# Supplementary Material - Growth mindset and mindfulness inductions to facilitate effort after negative feedback

Data processing is available in "script/data_processing.R".

S1. Exploratory factor analysis of the expriences after the experiment

After the last IQ performance was measured, we asked nine questions from the participants about their experiences during the study. We used exploratory factor analysis to extract the main factors from these questions. Based on multiple factor number estimating methods, we chose a three factor solution.
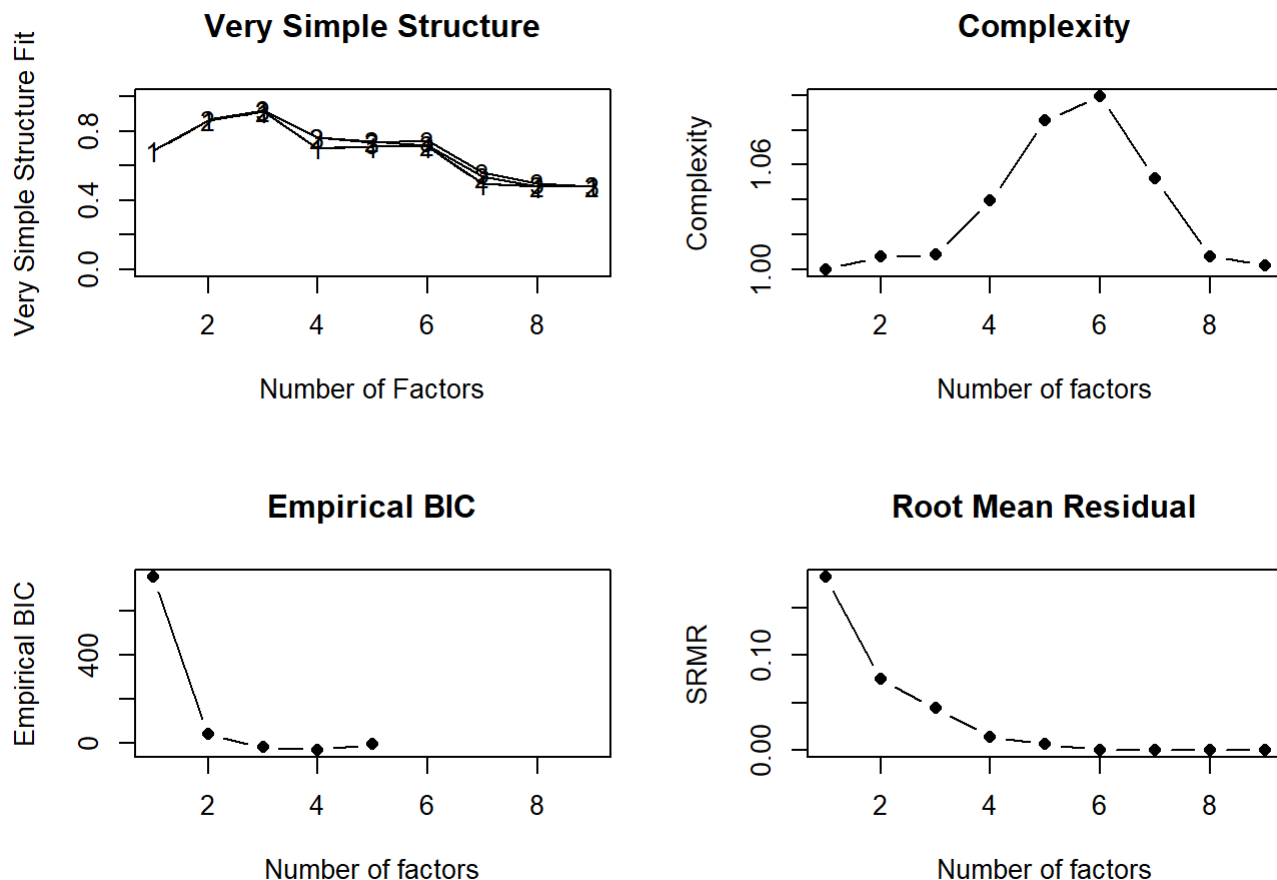
```
## 
## Number of factors
## Call: vss(x = x, n = n, rotate = rotate, diagonal = diagonal, fm = fm,
##     n.obs = n.obs, plot = FALSE, title = title, use = use, cor = cor,
##     max.iter = 500)
## VSS complexity 1 achieves a maximimum of 0.91  with  3  factors
## VSS complexity 2 achieves a maximimum of 0.92  with  3  factors
## The Velicer MAP achieves a minimum of 0.07  with  2  factors
## Empirical BIC achieves a minimum of  -30.24  with  4  factors
## Sample Size adjusted BIC achieves a minimum of  7.14  with  5  factors
## 
## Statistics by number of factors
##   vss1 vss2   map dof   chisq      prob sqresid  fit RMSEA    BIC SABIC complex
## 1 0.69 0.00 0.082  27 7.2e+02 2.7e-134     6.7 0.69  0.26 559.2 644.9     1.0
## 2 0.86 0.87 0.068  19 3.5e+02  3.0e-62     2.9 0.87  0.21 234.7 295.0     1.0
## 3 0.91 0.92 0.122  12 2.4e+02  6.2e-44     1.7 0.92  0.22 165.9 203.9     1.0
## 4 0.70 0.76 0.133   6 2.9e+01  6.4e-05     5.1 0.76  0.10  -6.8  12.2     1.0
## 5 0.71 0.74 0.181   1 9.9e+00  1.6e-03     5.3 0.75  0.15   4.0   7.1     1.1
## 6 0.71 0.72 0.302  -3 1.0e-05       NA     5.1 0.76    NA    NA    NA     1.1
## 7 0.49 0.54 0.482  -6 4.0e-08       NA     9.5 0.56    NA    NA    NA     1.1
## 8 0.48 0.48 1.000  -8 2.3e-11       NA    10.8 0.49    NA    NA    NA     1.0
## 9 0.48 0.48    NA  -9 0.0e+00       NA    11.0 0.48    NA    NA    NA     1.0
##    eChisq    SRMR eCRMS   eBIC
## 1 9.1e+02 1.8e-01 0.210  754.4
## 2 1.5e+02 7.5e-02 0.103   41.0
## 3 5.4e+01 4.4e-02 0.076  -17.8
## 4 5.4e+00 1.4e-02 0.034  -30.2
## 5 1.1e+00 6.3e-03 0.038   -4.9
## 6 1.6e-06 7.7e-06    NA    NA
## 7 4.3e-09 3.9e-07    NA    NA
## 8 1.7e-12 7.9e-09    NA    NA
## 9 2.5e-27 3.0e-16    NA    NA
```

Five questions loaded to the first factor (stress), and three questions loaded to the second factor (task boredom). Only one item loaded to the third factor, that we didn't analyze. Factor scores for task boredom and stress were calculated using the regression method, and were used in the later analyses.

EFA Factor loadings

	Factor 1	Factor 2	Factor 3	*Communality*
How boring was the IQ test for you?	0.03	0.96	0.02	*0.91*
How exciting was the IQ test for you?	0.02	-0.65	-0.01	*0.43*
How bored were you filling the survey?	-0.04	0.76	-0.03	*0.59*
How nervous were you filling the survey?	0.82	-0.07	0.06	*0.72*
How stressful did you find the IQ test?	0.86	-0.01	0.05	*0.77*
How calm were you during the IQ test?	-0.79	-0.01	0.04	*0.62*

Did stress affect your performance on the IQ test?	0.83	-0.01	-0.02	*0.66*
To what extent has stress worsened your performance on the IQ test?	0.83	0.08	-0.05	*0.64*
How challenging was the IQ test for you?	0.00	0.01	0.96	*0.92*
Total Communalities				*6.25*

S2. Compare baseline characteristics

Number of participants in each group, and by gender.

Number of participants by group			
Fixed - Control	**Fixed - Mindfulness**	**Growth - Control**	**Growth - Mindfulness**
90	102	101	90

Number of participants of each gender by group				
Gender	**Fixed - Control**	**Fixed - Mindfulness**	**Growth - Control**	**Growth - Mindfulness**
Female	74	79	82	71
Male	16	23	19	19

Compare baseline charactersitcs by group

	Group			
Measure	**Fixed-Control**	**Fixed-Mindfulness**	**Growth-Control**	**Growth-Mindfulness**
Gender: Male	18.0%	23.0%	19.0%	21.0%
Age	21.94 (2.38)	22.28 (4.33)	22.86 (4.89)	22.14 (4.63)
Prior growth mindset	4.02 (1.03)	3.90 (1.10)	4.14 (0.93)	3.97 (1.07)
Trait mindfulness	2.80 (0.39)	2.78 (0.46)	2.84 (0.40)	2.83 (0.38)
Ego-resilience	2.78 (0.50)	2.78 (0.42)	2.87 (0.48)	2.77 (0.43)
Grit	2.73 (0.68)	2.65 (0.75)	2.63 (0.70)	2.62 (0.67)

Measure	Group			
	Fixed-Control	**Fixed-Mindfulness**	**Growth-Control**	**Growth-Mindfulness**
Self-compassion	3.00 (0.64)	2.98 (0.66)	3.00 (0.58)	3.00 (0.65)
Global self-esteem	1.92 (0.52)	2.04 (0.57)	2.08 (0.55)	2.04 (0.54)

None of the groups differed in any trait characteristics. The following table shows the results of the linear models that were used for the comparisons.

term	estimate	std.error	statistic	p.value
Gender: Male				
(Intercept)	0.18	0.04	4.19	0.0000
mindsetGrowth	0.01	0.06	0.18	0.8594
interventionMindfulness	0.05	0.06	0.82	0.4129
mindsetGrowth:interventionMindfulness	−0.02	0.08	−0.30	0.7644
Age				
(Intercept)	21.94	0.44	49.50	0.0000
mindsetGrowth	0.92	0.61	1.50	0.1334
interventionMindfulness	0.34	0.61	0.56	0.5766
mindsetGrowth:interventionMindfulness	−1.06	0.86	−1.23	0.2205
Prior growth mindset				
(Intercept)	4.02	0.11	36.95	0.0000
mindsetGrowth	0.12	0.15	0.80	0.4262
interventionMindfulness	−0.12	0.15	−0.80	0.4221
mindsetGrowth:interventionMindfulness	−0.05	0.21	−0.25	0.8057
Trait mindfulness				
(Intercept)	2.80	0.04	64.71	0.0000
mindsetGrowth	0.04	0.06	0.66	0.5102

term	estimate	std.error	statistic	p.value
interventionMindfulness	−0.02	0.06	−0.35	0.7302
mindsetGrowth:interventionMindfulness	0.02	0.08	0.20	0.8448
Ego-resilience				
(Intercept)	2.78	0.05	57.48	0.0000
mindsetGrowth	0.09	0.07	1.31	0.1924
interventionMindfulness	0.00	0.07	0.03	0.9793
mindsetGrowth:interventionMindfulness	−0.10	0.09	−1.02	0.3094
Grit				
(Intercept)	2.73	0.07	36.46	0.0000
mindsetGrowth	−0.10	0.10	−1.01	0.3112
interventionMindfulness	−0.08	0.10	−0.79	0.4308
mindsetGrowth:interventionMindfulness	0.08	0.14	0.53	0.5958
Self-compassion				
(Intercept)	3.00	0.07	45.00	0.0000
mindsetGrowth	0.00	0.09	−0.02	0.9830
interventionMindfulness	−0.03	0.09	−0.30	0.7658
mindsetGrowth:interventionMindfulness	0.03	0.13	0.23	0.8217
Global self-esteem				
(Intercept)	1.92	0.06	33.04	0.0000
mindsetGrowth	0.16	0.08	1.96	0.0505
interventionMindfulness	0.12	0.08	1.46	0.1442
mindsetGrowth:interventionMindfulness	−0.15	0.11	−1.35	0.1789

S3. Determinants of the task performance

We fitted a linear model to predict iq_real with mindset and intervention. The model's explanatory power is very weak ($R2 = 3.57e-03$, adj. $R2 = -4.32e-03$). The model's intercept is at 0.74 (95% CI [0.70, 0.78]). Within this model:

- The effect of mindset [Growth] is statistically non-significant and negative (beta = -0.02, 95% CI [-0.07, 0.03], t(379) = -0.62, p = 0.533, Std. beta = -0.09)
- The effect of intervention [Mindfulness] is statistically non-significant and positive (beta = 2.83e-03, 95% CI [-0.05, 0.05], t(379) = 0.11, p = 0.911, Std. beta = 0.02)
- The interaction effect of intervention [Mindfulness] on mindset [Growth] is statistically non-significant and negative (beta = -9.11e-03, 95% CI [-0.08, 0.06], t(379) = -0.25, p = 0.800, Std. beta = -0.05)

Predictors	std. Beta	standardized CI	Statistic	p
		"Real" IQ test result		
(Intercept)	0.05	-0.16 – 0.26	39.63	**<0.001**
mindset [Growth]	-0.09	-0.38 – 0.20	-0.61	0.539
intervention [Mindfulness]	0.02	-0.27 – 0.30	0.11	0.912
mindset [Growth] * intervention [Mindfulness]	-0.05	-0.46 – 0.35	-0.25	0.801
Observations	383			
R^2 / R^2 adjusted	0.004 / -0.004			
AIC	-238.904			

S4. Moderators for the task performance

Here we only found that the score on the "real" IQ test was weakly associated with the grit score (the upper row means the name of the moderator, that is used in the table as "value").

term	estimate	conf.low	conf.high	statistic	p.value
Age					
(Intercept)	−0.52	−2.46	1.41	−0.53	0.5943
mindsetGrowth	1.10	−1.06	3.25	1.00	0.3171
interventionMindfulness	1.43	−0.76	3.62	1.29	0.1990
Age	0.03	−0.06	0.11	0.59	0.5579
mindsetGrowth:interventionMindfulness	−1.62	−4.21	0.98	−1.23	0.2210
mindsetGrowth:Age	−0.05	−0.15	0.04	−1.08	0.2811

term	estimate	conf.low	conf.high	statistic	p.value
interventionMindfulness:Age	−0.06	−0.16	0.03	−1.28	0.2029
mindsetGrowth:interventionMindfulness:Age	0.07	−0.05	0.19	1.19	0.2363
Trait mindfulness					
(Intercept)	0.05	−0.16	0.25	0.43	0.6704
mindsetGrowth	−0.09	−0.38	0.20	−0.62	0.5355
interventionMindfulness	0.03	−0.26	0.31	0.18	0.8571
Trait mindfulness	−0.13	−0.35	0.09	−1.18	0.2379
mindsetGrowth:interventionMindfulness	−0.06	−0.47	0.34	−0.31	0.7549
mindsetGrowth:Trait mindfulness	0.19	−0.10	0.49	1.28	0.2021
interventionMindfulness:Trait mindfulness	0.20	−0.08	0.48	1.42	0.1560
mindsetGrowth:interventionMindfulness:Trait mindfulness	−0.15	−0.56	0.26	−0.71	0.4780
Grit					
(Intercept)	0.06	−0.15	0.26	0.54	0.5884
mindsetGrowth	−0.10	−0.38	0.19	−0.67	0.5025
interventionMindfulness	0.01	−0.27	0.29	0.07	0.9471
Grit	0.22	0.00	0.43	1.99	0.0468
mindsetGrowth:interventionMindfulness	−0.04	−0.44	0.36	−0.20	0.8449
mindsetGrowth:Grit	−0.17	−0.46	0.12	−1.18	0.2378
interventionMindfulness:Grit	−0.07	−0.35	0.21	−0.50	0.6182
mindsetGrowth:interventionMindfulness:Grit	0.19	−0.22	0.59	0.91	0.3654
Prior growth mindset					
(Intercept)	0.05	−0.16	0.26	0.48	0.6331
mindsetGrowth	−0.07	−0.35	0.22	−0.46	0.6424

term	estimate	conf.low	conf.high	statistic	p.value
interventionMindfulness	0.01	−0.27	0.30	0.10	0.9181
Prior growth mindset	−0.09	−0.30	0.12	−0.83	0.4068
mindsetGrowth:interventionMindfulness	−0.08	−0.48	0.33	−0.38	0.7005
mindsetGrowth:Prior growth mindset	−0.10	−0.40	0.20	−0.64	0.5206
interventionMindfulness:Prior growth mindset	0.09	−0.19	0.37	0.62	0.5377
mindsetGrowth:interventionMindfulness:Prior growth mindset	−0.02	−0.42	0.39	−0.08	0.9359
Ego-resilience					
(Intercept)	0.05	−0.16	0.26	0.48	0.6288
mindsetGrowth	−0.08	−0.37	0.20	−0.57	0.5659
interventionMindfulness	0.01	−0.27	0.30	0.10	0.9217
Ego-resilience	0.04	−0.15	0.24	0.44	0.6588
mindsetGrowth:interventionMindfulness	−0.06	−0.46	0.35	−0.27	0.7861
mindsetGrowth:Ego-resilience	−0.10	−0.37	0.17	−0.75	0.4538
interventionMindfulness:Ego-resilience	−0.04	−0.33	0.25	−0.25	0.7995
mindsetGrowth:interventionMindfulness:Ego-resilience	0.14	−0.28	0.55	0.65	0.5172
Self-compassion					
(Intercept)	0.05	−0.16	0.26	0.47	0.6405
mindsetGrowth	−0.09	−0.38	0.20	−0.62	0.5382
interventionMindfulness	0.02	−0.27	0.30	0.11	0.9139
Self-compassion	−0.02	−0.22	0.19	−0.16	0.8718
mindsetGrowth:interventionMindfulness	−0.05	−0.46	0.35	−0.26	0.7945
mindsetGrowth:Self-compassion	−0.10	−0.39	0.20	−0.65	0.5163
interventionMindfulness:Self-compassion	0.01	−0.27	0.29	0.07	0.9408

term	estimate	conf.low	conf.high	statistic	p.value
mindsetGrowth:interventionMindfulness:Self-compassion	0.19	−0.22	0.60	0.93	0.3555
Global self-esteem					
(Intercept)	0.11	−0.10	0.32	1.04	0.3007
mindsetGrowth	−0.15	−0.43	0.14	−0.99	0.3214
interventionMindfulness	−0.05	−0.33	0.24	−0.33	0.7415
Global self-esteem	0.08	−0.14	0.30	0.74	0.4588
mindsetGrowth:interventionMindfulness	0.00	−0.40	0.41	0.02	0.9831
mindsetGrowth:Global self-esteem	−0.16	−0.45	0.13	−1.06	0.2901
interventionMindfulness:Global self-esteem	−0.01	−0.30	0.27	−0.09	0.9245
mindsetGrowth:interventionMindfulness:Global self-esteem	0.10	−0.30	0.51	0.49	0.6232

S5. Secondary outcomes

Task boredom

We fitted a linear model to predict out_2 with mindset and intervention. The model's explanatory power is very weak (R^2 = 2.02e-03, adj. R^2 = -5.88e-03). The model's intercept is at -0.02 (95% CI [-0.22, 0.18]). Within this model:

- The effect of mindset [Growth] is statistically non-significant and positive (beta = 0.09, 95% CI [-0.18, 0.37], $t(379)$ = 0.67, p = 0.500, Std. beta = 0.10)
- The effect of intervention [Mindfulness] is statistically non-significant and positive (beta = 1.56e-03, 95% CI [-0.27, 0.28], $t(379)$ = 0.01, p = 0.991, Std. beta = 1.62e-03)
- The interaction effect of intervention [Mindfulness] on mindset [Growth] is statistically non-significant and negative (beta = -0.11, 95% CI [-0.50, 0.28], $t(379)$ = -0.54, p = 0.587, Std. beta = -0.11)

	Boredom			
Predictors	std. Beta	standardized CI	Statistic	p
(Intercept)	-0.02	-0.23 – 0.18	-0.22	0.824
mindset [Growth]	0.10	-0.19 – 0.38	0.67	0.500
intervention [Mindfulness]	0.00	-0.28 – 0.29	0.01	0.991

mindset [Growth] * intervention [Mindfulness]	-0.11	-0.52 – 0.29	-0.54	0.587
Observations	383			
R^2 / R^2 adjusted	0.002 / -0.006			

Stress

We fitted a linear model to predict out_1 with mindset and intervention. The model's explanatory power is very weak ($R2$ = 0.01, adj. $R2$ = 2.48e-03). The model's intercept is at 0.12 (95% CI [-0.08, 0.32]). Within this model:

- The effect of mindset [Growth] is statistically non-significant and negative (beta = -0.23, 95% CI [-0.50, 0.05], t(379) = -1.63, p = 0.104, Std. beta = -0.24)
- The effect of intervention [Mindfulness] is statistically non-significant and negative (beta = -0.20, 95% CI [-0.47, 0.07], t(379) = -1.44, p = 0.152, Std. beta = -0.21)
- The interaction effect of intervention [Mindfulness] on mindset [Growth] is statistically non-significant and positive (beta = 0.38, 95% CI [-1.92e-03, 0.77], t(379) = 1.96, p = 0.051, Std. beta = 0.40)

	Stress/anxiety			
Predictors	std. Beta	standardized CI	Statistic	p
(Intercept)	0.13	-0.08 – 0.33	1.21	0.226
mindset [Growth]	-0.24	-0.52 – 0.05	-1.63	0.104
intervention [Mindfulness]	-0.21	-0.49 – 0.08	-1.44	0.152
mindset [Growth] * intervention [Mindfulness]	0.40	-0.00 – 0.80	1.96	0.051
Observations	383			
R^2 / R^2 adjusted	0.010 / 0.002			

Achievement goals

We fitted everal independent linear regressions with each achievement goal scale as the outcome. None of the achievement goal variables were associated with the manipulated variables.

term	estimate	conf.low	conf.high	statistic	p.value
agq_oap					
(Intercept)	3.76	3.37	4.14	19.23	0.0000
mindsetGrowth	−0.37	−0.90	0.15	−1.39	0.1641

term	estimate	conf.low	conf.high	statistic	p.value
interventionMindfulness	−0.02	−0.54	0.51	−0.06	0.9543
mindsetGrowth:interventionMindfulness	0.32	−0.42	1.07	0.85	0.3950
agq_oav					
(Intercept)	4.47	4.07	4.87	22.02	0.0000
mindsetGrowth	−0.07	−0.62	0.48	−0.25	0.8002
interventionMindfulness	0.13	−0.42	0.67	0.45	0.6497
mindsetGrowth:interventionMindfulness	0.32	−0.45	1.10	0.82	0.4144
agq_sap					
(Intercept)	4.55	4.23	4.87	28.06	0.0000
mindsetGrowth	−0.22	−0.66	0.22	−0.98	0.3281
interventionMindfulness	−0.03	−0.46	0.41	−0.11	0.9088
mindsetGrowth:interventionMindfulness	0.34	−0.28	0.96	1.09	0.2757
agq_sav					
(Intercept)	5.54	5.26	5.83	38.54	0.0000
mindsetGrowth	−0.12	−0.51	0.27	−0.60	0.5488
interventionMindfulness	0.05	−0.34	0.44	0.25	0.8053
mindsetGrowth:interventionMindfulness	0.23	−0.32	0.77	0.81	0.4200
agq_tap					
(Intercept)	5.62	5.36	5.88	42.54	0.0000
mindsetGrowth	0.19	−0.17	0.54	1.02	0.3081
interventionMindfulness	0.29	−0.07	0.64	1.57	0.1161
mindsetGrowth:interventionMindfulness	−0.38	−0.88	0.13	−1.47	0.1433
agq_tav					

term	estimate	conf.low	conf.high	statistic	p.value
(Intercept)	4.77	4.45	5.10	28.68	0.0000
mindsetGrowth	0.05	−0.40	0.50	0.22	0.8286
interventionMindfulness	0.31	−0.14	0.76	1.36	0.1737
mindsetGrowth:interventionMindfulness	−0.11	−0.74	0.53	−0.33	0.7452
agt_p_oap					
(Intercept)	3.61	3.13	4.08	14.98	0.0000
mindsetGrowth	−0.36	−1.00	0.29	−1.09	0.2772
interventionMindfulness	−0.14	−0.80	0.51	−0.44	0.6630
mindsetGrowth:interventionMindfulness	0.83	−0.08	1.75	1.80	0.0732
agt_p_oav					
(Intercept)	4.22	3.71	4.73	16.23	0.0000
mindsetGrowth	−0.23	−0.93	0.46	−0.66	0.5074
interventionMindfulness	−0.13	−0.83	0.58	−0.35	0.7257
mindsetGrowth:interventionMindfulness	0.89	−0.10	1.88	1.78	0.0767
agt_p_sap					
(Intercept)	4.58	4.16	5.00	21.31	0.0000
mindsetGrowth	−0.09	−0.66	0.49	−0.30	0.7673
interventionMindfulness	0.12	−0.46	0.71	0.42	0.6747
mindsetGrowth:interventionMindfulness	0.48	−0.34	1.29	1.15	0.2494
agt_p_sav					
(Intercept)	5.46	5.07	5.84	28.12	0.0000
mindsetGrowth	−0.12	−0.64	0.40	−0.45	0.6545
interventionMindfulness	0.04	−0.49	0.56	0.14	0.8926
mindsetGrowth:interventionMindfulness	0.32	−0.41	1.06	0.87	0.3870

term	estimate	conf.low	conf.high	statistic	p.value
agt_p_tap					
(Intercept)	5.45	5.11	5.79	31.75	0.0000
mindsetGrowth	0.12	−0.34	0.58	0.51	0.6100
interventionMindfulness	0.34	−0.12	0.81	1.45	0.1488
mindsetGrowth:interventionMindfulness	−0.21	−0.86	0.44	−0.63	0.5266
agt_p_tav					
(Intercept)	4.71	4.30	5.12	22.74	0.0000
mindsetGrowth	0.09	−0.46	0.64	0.32	0.7464
interventionMindfulness	0.32	−0.24	0.88	1.13	0.2613
mindsetGrowth:interventionMindfulness	0.27	−0.52	1.05	0.67	0.5062