice condition that was compared to the Random condition. Additionally, in experiment 3, ANOVA models with the OC/CP and the Dual-task/Single-task/Random conditions as between-subjects factors were used for the between-subjects comparisons, while mixed ANOVA models with the CP/OC condition as a within-subject and the Dual-task/Single-task/Random condition as a between-subjects factor were used for the block comparisons. The tables, however, present the pairwise comparisons that followed these models.

Finally, note that the differences in df within experiments originated from two sources - the exclusion of different numbers of subjects that counted points on each block, and the exclusion of outliers participants that was done separately for each condition.

Exp.	Subjective Measure	Block 1 (Between-subjects)		Block 2 (Between-subjects)		Blocks comparison (Within-subject)	
		Own Choice	Computer Picks	Own Choice	Computer Picks	Own Choice	Computer Picks
1a	Enjoyment	6.64 (1.59)	4.78 (2.65)	6.38 (1.94)	4.64 (0.93)	6.64 (1.59)	4.86 (1.78)
		$t(53)=3.18$, $p=.003$		$t(25)=3.01$, $p=.006$		$t(27)=5.4$, $p<.001$	
	Points	80.62 (29.93)	60.2 (21.83)	67.08 (23.98)	105.06 (60.48)	74.59 (48.68)	92.07 (59.82)
		$t(52)=2.82$, $p=.007$		$t(27)=-2.06$, $p=.05$		$t(27)=-2.16$, $p=.04$	
	Control	4.17 (2.24)	3.93 (3.04)	5 (2.35)	2.06 (1.77)	4.48 (2.4)	2.66 (2.42)
		$t(54)=0.35$, $p=.73$		$t(27)=3.85$, $p<.001$		$t(28)=4.17$, $p<.001$	
	Money	170.81 (70.98)	129.28 (68.33)	139.58 (59.18)	247.94 (183.16)	144.85 (59.28)	167.58 (121.53)
		$t(49)=2.13$, $p=.04$		$t(20)=.96$, $p=.35$		$t(25)=-1.21$, $p=.24$	
1b	Enjoyment	6.9 (1.77)	5.08 (2.13)	6.65 (0.81)	2.3 (0.95)	6.58 (0.7)	4.38 (2.23)
		$t(41)=3.01$, $p=.005$		$t(28)13.67=$, $p<.001$		$t(25)=4.98$, $p<.001$	
	Points	96.9 (42.96)	109 (38.08)	121.18 (40.82)	107 (45.84)	113.03 (43.67)	111.47 (40.2)
		$t(41)=-1.01$, $p=.32$		$t(30)=0.88$, $p=.39$		$t(29)=.024$, $p=.81$	
	Control	3.95 (1.57)	3.57 (2.92)	5.09 (2.54)	1 (0)	4.15 (2.13)	1.89 (1.58)
		$t(41)=0.53$ $p=.6$		$t(30)=5.04$, $p<.001$		$t(26)=5.48$, $p<.001$	
2	Enjoyment	6.01 (2.22)	6.02 (1.84)	6.28 (2.44)	4.03 (2.44)	6.13 (2.23)	4.86 (2.43)
		$t(130)=-0.01$, $p=.99$		$t(132)=5.51$, $p<.001$		$t(133)=6.35$, $p<.001$	
	Points	129.41 (50.89)	136.41 (54.98)	146.1 (56.19)	118.49 (44.59)	137.01 (53.82)	126.65 (50.2)
		$t(132)=-.76$, $p=.45$		$t(132)=3.17$, $p=.002$		$t(133)=-4.4$, $p<.001$	
	Control	3.21 (2.14)	2.87 (2.35)	4.2 (2.6)	1.25 (0.59)	3.25 (2.11)	1.85 (1.46)
		$t(132)=0.87$, $p=.39$		$t(122)=8.75$, $p<.001$		$t(121)=7.91$, $p<.001$	

3 Preference based	Enjoyment	7.62 (1.39)	7.21 (1.29)	*6.5 (1.91)*	6.44 (1.93)	7.15 (1.6)	6.91 (1.53)
		$t(96)=1.15$, $p=.25$		$t(94)=0.14$, $p=.89$		$z=1.1$, $p=.27$	
	Interest	6.47 (1.52)	6.53 (1.69)	6.21 (1.87)	5.56 (2.02)	6.42 (1.58)	6.12 (1.82)
		$t(96)=-0.15$, $p=.88$		$t(93)=1.55$, $p=.12$		$z=1.39$, $p=.16$	
	Boredom	2.41 (1.88)	2.88 (1.53)	3.41 (1.71)	3.97 (2.35)	3.04 (1.68)	3.34 (1.94)
		$t(94)=-1.21$, $p=.23$		$t(94)=-1.2$, $p=.24$		$z=-1.34$, $p=.18$	
	Hard 1-back task	3.32 (1.55)	3.65 (1.97)	4.03 (1.83)	3.44 (1.78)	3.68 (1.72)	3.58 (1.85)
		$t(97)=-.77$, $p=.45$		$t(97)=1.44$, $p=.16$		$z=.47$, $p=.64$	
3 Random	Enjoyment	6.73 (1.53)	6.61 (1.69)	6.6 (0.83)	6.67 (1.54)	6.47 (1.41)	6.64 (1.6)
		$t(96)=.24$, $p=.81$		$t(94)=-0.1$, $p=.92$		$z=-21$, $p=.48$	
	Interest	6.8 (1.74)	5.76 (1.2)	6.44 (1.03)	6.46 (0.88)	6.69 (1.45)	6.03 (1.4)
		$t(96)=1.86$, $p=.07$		$t(93)=-.04$, $p=.97$		$z=2.21$, $p=.03$	
	Boredom	2.5 (1.02)	3.78 (2.51)	2.88 (1.58)	3.53 (1.64)	2.78 (1.39)	3.35 (1.78)
		$t(94)=-2.24$, $p=.03$		$t(94)=-0.95$, $p=.34$		$Z=-1.81$, $p=.07$	
	Hard 1-back task	3.93 (1.58)	3.39 (1.75)	4.67 (1.64)	3.13 (1.06)	4.38 (1.64)	3.29 (1.51)
		$t(97)=.89$, $p=.37$		$t(97)=2.6$, $p=.01$		$Z=3.22$, $p=.001$	
4	Enjoyment	6.64 (2.73)	5.7 (1.77)	5.7 (1.7)	6.18 (2.89)	6.19 (2.29)	5.95 (2.38)
		$t_{(19)}=.92$, $p=.37$		$t_{(19)}=0.46$, $p=.65$		$t_{()}=$, $p=$	
	Interest	4.36 (2.25)	5.1 (1.85)	5.4 (1.71)	4 (2.37)	4.86 (2.03)	4.52 (2.16)
		$t_{(19)}=-.81$, $p=.43$		$T_{(19)}=1.54$, $p=.14$		$t_{()}=$, $p=$	
	Control	8.27 (1.35)	7 (1.33)	6.2 (2.94)	7.55 (1.81)	7.89 (1.56)	7.37 (1.57)
		$t_{(19)}=2.17$, $p=.04$		$t_{(19)}=-1.28$, $p=22$		$t_{(18)}=1.19$, $p=.25$	
	Hard	1.73 (1.79)	1.4 (0.52)	1.5 (1.27)	2 (2.19)	1 (0)	1.13 (0.34)
		$t_{(19)}=0.56$, $p=.59$		$t_{(19)}=-0.63$, $p=.54$		$t_{(15)}=-1.46$, $p=.16$	

S2. Comparing having experience to not having experience with the task (meta-analysis)

Method

Participants and design

There was a total of 417 (270 females; *Mean age*=25.57, *SD*=5.24) participants across experiments (1a, 1b & 2). Our interest was to compare between an Actual-Choice

(AC; n=163) and a Simulated-choice (SC; n=254) conditions. Participants in these experiments red the same instructions and answered the same questions – they differed only in whether they answered the questions after (AC) or before (SC) experiencing the task.

Results

Preference for choice. A two-sample test of proportions revealed that AC participants preferred choosing at a higher rate (83.44%, $CI_{95\%}$ 77.73-89.14) compared to SC participants (72.05%, $CI_{95\%}$ 66.49-77.6), z=2.68, p<.01. Thus, actual experience with choice and no-choice situations adds ~11% to the divergence from indifference (50%).

Subjective experience.

Enjoyment. To test the combined effect of Experience with the task and Choosing condition (OC/CP) we used two-way ANOVA models. In the first block, a main effect for the Choosing condition, $F_{(1,413)}$=10.77, p<.005, and a main effect for Experience, $F_{(1,413)}$=3.98, p=.047, were found. Furthermore, these two factors interacted, $F_{(1,413)}$=13.58, p<.001, and only in the AC experiments participants enjoyed the OC more compared to those in the CP condition (Figure S3). In the second block, main effects were found for the Choosing condition, $F_{(1,413)}$=95.24, p<.001, and for Experience – $F_{(1,413)}$=8.43, p<.005, but these factors did not interact, $F_{(1,413)}$=.07, p=.79. In both AC and SC experiments participants reported higher enjoyment in the OC compared to the CP condition (Figure S3).

To test the effect of Experience and choosing condition on the *within-subject* Enjoyment, we used a repeated-measures ANOVA and found main effects for the Choosing condition, $F_{(1,415)}$=188.18, p<.001, and for Experience, $F_{(1,415)}$=7.05, p<.01.

Furthermore, there was an interaction between these factors, $F_{(1,415)}$=12.59, p<.001 – choosing for oneself led to higher enjoyment in both AC and SC experiments, but this difference was stronger with actual experience (Figure S3).

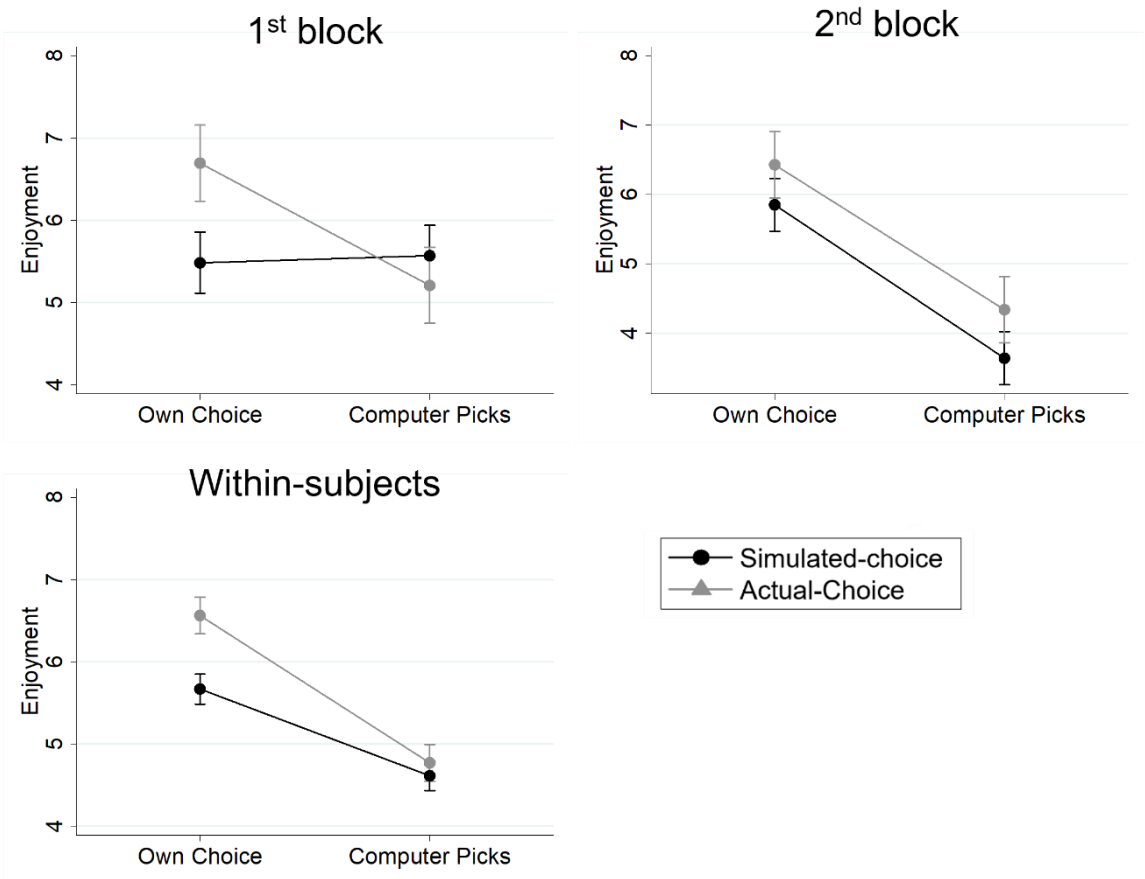

Figure S3. Means and 95% confidence intervals of participants' Enjoyment pending on the experimental condition and the Experience they had or did not have with the task.

Points. In the first block, a single main effect was detected for the Experience, $F_{(1,358)}$=5.18, p=.02 (Choosing condition – $F_{(1,358)}$=2.71, p=.1; Interaction – $F_{(1,358)}$=2.1, p=.15; Figure S4). In the second block, a single marginal effect was found for the Experience, $F_{(1,358)}$=2.84, p=.09 (Choosing condition – $F_{(1,358)}$=0.8, p=.38; Interaction – $F_{(1,358)}$=0.53, p=.47; Figure S4).

A repeated-measures ANOVA that tested the combined effect of Experience and Choosing condition on the *within*-subject estimated Points detected a single main effect for Experience, $F_{(1,360)}$=4, p=.046 (Choosing condition – $F_{(1,360)}$=0.14, p=.71; Interaction – $F_{(1,360)}$=0.18, p=.67). Participants believed that they would gain more points in the SC experiments compared to the points that participants in the AC experiments reported they had gained (Figure S4).

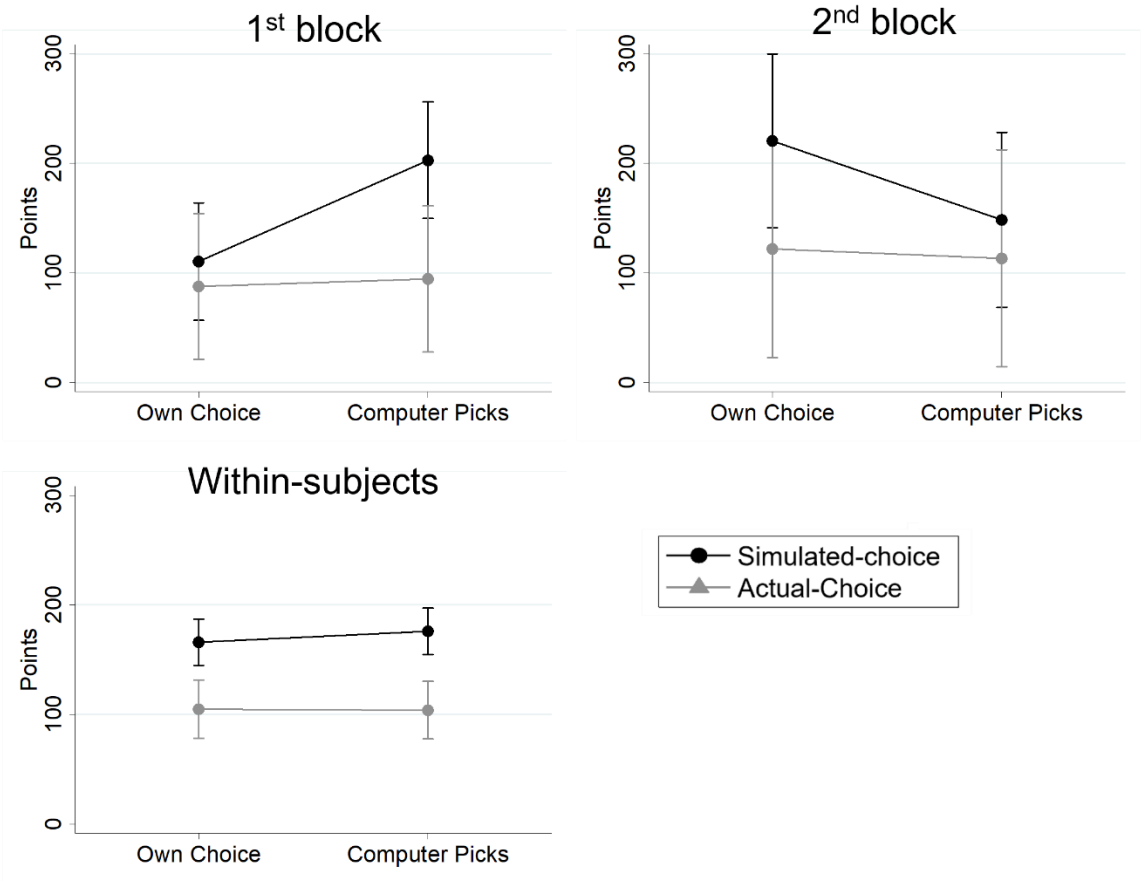

Figure S4. Means and 95% confidence intervals of participants' Points pending on the experimental condition and the Experience they had or did not have with the task.

What predicts preference for choice? A simultaneous logistic regression with the Difference in enjoyment, Experience and their interaction as input variables and the probability to choose as an output variable was reliable ($\chi^2_{(3)}$=37.69, p<.001, R^2=.08).

The coefficient of Enjoyment Difference was significant (z=2.82, p=.005, Coef.=1.23, $CI_{95\%}$ 1.07-1.43), but not that of Experience (z=.71, p=.48, Coef.=1.23, $CI_{95\%}$ 0.7-2.16). However, these factors interacted (z=2.22, p=.03, Coef.=1.45, $CI_{95\%}$ 1.04-2.02). A greater difference in enjoyment (positive values mean higher enjoyment in the OC compared to the CP condition) predicted an increased probability of a person preferring to choose for herself, and this pattern was stronger in the AC experiments. To evaluate how the probability to choose was related to the difference in enjoyment we tested its influence around zero that reflects a situation in which participants reported equivalent enjoyment in the CP and OC conditions; specifically, at -1 to 1 enjoyment difference. This shift in enjoyment corresponded to a change of 22.98% in the probability of deciding to choose for oneself in AC experiments and of 9.07% in this probability in SC experiments.

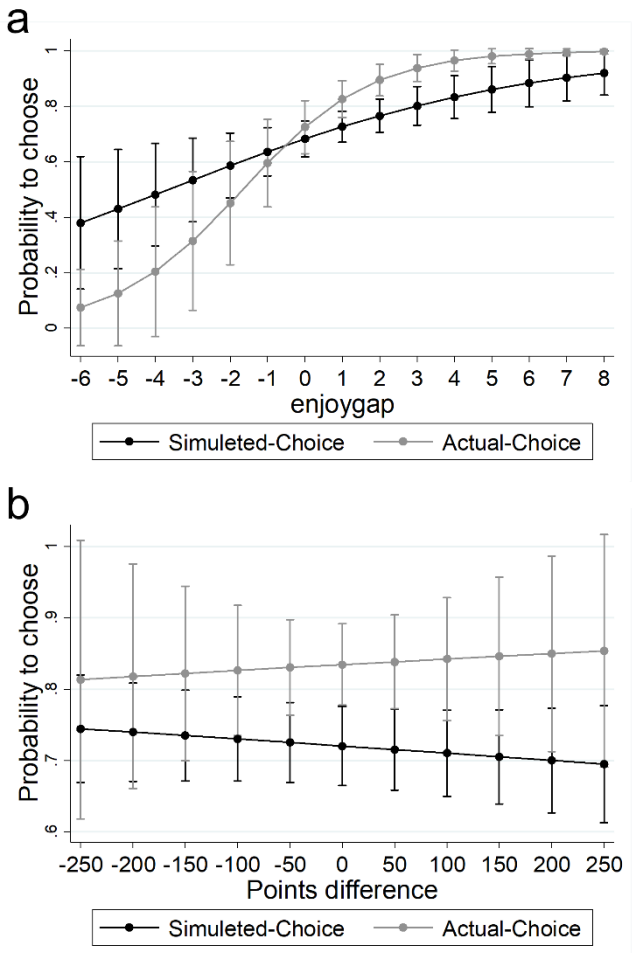

Figure S5. Adjusted prediction of the probability to choose for oneself (1) or let the computer choose (0) with 95% confidence intervals, pending on the Difference in Enjoyment (a) and on the difference in Points (b), combined with the Experience with the task.

A simultaneous logistic regression with the Difference in estimated points gained, Experience and their interaction as input variables and the probability to choose as the output variable was significant as well ($\chi^2_{(3)}$=8.35, p=.04, R^2=.02), and only the coefficient for Experience was significant (z=2.65, p<=.008, Coef.=1.96, $CI_{95\%}$ 1.19-3.21; Points - z=-.86, p=.39, Coef.=1, $CI_{95\%}$ 0.998-1.001; interaction - z=.42, p=.68, Coef.=1, $CI_{95\%}$ .996-1.006). This model was significant because AC was correlated with the probability to choose to a higher degree compared to SC (Figure S5).

S3. Experiment 3 – PFC under cognitive load (results)

This section presents the full report of participants' subjective experience at Experiment 3, while only the summary of these results was included in the main paper.

Subjective experience. As the sole difference between the Dual- and Single-Task conditions was in the PFC question that appeared *after* participants answered the subjective experience questions, participants' subjective experiences from these conditions were combined to attain better estimations. For these analyses, we refer to the combination of these conditions as the Preference-Based condition, that was compared to the Random Choice condition.

To test the effect of the choosing condition (OC vs. CP), the experimental condition (Preference-Based vs. Random Choice) and their interaction on the between-subject subjective experiences in the first and second blocks, 6 two-way ANOVA tests were used (1 for each block for the Enjoyment, Interest and Boredom variables; the difficulty of performing the 1-back task was not included as it is less relevant to rational of the study). Regarding the analysis of the within-subject subjective experiences, 3 mixed-effects multi-level regressions were used, with the choosing condition and the experimental condition as the fixed, and participant as the random effect. These analyses were conducted separately for each subjective feeling to increase the sensitivity of the analysis and to detect any effect if present.

Taken together, participants' subjective experiences in this experiment were distorted compared to the previous experiments. Most probably, the cognitive load that accompanied the task was responsible for distorting these experiences as it was the sole difference between the previous (1a & 1b) and the current experiment.

Enjoyment. The ANOVA model for the Enjoyment that participants experienced during the first block was insignificant, $F(3,114)=1.51$, $p=.22$, as well as the model for their Enjoyment in the second block, $F(3,114)=.38$, $p=.77$ (Figure S6). The mixed-effects multi-level regression model that evaluated the within-subject Enjoyment was insignificant as well, $\chi^2_{(3)}=5.13$, $p=.16$. However, Figure S6 shows that the choosing condition (OC/CP) and the experimental condition seem to interact, and indeed, the contrast of the linear prediction for this interaction term was marginal, $\chi^2_{(1)}=2.92$, $p=.09$. Participants that chose according to their preferences tended to enjoy the OC more than the CP condition, while the opposite trend was detected for participants that chose at random.

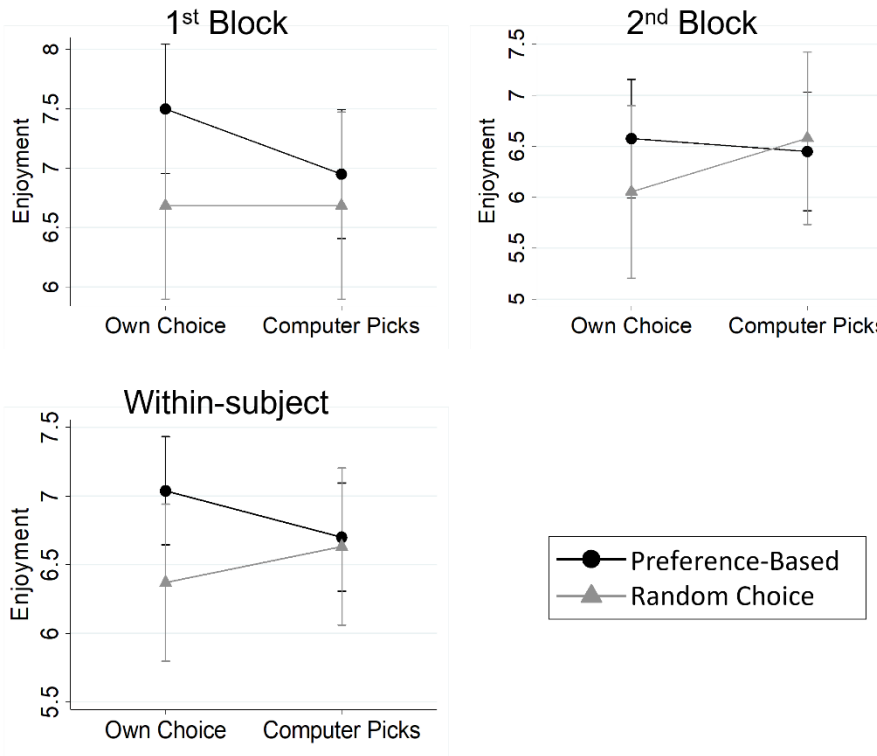

Figure 6. Linear predictions of participant's Enjoyment in the first and second blocks (between-subject comparisons) and in the within-subject comparison, pending on the choosing condition (OC/CP) and on the experimental condition (the combination of Dual- and Single-Task (Preference-Based) vs. Random Choice).

Interest. The ANOVA model for the Interest that participants experienced was insignificant in the first, $F(3,114)=1.05$, $p=.37$, as well as the second block, $F(3,114)=.93$, $p=.43$ (Figure S7). Similarly, the mixed-effects multi-level regression of the within-subject Interest was insignificant, $\chi^2_{(3)}=5.16$, $p=.16$. However, Figure S7 shows that the contrast of the linear prediction for the Choosing condition was significant, $\chi^2_{(1)}=4.9$, $p=.03$, suggesting that overall, participants tended to find the OC more interesting than the CP condition.

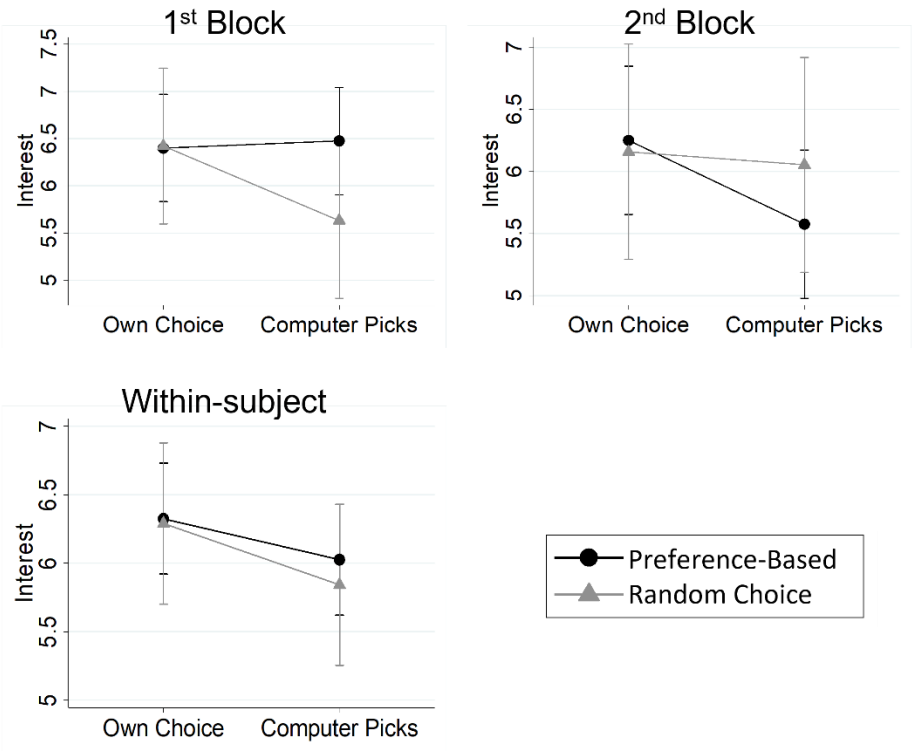

Figure 7. Linear predictions of participant's Interest in the first and second blocks (between-subject comparisons) and in the within-subject comparison, pending on the choosing condition (OC/CP) and on the experimental condition (the combination of Dual- and Single-Task (Preference-Based) vs. Random Choice).

Boredom. The ANOVA model for the Boredom that participants experienced during the first block was insignificant, $F(3,114)=1.72$, $p=.17$, although the experimental condition factor was significant, $F(1,114)=1.22$, $p=.049$, $\eta_p^2=.03$, as participants tended

to report higher boredom after the Random Choice condition (Figure S8). In contrast, the model of participants' boredom in the second block was insignificant, $F(3,114)=.72$, $p=.54$.

Regarding the within-subject Boredom, the mixed-effects multi-level regression was exactly at significance level, $\chi^2_{(3)}=7.7$, $p=.053$. Only the contrasts of the linear prediction for the Choosing condition term led to this result ($\chi^2_{(1)}=6.35$, $p=.01$), as participants experienced more boredom in the CP compared to the OC condition (Figure S8).

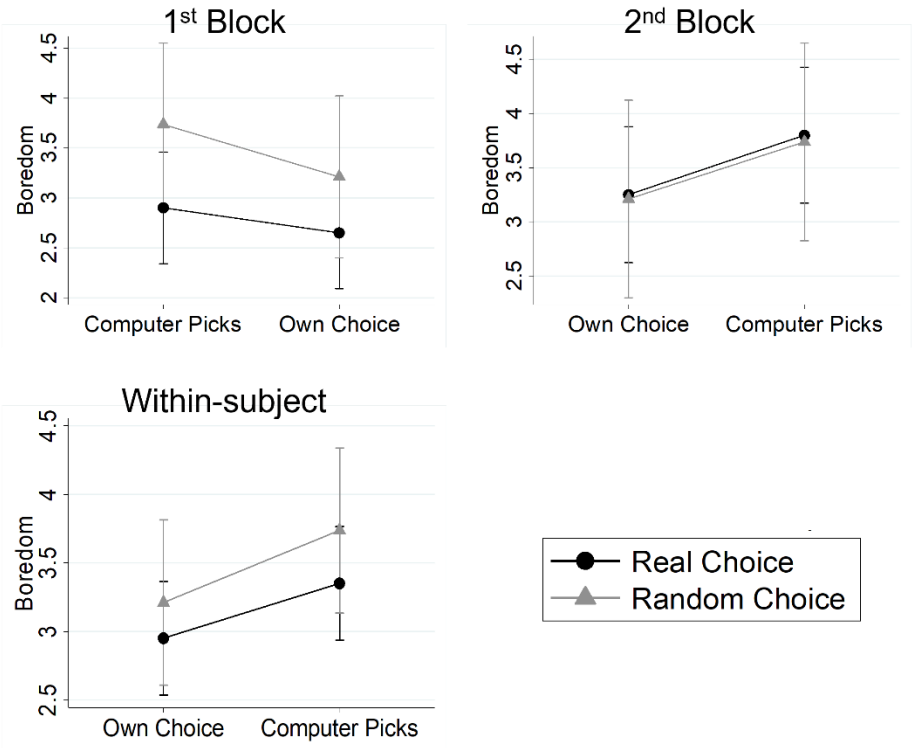

Figure 8. Linear predictions of participant's Boredom in the first and second blocks (between-subject comparisons) and in the within-subject comparison, pending on the choosing condition (OC/CP) and on the experimental condition (the combination of Dual- and Single-Task (Preference-Based) vs. Random Choice).

Predicting PFC using self-reported experience. Three logistic regressions were conducted with each Difference Variable (Enjoyment, Interest, and Boredom), the between-subjects condition, and their interaction as the input variables.

Entering the difference in enjoyment to the regression yielded a significant model ($\chi^2_{(5)}$=19.75, p<.01, R^2=.12) when the enjoyment coefficient was the only one that approached the significance level (z=1.75, p=.08, Coef.=.63, $CI_{95\%}$ -.07-1.33; Figure 9). Entering the difference in interest, or the difference in Boredom, to the regression yielded significant models as well (Interest - $\chi^2_{(5)}$=32.06, p<.001, R^2=.2; Boredom - $\chi^2_{(5)}$=24.38, p<.001, R^2=.15). But differing from the model for enjoyment, in these models both the coefficients of the subjective experiences and the between-subjects conditions contributed to the model (Figure 9).

To summarize – while boredom and interest predicted PFC, they did so with varying success for the Preference-based and the Random Choice conditions. Conversely, task-related enjoyment similarly predicted PFC for all between-subjects conditions.

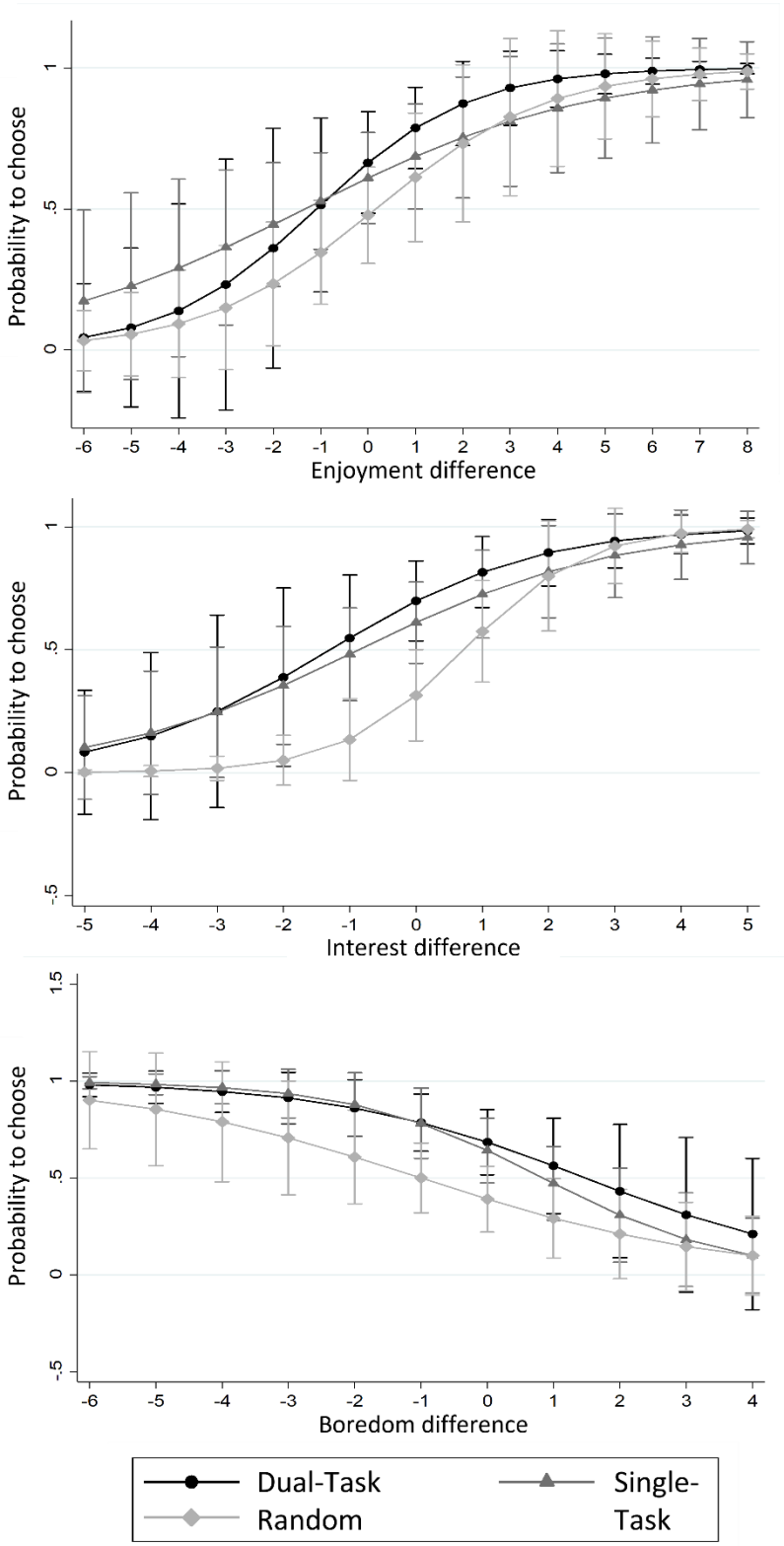

Figure 9. Adjusted prediction of the probability to choose for oneself (1) or let the computer choose (0) with 95% confidence intervals, pending on the Difference in Enjoyment (a), Interest (b) or Boredom (c) and the Experimental condition.

S4. Correlation Matrixes

Following are the correlation matrices of all the subjective experience probes that were administered throughout the experiments *before the crucial PFC probe* (Figures S10-S15). As all the subjective experience probes focused on feelings that were generated by the process of choice, at least some significant correlations between them are to be expected. However, only a few correlations were stronger than 0.6 and these strong correlations were found mainly in the second block or between the same probes appearing in the first and second blocks.

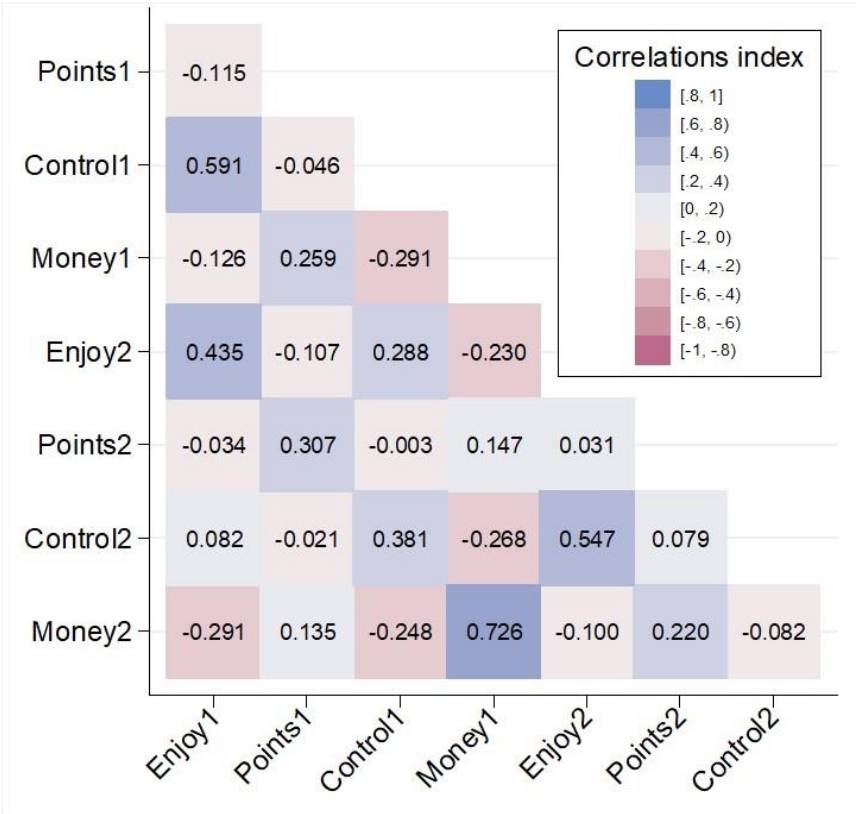

Figure S10. Subjective experiences correlations in **Experiment 1a**. The numbers at the end of the variables' names represent the block number.

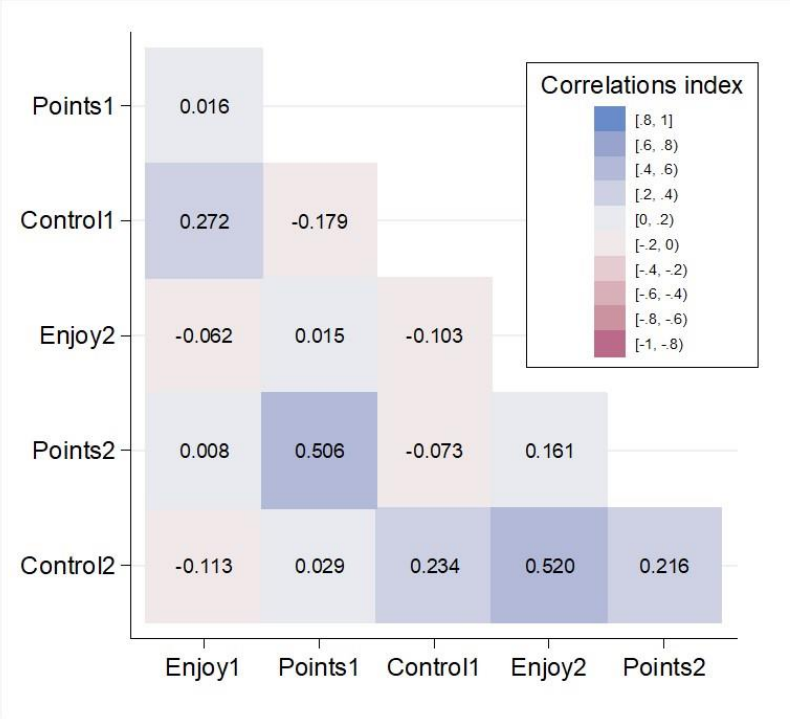

Figure S11. Subjective experiences correlations in **Experiment 1b**. The numbers at the end of the variables' names represent the block number.

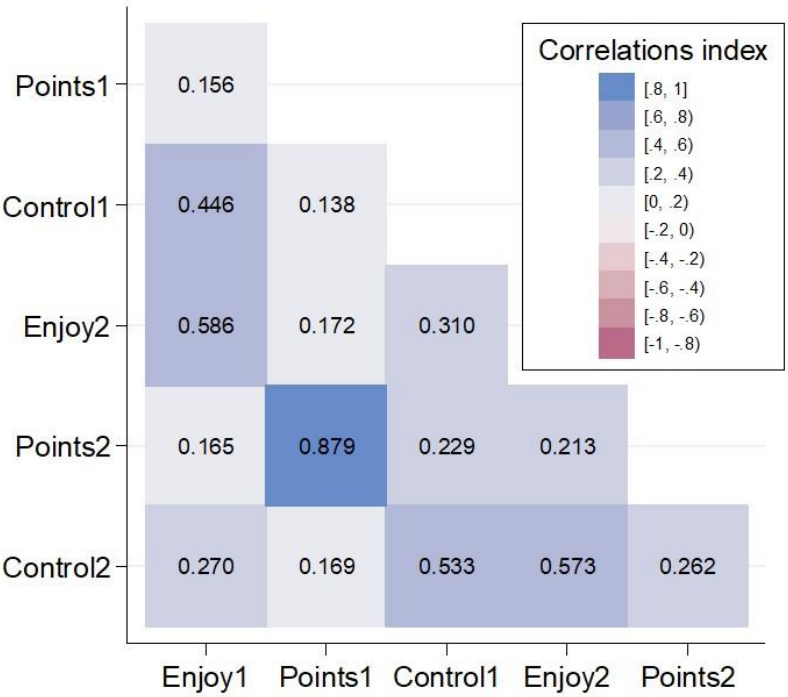

Figure S12. Subjective experiences correlations in **Experiment 2**. The numbers at the end of the variables' names represent the block number.

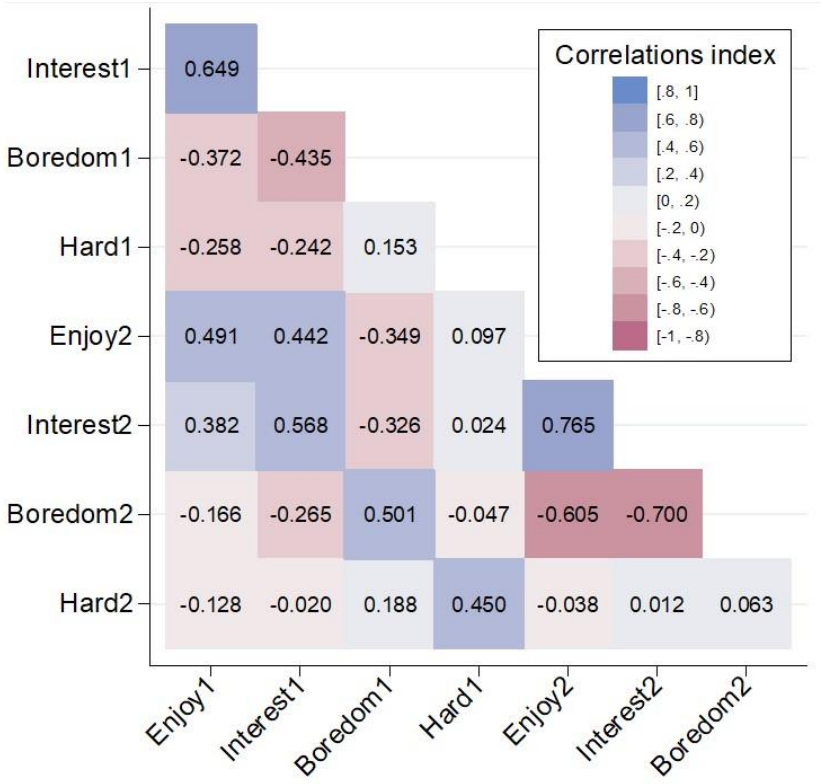

Figure S13. Subjective experiences correlations in the **Real Choice condition of Experiment 3**. The numbers at the end of the variables' names represent the block number.

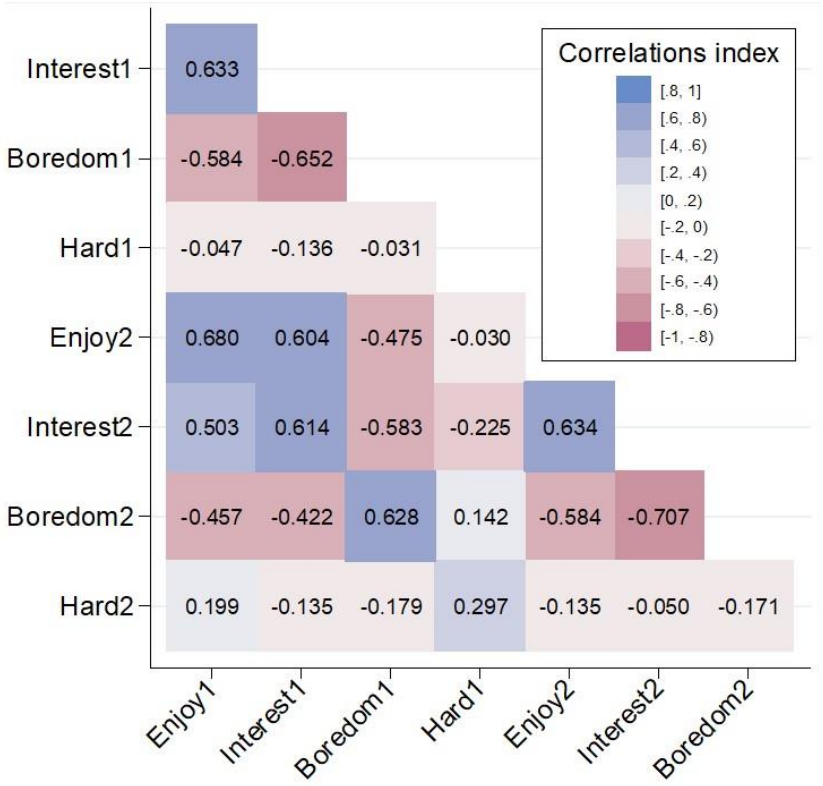

Figure S14. Subjective experiences correlations in the **Random Choice condition of Experiment 3**. The numbers at the end of the variables' names represent the block number.

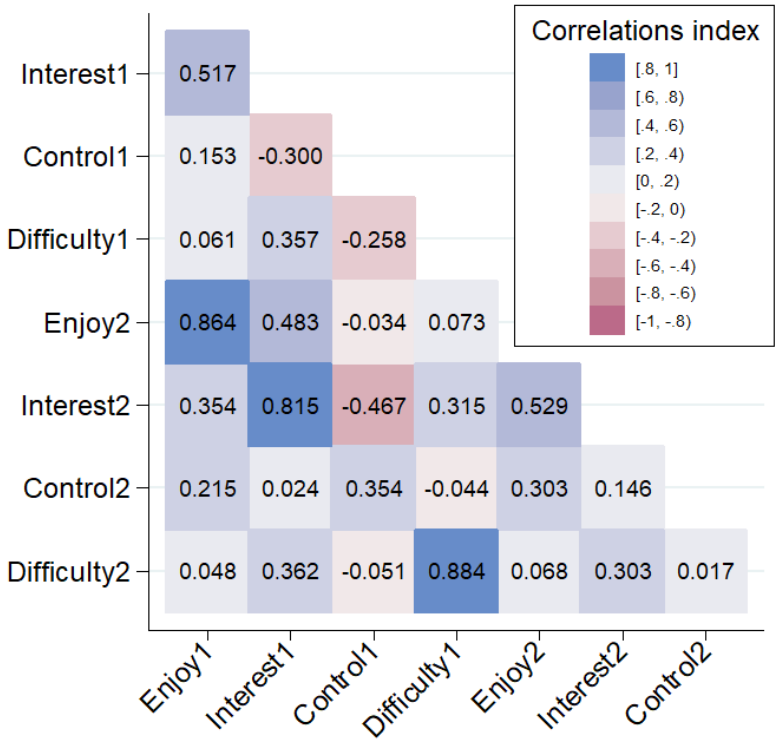

Figure S15. Subjective experiences correlations in **Experiment 4**. The numbers at the end of the variables' names represent the block number.

S5. Additional Measurements

The following tables present descriptive statistics of measurements that were collected in the experiments but are not specified in the main text. Notice that *most of these measurements were collected at the very end of the experiment.* . Hence, *these questions could not affect the primary results* specified in the main text and are specified here for the sake of completeness and transparency.

Each table indicates the phase in which each of these measurements was taken. For clarity, several measurements, such as subjective enjoyment and the estimated amount of points gained, were collected both after each block and at the end of the experiments. In these cases, the data from the end of each block was used in the main text and the following tables present the data from the end of the experiments.

Table S2. Additional measurements from Experiment 1a that were not specified in the main text.

Question	After block 1	After block 2	At the end of the experiment
How many rounds were there? (OC)	25.88 11.44 52	41.51 50.72 55	
How many rounds were there? (CP)	24.93 11.95 55	35.17 12.92 52	
How accurately did you count? (OC)	5.5 .71 2	6.03 2.06 32	
How accurately did you count? (CP)	3.57 3.46 7	6.05 1.68 22	
Willingness to pay (for OC)			84.03 179.94 87

Willingness to pay (for CP)	17.25 36.33 20
How important was it for you to gain more points?	6.55 1.92 107
How much more (%) did you earn in OC?	28.42 25.14 69
How much more (%) did you earn in CP?	32.81 34.01 16
How much more (Agorot) did you earn in OC?	197.5 966.21 68
How much more (Agorot) did you earn in CP?	41.88 27.38 16
To what degree did you enjoy the OC block?	6.5 1.92 107
To what degree did you enjoy the CP block?	4.37 2.17 107
How hard and unpleasant was the OC block?	2.96 1.83 107
How hard and unpleasant was the CP block?	3.55 2.38 107

Table S3. Additional measurements that were collected *at the end* of Experiment 1b and were not specified in the main text.

Question		Question	
Willingness to pay (for OC)	653.53 1710.97 49	**To what degree was the OC block difficult and unpleasant?**	3.05 1.7 56
Willingness to pay (for CP)	284.14 363.49 7	**To what degree was the CP block difficult and unpleasant?**	2.89 2.25 56

How important was it for you to gain more points?	7.46 1.56 56	**To what degree did you feel in control in the OC block?**	5.77 2.16 56
How much more (%) did you earn in OC?	16.72 12.64 29	**To what degree did you feel in control in the CP block?**	2.66 2.39 56
How much more (%) did you earn in CP?	18.64 13.55 14	**To what degree did you feel that you lack control in the OC block?**	4.13 2.22 56
How much more (Points) did you earn in OC?	28.34 31.03 29	**To what degree did you feel that you lack control in the CP block?**	6.98 2.58 56
How much more (Points) did you earn in CP?	29.79 20.49 14	**How accurately did you count? (1th block counters)**	4.5 2.12 2
To what degree did you enjoy the OC block?	6.93 1.68 56	**How accurately did you count? (2nd block counters)**	6 1.69 15
To what degree did you enjoy the CP block?	3.75 2.27 56	**How accurately did you count? (both blocks counters)**	1 - 1

Table S4. Additional measurements that were collected *at the end* of Experiment 1c and were not specified in the main text.

Question		Question	
OC estimated mean (Points)	10.46 1.63 41	**How many rounds did the task include?**	23.09 7.36 43
CP estimated mean (Points)	7.98 4.15 43	**To what degree did you feel in control during the OC block?**	4.77 3 44
How many points did you earn during the task?	138.88 76.06 43	**Willingness to pay (for OC)**	31.05 21.14 22
To what degree did you enjoy the task, while performing it?	7.76 .78 34	**Willingness to pay (for CP)**	22.5 18.93 4

Table 4. Additional measurements that were collected *at the end* of Experiment 2 and were not specified in the main text.

Question	
Willingness to pay (for OC)	51.48 313.26 183
Willingness to pay (for CP)	36.68 237.85 71

Table S5. Additional measurements that were collected *at the end* of Experiment 3 and were not specified in the main text.

	Dual Task	Single Task	**R**andom
Willingness to pay (for OC)	316.79 946.08 28	59.72 124.225	146.47 150.3717
Willingness to pay (for CP)	7.69 14.23 13	222.86 531.69 14	29.52 71.3821
How important was it for you to gain more points?	8.02 1.2341	7.49 1.7939	7.45 1.6438
How much more (Points) did you earn in OC?	21.06 19.09 18	18.5 9.4712	20.46 20.5313
How much more (Points) did you earn in CP?	18.54 12.71 13	10 5.689	8.61 6.614
To what degree did you enjoy the OC block?	7.15 1.6741	6.49 1.8839	6.34 1.9938

To what degree did you enjoy the CP block?	6.22 1.86 41	6.03 2.07 39	6.15 1.94 38
To what degree was the OC block difficult and unpleasant?	3.51 1.63 41	3.26 1.82 39	4.21 2.07 38
To what degree was the CP block difficult and unpleasant?	3.17 1.76 41	3.26 1.68 39	3.53 1.89 38
How accurately did you count? (both blocks counters)	9 - 1	7.33 .58 3	3 - 1

References

Gelman, A., & Hill, J. (2006). *Data analysis using regression and multilevel/hierarchical models*. Cambridge university press.

Tukey, J. W. (1977). *Exploratory data analysis*. Addison-Wesley.