Modeling Notebook

```
md"# Modeling Notebook"
```

```
using CSV, DataFrames, Plots, Random, Statistics, GLM, StatsPlots, Tables, Printf
, MixedModels, Pipe
```

```
cond_num = 1
```

```
cond_num = 1
```

```
dfpre = CSV.File(raw"E:\+WORKSPACE\acro\affvids_physio_with_phobia.csv") |>
DataFrame;
```

```
["107", "107", "107", "107", "107", "107", "107", "107", "107", "107", "107", "1
```

```
dfpre[:, :participant_num_str] = dfpre[:, :participant_num] .|> string
```

df1pre =

	Column1	Unnamed: 0	video	video_condition	im_condition	pred_
1	3	3	"heights_low_3.mov"	1	1	2
2	8	8	"heights_low_2.m4v"	1	1	2
3	9	9	"heights_high_1.m4v"	1	2	1
4	10	10	"heights_high_3.m4v"	1	2	1
5	14	14	"heights_high_5.mov"	1	2	2
6	15	15	"heights_high_4.m4v"	1	2	1
7	16	16	"heights_low_6.m4v"	1	1	1
8	20	20	"heights_low_1.m4v"	1	1	2
9	25	25	"heights_low_4.m4v"	1	1	2
10	26	26	"heights_low_5.m4v"	1	1	1
⋮ more						
1233	3782	3783	"heights_low_2.m4v"	1	1	1

```
1 df1pre = dfpre[dfpre[:, :video_condition] .== cond_num, :]
```

df2pre_pre =

	Column1	Unnamed: 0	video	video_condition	im_condition	pred_
1	0	0	"spider_high_5.m4v"	3	2	2
2	1	1	"spider_low_3.m4v"	3	1	1
3	2	2	"spider_low_6.m4v"	3	1	1
4	3	3	"heights_low_3.mov"	1	1	2
5	4	4	"social_low_1.m4v"	2	1	2
6	5	5	"social_high_6.mov"	2	2	1
7	6	6	"social_low_6.m4v"	2	1	1
8	7	7	"spider_high_6.mov"	3	2	2
9	8	8	"heights_low_2.m4v"	1	1	2
10	9	9	"heights_high_1.m4v"	1	2	1
⋮ more						
3691	3788	3789	"spider_low_5.mov"	3	1	1

```
df2pre_pre = @pipe dfpre |>
    groupby(_,:participant_num) |>
    transform(_, [:video_scr, :video_hp, :resp_arousal, :resp_fear,
    :resp_valence] .=> mean, [:video_scr, :video_hp, :resp_arousal, :resp_fear,
    :resp_valence] .=> std) |>
    transform(_, [:video_scr, :video_scr_mean]=> ByRow(-) => :video_scr_cmc,
    [:video_hp, :video_hp_mean]=> ByRow(-) => :video_hp_cmc, [:resp_arousal,
    :resp_arousal_mean]=> ByRow(-) => :resp_arousal_cmc, [:resp_fear,
    :resp_fear_mean]=> ByRow(-) => :resp_fear_cmc, [:resp_valence,
    :resp_valence_mean]=> ByRow(-) => :resp_valence_cmc) |>
    transform(_, [:video_scr_cmc, :video_scr_std]=> ByRow(/) => :video_scr_z,
    [:video_hp_cmc, :video_hp_std]=> ByRow(/) => :video_hp_z,
    [:resp_arousal_cmc, :resp_arousal_std]=> ByRow(/) => :resp_arousal_z,
    [:resp_fear_cmc, :resp_fear_std]=> ByRow(/) => :resp_fear_z,
    [:resp_valence_cmc, :resp_valence_std]=> ByRow(/) => :resp_valence_z)
```

df2pre =

	Column1	Unnamed: 0	video	video_condition	im_condition	pred_
1	3	3	"heights_low_3.mov"	1	1	2
2	8	8	"heights_low_2.m4v"	1	1	2
3	9	9	"heights_high_1.m4v"	1	2	1
4	10	10	"heights_high_3.m4v"	1	2	1
5	14	14	"heights_high_5.mov"	1	2	2
6	15	15	"heights_high_4.m4v"	1	2	1
7	16	16	"heights_low_6.m4v"	1	1	1
8	20	20	"heights_low_1.m4v"	1	1	2
9	25	25	"heights_low_4.m4v"	1	1	2
10	26	26	"heights_low_5.m4v"	1	1	1
⋮ more						
1233	3782	3783	"heights_low_2.m4v"	1	1	1

```
1 df2pre = df2pre_pre[df2pre_pre[:, :video_condition] .== cond_num, :]
```

Test Area

	Column1	Unnamed: 0	video	video_condition	im_condition	pred_
1	3	3	"heights_low_3.mov"	1	1	2
2	8	8	"heights_low_2.m4v"	1	1	2
3	9	9	"heights_high_1.m4v"	1	2	1
4	10	10	"heights_high_3.m4v"	1	2	1
5	14	14	"heights_high_5.mov"	1	2	2
6	15	15	"heights_high_4.m4v"	1	2	1
7	16	16	"heights_low_6.m4v"	1	1	1
8	20	20	"heights_low_1.m4v"	1	1	2
9	25	25	"heights_low_4.m4v"	1	1	2
10	26	26	"heights_low_5.m4v"	1	1	1
⋮ more						
1233	3782	3783	"heights_low_2.m4v"	1	1	1

```
df1pre
```

```
collist = ["video",
"participant_num",
"resp_exp_fear",
"rt_exp_fear",
"resp_current_anxiety",
"rt_current_anxiety",
"resp_fear",
"resp_anxiety",
"resp_arousal",
"resp_valence",
"rt_fear",
"rt_anxiety",
"rt_arousal",
"rt_valence",
"video_hp",
"video_scr",
"base_ECG",
"base_scr",
"hp_change_video",
"scr_change_video",
"heights_phobia",
"participant_num_str"];
```

dfcleancol =

	video	participant_num	resp_exp_fear	rt_exp_fear	resp_current_a
1	"heights_low_3.mov"	107	0.048	2.503	0.045
2	"heights_low_2.m4v"	107	0.033	3.754	0.036
3	"heights_high_1.m4v"	107	0.032	2.52	0.024
4	"heights_high_3.m4v"	107	0.039	2.219	0.036
5	"heights_high_5.mov"	107	0.058	3.754	0.053
6	"heights_high_4.m4v"	107	0.282	4.355	0.17
7	"heights_low_6.m4v"	107	0.287	1.485	0.321
8	"heights_low_1.m4v"	107	0.05	2.319	0.044
9	"heights_low_4.m4v"	107	0.289	1.802	0.038
10	"heights_low_5.m4v"	107	0.059	1.368	0.056
⋮ more					
1233	"heights_low_2.m4v"	232	0.264	4.722	0.081

```
dfcleancol = coalesce.(df1pre[:, collist], 0)
```

```
collist_df2 = ["video",
"participant_num",
"resp_exp_fear",
"rt_exp_fear",
"resp_current_anxiety",
"rt_current_anxiety",
"resp_fear",
"resp_anxiety",
"resp_arousal",
"resp_valence",
"rt_fear",
"rt_anxiety",
"rt_arousal",
"rt_valence",
"video_hp",
"video_scr",
"base_ECG",
"base_scr",
"hp_change_video",
"scr_change_video",
"heights_phobia",
"participant_num_str",
"video_scr_mean",
"resp_arousal_mean",
"resp_fear_mean",
"resp_valence_mean",
"video_scr_std",
"resp_arousal_std",
"resp_fear_std",
"resp_valence_std",
"video_scr_cmc",
"resp_arousal_cmc",
"resp_fear_cmc",
"resp_valence_cmc",
"video_scr_z",
"resp_arousal_z",
"resp_fear_z",
"resp_valence_z"];
```

df2cleancol =

	video	participant_num	resp_exp_fear	rt_exp_fear	resp_current_a
1	"heights_low_3.mov"	107	0.048	2.503	0.045
2	"heights_low_2.m4v"	107	0.033	3.754	0.036
3	"heights_high_1.m4v"	107	0.032	2.52	0.024
4	"heights_high_3.m4v"	107	0.039	2.219	0.036
5	"heights_high_5.mov"	107	0.058	3.754	0.053
6	"heights_high_4.m4v"	107	0.282	4.355	0.17
7	"heights_low_6.m4v"	107	0.287	1.485	0.321
8	"heights_low_1.m4v"	107	0.05	2.319	0.044
9	"heights_low_4.m4v"	107	0.289	1.802	0.038
10	"heights_low_5.m4v"	107	0.059	1.368	0.056
⋮ more					
1233	"heights_low_2.m4v"	232	0.264	4.722	0.081

```
1 df2cleancol = coalesce.(df2pre[:, collist_df2], 0)
```

	video	participant_num	resp_exp_fear	rt_exp_fear	resp_current_an
1	"heights_high_2.mov"	224	0.513	1.102	0.5
2	"heights_low_3.mov"	224	0.503	7.075	0.5
3	"heights_high_6.mov"	224	0.5	0.935	0.5
4	"heights_low_2.m4v"	224	0.5	0.484	0.5
5	"heights_high_1.m4v"	224	0.496	2.87	0.5
6	"heights_high_3.m4v"	224	0.5	0.684	0.5
7	"heights_low_1.m4v"	224	0.534	5.356	0.5
8	"heights_low_6.m4v"	224	0.5	1.418	0.5
9	"heights_high_5.mov"	224	0.486	9.411	0.5
10	"heights_high_4.m4v"	224	0.5	2.203	0.5
11	"heights_low_5.m4v"	224	0.5	1.652	0.5
12	"heights_low_4.m4v"	224	0.5	0.651	0.5

```
dfcleancol[dfcleancol[:,:participant_num] .== 224,:]
```

▸ [0.0, 0.053, 0.103, 0.102, 0.158, 0.156, 0.118, 0.05, 0.05, 0.0, 0.154, 0.101, 0.0, 0.1

```
dfcleancol[:,"video_scr"]
```

comparevar (generic function with 1 method)

```
function comparevar(var1) #with phobia correlation
    return cor(dfcleancol[:,"heights_phobia"],dfcleancol[:,var1])
end
```

-0.012923105957940008

```
comparevar("video_scr")
```

0.038559033641762615

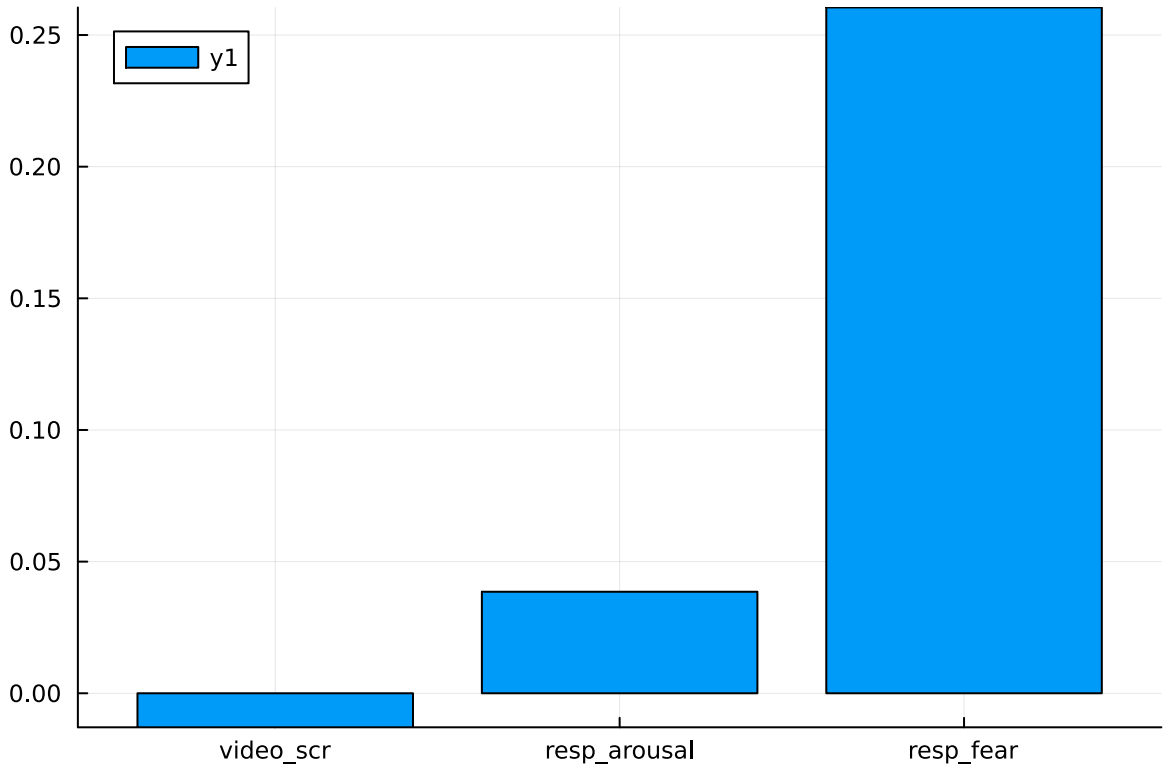
```
comparevar("resp_arousal")
```

0.2604838550544422

```
comparevar("resp_fear")
```

```
plotdata = [comparevar("video_scr"), comparevar("resp_arousal"),
comparevar("resp_fear")];
```

```
plotcols = ["video_scr", "resp_arousal", "resp_fear"];
```




```
plot(bar(plotcols, plotdata))
```

```
var1 = "video_scr"
```

```
var1 = "video_scr"
```

```
var2 = "resp_arousal"
```

```
var2 = "resp_arousal"
```

```
lm1 =
StatsModels.TableRegressionModel{LinearModel{GLM.LmResp{Vector{Float64}}, GLM.DensePre

video_scr ~ 1 + resp_arousal

Coefficients:
```

	Coef.	Std. Error	t	Pr(>|t|)	Lower 95%	Upper 95%
(Intercept)	0.0402875	0.0037051	10.87	<1e-25	0.0330185	0.0475565
resp_arousal	0.0499454	0.00607627	8.22	<1e-15	0.0380244	0.0618664

```
lm1 = lm(@formula(video_scr~ resp_arousal),dfcleancol)
```

```
0.04028753141479971
```

```
coef(lm1)[1]
```

gdf =

GroupedDataFrame with 105 groups based on key: participant_num_str

First Group (12 rows): participant_num_str = "107"

Row	video String31	participant_num Int64	resp_exp_fear Float64	rt_exp_fear Float64	resp_current_a Float64
1	heights_low_3.mov	107	0.048	2.503	
2	heights_low_2.m4v	107	0.033	3.754	
3	heights_high_1.m4v	107	0.032	2.52	
4	heights_high_3.m4v	107	0.039	2.219	
5	heights_high_5.mov	107	0.058	3.754	
6	heights_high_4.m4v	107	0.282	4.355	
7	heights_low_6.m4v	107	0.287	1.485	
8	heights_low_1.m4v	107	0.05	2.319	
9	heights_low_4.m4v	107	0.289	1.802	
10	heights_low_5.m4v	107	0.059	1.368	
11	heights_high_6.mov	107	0.055	2.419	
12	heights_high_2.mov	107	0.103	1.785	

⋮

Last Group (10 rows): participant_num_str = "232"

Row	video String31	participant_num Int64	resp_exp_fear Float64	rt_exp_fear Float64	resp_current_a Float64
1	heights_high_1.m4v	232	0.352	4.822	
2	heights_low_3.mov	232	0.5	2.303	
3	heights_high_3.m4v	232	0.51	4.138	
4	heights_low_4.m4v	232	0.393	3.454	
5	heights_high_6.mov	232	0.35	4.388	
6	heights_low_6.m4v	232	0.295	55.528	
7	heights_low_5.m4v	232	0.308	11.947	
8	heights_high_2.mov	232	0.236	8.943	
9	heights_high_4.m4v	232	0.306	7.008	
10	heights_low_2.m4v	232	0.264	4.722	

```
1 gdf = groupby(dfcleancol, :participant_num_str)
```

	video	participant_num	resp_exp_fear	rt_exp_fear	resp_current_an
1	"heights_high_6.mov"	114	0.752	2.503	0.611
2	"heights_high_4.m4v"	114	0.79	2.503	0.709
3	"heights_low_6.m4v"	114	0.665	2.92	0.482
4	"heights_low_3.mov"	114	0.554	2.62	0.617
5	"heights_low_1.m4v"	114	0.448	2.436	0.33
6	"heights_high_5.mov"	114	0.5	2.186	0.5
7	"heights_low_2.m4v"	114	0.736	2.169	0.761
8	"heights_high_2.mov"	114	0.706	1.819	0.729
9	"heights_low_4.m4v"	114	0.5	1.752	0.5
10	"heights_low_5.m4v"	114	0.317	2.887	0.289
11	"heights_high_3.m4v"	114	0.53	2.186	0.5
12	"heights_high_1.m4v"	114	0.51	1.769	0.5

```
gdf[6]
```

```
collist2 = [
"resp_exp_fear",
"rt_exp_fear",
"resp_current_anxiety",
"rt_current_anxiety",
"resp_fear",
"resp_anxiety",
"resp_arousal",
"resp_valence",
"rt_fear",
"rt_anxiety",
"rt_arousal",
"rt_valence",
"video_hp",
"video_scr",
"base_ECG",
"base_scr",
"hp_change_video",
"scr_change_video",
"heights_phobia"];
```

```
meantest (generic function with 1 method)
```

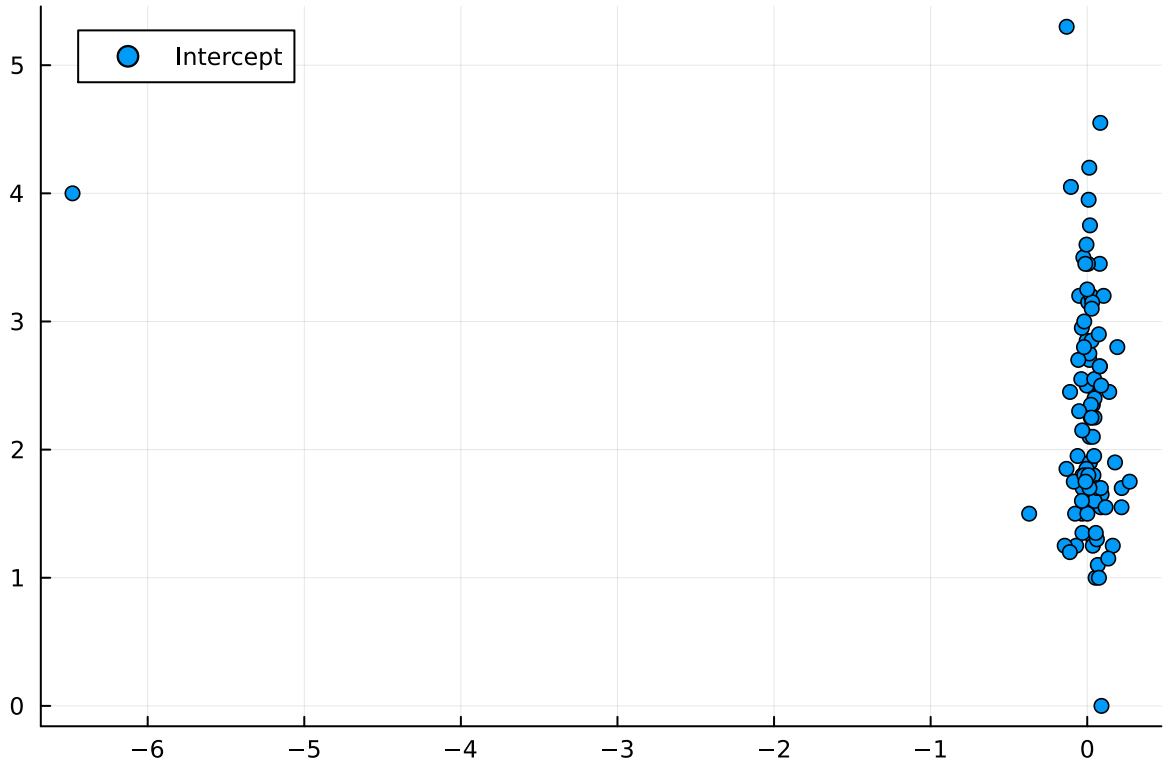
```
function meantest(series1, series2)
    if sum(series1) == 0 && mean(series1) == 0
        return missing
    end
    dfloc = DataFrame(a=series1, b=series2)
    lm1 = lm(@formula(a~ b),dfloc)
    return (coef(lm1)[1], coef(lm1)[2], loglikelihood(lm1))
end
```

Fitting SCR to Arousal

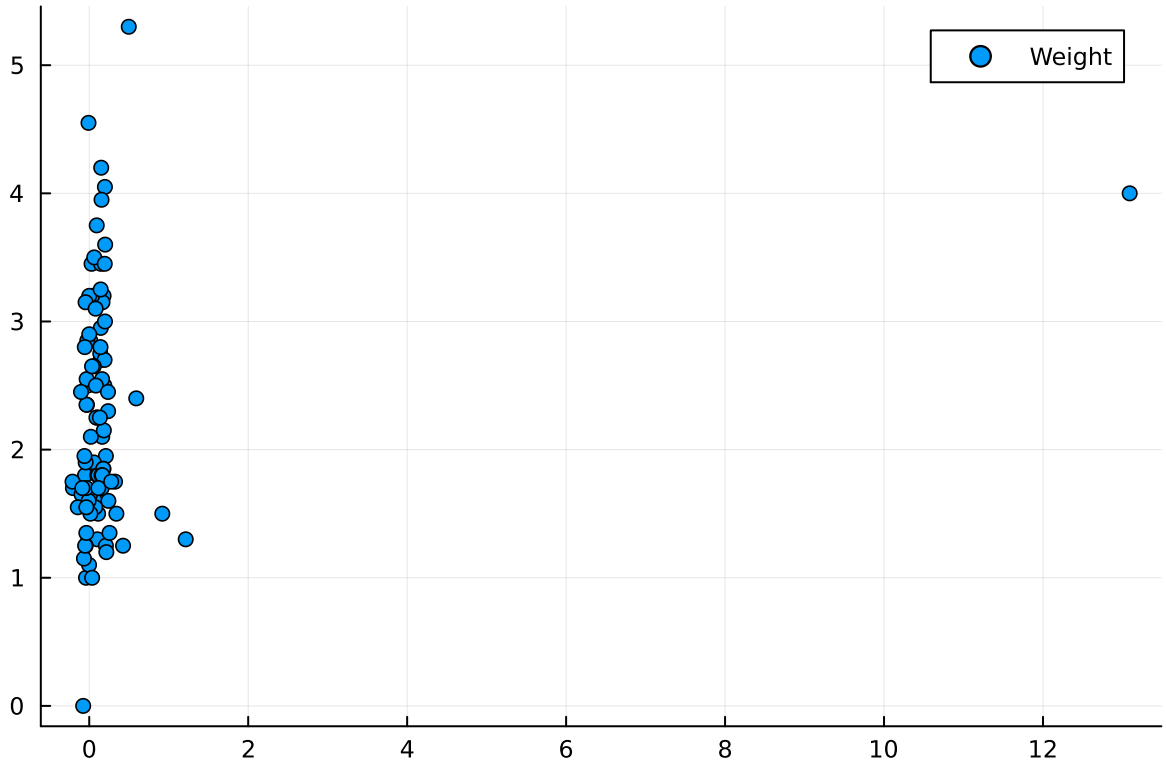
```
df2_subjlvl =
```

	participant_num_str	video_scr_resp_arousal	heights_phobia
1	"107"	(-0.0294172, 0.156027, 20.3867)	1.7
2	"108"	(0.0141399, 0.145324, 19.3618)	2.7
3	"109"	(0.0221785, 0.0971803, 18.5038)	2.25
4	"110"	(0.0133715, 0.138547, 22.0338)	2.75
5	"112"	(-0.0511336, 0.180373, 20.984)	3.2
6	"115"	(-0.0615343, 0.209231, 17.4484)	1.95
7	"118"	(0.220318, -0.205341, 18.3522)	1.7
8	"119"	(-0.00383224, 0.0134798, 34.83)	2.85
9	"120"	(0.0426463, -0.0115811, 19.8829)	1.3
10	"122"	(0.0389395, 0.102618, 20.9955)	1.3
⋮	more		
95	"232"	(-0.0108559, 0.276243, 22.3012)	1.75

```
df2_subjlvl = combine(gdf, [:video_scr, :resp_arousal] => meantest,
:heights_phobia => mean, renamecols=false) |> dropmissing
```




```
scatter(df2_subjlvl.video_scr_resp_arousal .|> x -> x[1],
df2_subjlvl.heights_phobia, label="Intercept")
```




```
scatter(df2_subjlvl.video_scr_resp_arousal .|> x -> x[2],
df2_subjlvl.heights_phobia, label="Weight")
```

```
scr_to_aro_int = -0.21189583908938775
```

```
scr_to_aro_int = cor(df2_subjlvl.video_scr_resp_arousal .|> x -> x[1],
df2_subjlvl.heights_phobia)
```

```
scr_to_aro_coef = 0.2042837512528689
```

```
scr_to_aro_coef = cor(df2_subjlvl.video_scr_resp_arousal .|> x -> x[2],
df2_subjlvl.heights_phobia)
```

▸ [20.3867, 19.3618, 18.5038, 22.0338, 20.984, 17.4484, 18.3522, 34.83, 19.8829, 20.9955

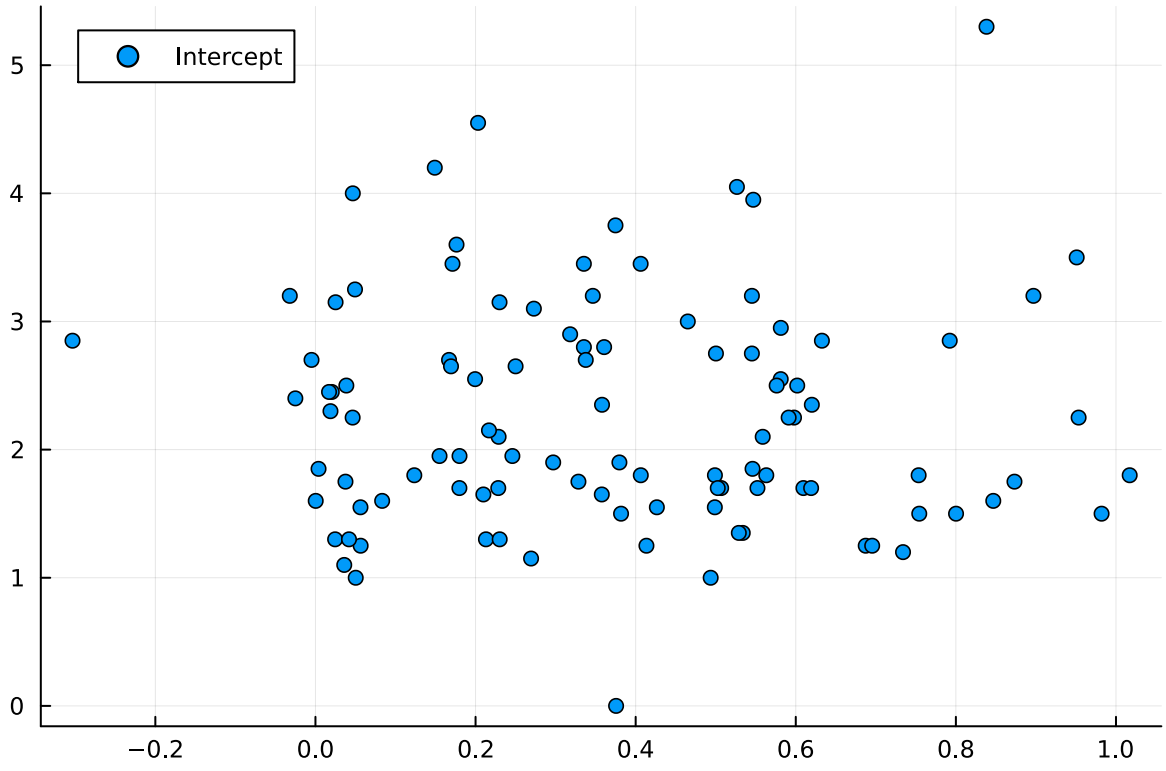
```
df2_subjlvl.video_scr_resp_arousal .|> x -> x[3]
```

Fitting Arousal to Fear Response

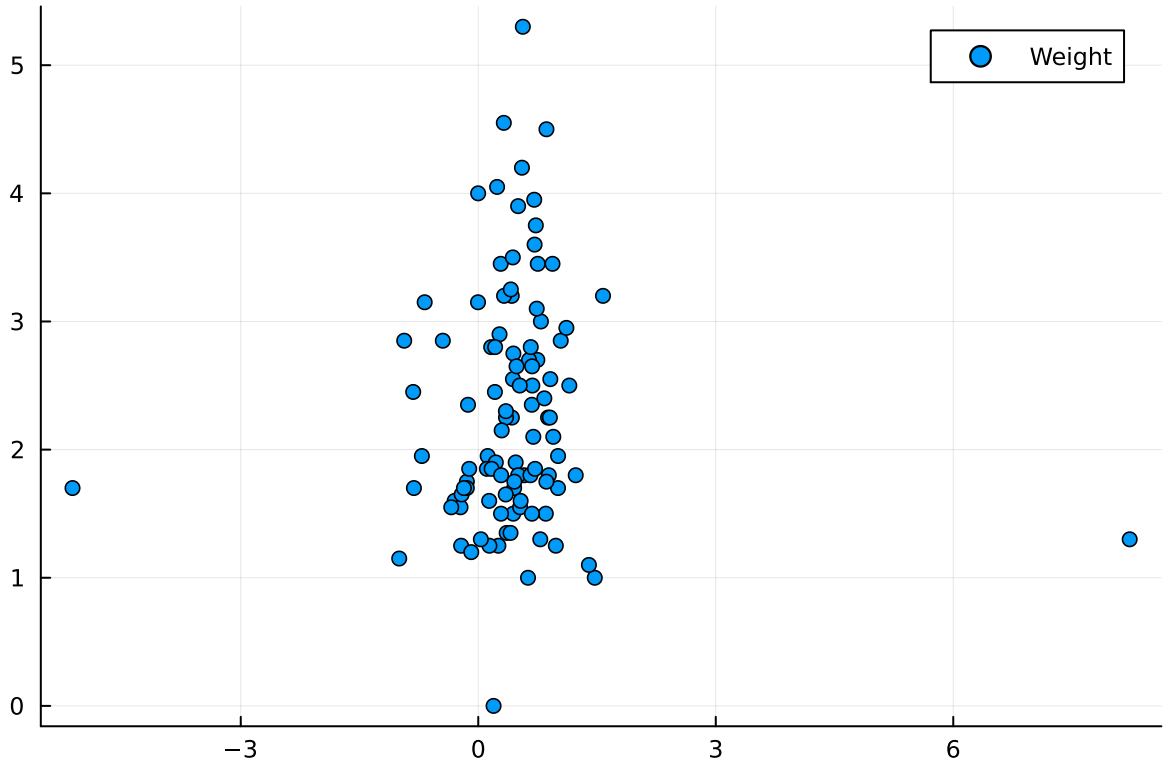
df2_subjlvl_2 =

	participant_num_str	resp_arousal_resp_fear	heights_phobia
1	"107"	(0.609566, 0.453225, 5.8691)	1.7
2	"108"	(0.166877, 0.746293, 6.17599)	2.7
3	"109"	(0.597806, 0.424352, 1.58945)	2.25
4	"110"	(0.545174, 0.443759, 0.676331)	2.75
5	"112"	(0.346466, 0.422949, 11.9338)	3.2
6	"114"	(0.179951, 0.881707, 12.8563)	2.25
7	"115"	(0.552143, 0.119097, 12.3195)	1.95
8	"118"	(0.632647, -0.81288, 17.0034)	1.7
9	"119"	(0.0245644, 1.0417, 9.90382)	2.85
10	"120"	(0.212973, 8.22849, -1.17997)	1.3
⋮	more		
104	"232"	(0.0419014, 0.860468, 7.79749)	1.75

```
df2_subjlvl_2 = combine(gdf, [:resp_arousal, :resp_fear] => meantest,
:heights_phobia => mean, renamecols=false) |> dropmissing
```




```
scatter(df2_subjlvl_2.resp_arousal_resp_fear .|> x -> x[1],
df2_subjlvl.heights_phobia, label="Intercept")
```




```
scatter(df2_subjlvl_2.resp_arousal_resp_fear .|> x -> x[2],
df2_subjlvl_2.heights_phobia, label="Weight")
```

```
aro_to_fear_int = -0.17245110040792372
```

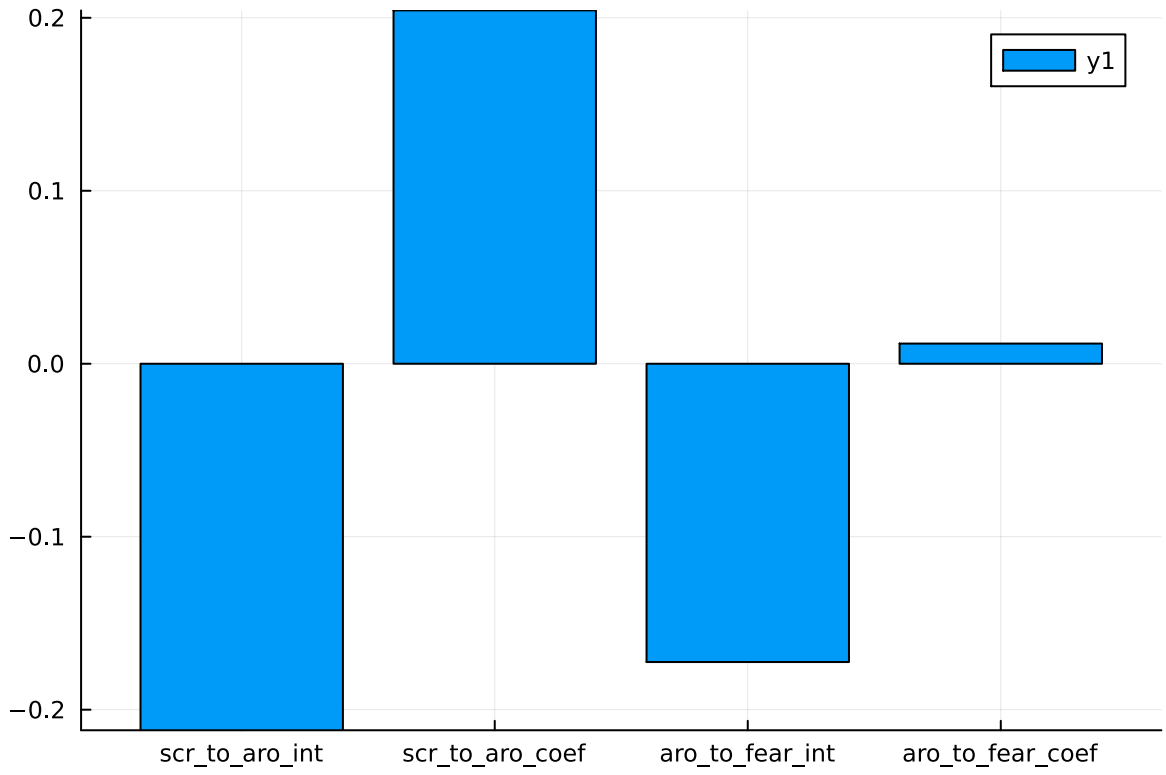
```
aro_to_fear_int = cor(df2_subjlvl_2.resp_arousal_resp_fear .|> x -> x[1],
df2_subjlvl_2.heights_phobia)
```

```
aro_to_fear_coef = 0.011662764820563476
```

```
aro_to_fear_coef = cor(df2_subjlvl_2.resp_arousal_resp_fear .|> x -> x[2],
df2_subjlvl_2.heights_phobia)
```

```
plotdata2 = [scr_to_aro_int,scr_to_aro_coef, aro_to_fear_int, aro_to_fear_coef];
```

```
plotcols2 = ["scr_to_aro_int","scr_to_aro_coef", "aro_to_fear_int",
"aro_to_fear_coef"];
```




```
plot(bar(plotcols2, plotdata2))
```

Test Area 2

```
df2_subjlvl_hp = combine(gdf, :heights_phobia => mean, renamecols=false);
```

	video	participant_num	resp_exp_fear	rt_exp_fear	resp_current_a
1	"heights_low_3.mov"	107	0.048	2.503	0.045
2	"heights_low_2.m4v"	107	0.033	3.754	0.036
3	"heights_high_1.m4v"	107	0.032	2.52	0.024
4	"heights_high_3.m4v"	107	0.039	2.219	0.036
5	"heights_high_5.mov"	107	0.058	3.754	0.053
6	"heights_high_4.m4v"	107	0.282	4.355	0.17
7	"heights_low_6.m4v"	107	0.287	1.485	0.321
8	"heights_low_1.m4v"	107	0.05	2.319	0.044
9	"heights_low_4.m4v"	107	0.289	1.802	0.038
10	"heights_low_5.m4v"	107	0.059	1.368	0.056
⋮ more					
1233	"heights_low_2.m4v"	232	0.264	4.722	0.081

```
dfcleancol
```

mm2 =

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.4623	0.0203	22.78	<1e-99	0.1796
video_scr	1.0109	0.1191	8.49	<1e-16	
Residual	0.2291				

```
Minimizing 2     Time: 0:00:00 ( 0.46  s/it)
  objective:  159.03687385603598

Minimizing 20    Time: 0:00:00 (49.15 ms/it)
```

	Column	Variance	Std.Dev
participant_num_str	(Intercept)	0.032247	0.179575
Residual		0.052465	0.229053

```
VarCorr(mm2)
```

▸ [1×105 Matrix{Float64}:
0.172852 -0.0672146 0.170205 0.106371 … -0.205337 0.10034 0.227672 -0.20205

```
ranef(mm2)
```

0.028574795465711653

```
var(only(ranef(mm2)))
```

	participant_num_str	(Intercept)
1	"107"	0.172852
2	"108"	-0.0672146
3	"109"	0.170205
4	"110"	0.106371
5	"112"	0.0510754
6	"114"	0.146462
7	"115"	0.0664402
8	"118"	0.0439839
9	"119"	0.117068
10	"120"	-0.0940886
⋮	more	
105	"232"	-0.202058

```
DataFrame(only(raneftables(mm2)))
```

Mixed Models

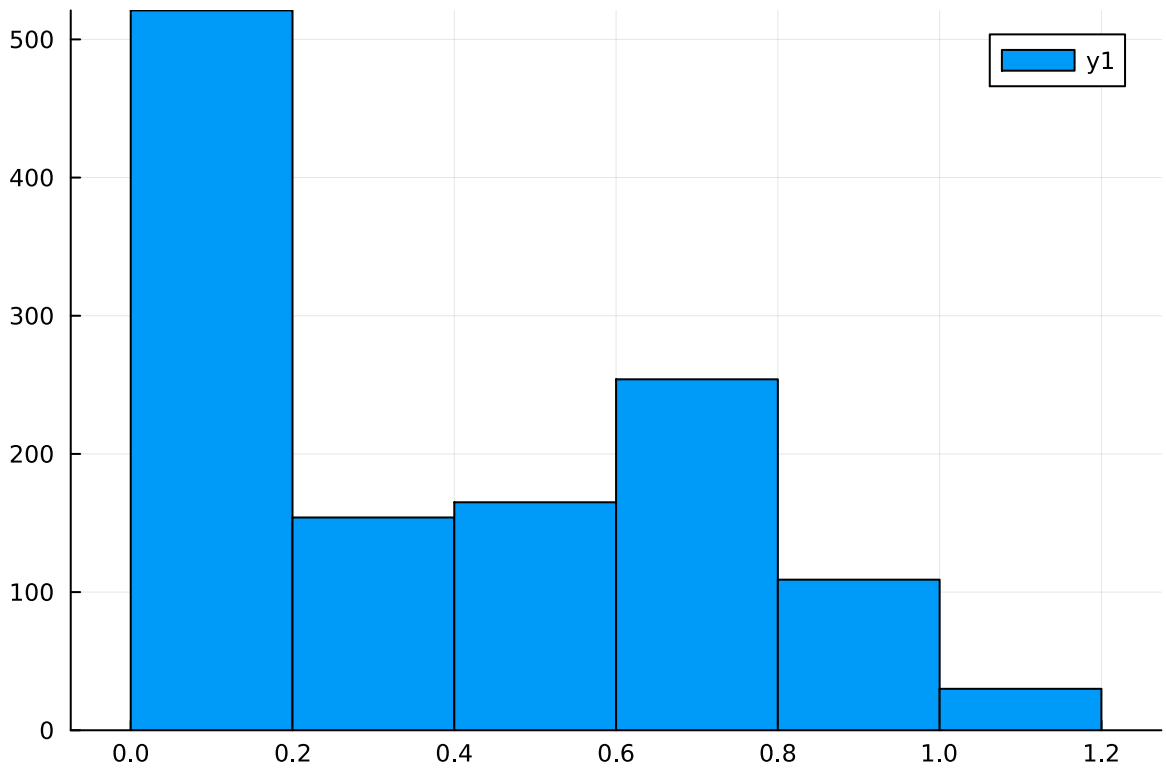
```
md"## Mixed Models"
```

dfcleancol2 =

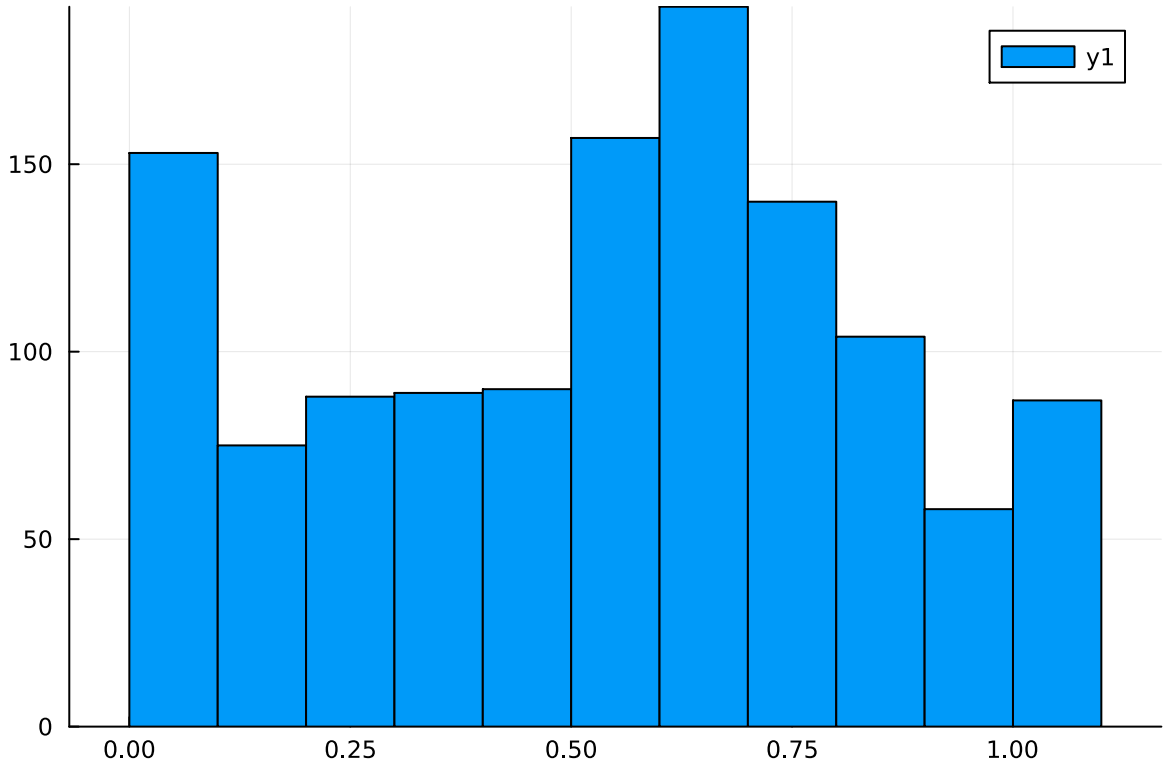
	video	participant_num	resp_exp_fear	rt_exp_fear	resp_current_a
1	"heights_low_3.mov"	107	0.048	2.503	0.045
2	"heights_low_2.m4v"	107	0.033	3.754	0.036
3	"heights_high_1.m4v"	107	0.032	2.52	0.024
4	"heights_high_3.m4v"	107	0.039	2.219	0.036
5	"heights_high_5.mov"	107	0.058	3.754	0.053
6	"heights_high_4.m4v"	107	0.282	4.355	0.17
7	"heights_low_6.m4v"	107	0.287	1.485	0.321
8	"heights_low_1.m4v"	107	0.05	2.319	0.044
9	"heights_low_4.m4v"	107	0.289	1.802	0.038
10	"heights_low_5.m4v"	107	0.059	1.368	0.056
⋮ more					
1233	"heights_low_2.m4v"	232	0.264	4.722	0.081

```
dfcleancol2 = @pipe dfcleancol |>
            groupby(_,:participant_num_str) |>
            transform(_, [:video_scr, :video_hp, :resp_arousal,
:scr_change_video, :resp_valence] .=> mean)|>
            transform(_, [:video_scr, :video_scr_mean] => ByRow(-) =>
:video_scr_cmc,
                [:video_hp, :video_hp_mean] => ByRow(-) => :video_hp_cmc,
                [:resp_arousal, :resp_arousal_mean] => ByRow(-) =>
                :resp_arousal_cmc,
                [:scr_change_video, :scr_change_video_mean] => ByRow(-) =>
                :scr_change_video_cmc,
                [:resp_valence, :resp_valence_mean] => ByRow(-) =>
                :resp_valence_cmc)
```

```
get_trunc (generic function with 1 method)
```




```
1 histogram(dfcleancol2.resp_fear)
```




```
1 histogram(dfcleancol2.resp_arousal)
```

Model 1: src to arousal

mm3 =

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.4594	0.0369	12.46	<1e-34	0.1806
video_scr_cmc	0.8985	0.1773	5.07	<1e-06	1.2116
video_scr_mean	1.0558	0.4809	2.20	0.0281	
Residual	0.2193				

```
mm3 = fit(LinearMixedModel, @formula(resp_arousal ~ video_scr_cmc +
video_scr_mean + (video_scr_cmc|participant_num_str)), dfcleancol2)
```

Scr to arousal, loglike: -27.208289501774402

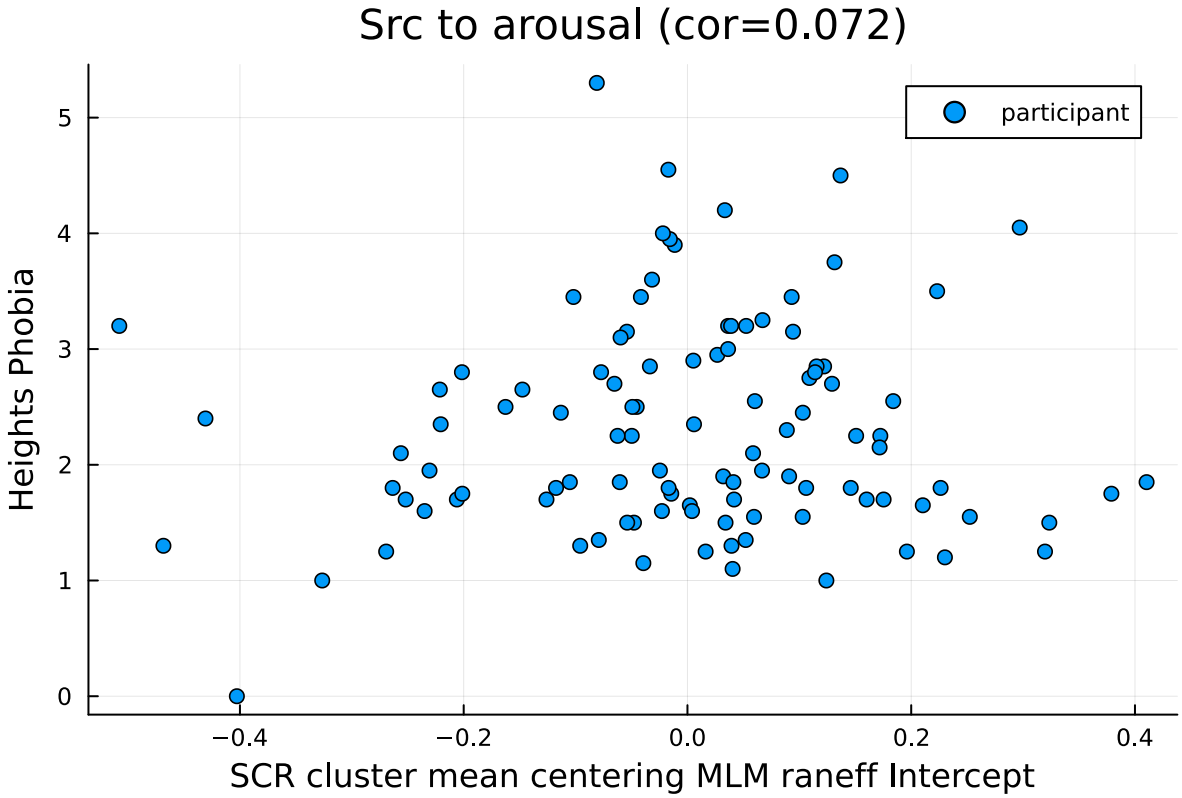
```
md"#### Scr to arousal, loglike: $(loglikelihood(mm3))"
```

Scr to arousal, AIC: 68.4165790035488

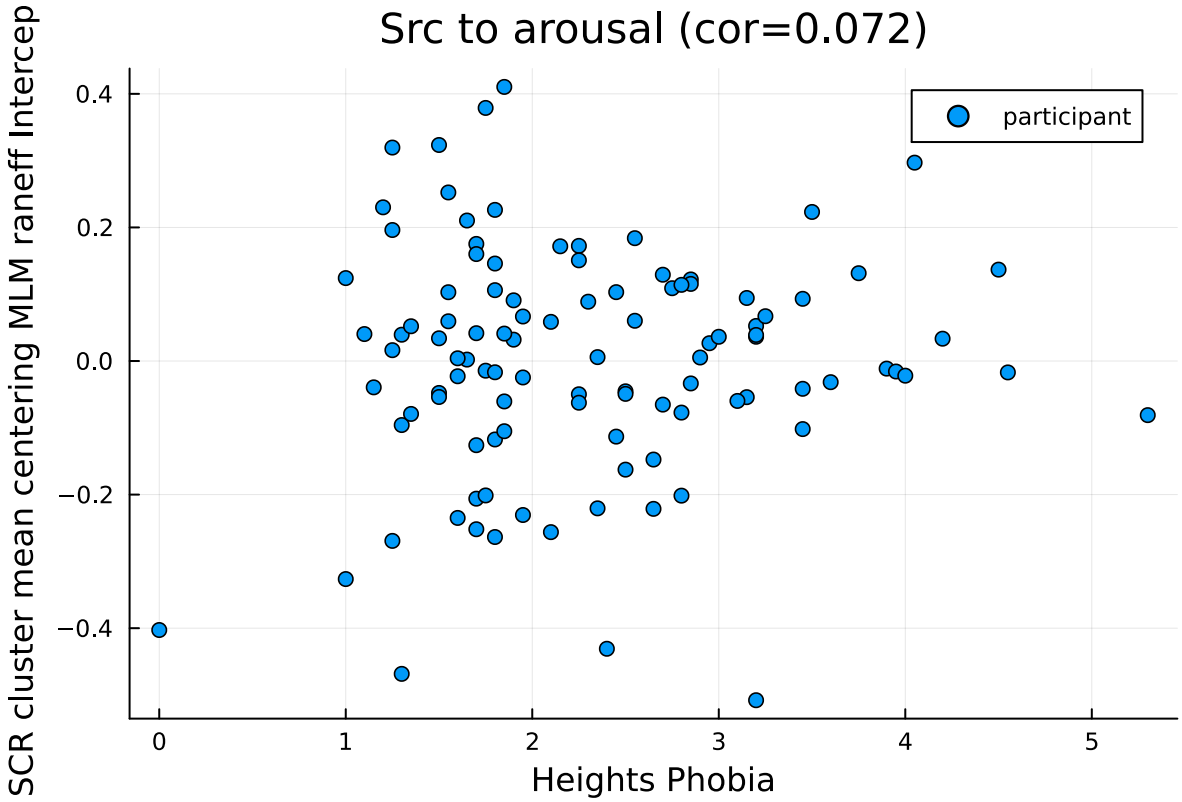
```
md"#### Scr to arousal, AIC: $(aic(mm3))"
```

```
mm3coef_i = cor(ranef(mm3)[1][1,:], df2_subjlvl_hp.heights_phobia);
```

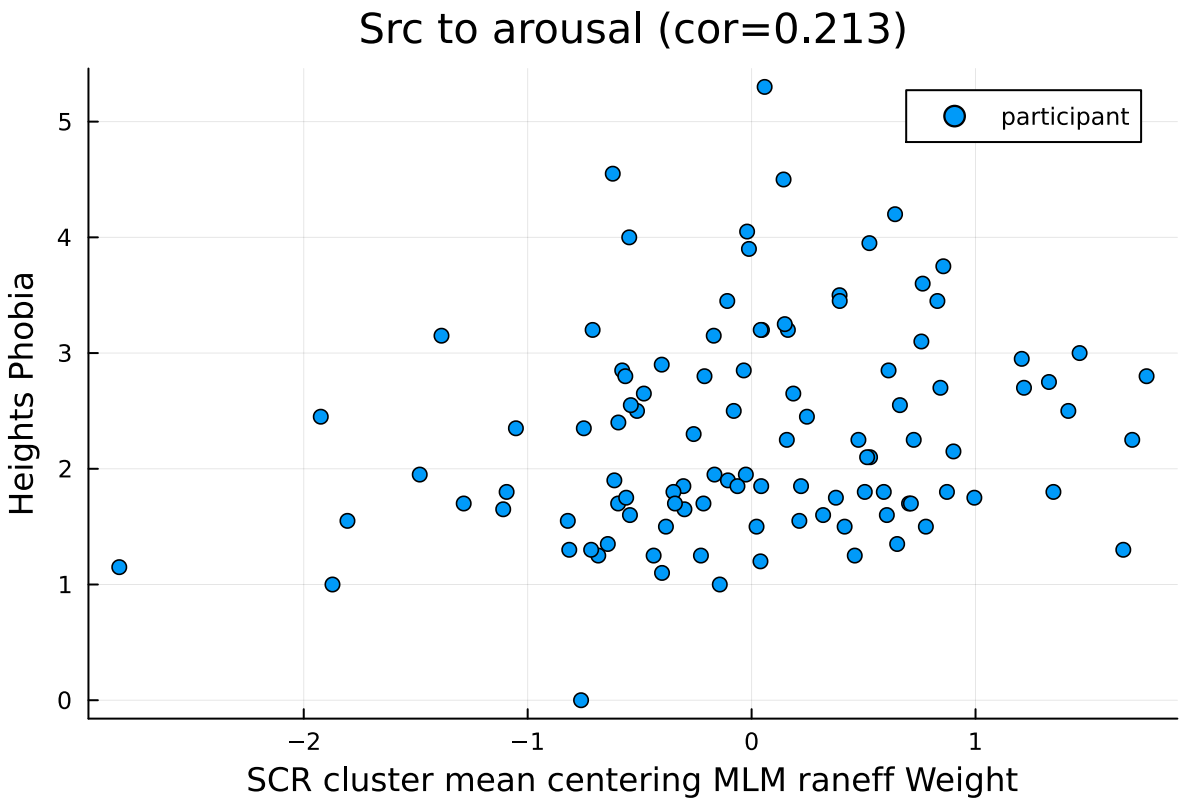
```
mm3coef_w = cor(ranef(mm3)[1][2,:], df2_subjlvl_hp.heights_phobia);
```




```
scatter(ranef(mm3)[1][1,:], df2_subjlvl_hp.heights_phobia, label="participant",
title="Src to arousal (cor=$(get_trunc(mm3coef_i)))", xlabel="SCR cluster mean
centering MLM raneff Intercept", ylabel="Heights Phobia")
```




```
scatter( df2_subjlvl_hp.heights_phobia,ranef(mm3)[1][1,:], label="participant",
title="Src to arousal (cor=$(get_trunc(mm3coef_i)))", ylabel="SCR cluster mean
centering MLM raneff Intercept", xlabel="Heights Phobia")
```




```
scatter(ranef(mm3)[1][2,:], df2_subjlvl_hp.heights_phobia, label="participant",
title="Src to arousal (cor=$(get_trunc(mm3coef_w)))", xlabel="SCR cluster mean
centering MLM raneff Weight", ylabel="Heights Phobia")
```

Model 2: arousal to fear

```
md"## Model 2: arousal to fear"
```

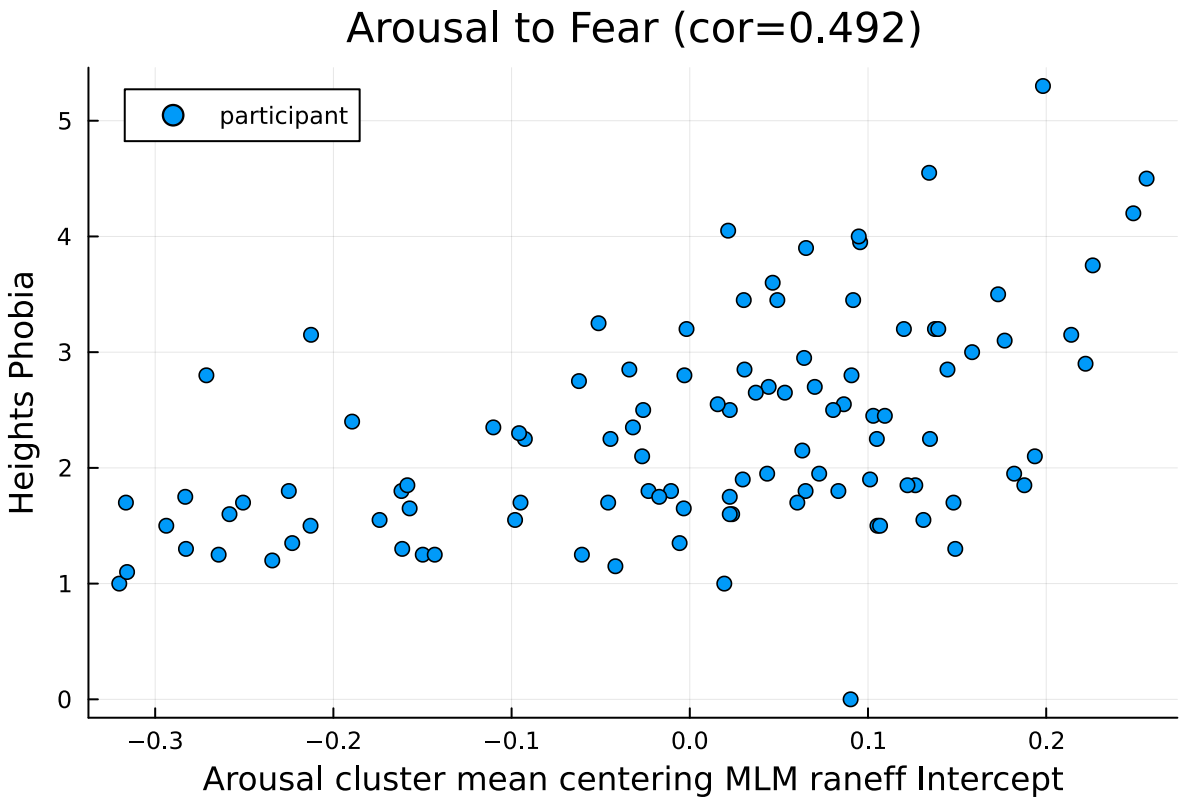
mm4 =

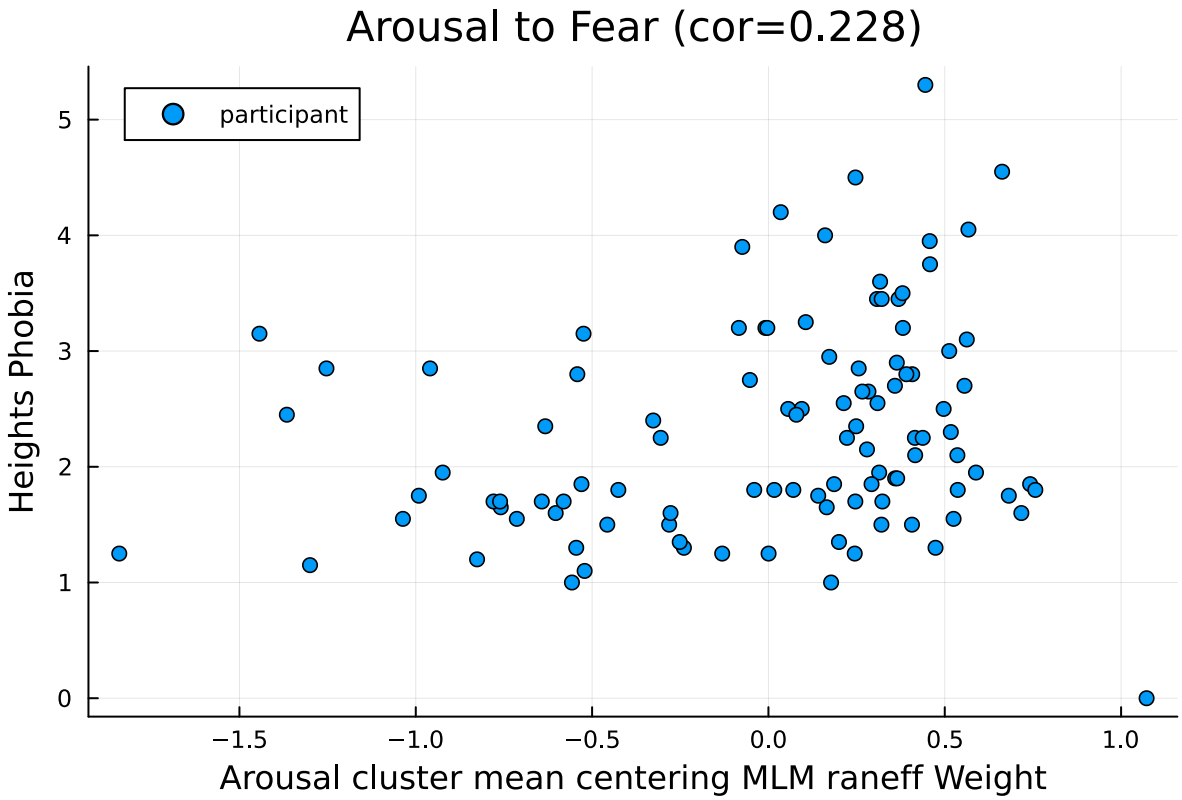
	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.2606	0.0449	5.81	<1e-08	0.1559
resp_arousal_cmc	0.6154	0.0719	8.56	<1e-16	0.6385
resp_arousal_mean	0.2109	0.0790	2.67	0.0076	
Residual	0.2034				

```
mm4 = fit(LinearMixedModel, @formula(resp_fear ~ resp_arousal_cmc +
resp_arousal_mean + (resp_arousal_cmc|participant_num_str)), dfcleancol2)
```

Arousal to fear, loglike: 24.980327153317063

Arousal to fear, AIC: -35.960654306634126






```
scatter(ranef(mm4)[1][2,:], df2_subjlvl_hp.heights_phobia, label="participant",
title="Arousal to Fear (cor=$(get_trunc(mm4coef_w)))", xlabel="Arousal cluster
mean centering MLM raneff Weight", ylabel="Heights Phobia")
```

Model 3: scr to fear

```
md"## Model 3: scr to fear"
```

mm6 =

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.3895	0.0322	12.11	<1e-33	0.1553
video_scr_cmc	2.3274	0.1552	14.99	<1e-50	0.7213
video_scr_mean	-0.2605	0.4151	-0.63	0.5303	
Residual	0.2508				

```
mm6 = fit(LinearMixedModel, @formula(resp_fear ~ video_scr_cmc + video_scr_mean
+ (video_scr_cmc|participant_num_str)), dfcleancol2)
```

Scr to fear, loglike: -137.6093450192117

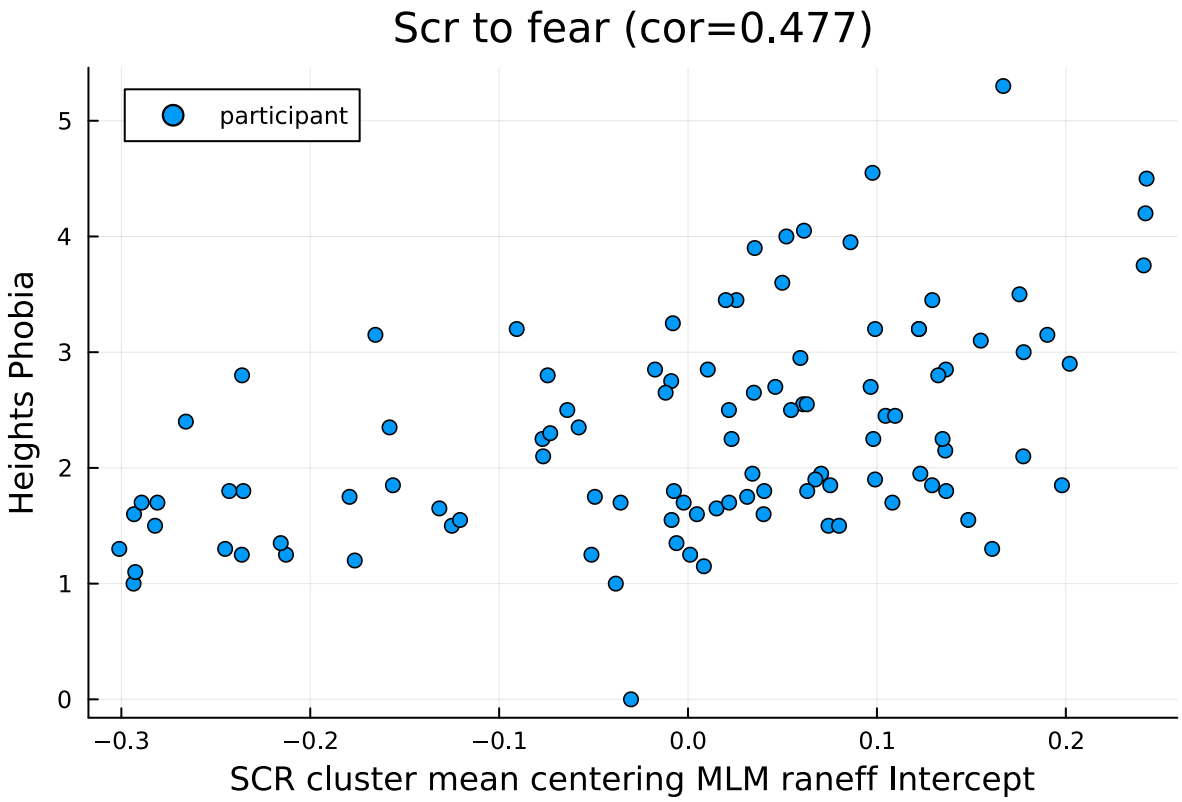
```
md"#### Scr to fear, loglike: $(loglikelihood(mm6))"
```

Scr to fear, AIC: 289.2186900384234

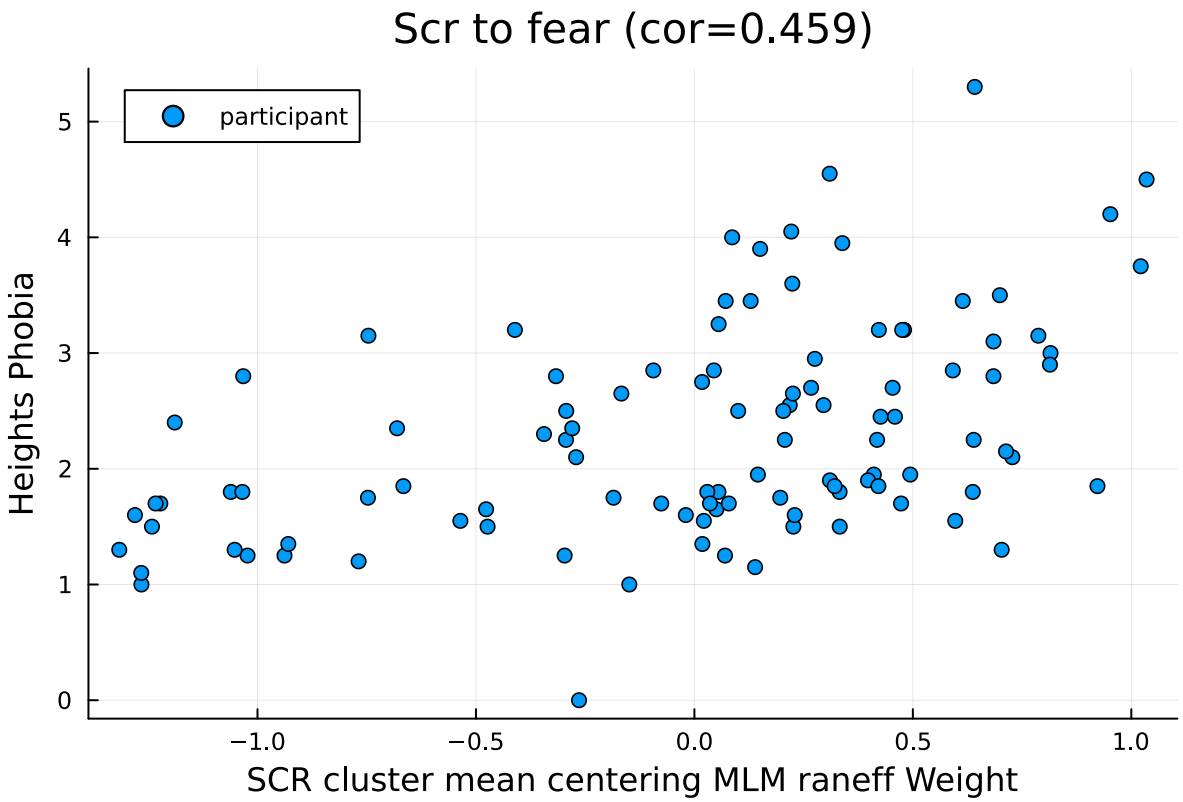
```
md"#### Scr to fear, AIC: $(aic(mm6))"
```

```
mm6coef_i = cor(ranef(mm6)[1][1,:], df2_subjlvl_hp.heights_phobia);
```

```
mm6coef_w = cor(ranef(mm6)[1][2,:], df2_subjlvl_hp.heights_phobia);
```




```
scatter(ranef(mm6)[1][1,:], df2_subjlvl_hp.heights_phobia, label="participant",
title="Scr to fear (cor=$(get_trunc(mm6coef_i)))", xlabel="SCR cluster mean
centering MLM raneff Intercept", ylabel="Heights Phobia")
```




```
scatter(ranef(mm6)[1][2,:], df2_subjlvl_hp.heights_phobia, label="participant",
title="Scr to fear (cor=$(get_trunc(mm6coef_w)))", xlabel="SCR cluster mean
centering MLM raneff Weight", ylabel="Heights Phobia")
```

Model 4: scr to valence

```
md"## Model 4: scr to valence"
```

mm12 =

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.5762	0.0267	21.60	<1e-99	0.1168
video_scr_cmc	-2.1037	0.1551	-13.57	<1e-41	0.5698
video_scr_mean	0.1935	0.3453	0.56	0.5751	
Residual	0.2654				

```
mm12 = fit(LinearMixedModel, @formula(resp_valence ~ video_scr_cmc +
video_scr_mean + (video_scr_cmc|participant_num_str)), dfcleancol2)
```

Scr to arousal, loglike: -178.58254233849124

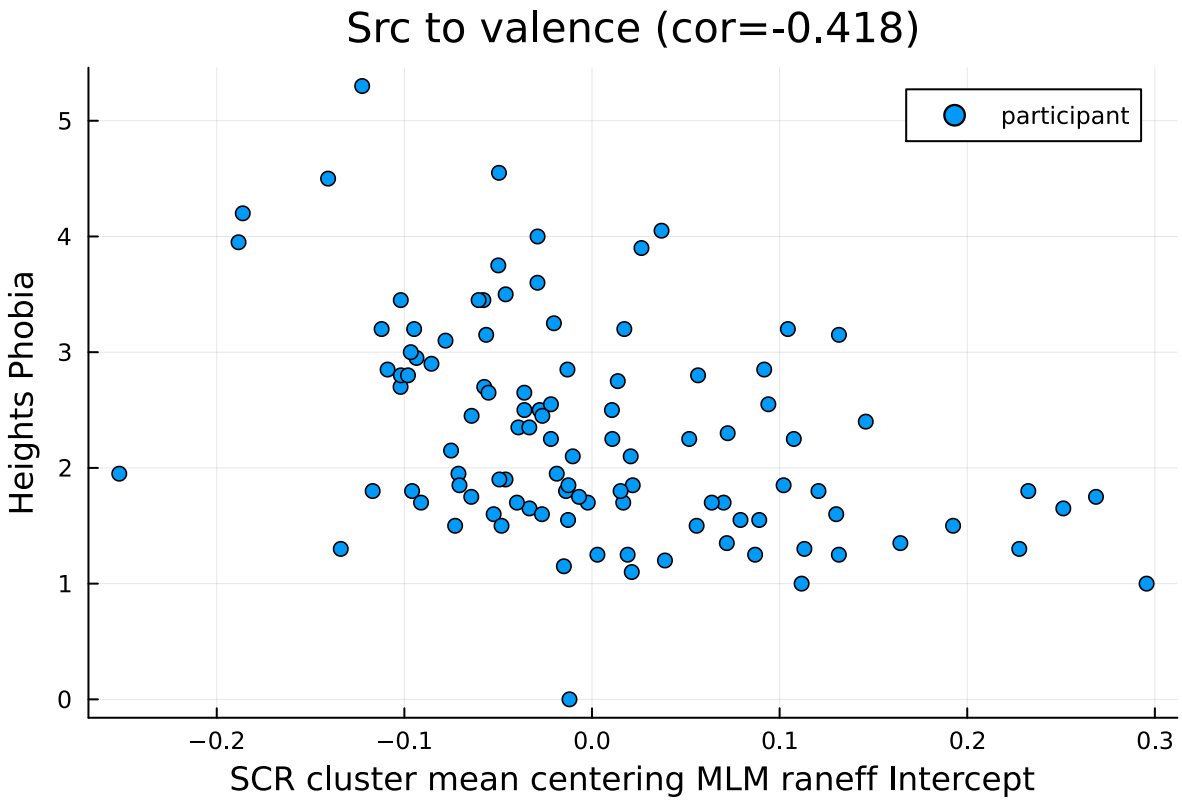
```
md"#### Scr to arousal, loglike: $(loglikelihood(mm12))"
```

Scr to arousal, AIC: 371.1650846769825

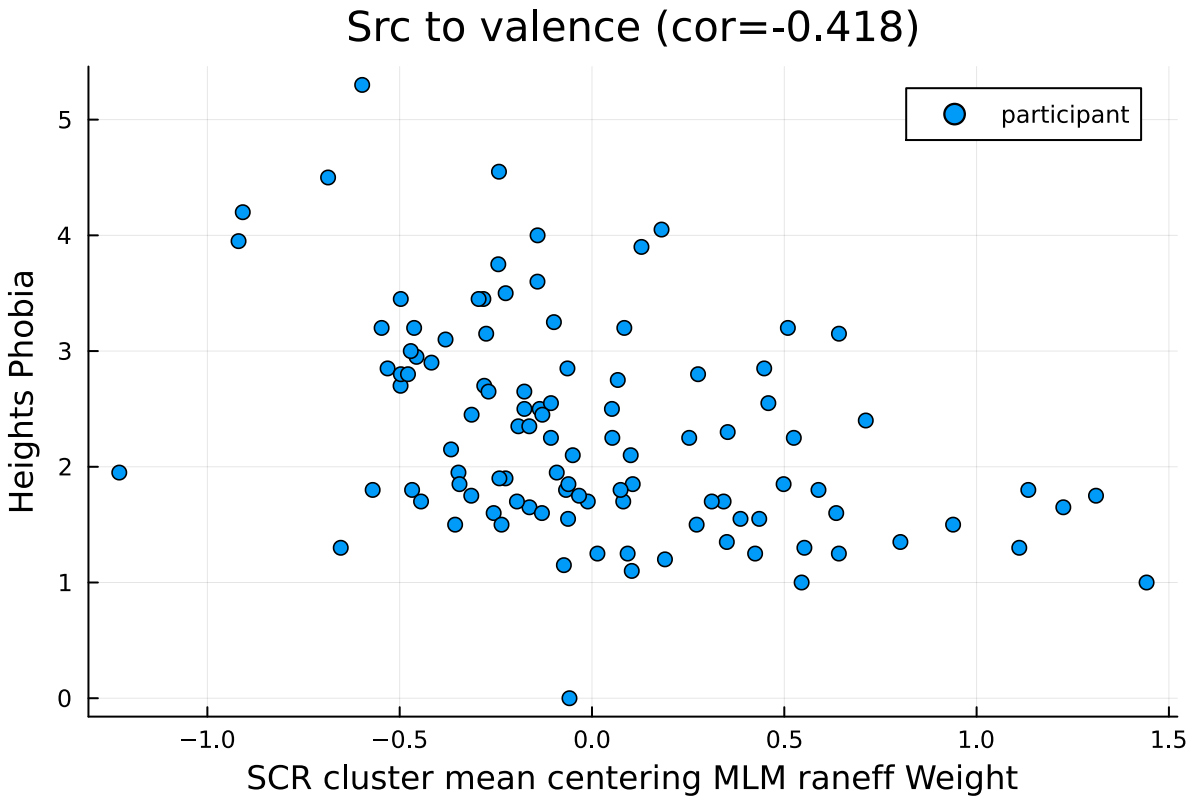
```
md"#### Scr to arousal, AIC: $(aic(mm12))"
```

```
mm12coef_i = cor(ranef(mm12)[1][1,:], df2_subjlvl_hp.heights_phobia);
```

```
mm12coef_w = cor(ranef(mm12)[1][2,:], df2_subjlvl_hp.heights_phobia);
```




```
scatter(ranef(mm12)[1][1,:], df2_subjlvl_hp.heights_phobia, label="participant",
title="Src to valence (cor=$(get_trunc(mm12coef_i)))", xlabel="SCR cluster mean
centering MLM raneff Intercept", ylabel="Heights Phobia")
```



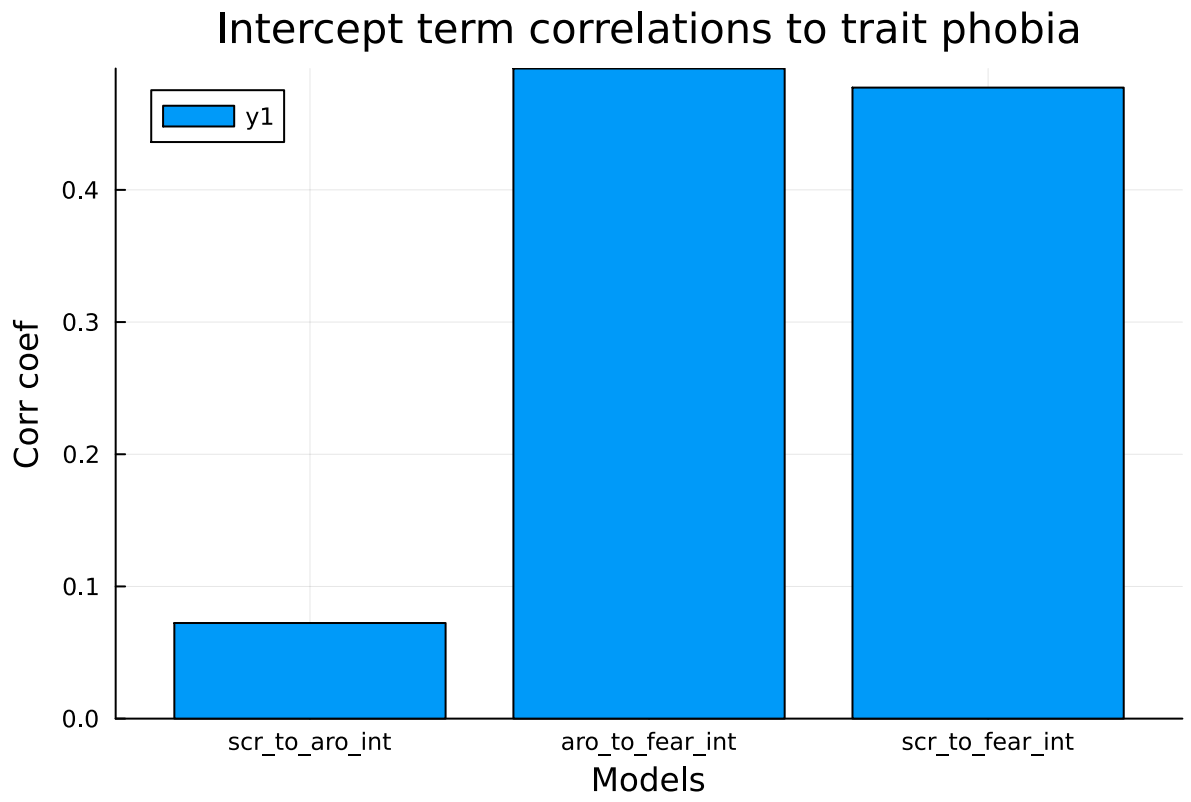

```
scatter(ranef(mm12)[1][2,:], df2_subjlvl_hp.heights_phobia, label="participant",
title="Src to valence (cor=$(get_trunc(mm12coef_w)))", xlabel="SCR cluster mean
centering MLM raneff Weight", ylabel="Heights Phobia")
```

Model correlation comparison plots

```
md"## Model correlation comparison plots"
```

```
plotdata3 = [mm3coef_i,mm4coef_i,mm6coef_i];
```

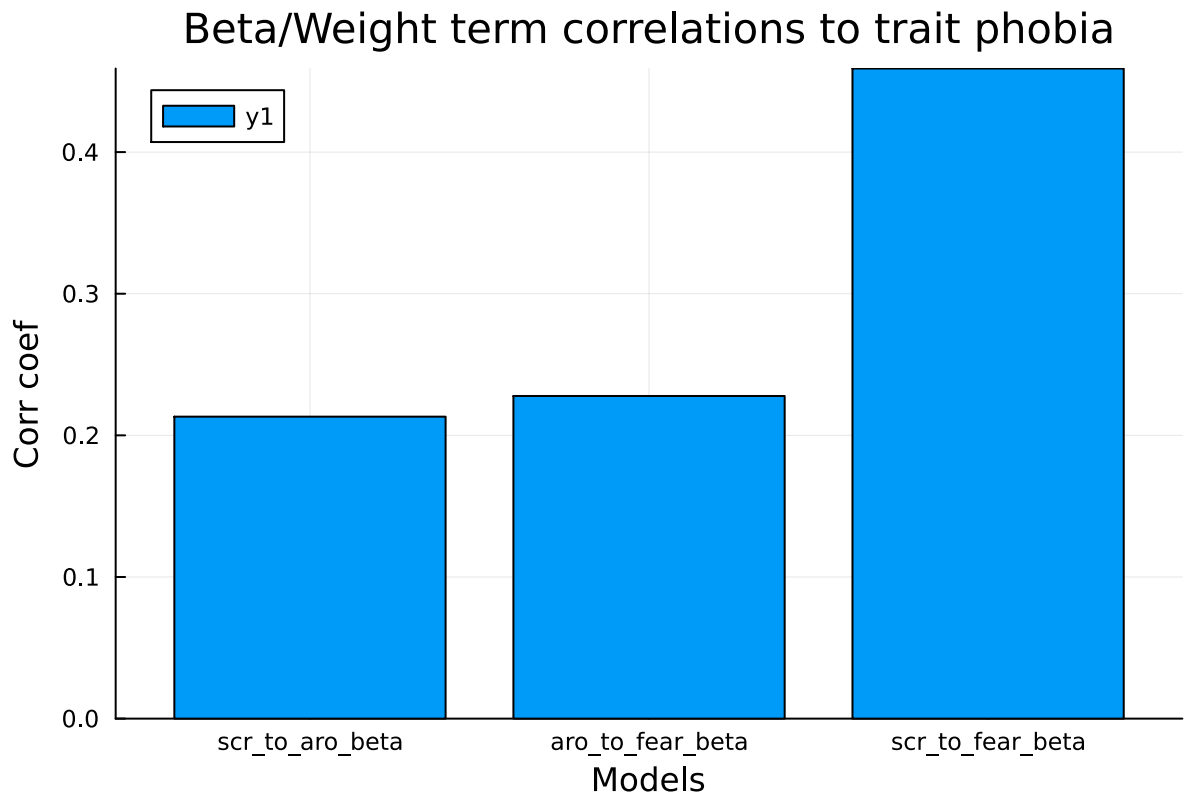
```
plotcols3 = ["scr_to_aro_int","aro_to_fear_int", "scr_to_fear_int"];
```




```
plot(bar(plotcols3, plotdata3), title="Intercept term correlations to trait phobia", xlabel="Models", ylabel="Corr coef")
```

```
plotdata4 = [mm3coef_w,mm4coef_w,mm6coef_w];
```

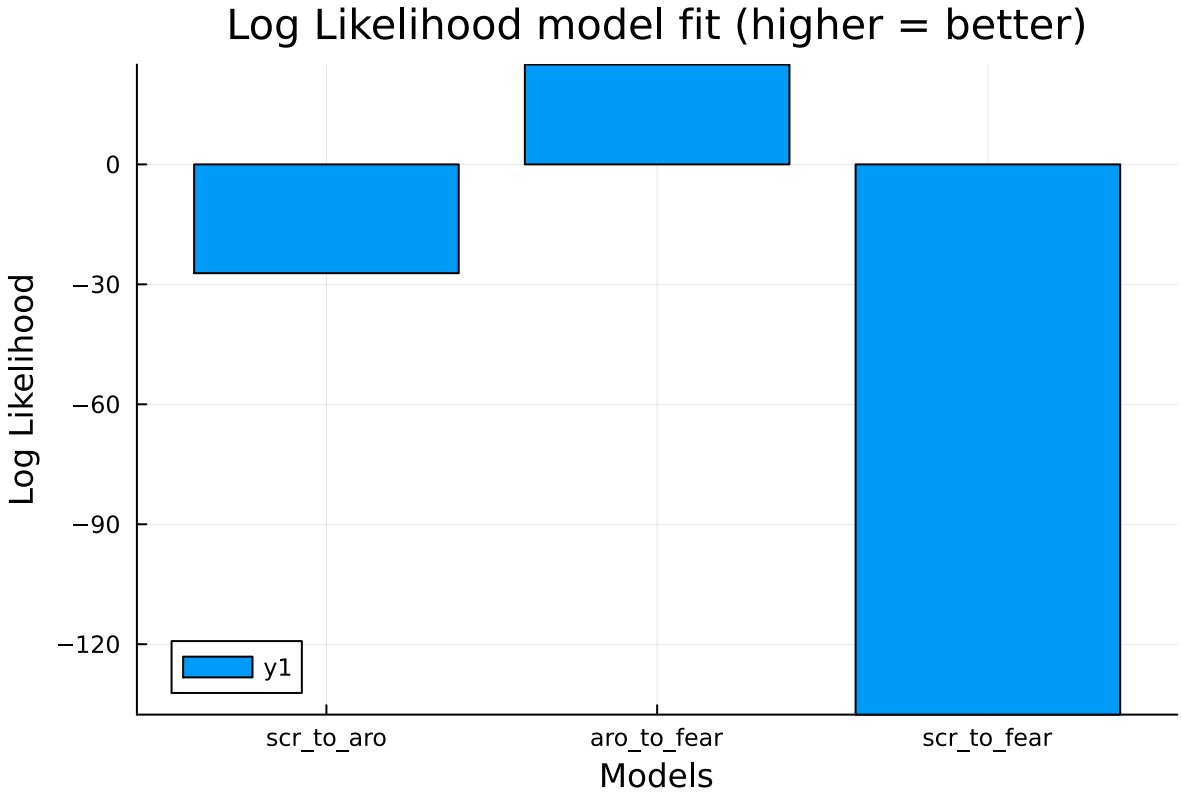
```
plotcols4 = ["scr_to_aro_beta","aro_to_fear_beta", "scr_to_fear_beta"];
```



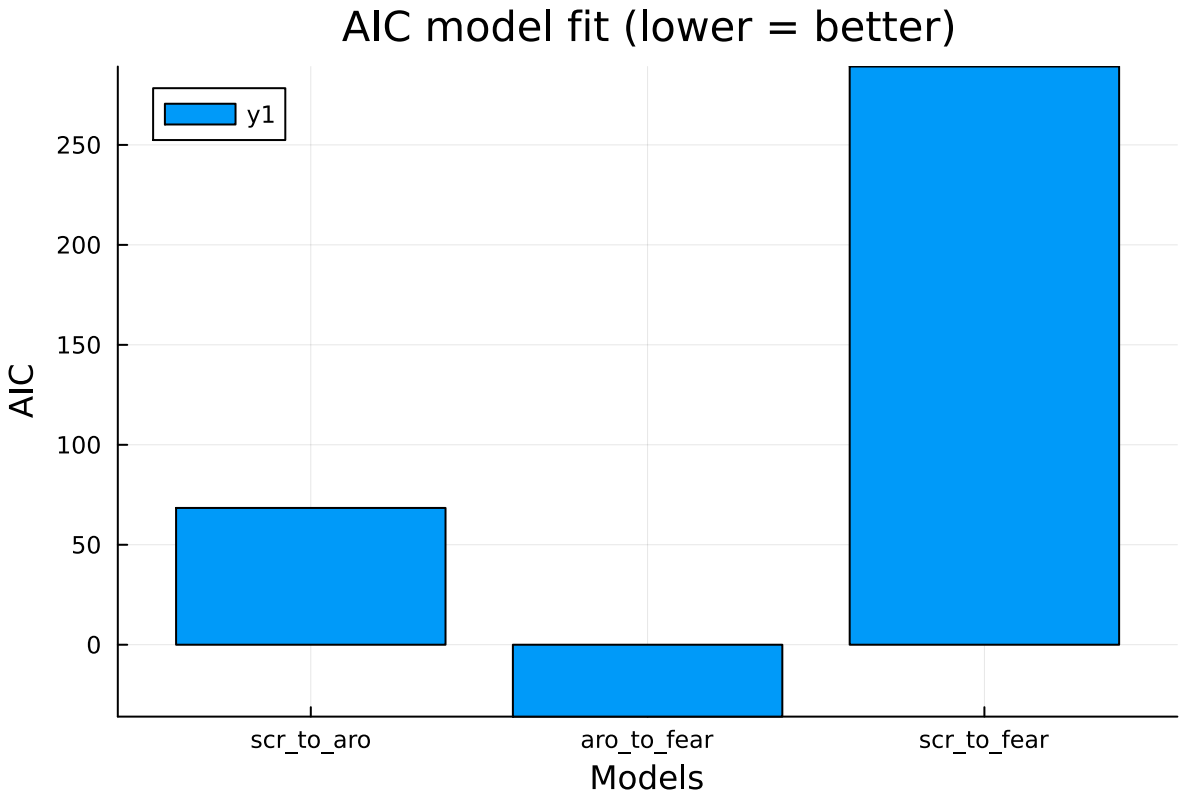

```
plot(bar(plotcols4, plotdata4), title="Beta/Weight term correlations to trait phobia", xlabel="Models", ylabel="Corr coef")
```

```
models = [mm3,mm4,mm6];
```

```
plotcols5 = ["scr_to_aro","aro_to_fear", "scr_to_fear"];
```




```
plot(bar(plotcols5, models .|> loglikelihood), title="Log Likelihood model fit
(higher = better)", xlabel="Models", ylabel="Log Likelihood")
```




```
plot(bar(plotcols5, models .|> aic), title="AIC model fit (lower = better)",
xlabel="Models", ylabel="AIC")
```

Extra models

Scr change to Arousal

mm5 =

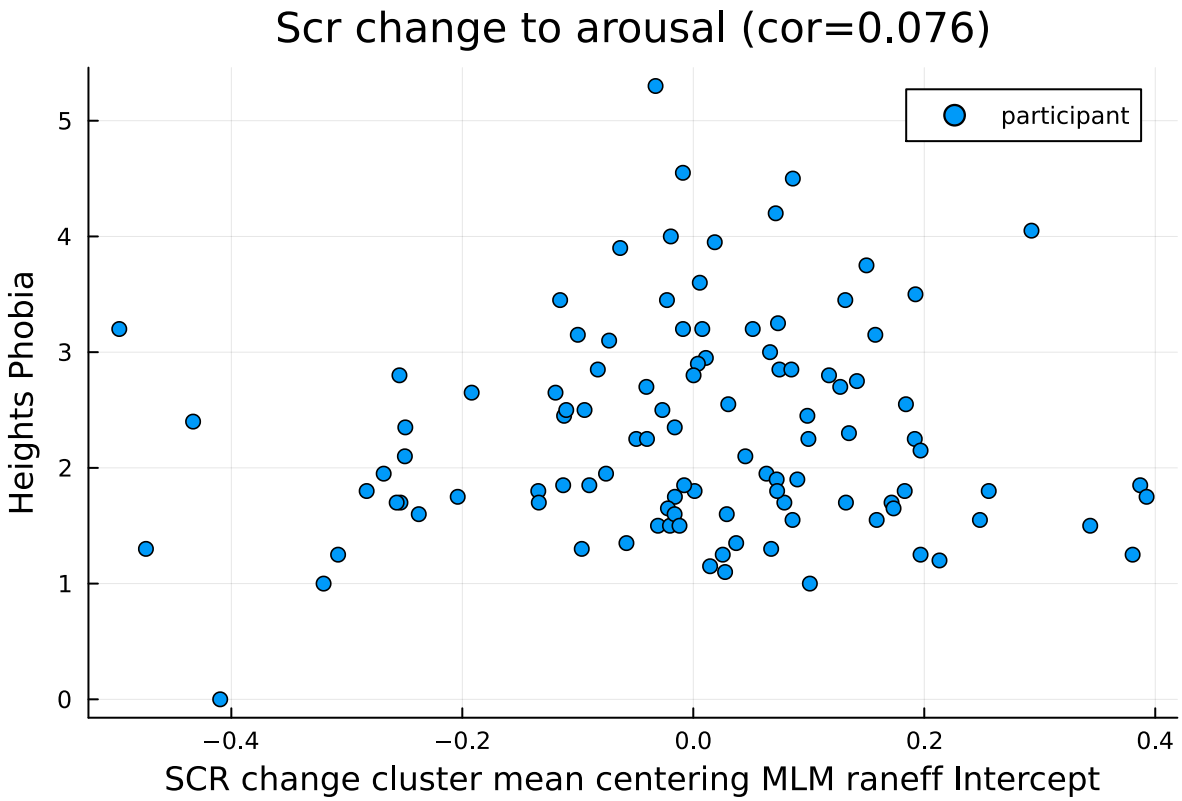
	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.5173	0.0238	21.69	<1e-99	0.1847
scr_change_video_cmc	0.8820	0.1797	4.91	<1e-06	1.2303
scr_change_video_mean	0.4667	0.5647	0.83	0.4085	
Residual	0.2193				

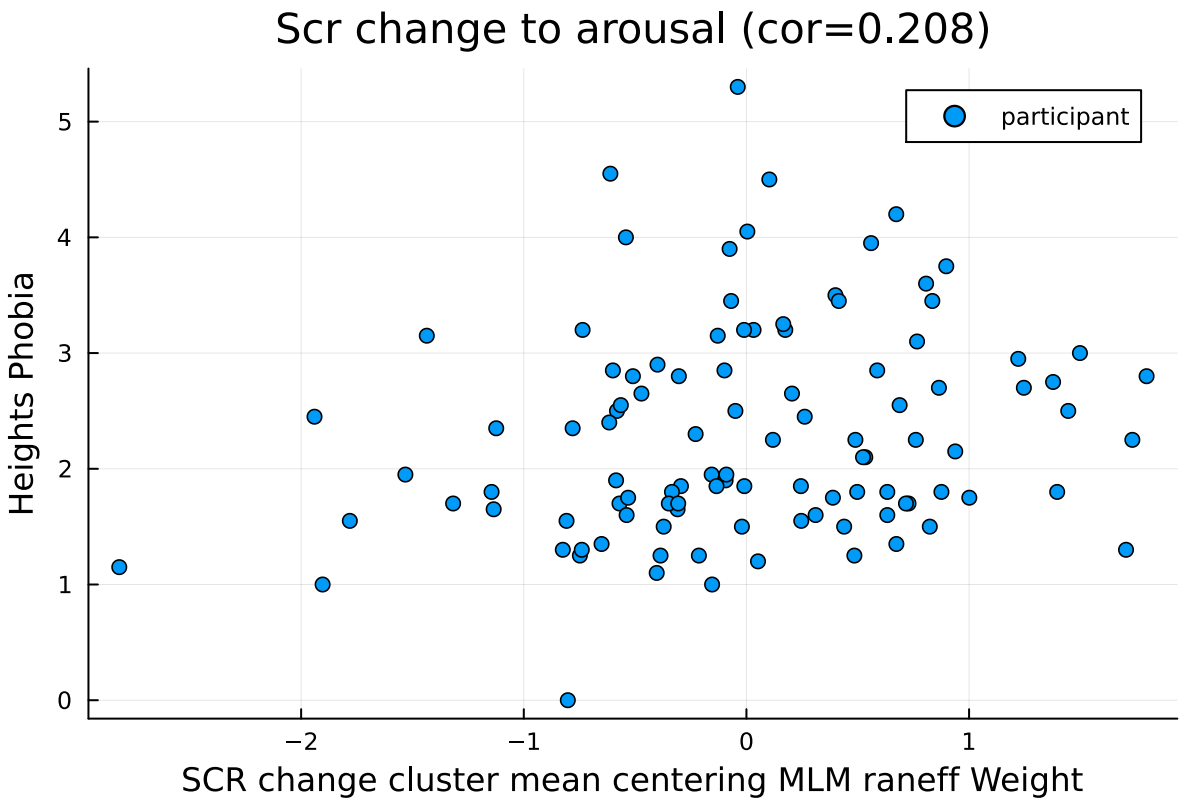
```
mm5 = fit(LinearMixedModel, @formula(resp_arousal ~ scr_change_video_cmc +
scr_change_video_mean + (scr_change_video_cmc|participant_num_str)), dfcleancol2)
```

```
-29.25065078031804
```

```
loglikelihood(mm5)
```

72.50130156063608





Scr change to Fear

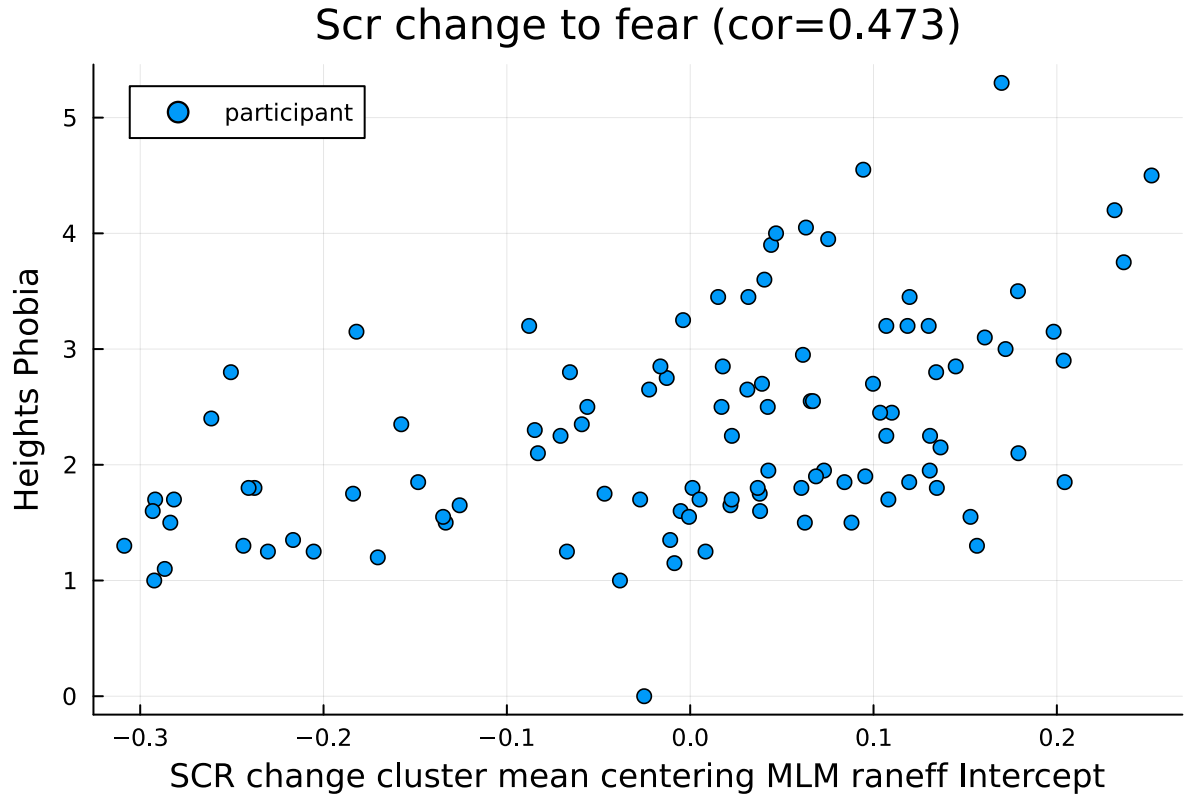
```
mm7 =
```

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.3788	0.0204	18.53	<1e-75	0.1558
scr_change_video_cmc	2.3523	0.1552	15.15	<1e-51	0.7343
scr_change_video_mean	-0.2576	0.4594	-0.56	0.5751	
Residual	0.2508				

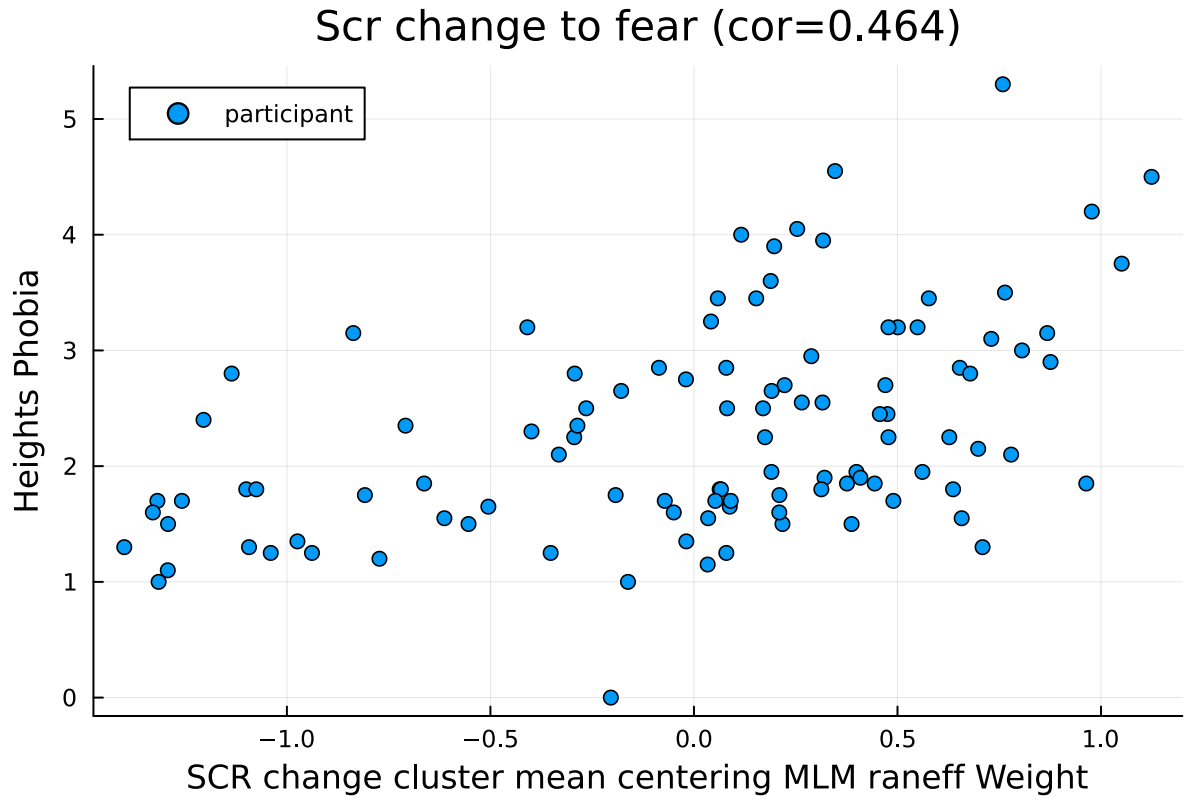
```
1 mm7 = fit(LinearMixedModel, @formula(resp_fear ~ scr_change_video_cmc +
  scr_change_video_mean + (scr_change_video_cmc|participant_num_str)), dfcleancol2)
```

```
-137.78765454448893
```

```
1 mm7coef_i = cor(ranef(mm7)[1][1,:], df2_subjlvl_hp.heights_phobia);
```




```
scatter(ranef(mm7)[1][1,:], df2_subjlvl_hp.heights_phobia, label="participant",
title="Scr change to fear (cor=$(get_trunc(mm7coef_i)))", xlabel="SCR change
cluster mean centering MLM raneff Intercept", ylabel="Heights Phobia")
```



Scr to Arousal with heights phobia modulating term

mm8 =

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.4247	0.0602	7.05	<1e-11	0.1801
video_scr_cmc	-0.0220	0.4625	-0.05	0.9621	1.1613
heights_phobia	0.0147	0.0204	0.72	0.4728	
video_scr_mean	1.0701	0.4800	2.23	0.0258	
video_scr_cmc & heights_phobia	0.4054	0.1878	2.16	0.0309	
Residual	0.2193				

```
mm8 = fit(LinearMixedModel, @formula(resp_arousal ~ video_scr_cmc * heights_phobia + video_scr_mean + (video_scr_cmc|participant_num_str)), dfcleancol2)
```

-24.789538551311736

```
loglikelihood(mm8)
```

67.57907710262347

```
aic(mm8)
```

mm8coef_i = 9.216959943853414e-15

```
mm8coef_i = cor(ranef(mm8)[1][1,:], df2_subjlvl_hp.heights_phobia)
```

mm8coef_w = 8.755549605129113e-16

```
mm8coef_w = cor(ranef(mm8)[1][2,:], df2_subjlvl_hp.heights_phobia)
```

mm9 =

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.0663	0.0518	1.28	0.2006	0.1325
resp_arousal_cmc	0.2898	0.1994	1.45	0.1460	0.6247
heights_phobia	0.0901	0.0155	5.80	<1e-08	
resp_arousal_mean	0.1862	0.0698	2.67	0.0076	
resp_arousal_cmc & heights_phobia	0.1415	0.0812	1.74	0.0812	
Residual	0.2034				

```
mm9= fit(LinearMixedModel, @formula(resp_fear ~ resp_arousal_cmc * heights_phobia + resp_arousal_mean + (resp_arousal_cmc|participant_num_str)), dfcleancol2)
```

39.59030744504807

```
1 loglikelihood(mm9)
```

mm10 =

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.1740	0.0466	3.73	0.0002	0.1304
video_scr_cmc	2.0525	0.4129	4.97	<1e-06	0.7175
heights_phobia	0.0923	0.0160	5.78	<1e-08	
video_scr_mean	-0.2135	0.3603	-0.59	0.5535	
video_scr_cmc & heights_phobia	0.1192	0.1660	0.72	0.4727	
Residual	0.2507				

```
1 mm10= fit(LinearMixedModel, @formula(resp_fear ~ video_scr_cmc * heights_phobia
  + video_scr_mean + (video_scr_cmc|participant_num_str)), dfcleancol2)
```

-121.89308625320413

```
1 loglikelihood(mm10)
```

mm11 =

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.0620	0.0528	1.17	0.2407	0.1352
video_scr_cmc	1.6754	0.3684	4.55	<1e-05	0.7442
heights_phobia	0.0874	0.0157	5.56	<1e-07	
resp_arousal_cmc	0.2596	0.1838	1.41	0.1578	0.5668
video_scr_mean	-0.4967	0.3446	-1.44	0.1495	
resp_arousal_mean	0.2576	0.0668	3.86	0.0001	
video_scr_cmc & heights_phobia	-0.1288	0.1504	-0.86	0.3918	
video_scr_cmc & resp_arousal_cmc	2.0879	1.7785	1.17	0.2404	2.5301
heights_phobia & resp_arousal_cmc	0.1195	0.0750	1.59	0.1111	
video_scr_cmc & heights_phobia & resp_arousal_cmc	-0.1720	0.7407	-0.23	0.8164	
Residual	0.1857				

```
1 mm11= fit(LinearMixedModel, @formula(resp_fear ~ video_scr_cmc * heights_phobia
  * resp_arousal_cmc + video_scr_mean + resp_arousal_mean +  (video_scr_cmc *
  resp_arousal_cmc|participant_num_str)), dfcleancol2)
```

```
Minimizing 1278      Time: 0:00:00 (79.03 μs/it)
  objective:  -260.2072339312265

Minimizing 1414      Time: 0:00:00 (77.09 μs/it)


Minimizing 1415      Time: 0:00:00 (77.03 μs/it)
  objective:  -260.2074005105393
```

mm13 =

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.5217	0.0735	7.10	<1e-11	0.1269
heights_phobia	0.0561	0.0155	3.62	0.0003	
video_scr_cmc	0.8207	0.2142	3.83	0.0001	0.0590
resp_arousal_cmc	0.2671	0.0929	2.88	0.0040	0.1976
resp_valence_cmc	-0.6053	0.0800	-7.56	<1e-13	0.2262
video_scr_mean	-0.2194	0.2583	-0.85	0.3955	
resp_arousal_mean	0.1546	0.0518	2.99	0.0028	
resp_valence_mean	-0.5808	0.0813	-7.15	<1e-12	
heights_phobia & video_scr_cmc	-0.0544	0.0888	-0.61	0.5403	
heights_phobia & resp_arousal_cmc	0.0313	0.0392	0.80	0.4246	
video_scr_cmc & resp_arousal_cmc	-0.2810	1.4116	-0.20	0.8422	2.0613
heights_phobia & resp_valence_cmc	-0.0019	0.0334	-0.06	0.9556	
video_scr_cmc & resp_valence_cmc	-1.4774	0.9860	-1.50	0.1341	1.4076
resp_arousal_cmc & resp_valence_cmc	-0.4315	0.3145	-1.37	0.1701	0.6180
heights_phobia & video_scr_cmc & resp_arousal_cmc	0.6242	0.6167	1.01	0.3115	
heights_phobia & video_scr_cmc & resp_valence_cmc	0.9275	0.4161	2.23	0.0258	
heights_phobia & resp_arousal_cmc & resp_valence_cmc	0.1060	0.1279	0.83	0.4073	
video_scr_cmc & resp_arousal_cmc & resp_valence_cmc	4.1541	3.5510	1.17	0.2421	1.4796
heights_phobia & video_scr_cmc & resp_arousal_cmc & resp_valence_cmc	-0.1827	1.5677	-0.12	0.9072	
Residual	0.1268				

```
mm13= fit(LinearMixedModel, @formula(resp_fear ~ heights_phobia * video_scr_cmc * resp_arousal_cmc * resp_valence_cmc + video_scr_mean + resp_arousal_mean + resp_valence_mean + (video_scr_cmc * resp_arousal_cmc * resp_valence_cmc|participant_num_str)), dfcleancol2)
```

```
Minimizing 582   Time: 0:00:00 ( 0.17 ms/it)
```

```
  objective:  -1159.592666664854

Minimizing 1300      Time: 0:00:00 ( 0.16 ms/it)
  objective:  -1163.5130095762697

Minimizing 2015      Time: 0:00:00 ( 0.15 ms/it)
  objective:  -1163.8985547007208

Minimizing 2730      Time: 0:00:00 ( 0.15 ms/it)
  objective:  -1164.1868086319992

Minimizing 3439      Time: 0:00:00 ( 0.15 ms/it)
  objective:  -1164.357259443793

Minimizing 4148      Time: 0:00:00 ( 0.15 ms/it)
  objective:  -1164.4885596285526

Minimizing 4864      Time: 0:00:00 ( 0.15 ms/it)
  objective:  -1164.5586210618906

Minimizing 5582      Time: 0:00:00 ( 0.15 ms/it)
  objective:  -1164.5883240442895

Minimizing 6291      Time: 0:00:00 ( 0.14 ms/it)
  objective:  -1164.6024510012867
```

130.10370025526964

```
1 loglikelihood(mm11)
```

582.308122868242

```
1 loglikelihood(mm13)
```

-218.2074005105393

```
1 aic(mm11)
```

-1052.616245736484

```
1 aic(mm13)
```

mm14 =

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.5287	0.0718	7.36	<1e-12	0.1272
heights_phobia	0.0567	0.0153	3.71	0.0002	
video_scr_cmc	0.7927	0.2797	2.83	0.0046	0.6143
video_hp_cmc	0.1346	0.0724	1.86	0.0632	0.0838
resp_arousal_cmc	0.2730	0.0979	2.79	0.0053	0.2311
resp_valence_cmc	-0.5273	0.0826	-6.38	<1e-09	0.2433
video_scr_mean	-0.0342	0.2513	-0.14	0.8919	
video_hp_mean	-0.0561	0.0325	-1.73	0.0845	
resp_arousal_mean	0.1830	0.0487	3.76	0.0002	
resp_valence_mean	-0.5744	0.0766	-7.50	<1e-13	
heights_phobia & video_scr_cmc	-0.0558	0.1162	-0.48	0.6314	
heights_phobia & video_hp_cmc	-0.0154	0.0301	-0.51	0.6101	
video_scr_cmc & video_hp_cmc	0.3960	1.8161	0.22	0.8274	2.8498
heights_phobia & resp_arousal_cmc	0.0234	0.0407	0.58	0.5651	
video_scr_cmc & resp_arousal_cmc	0.1451	1.4799	0.10	0.9219	2.4603
video_hp_cmc & resp_arousal_cmc	0.4229	0.3997	1.06	0.2900	0.1240
heights_phobia & resp_valence_cmc	-0.0284	0.0341	-0.83	0.4048	
video_scr_cmc & resp_valence_cmc	-0.7263	0.9757	-0.74	0.4567	1.3719
video_hp_cmc & resp_valence_cmc	-0.0148	0.3102	-0.05	0.9619	0.4508
resp_arousal_cmc & resp_valence_cmc	-0.5432	0.2778	-1.96	0.0506	0.5085
heights_phobia & video_scr_cmc & video_hp_cmc	0.1696	0.7501	0.23	0.8211	
heights_phobia & video_scr_cmc & resp_arousal_cmc	0.3066	0.6540	0.47	0.6392	
heights_phobia & video_hp_cmc & resp_arousal_cmc	-0.3282	0.1829	-1.79	0.0727	
video_scr_cmc & video_hp_cmc & resp_arousal_cmc	18.6106	9.7989	1.90	0.0575	9.0751
heights_phobia & video_scr_cmc & resp_valence_cmc	0.6375	0.4172	1.53	0.1266	

heights_phobia & video_hp_cmc & resp_valence_cmc	-0.0856	0.1270	-0.67	0.5003	
video_scr_cmc & video_hp_cmc & resp_valence_cmc	12.7287	5.7648	2.21	0.0272	2.5087
heights_phobia & resp_arousal_cmc & resp_valence_cmc	0.1475	0.1127	1.31	0.1903	
video_scr_cmc & resp_arousal_cmc & resp_valence_cmc	-0.4491	4.5726	-0.10	0.9218	6.0251
video_hp_cmc & resp_arousal_cmc & resp_valence_cmc	3.8316	1.6401	2.34	0.0195	2.0238
heights_phobia & video_scr_cmc & video_hp_cmc & resp_arousal_cmc	-6.2221	4.2922	-1.45	0.1472	
heights_phobia & video_scr_cmc & video_hp_cmc & resp_valence_cmc	-3.9741	2.4264	-1.64	0.1015	
heights_phobia & video_scr_cmc & resp_arousal_cmc & resp_valence_cmc	1.3406	1.9593	0.68	0.4938	
heights_phobia & video_hp_cmc & resp_arousal_cmc & resp_valence_cmc	-0.9903	0.6975	-1.42	0.1557	
video_scr_cmc & video_hp_cmc & resp_arousal_cmc & resp_valence_cmc	49.9900	29.9565	1.67	0.0952	7.9913
heights_phobia & video_scr_cmc & video_hp_cmc & resp_arousal_cmc & resp_valence_cmc	-19.1634	12.0905	-1.59	0.1130	
Residual	0.1169				

```
mm14 = fit(LinearMixedModel, @formula(resp_fear ~ heights_phobia * video_scr_cmc * video_hp_cmc * resp_arousal_cmc * resp_valence_cmc + video_scr_mean + video_hp_mean + resp_arousal_mean + resp_valence_mean + (video_scr_cmc * video_hp_cmc * resp_arousal_cmc * resp_valence_cmc|participant_num_str)), dfcleancol2)
```

```
Minimizing 250   Time: 0:00:00 ( 0.40 ms/it)
  objective:  -1064.5511667209425

Minimizing 495   Time: 0:00:00 ( 0.62 ms/it)
```

```
  objective:  -1181.7072303527345

Minimizing 614   Time: 0:00:00 ( 0.68 ms/it)
  objective:  -1184.3537229790531

Minimizing 724   Time: 0:00:00 ( 0.71 ms/it)
  objective:  -1186.8967673198495

Minimizing 833   Time: 0:00:00 ( 0.75 ms/it)
  objective:  -1190.6173685300637

Minimizing 942   Time: 0:00:00 ( 0.77 ms/it)
  objective:  -1194.1845715191353

Minimizing 1050      Time: 0:00:00 ( 0.79 ms/it)
  objective:  -1197.8370791680895

Minimizing 1149      Time: 0:00:00 ( 0.81 ms/it)
  objective:  -1200.8051201499388

Minimizing 1256      Time: 0:00:01 ( 0.82 ms/it)
  objective:  -1203.6530094976506
```

Plot Test

	video	participant_num	resp_exp_fear	rt_exp_fear	resp_current_a
1	"heights_low_3.mov"	107	0.048	2.503	0.045
2	"heights_low_2.m4v"	107	0.033	3.754	0.036
3	"heights_high_1.m4v"	107	0.032	2.52	0.024
4	"heights_high_3.m4v"	107	0.039	2.219	0.036
5	"heights_high_5.mov"	107	0.058	3.754	0.053
6	"heights_high_4.m4v"	107	0.282	4.355	0.17
7	"heights_low_6.m4v"	107	0.287	1.485	0.321
8	"heights_low_1.m4v"	107	0.05	2.319	0.044
9	"heights_low_4.m4v"	107	0.289	1.802	0.038
10	"heights_low_5.m4v"	107	0.059	1.368	0.056
⋮ more					
1233	"heights_low_2.m4v"	232	0.264	4.722	0.081

```
dfcleancol2
```

▸ [0.675, 0.774, 0.931, 0.918, 0.807, 0.912, 0.518, 0.596, 0.797, 0.255, 0.814, 0.963, 0.

```
dfcleancol2.resp_arousal
```

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.4594	0.0369	12.46	<1e-34	0.1806
video_scr_cmc	0.8985	0.1773	5.07	<1e-06	1.2116
video_scr_mean	1.0558	0.4809	2.20	0.0281	
Residual	0.2193				

```
mm3
```

```
randeff =
2×105 Matrix{Float64}:
 0.175326  -0.065261  0.172386  0.109007  …  0.103113  0.23012    -0.201264
 0.703015   1.21637   0.72402   1.32789      0.247021  0.0395284   0.99476
```

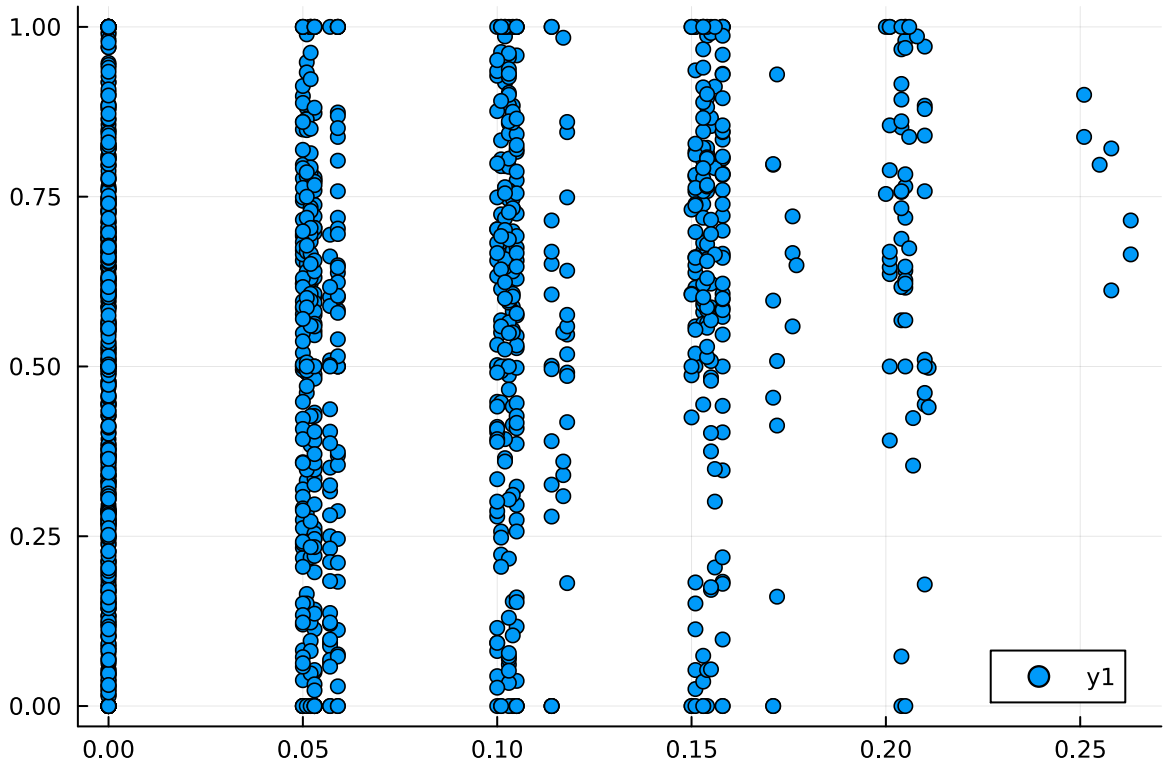
```
randeff = only(ranef(mm3))
```

```
▸ [0.175326, -0.065261, 0.172386, 0.109007, 0.0524988, 0.150766, 0.0666498, 0.0416653, 0
```

```
1 randeff[1,:]
```

```
2×1 Matrix{Float64}:
 0.17095474322780604
 0.8182084924876699
```

```
1 std(only(ranef(mm3)), dims=2)
```




```
1 scatter(dfcleancol2.video_scr, dfcleancol2.resp_arousal)
```

```
0.263
```

```
1 maximum(dfcleancol2.video_scr)
```

```
0.0
```

```
1 minimum(dfcleancol2.video_scr)
```

```
xax =
10-element LinRange{Float64, Int64}:
 0.0,0.0292222,0.0584444,0.0876667,0.116889,0.146111,0.175333,0.204556,0.233778,0.263
```

```
1 xax = LinRange(minimum(dfcleancol2.video_scr),maximum(dfcleancol2.video_scr),10)
```

```
inter = 0.459362578400302
```

```
1 inter = coef(mm3)[1]
```

```
cmcbeta = 0.8984889479570923
```

```
1 cmcbeta = coef(mm3)[2]
```

```
meanbeta = 1.0557520457869927
```

```
1 meanbeta = coef(mm3)[3]
```

```
yax =
10-element LinRange{Float64, Int64}:
 0.459363,0.51647,0.573577,0.630684,0.687792,…,0.802006,0.859113,0.916221,0.973328
```

```
1 yax = inter .+ ((cmcbeta .* xax) + (meanbeta .* xax))
```

```
▸ [1.7, 2.7, 2.25, 2.75, 3.2, 2.25, 1.95, 1.7, 2.85, 1.3, 1.3, 3.45, 4.05, 1.5, 1.5, 1.8,
```

```
1 df2_subjlvl_hp.heights_phobia
```

```
0.9186874994315104
```

```
1 std(df2_subjlvl_hp.heights_phobia)
```

```
std_up = 3.2205922613362716
```

```
1 std_up = mean(df2_subjlvl_hp.heights_phobia) + std(df2_subjlvl_hp.heights_phobia)
```

```
bm_std_up =
▸ BitVector: [false, false, false, false, false, false, false, false, false, false, fals
```

```
1 bm_std_up = df2_subjlvl_hp.heights_phobia .> std_up
```

```
0.04398057803493485
```

```
1 mean(randeff[1,bm_std_up])
```

```
std_dwn = 1.383217262473251
```

```
1 std_dwn = mean(df2_subjlvl_hp.heights_phobia) -
  std(df2_subjlvl_hp.heights_phobia)
```

```
bm_std_dwn =
▸ BitVector: [false, false, false, false, false, false, false, false, false, true, true,
```

```
1 bm_std_dwn = df2_subjlvl_hp.heights_phobia .< std_dwn
```

```
-0.044226358227131515
```

```
1 mean(randeff[1,bm_std_dwn])
```

```
yax_up =
10-element LinRange{Float64, Int64}:
 0.0439806,0.0506916,0.0574026,0.0641136,…,0.0842465,0.0909575,0.0976685,0.10438
```

```
1 yax_up = mean(randeff[1,bm_std_up]) .+ (mean(randeff[2,bm_std_up]).* xax)
```

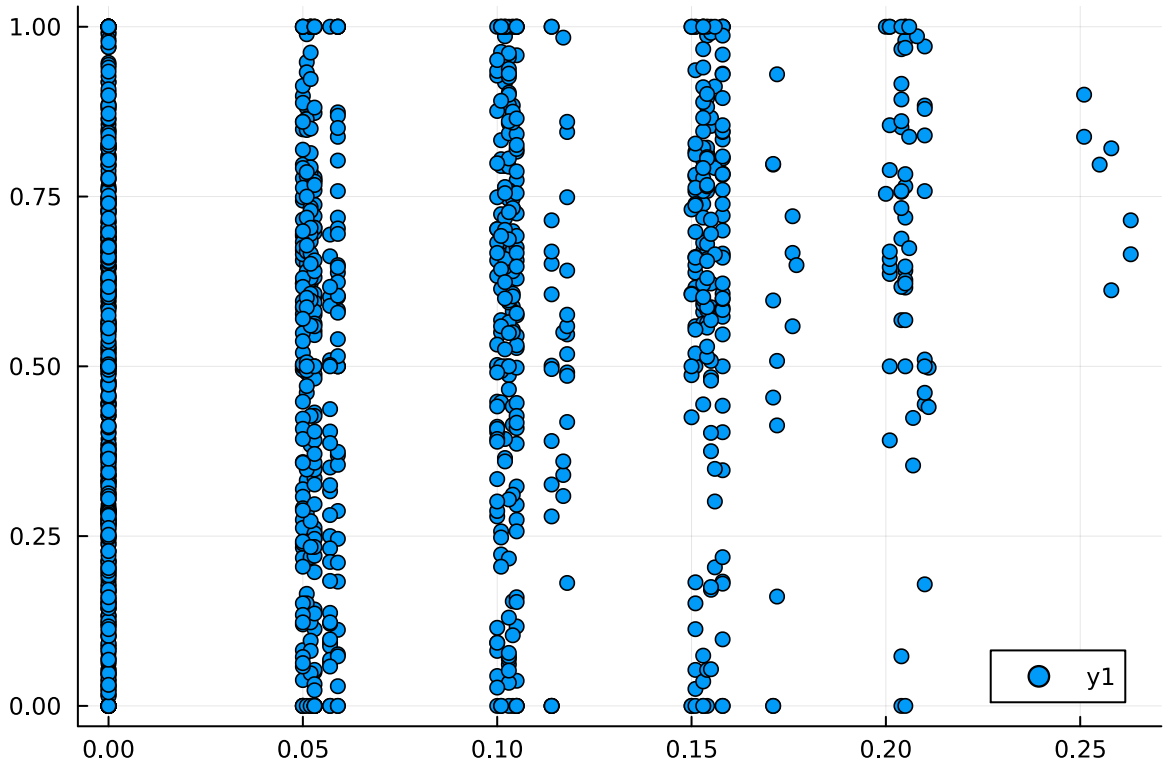
```
yax_dwn =
▸ [0.0442264, 0.0572995, 0.0703726, 0.0834458, 0.0965189, 0.109592, 0.122665, 0.135738,
```

```
1 yax_dwn = abs.(mean(randeff[1,bm_std_dwn]) .+ (mean(randeff[2,bm_std_dwn]).*
  xax))
```

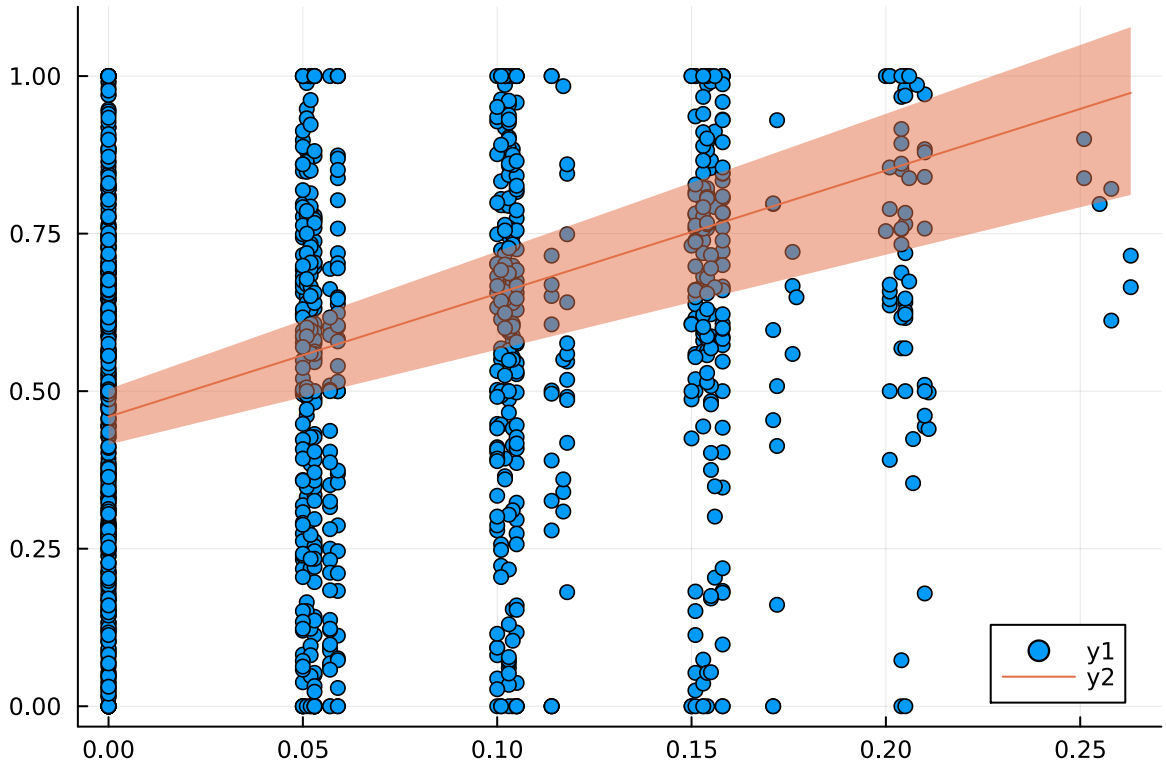
df =

	xax	yax	yax_up	yax_dwn
1	0.0	0.459363	0.0439806	0.0442264
2	0.0292222	0.51647	0.0506916	0.0572995
3	0.0584444	0.573577	0.0574026	0.0703726
4	0.0876667	0.630684	0.0641136	0.0834458
5	0.116889	0.687792	0.0708246	0.0965189
6	0.146111	0.744899	0.0775355	0.109592
7	0.175333	0.802006	0.0842465	0.122665
8	0.204556	0.859113	0.0909575	0.135738
9	0.233778	0.916221	0.0976685	0.148811
10	0.263	0.973328	0.10438	0.161885

```
1 df = DataFrame(xax = xax, yax = yax, yax_up = yax_up, yax_dwn = yax_dwn)
```




```
scatter(dfcleancol2.video_scr, dfcleancol2.resp_arousal)
```




```
@df df plot!(:xax, :yax, ribbon=(:yax_dwn,:yax_up))
```

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.4594	0.0369	12.46	<1e-34	0.1806
video_scr_cmc	0.8985	0.1773	5.07	<1e-06	1.2116
video_scr_mean	1.0558	0.4809	2.20	0.0281	
Residual	0.2193				

```
mm3
```

```
▸ [2×105 Matrix{Float64}:                                                    ]
  0.175326  -0.065261  0.172386  0.109007  …  0.103113  0.23012    -0.201264
```

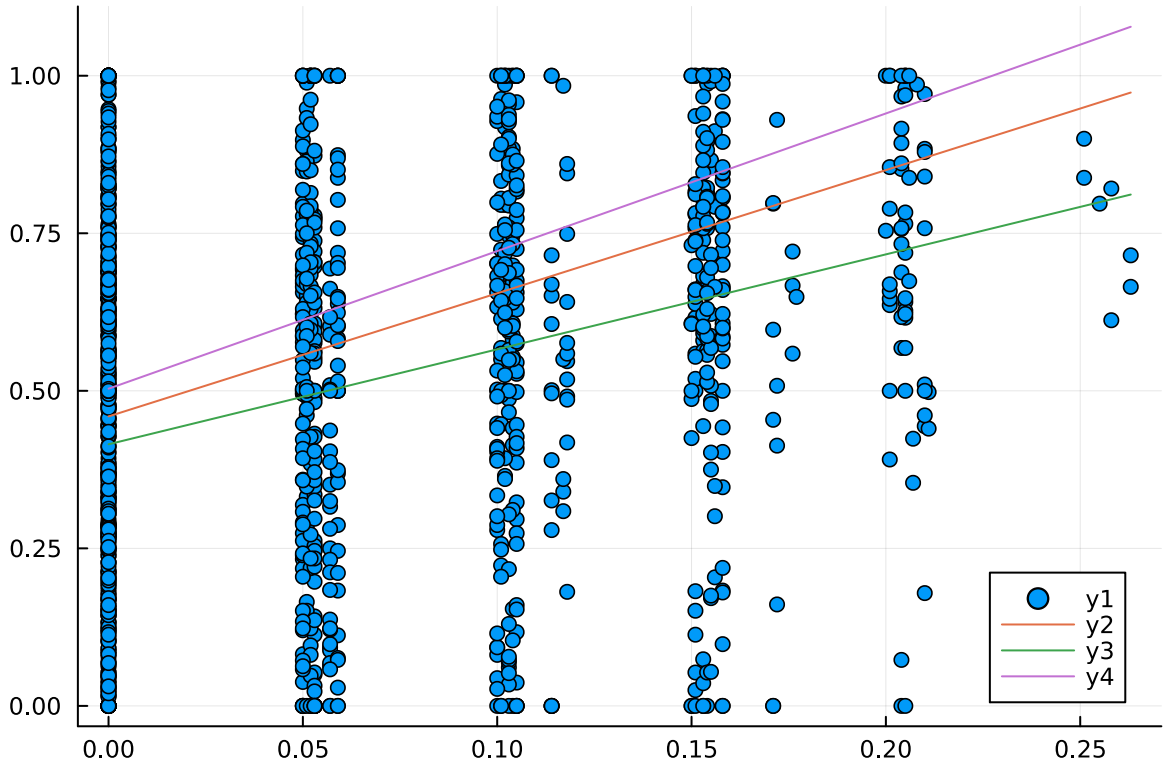
```
ranef(mm3)
```

```
Enter cell code...
```

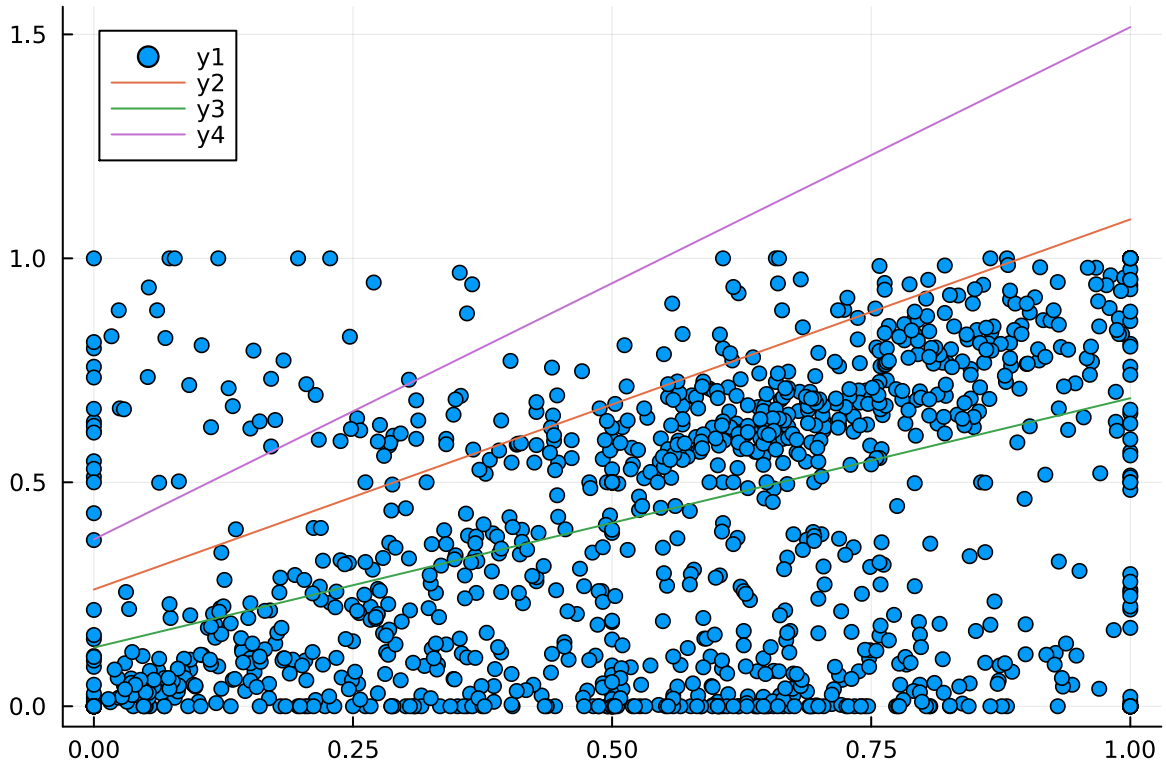
Plot Generic

```
plot_mm (generic function with 1 method)
```

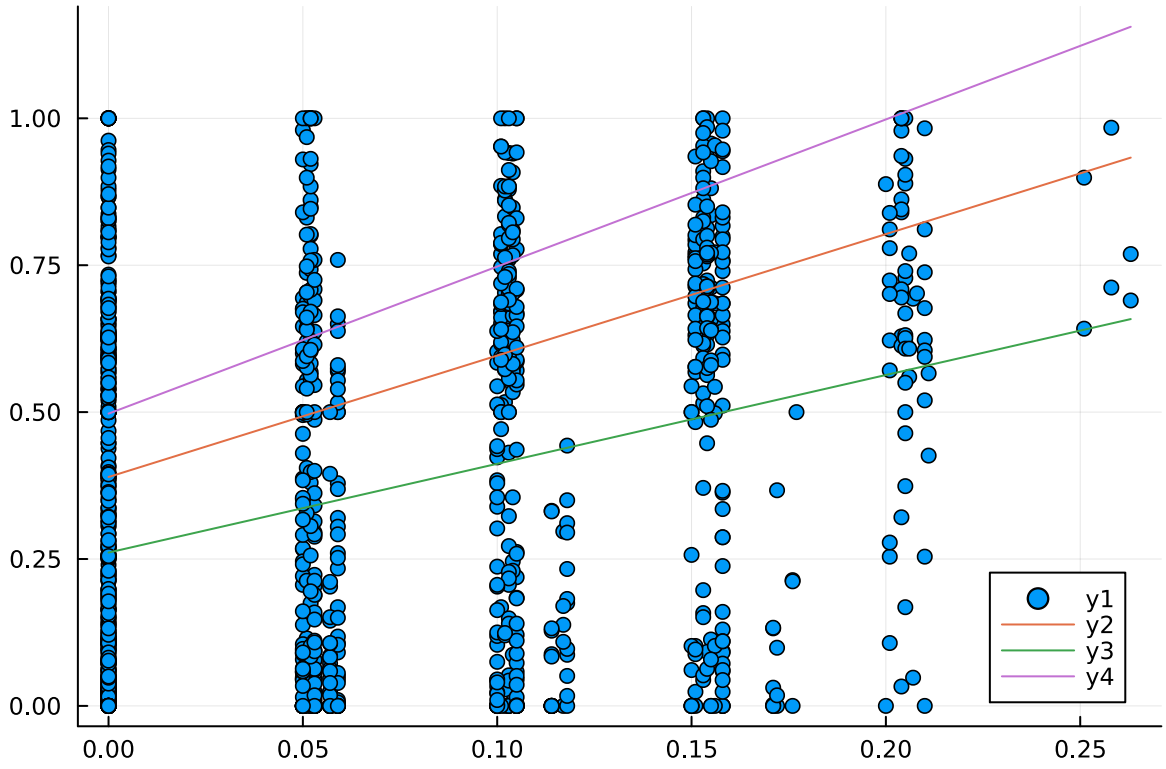
```
function plot_mm(mm, varx, vary)
    randeff = only(ranef(mm))
    xax = LinRange(minimum(varx),maximum(varx),10)
    inter = coef(mm)[1]
    cmcbeta = coef(mm)[2]
    meanbeta = coef(mm)[3]
    yax = inter .+ ((cmcbeta .* xax) + (meanbeta .* xax))
    std_up = mean(df2_subjlvl_hp.heights_phobia) +
    std(df2_subjlvl_hp.heights_phobia)
    bm_std_up = df2_subjlvl_hp.heights_phobia .> std_up
    std_dwn = mean(df2_subjlvl_hp.heights_phobia) -
    std(df2_subjlvl_hp.heights_phobia)
    bm_std_dwn = df2_subjlvl_hp.heights_phobia .< std_dwn
    yax_up = yax + (mean(randeff[1,bm_std_up]) .+ (mean(randeff[2,bm_std_up]).*
    xax))
    yax_dwn = yax + (mean(randeff[1,bm_std_dwn]) .+
    (mean(randeff[2,bm_std_dwn]).* xax))
    df = DataFrame(xax = xax, yax = yax, yax_up = yax_up, yax_dwn = yax_dwn)
    scatter(varx, vary)
    @df df plot!(:xax, :yax)
    @df df plot!(:xax, :yax_dwn)
    @df df plot!(:xax, :yax_up)
end
```




```
plot_mm(mm3, dfcleancol2.video_scr, dfcleancol2.resp_arousal)
```




```
plot_mm(mm4, dfcleancol2.resp_arousal, dfcleancol2.resp_fear)
```




```
1 plot_mm(mm6, dfcleancol2.video_scr, dfcleancol2.resp_fear)
```

Mixed Models - With z-scores

df2cleancol2 =

	video	participant_num	resp_exp_fear	rt_exp_fear	resp_current_a
1	"heights_low_3.mov"	107	0.048	2.503	0.045
2	"heights_low_2.m4v"	107	0.033	3.754	0.036
3	"heights_high_1.m4v"	107	0.032	2.52	0.024
4	"heights_high_3.m4v"	107	0.039	2.219	0.036
5	"heights_high_5.mov"	107	0.058	3.754	0.053
6	"heights_high_4.m4v"	107	0.282	4.355	0.17
7	"heights_low_6.m4v"	107	0.287	1.485	0.321
8	"heights_low_1.m4v"	107	0.05	2.319	0.044
9	"heights_low_4.m4v"	107	0.289	1.802	0.038
10	"heights_low_5.m4v"	107	0.059	1.368	0.056
⋮	more				
1233	"heights_low_2.m4v"	232	0.264	4.722	0.081

```
df2cleancol2 = @pipe df2cleancol |>
            groupby(_,:participant_num_str) |> # group by participant
            transform(_, [:resp_arousal_z, :video_scr_z] .=> mean)|>
            transform(_, [:resp_arousal_z, :resp_arousal_z_mean] => ByRow(-) =>
            :resp_arousal_z_cmc, [:video_scr_z, :video_scr_z_mean]=> ByRow(-) =>
            :video_scr_z_cmc) |> dropmissing
```

dropnan (generic function with 1 method)

```
function dropnan(A)
    boolmask = (!).(any.(eachrow(isnan.(A))))
    return A[boolmask,:]
end
```

dropnanbm (generic function with 1 method)

```
function dropnanbm(A)
    boolmask = (!).(any.(eachrow(isnan.(A))))
    return boolmask
end
```

bmask =

▸ BitVector: [true, true, true, true, true, true, true, true, true, true, true, true, tru

```
1 bmask = dropnanbm(df2cleancol2[:,[:resp_arousal_z_mean,
  :resp_arousal_z_cmc,:video_scr_z_mean,:video_scr_z_cmc]])
```

df2cleancol3 =

	video	participant_num	resp_exp_fear	rt_exp_fear	resp_current_
1	"heights_low_3.mov"	107	0.048	2.503	0.045
2	"heights_low_2.m4v"	107	0.033	3.754	0.036
3	"heights_high_1.m4v"	107	0.032	2.52	0.024
4	"heights_high_3.m4v"	107	0.039	2.219	0.036
5	"heights_high_5.mov"	107	0.058	3.754	0.053
6	"heights_high_4.m4v"	107	0.282	4.355	0.17
7	"heights_low_6.m4v"	107	0.287	1.485	0.321
8	"heights_low_1.m4v"	107	0.05	2.319	0.044
9	"heights_low_4.m4v"	107	0.289	1.802	0.038
10	"heights_low_5.m4v"	107	0.059	1.368	0.056
⋮ more					
1226	"heights_low_2.m4v"	232	0.264	4.722	0.081

```
1 df2cleancol3 = df2cleancol2[bmask,:]
```

```
1 gdf3 = groupby(df2cleancol3, :participant_num_str);
```

```
1 hparr = combine(gdf3, :heights_phobia => mean, renamecols=false).heights_phobia;
```

Zcored Model 1: src to arousal

```
mmz1 =
```

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.0226	0.0535	0.42	0.6725	0.2082
video_scr_z_cmc	0.2000	0.0357	5.60	<1e-07	0.2480
video_scr_z_mean	0.2327	0.0986	2.36	0.0182	
Residual	0.8855				

```
1 mmz1 = fit(LinearMixedModel, @formula(resp_arousal_z ~ video_scr_z_cmc +
  video_scr_z_mean + (video_scr_z_cmc|participant_num_str)), df2cleancol3 )
```

Zscored Scr to arousal, loglike: -1647.1729917327402

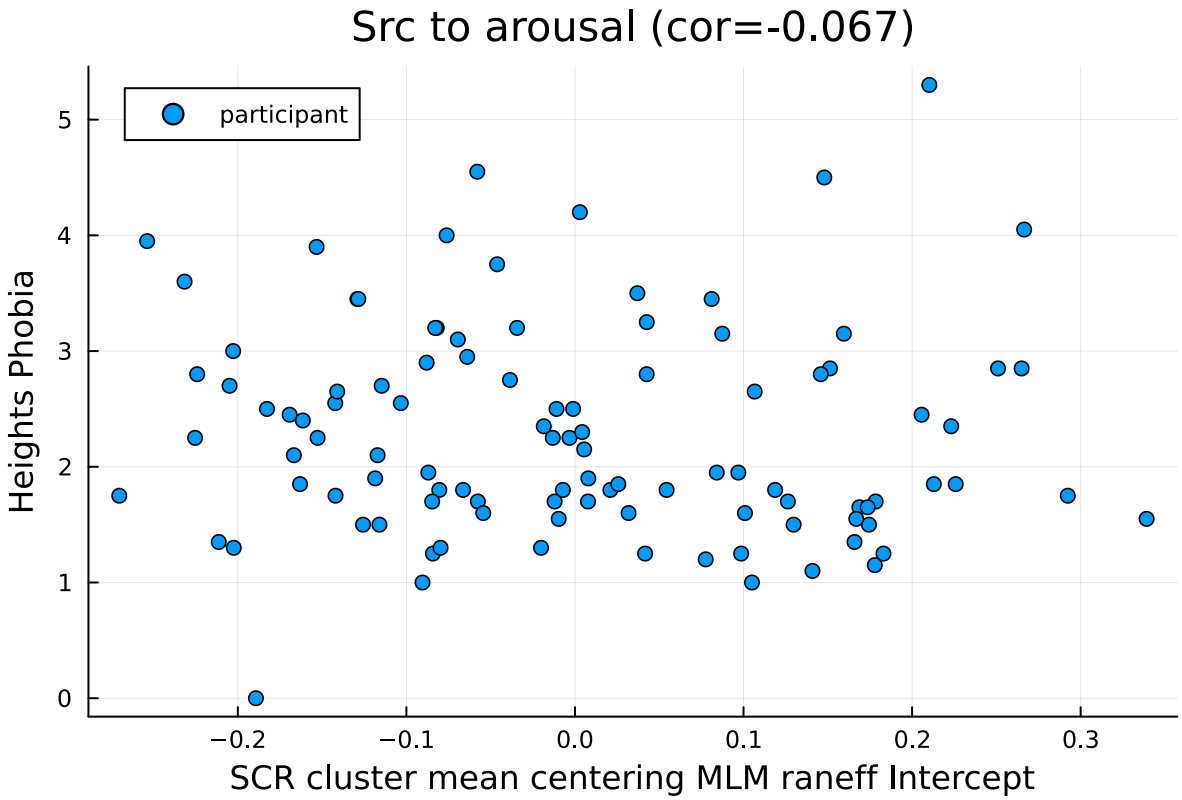
Zscored Scr to arousal, AIC: 3308.3459834654805

```
mmz1coef_w = 0.14764682287088873
```

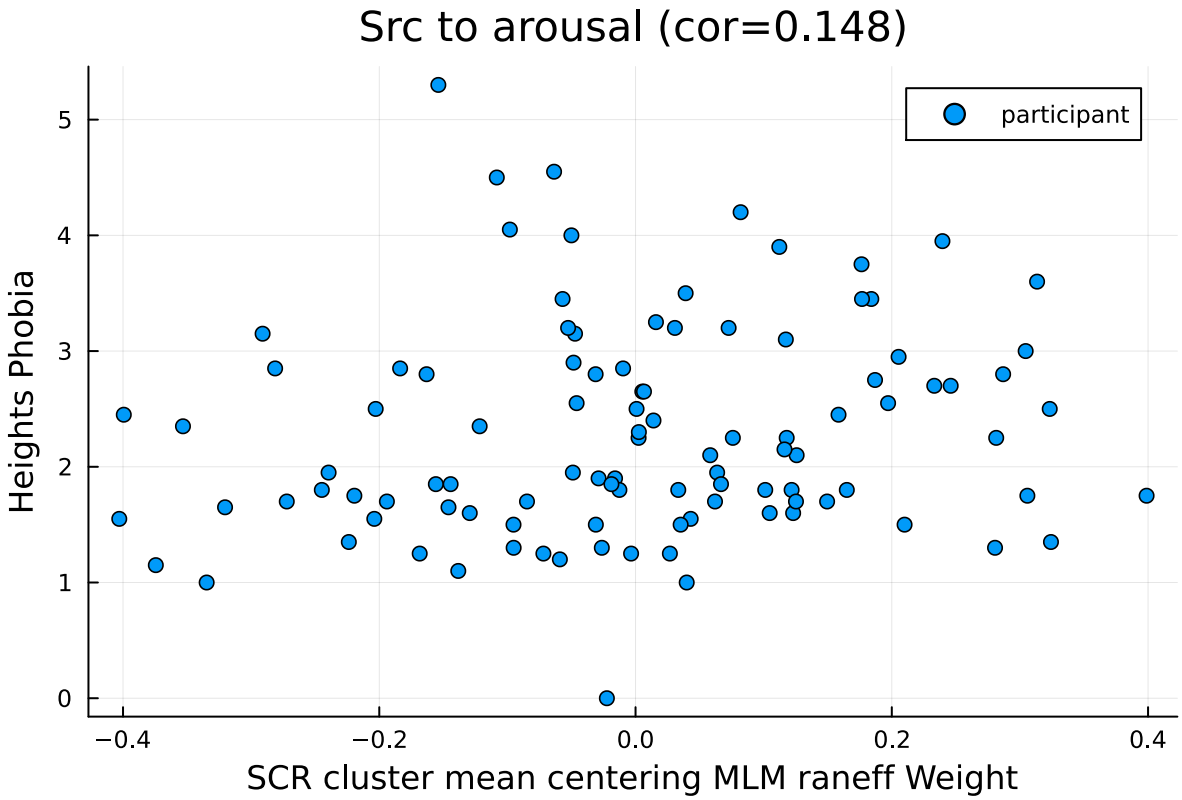
```
1 mmz1coef_w = cor(ranef(mmz1)[1][2,:], hparr)
```

```
mmz1coef_i = -0.06659750077776332
```

```
1 mmz1coef_i = cor(ranef(mmz1)[1][1,:], hparr)
```




```
scatter(ranef(mmz1)[1][1,:], hparr, label="participant", title="Src to arousal
(cor=$(get_trunc(mmz1coef_i)))", xlabel="SCR cluster mean centering MLM raneff
Intercept", ylabel="Heights Phobia")
```




```
scatter(ranef(mmz1)[1][2,:], hparr, label="participant", title="Src to arousal (cor=$(get_trunc(mmz1coef_w)))", xlabel="SCR cluster mean centering MLM raneff Weight", ylabel="Heights Phobia")
```

Zscored Model 2: arousal to fear

mmz2 =

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	-0.0496	0.0273	-1.82	0.0691	0.1084
resp_arousal_z_cmc	0.5211	0.0583	8.93	<1e-18	0.5112
resp_arousal_z_mean	0.3436	0.0749	4.59	<1e-05	
Residual	0.8181				

```
mmz2 = fit(LinearMixedModel, @formula(resp_fear_z ~ resp_arousal_z_cmc + resp_arousal_z_mean + (resp_arousal_z_cmc|participant_num_str)), df2cleancol3)
```

Zscored Scr to arousal, loglike: -1577.1839957028585

```
md"#### Zscored Scr to arousal, loglike: $(loglikelihood(mmz2))"
```

Zscored Scr to arousal, AIC: 3168.367991405717

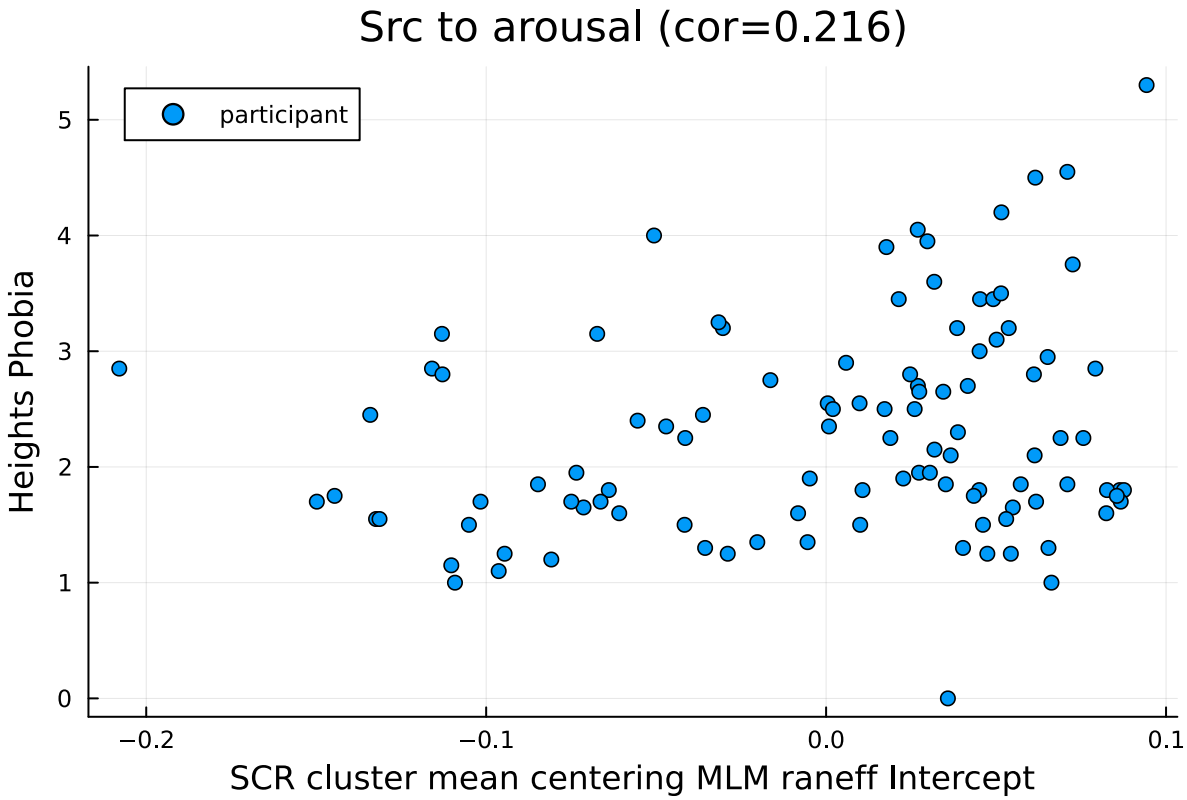
```
md"#### Zscored Scr to arousal, AIC: $(aic(mmz2))"
```

mmz2coef_w = 0.17829492045741993

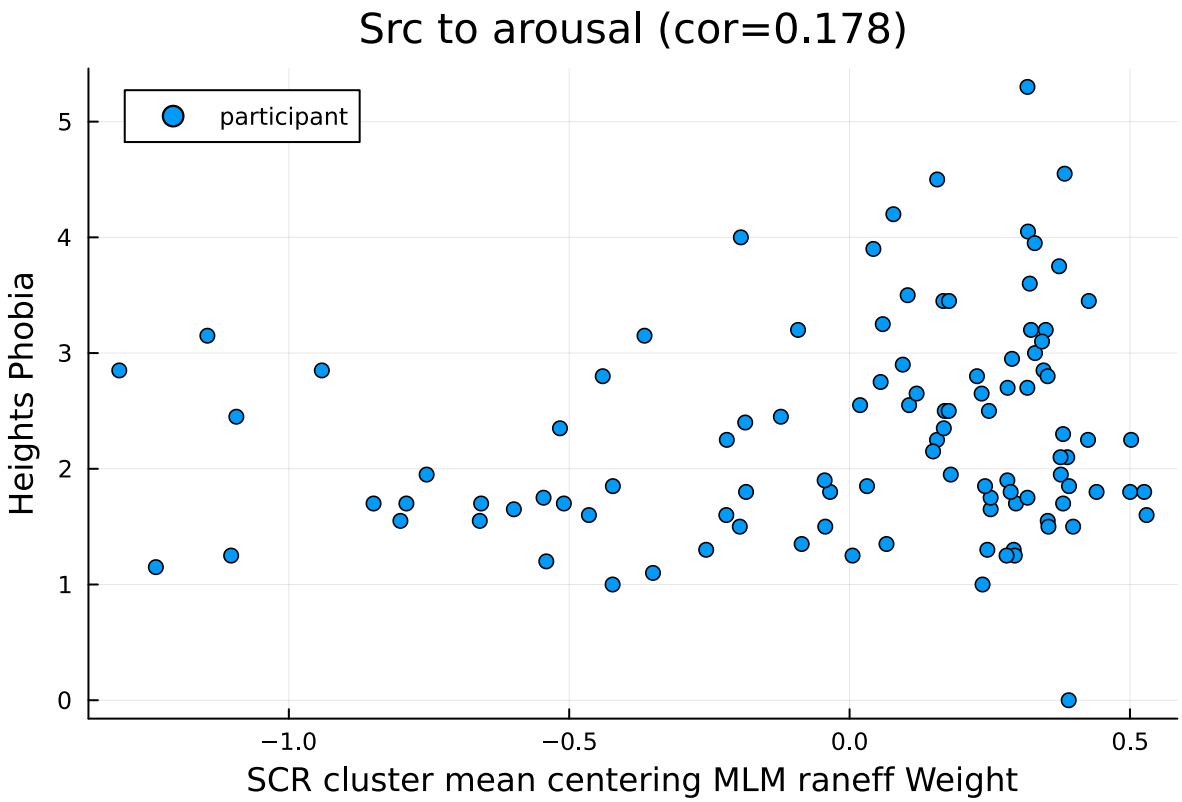
```
mmz2coef_w = cor(ranef(mmz2)[1][2,:], hparr)
```

mmz2coef_i = 0.21638463025080923

```
mmz2coef_i = cor(ranef(mmz2)[1][1,:], hparr)
```




```
scatter(ranef(mmz2)[1][1,:], hparr, label="participant", title="Src to arousal
(cor=$(get_trunc(mmz2coef_i)))", xlabel="SCR cluster mean centering MLM raneff
Intercept", ylabel="Heights Phobia")
```




```
scatter(ranef(mmz2)[1][2,:], hparr, label="participant", title="Src to arousal (cor=$(get_trunc(mmz2coef_w)))", xlabel="SCR cluster mean centering MLM raneff Weight", ylabel="Heights Phobia")
```

Zscored Model 3: scr to fear

```
md"## Zscored Model 3: scr to fear"
```

mmz3 =

	Est.	SE	z	p	σ_participant_num_str
(Intercept)	0.0003	0.0490	0.01	0.9954	0.1068
video_scr_z_cmc	0.4262	0.0300	14.21	<1e-45	0.1354
video_scr_z_mean	-0.0167	0.0908	-0.18	0.8541	
Residual	0.9594				

```
mmz3 = fit(LinearMixedModel, @formula(resp_fear_z ~ video_scr_z_cmc + video_scr_z_mean + (video_scr_z_cmc|participant_num_str)), df2cleancol3)
```

Scr to fear, loglike: -1706.1228183690966

```
md"#### Scr to fear, loglike: $(loglikelihood(mmz3))"
```

Scr to fear, AIC: 3426.2456367381933

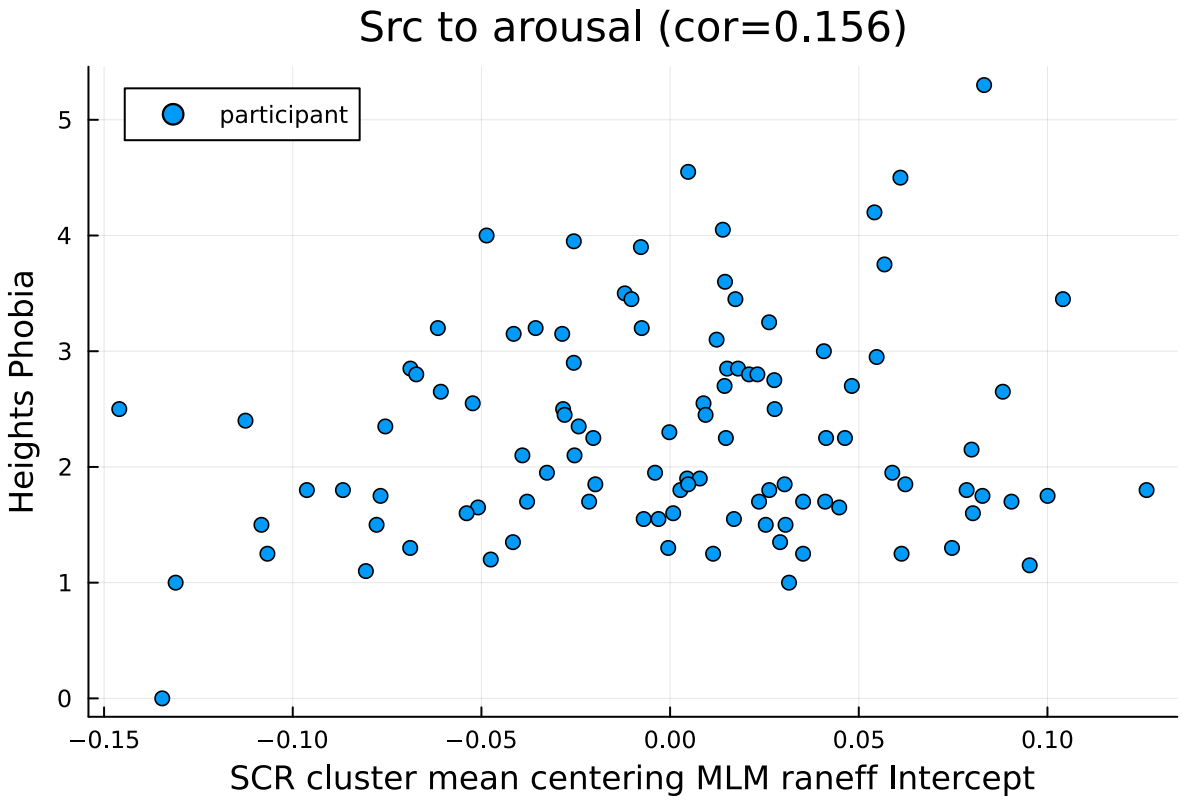
```
md"#### Scr to fear, AIC: $(aic(mmz3))"
```

```
mmz3coef_w = 0.15624136004798708
```

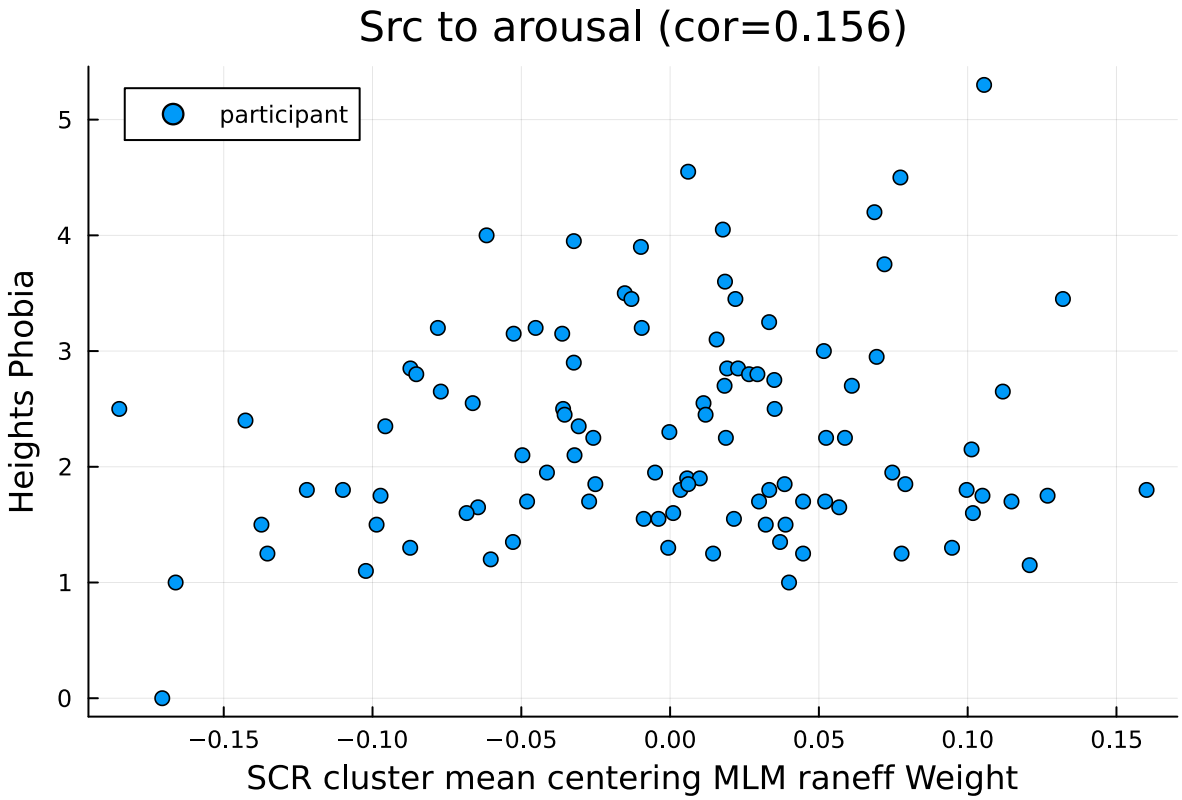
```
mmz3coef_w = cor(ranef(mmz3)[1][2,:], hparr)
```

```
mmz3coef_i = 0.15624136004798714
```

```
mmz3coef_i = cor(ranef(mmz3)[1][1,:], hparr)
```




```
scatter(ranef(mmz3)[1][1,:], hparr, label="participant", title="Src to arousal
(cor=$(get_trunc(mmz3coef_i)))", xlabel="SCR cluster mean centering MLM raneff
Intercept", ylabel="Heights Phobia")
```



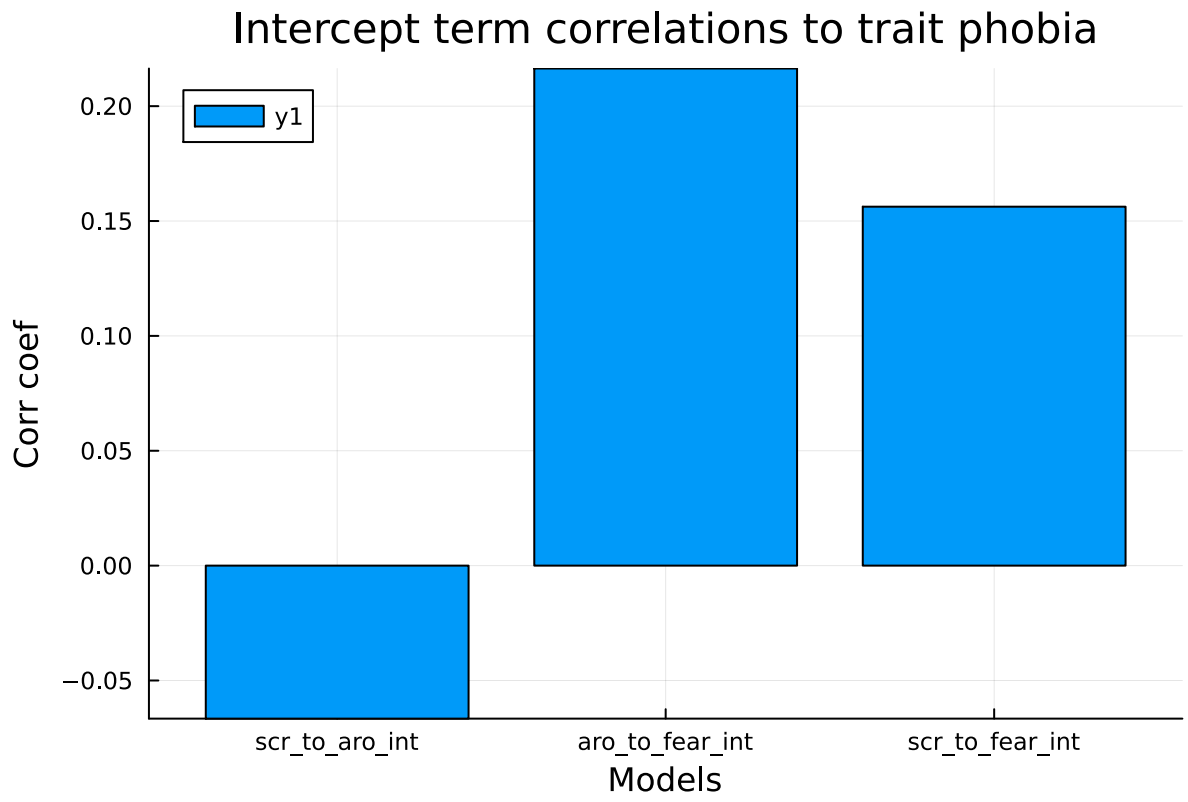

```
scatter(ranef(mmz3)[1][2,:], hparr, label="participant", title="Src to arousal (cor=$(get_trunc(mmz3coef_w)))", xlabel="SCR cluster mean centering MLM raneff Weight", ylabel="Heights Phobia")
```

Zscored Model correlation comparison plots

```
md"## Zscored Model correlation comparison plots"
```

```
plotdata_z = [mmz1coef_i,mmz2coef_i,mmz3coef_i];
```

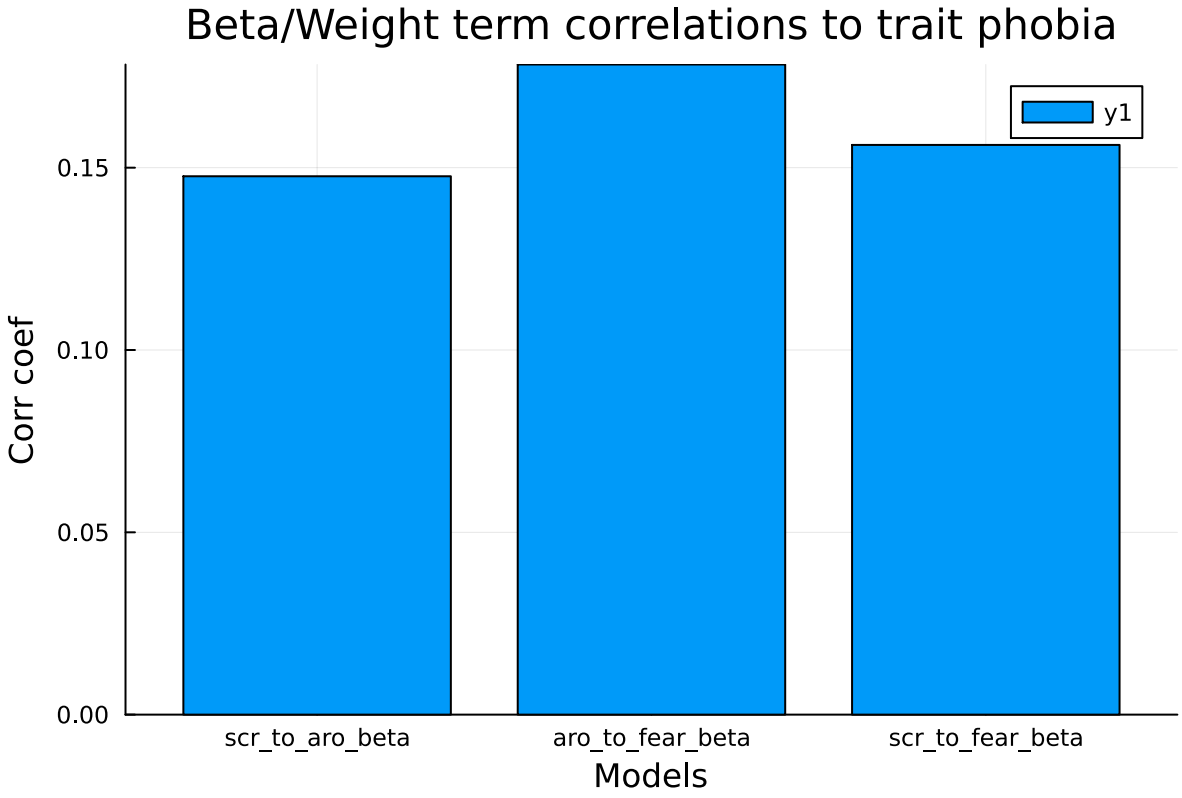
```
plotcols_z = ["scr_to_aro_int","aro_to_fear_int", "scr_to_fear_int"];
```




```
plot(bar(plotcols_z, plotdata_z), title="Intercept term correlations to trait phobia", xlabel="Models", ylabel="Corr coef")
```

```
plotdata_z1 = [mmz1coef_w,mmz2coef_w,mmz3coef_w];
```

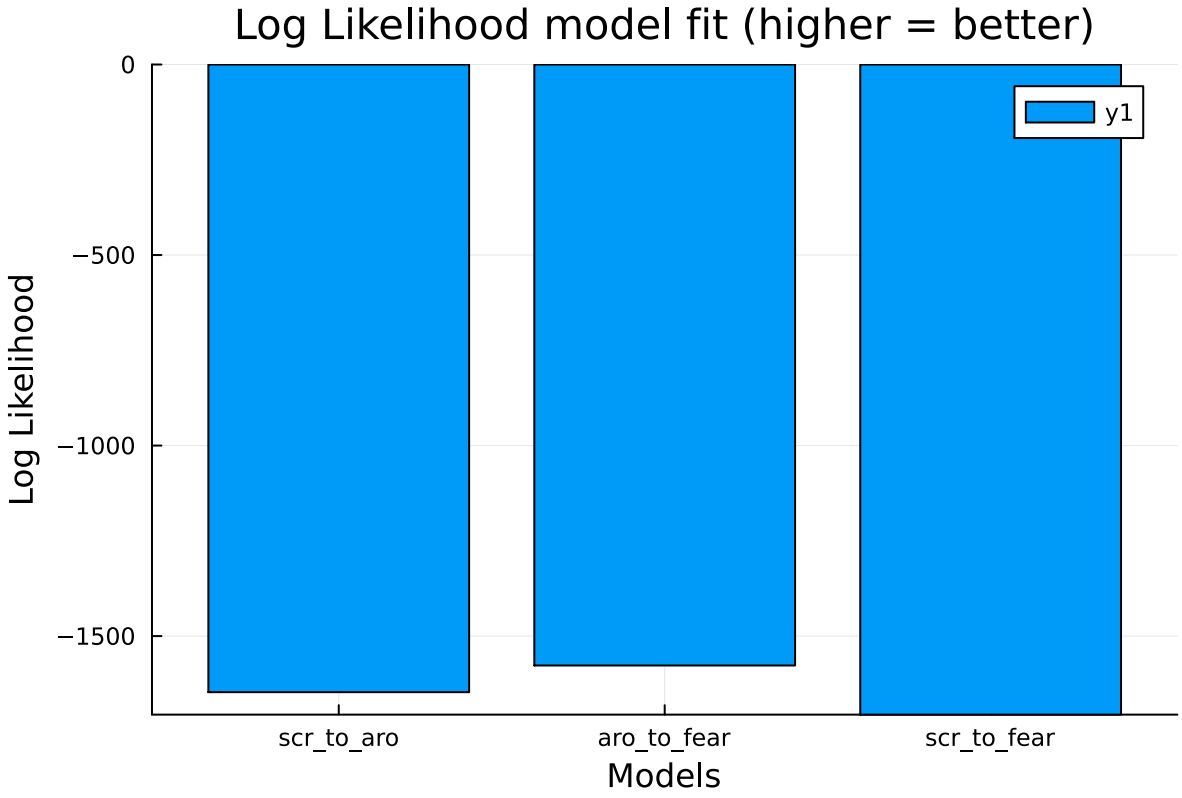
```
plotcols_z1 = ["scr_to_aro_beta","aro_to_fear_beta", "scr_to_fear_beta"];
```



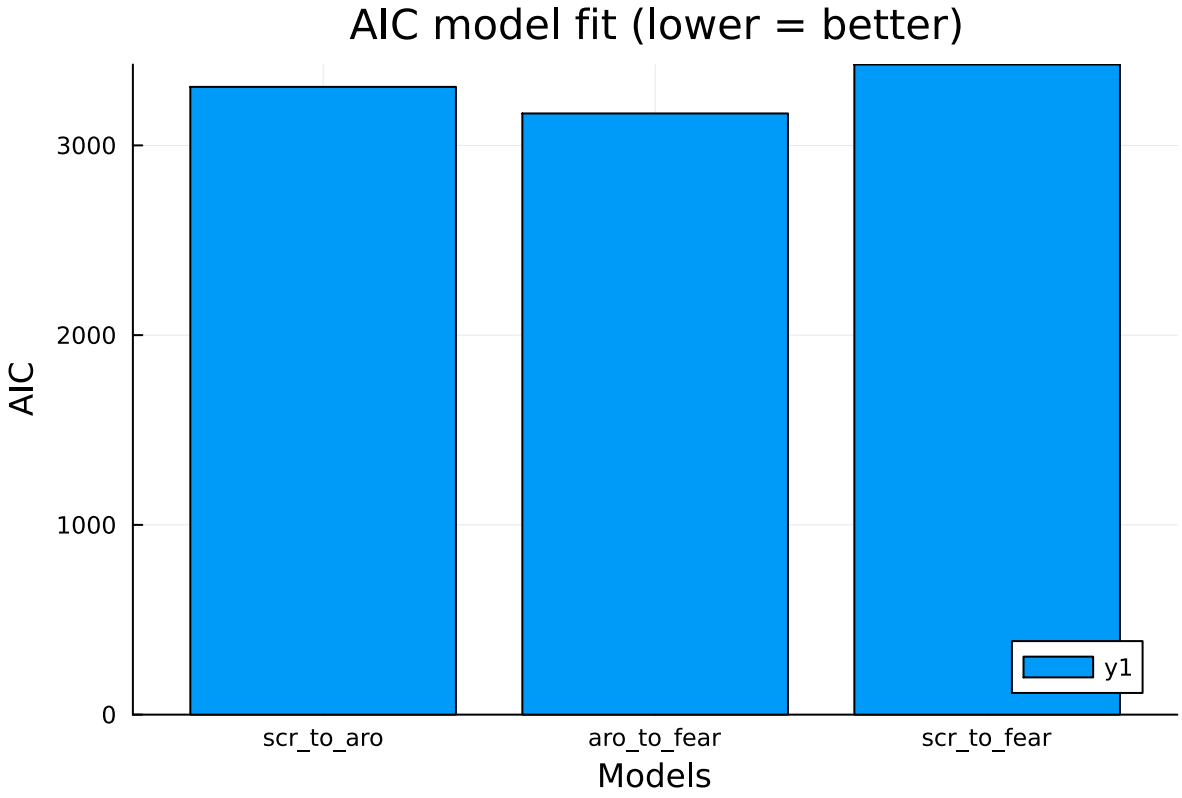

```
plot(bar(plotcols_z1, plotdata_z1), title="Beta/Weight term correlations to
trait phobia", xlabel="Models", ylabel="Corr coef")
```

```
models2 = [mmz1,mmz2,mmz3];
```

```
plotcols_z3 = ["scr_to_aro","aro_to_fear", "scr_to_fear"];
```




```
plot(bar(plotcols_z3, models2 .|> loglikelihood), title="Log Likelihood model
fit (higher = better)", xlabel="Models", ylabel="Log Likelihood")
```




```
plot(bar(plotcols_z3, models2 .|> aic), title="AIC model fit (lower = better)",
xlabel="Models", ylabel="AIC")
```