

Intro to mixed effects models

Warm-up: class activity

https://sta712-f22.github.io/class_activities/ca_lecture_39.html

Fitting mixed effects models

Assumptions

$$Anxiety_{ij} = \beta_0 + u_i + \beta_1 SmallEnsemble_{ij} + \beta_2 Solo_{ij} + \varepsilon_{ij}$$

$$u_i \stackrel{iid}{\sim} N(0, \sigma_u^2) \quad \varepsilon_{ij} \stackrel{iid}{\sim} N(0, \sigma_\varepsilon^2)$$

What assumptions does this mixed effects model make?

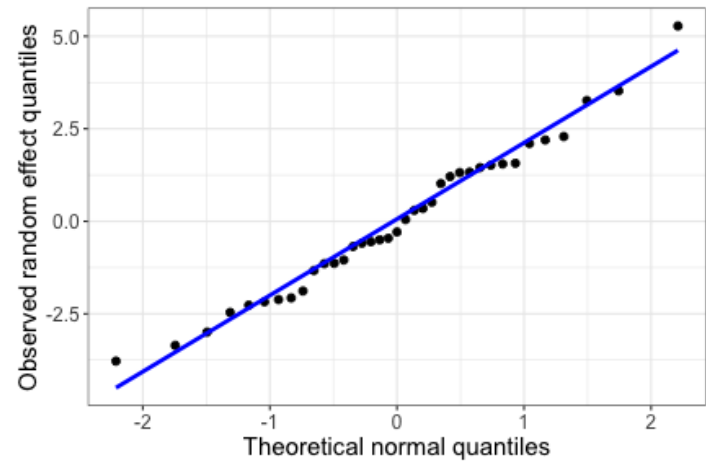
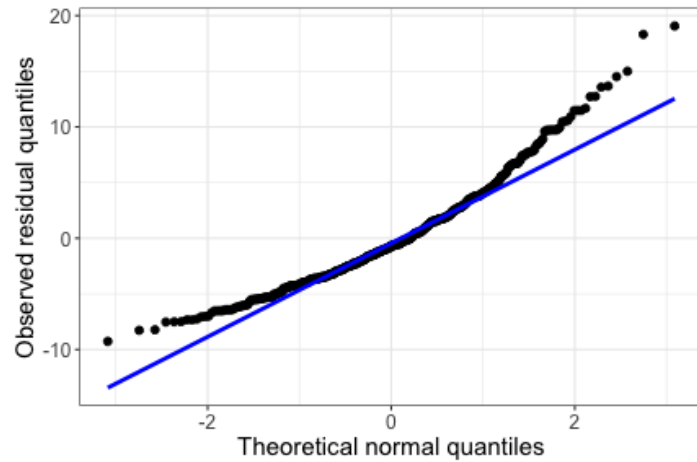
Assessing normality

$$Anxiety_{ij} = \beta_0 + u_i + \beta_1 SmallEnsemble_{ij} + \beta_2 Solo_{ij} + \varepsilon_{ij}$$

$$u_i \stackrel{iid}{\sim} N(0, \sigma_u^2) \quad \varepsilon_{ij} \stackrel{iid}{\sim} N(0, \sigma_\varepsilon^2)$$

How should we check the normality assumption?

QQ plots



Changing the model

$$Anxiety_{ij} = \beta_0 + u_i + \beta_1 SmallEnsemble_{ij} + \beta_2 Solo_{ij} + \varepsilon_{ij}$$

$$u_i \stackrel{iid}{\sim} N(0, \sigma_u^2) \quad \varepsilon_{ij} \stackrel{iid}{\sim} N(0, \sigma_\varepsilon^2)$$

How could we change the model to allow the effect of performance type to differ between musicians?

Fitting the model

```
m2 <- lmer(na ~ perform_type + (perform_type|id),
           data = music)
summary(m2)
```

...

Random effects:

## Groups	Name	Variance	Std.Dev.	Corr
## id	(Intercept)	3.986	1.997	
##	perform_typeSmall Ensemble	2.019	1.421	-0.43
##	perform_typeSolo	1.017	1.008	0.74 0.29
## Residual		21.288	4.614	

Number of obs: 497, groups: id, 37

##

Fixed effects:

##	Estimate	Std. Error	t value
## (Intercept)	15.0503	0.5436	27.685
## perform_typeSmall Ensemble	0.6996	0.7410	0.944
## perform_typeSolo	2.0134	0.5671	3.550

...

Prediction

What is the estimated anxiety for Musician 1 before a solo performance?

```
coef(m2)
```

```
...  
## $id  
##      (Intercept) perform_typeSmall Ensemble perform_typeSolo  
## 1      12.37560          0.84623321          0.6590148  
## 2      13.61693          0.30915635          1.0413577  
## 3      12.86707          1.31366273          1.1674007  
...
```