

## Description of output of glmer in R

```
MLMmodel<- glmer(rec_acc~PE*rec_session+(rec_session*PE|particip_code), family=
binomial, data=data)
```

Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) ['glmerMod']

Family: binomial ( logit )

Formula: rec\_acc ~ PE \* rec\_session + (rec\_session \* PE | particip\_code)

Data: data

AIC	BIC	logLik	deviance	df.resid
6545.7	6723.6	-3245.9	6491.7	5349

Scaled residuals:

Min	1Q	Median	3Q	Max
-3.3785	-0.9026	0.3659	0.8036	3.7504

Random effects:

Groups	Name	Variance	Std.Dev.	Corr
particip_code	(Intercept)	2.35249	1.5338	
	rec_sessionDelayed	2.96666	1.7224	-0.90
	PEmedium	0.10719	0.3274	-0.21 0.40
	PEhigh	0.13557	0.3682	-0.63 0.90 0.47
	rec_sessionDelayed:PEmedium	0.04902	0.2214	0.29 -0.34 -0.95 -0.28
	rec_sessionDelayed:PEhigh	0.09614	0.3101	0.72 -0.58 0.50 -0.35 -0.46

Number of obs: 5376, groups: particip\_code, 32

Fixed effects:

	Estimate	Std. Error	z value	Pr(> z )
(Intercept)	0.181209	0.288006	0.629	0.5292
PEmedium	0.328195	0.132237	2.482	0.0131 *
PEhigh	0.005379	0.140372	0.038	0.9694
rec_sessionDelayed	-0.488775	0.328948	-1.486	0.1373
PEmedium:rec_sessionDelayed	0.103703	0.159884	0.649	0.5166
PEhigh:rec_sessionDelayed	0.262589	0.175664	1.495	0.1350

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Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) ['glmerMod']

Family: binomial ( logit )

Formula: rec\_acc ~ PE \* rec\_session + (rec\_session \* PE | particip\_code)

Data: data

AIC	BIC	logLik	deviance	df.resid
6545.7	6723.6	-3245.9	6491.7	5349



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These are some values indicating the fit of the model, much like residual sum of squares in a general linear model.

In order to compare different models, the deviance is typically used. Deviance is  $-2 * \log\text{Likelihood}$  and follows a Chi Square distribution. Smaller values indicate better fit.

```

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               rec_sessionDelayed  2.96666  1.7224  -0.90
               PEmedium           0.10719  0.3274  -0.21  0.40
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Number of obs: 5376, groups:  particip_code, 32

```

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This is the random part of the model. The values are shown as contrasts, i.e. difference with the reference levels (PElow for PE and rec\_sessionImmediate for the rec\_session).

The random intercept for participants show how much participants ( in the rec\_session = immediate, PE level = low) vary in their average scores in the recognition test.

The rec\_sessionDelayed shows how much the difference in participants' scores between the session delayed and immediate (the reference) for the PElow condition (reference for PE) varied across participants.

PEmedium represents how much the difference in PEmedium rec\_sessionImmediate and PElow rec\_sessionImmediate varied across participants, while PEhigh represents the same value but for the difference between PEhigh and PElow.

```

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  Groups             Name                Variance Std.Dev. Corr
  particip_code (Intercept)          2.35249   1.5338
                rec_sessionDelayed    2.96666   1.7224  -0.90
                PEmedium              0.10719   0.3274  -0.21  0.40
                PEhigh                0.13557   0.3682  -0.63  0.90  0.47
                rec_sessionDelayed:PEmedium 0.04902   0.2214   0.29 -0.34 -0.95 -0.28
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Number of obs: 5376, groups:  particip_code, 32

```

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Interactions of random slopes.

Rec\_sessionDelayed:PEmedium represents how much the difference in rec\_acc between the rec\_sessionDelayed for PEmedium and the rec\_sessionImmediate for PElow (intercept) varies between participants.

Rec\_sessionDelayed:PEhigh represents how much the difference between rec\_sessionDelayeres for PEhigh and rec\_sessionImmediate for PElow (intercept) varies between participants.

Number of obs – total number of observation

Groups: levels of our grouping variable. In our case, number of participants

Fixed effects:

	Estimate	Std. Error	z value	Pr(> z )
(Intercept)	0.181209	0.288006	0.629	0.5292
PEmedium	0.328195	0.132237	2.482	0.0131 *
PEhigh	0.005379	0.140372	0.038	0.9694
rec_sessionDelayed	-0.488775	0.328948	-1.486	0.1373
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The fixed effects are the estimated for the entire group, after taking into account between-participants variance. They are presented as contrasts, just like the random effects. As the coefficients have been obtained through a logit function, they need to be exponentiated in order to be interpreted.

The exponentiation of the coefficients gives us the odds ratio for that those variables, namely how much change in our outcome variable we can expect after one unit change in our predictors.

Fixed effects:

	Estimate	Std. Error	z value	Pr(> z )
(Intercept)	0.181209	0.288006	0.629	0.5292
PEmedium	0.328195	0.132237	2.482	0.0131 *
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The intercept represent the level of `rec_acc` for `rec_sessionImmediate` and `PElow` (reference levels). It generally means that participants on those conditions are  $\exp(0.18) = 1.20$  times more likely to correctly recognize an item (`rec_acc=1`) than incorrectly recognize it (`rec_acc=0`). Their recognition levels are at chance ( $p = 0.53$ ).

`PEmedium` represents the difference between `rec_acc` for `PEmedium` (`rec_sessionImmediate`) and `PElow` (`rec_sessionImmediate`). This tells us that participants in the `PEmedium` condition are  $\exp(0.32) = 1.38$  times more likely to recognize an item, and that this improvement is significant ( $p = 0.01$ ).

The rest of the effects can be interpreted as we did for the random effects, with the difference that here we are considering not the variation among participants, but the effects of the variables on the group level.