Test link between subject-verb order and interrogative position

Load libraries and data

```
library(lme4)
library(sjPlot)
```

```
d = read.csv("wals-language.csv/language.csv")
```

Make variables

```
d$IP = d$X93A.Position.of.Interrogative.Phrases.in.Content.Questions

d$IP[d$IP %in% c("3 Mixed")] = NA
d$IP[d$IP %in% c("")] = NA
d$IP = as.character(d$IP)
d$IP[d$IP=="1 Initial interrogative phrase"] = "Initial"
d$IP[d$IP=="2 Not initial interrogative phrase"] = "Non-Initial"
d$IP = factor(d$IP)

d$WO = d$X81A.Order.of.Subject..Object.and.Verb

d$SV = d$X82A.Order.of.Subject.and.Verb
d$SV[d$SV==""] = NA
d$SV[d$SV=="3 No dominant order"] = NA
d$SV = d$SV == "1 SV"
```

Contingency table of initial interrogative phrase by basic word order:

```
table(d$WO,d$IP) / rowSums(table(d$WO,d$IP))
```

```
##
##                          Initial Non-Initial
##                        0.1923077   0.8076923
##   1 SOV                0.1790123   0.8209877
##   2 SVO                0.2482759   0.7517241
##   3 VSO                0.7076923   0.2923077
##   4 VOS                0.7692308   0.2307692
##   5 OVS                0.5714286   0.4285714
##   6 OSV                0.0000000   1.0000000
##   7 No dominant order  0.5900000   0.4100000
```

Pattern:

- Subject before verb = non-initial
- Verb before subject = initial

Mixed effects model

Predict order of subject and verb by interrogative phrase position, controlling for family and macroarea.

```
m0 = glmer(IP ~ 1 + (1 + SV | family) + (1 + SV| macroarea),
           data=d[!is.na(d$IP),], family = binomial)
m1 = glmer(IP ~ 1 + SV + (1 + SV| family) + (1 + SV| macroarea),
           data=d[!is.na(d$IP),], family = binomial)
anova(m0,m1)
```

```
## Data: d[!is.na(d$IP), ]
## Models:
## m0: IP ~ 1 + (1 + SV | family) + (1 + SV | macroarea)
## m1: IP ~ 1 + SV + (1 + SV | family) + (1 + SV | macroarea)
##    Df    AIC    BIC  logLik deviance  Chisq Chi Df Pr(>Chisq)
## m0  7 624.36 657.16 -305.18   610.36
## m1  8 610.47 647.95 -297.24   594.47 15.894      1    6.7e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

There was a significant main effect of subject-verb order (beta = 2.6 , std.err = 0.42 , Wald t = 6.2 , Wald p = 6.3e-10 ; log likelihood difference = 7.9 , df = 1 , Chi Squared = 15.89 , p = 6.7e-05).. Probability of initial interrogatives with subject-verb order = 0.2266233. Probability of initial interrogatives with verb-subject = 0.7990444

Look at direction:

```
summary(m1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: IP ~ 1 + SV + (1 + SV | family) + (1 + SV | macroarea)
##    Data: d[!is.na(d$IP), ]
##
##      AIC      BIC   logLik deviance df.resid
##    610.5    647.9   -297.2    594.5      792
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.9615 -0.2197  0.1677  0.3607  4.5511
##
## Random effects:
##  Groups    Name        Variance  Std.Dev. Corr
##  family    (Intercept) 9.848e-01 0.992392
##            SVTRUE      6.602e-03 0.081250 1.00
##  macroarea (Intercept) 3.031e+00 1.740881
##            SVTRUE      1.618e-06 0.001272 1.00
## Number of obs: 800, groups:  family, 140; macroarea, 7
##
## Fixed effects:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)  -1.2275     0.7953  -1.543    0.123
## SVTRUE        2.6078     0.4218   6.182 6.33e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

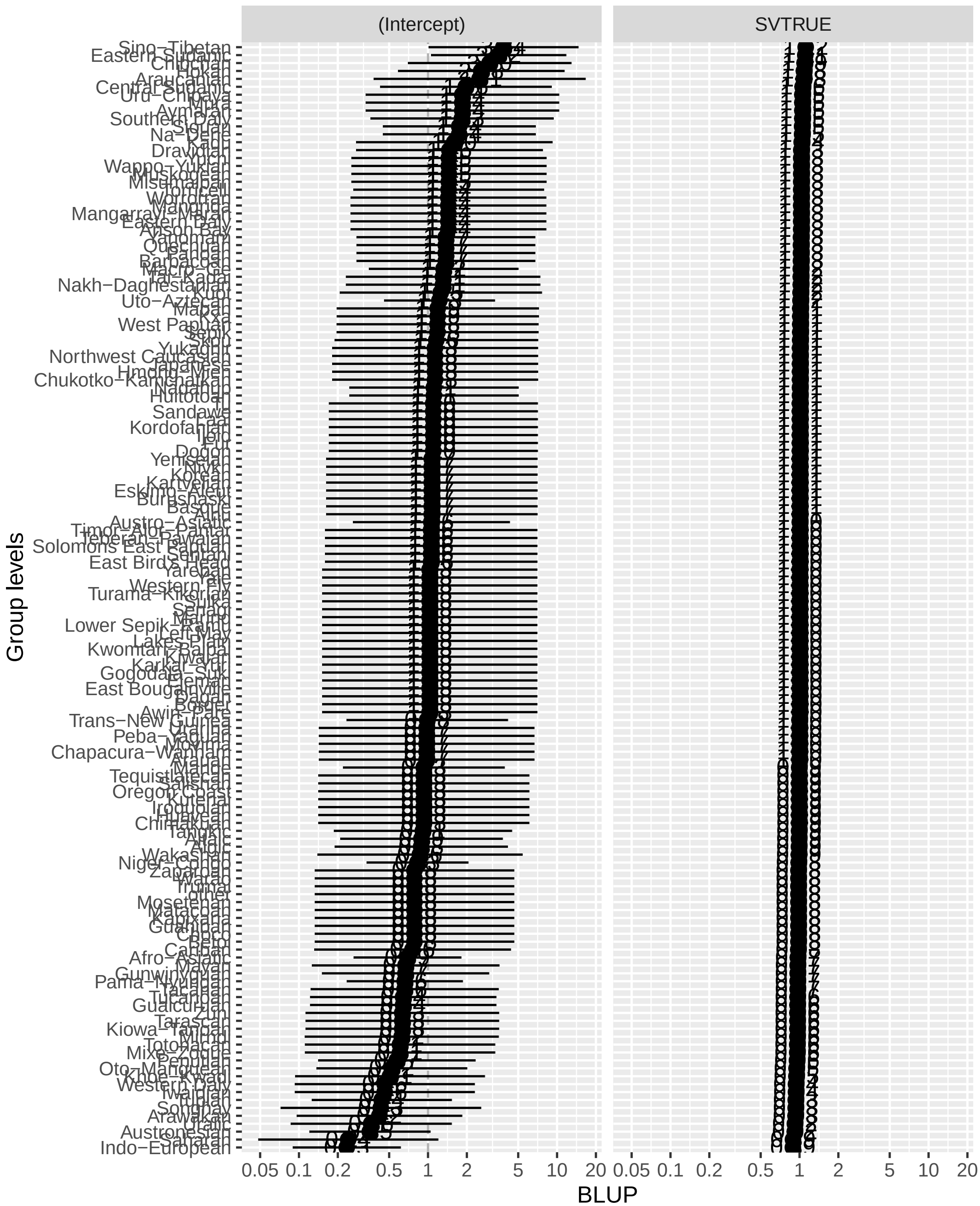
```
##
## Correlation of Fixed Effects:
##        (Intr)
## SVTRUE -0.435
```

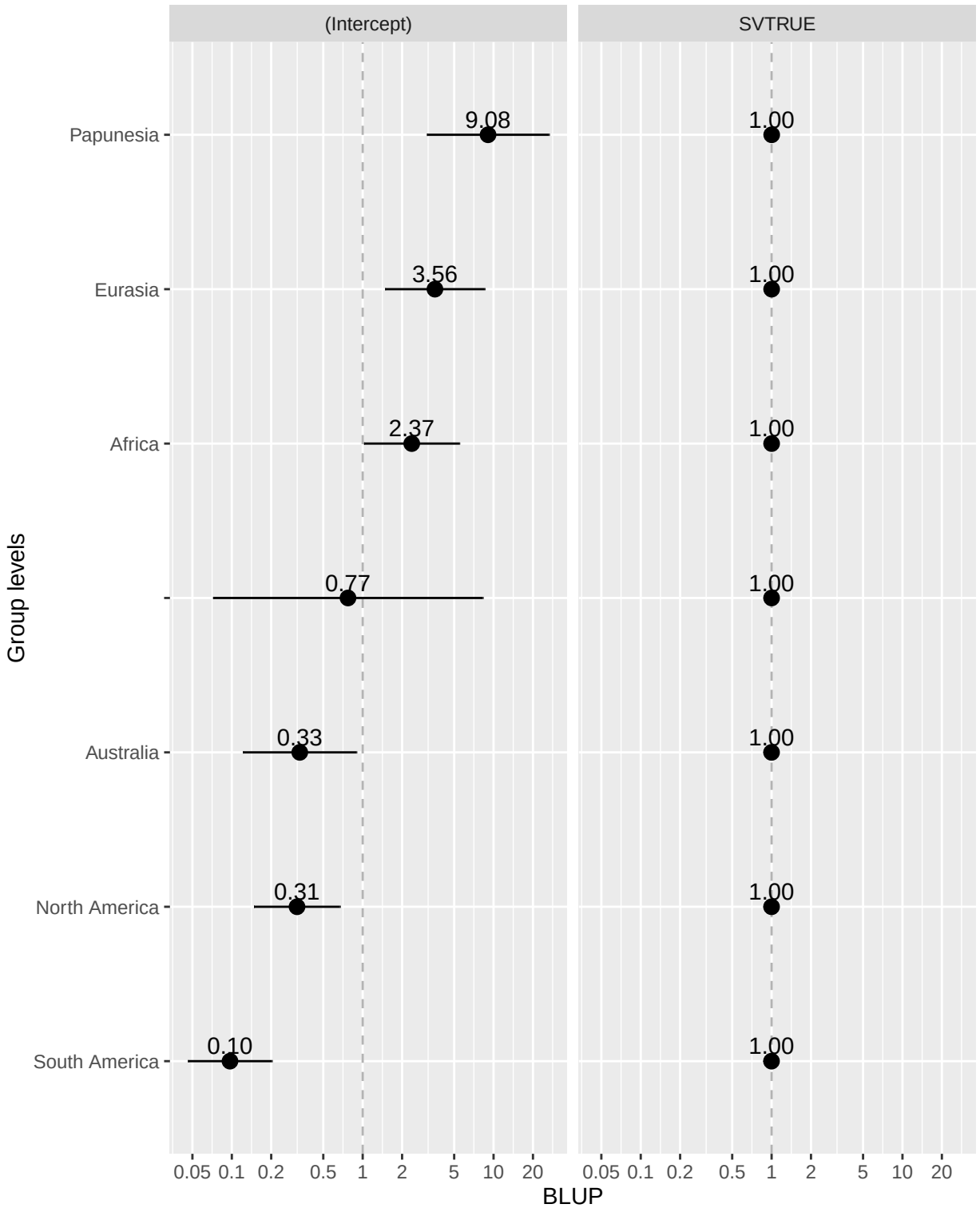
Random effects

Note that there are very small differences between random slope for SV by macroarea. The convergence is singulative (total correlation between intercept and slopes), but there are no qualitative differences when removing the random slopes.

```
sjp.glmer(m1, 're',sort.est = "(Intercept)", geom.colors = c(1,1))
```

```
## Plotting random effects...
## Plotting random effects...
```


(Intercept)
SVTRUE
Group levels
BLUP
0.05 0.1 0.2 0.5 1 2 5 10 20
Sino−Tibetan
Eastern Sudanic
Araucanian
Central Sudanic
Uru−Chipaya
Aymaran
Southern Daly
Na−Dene
Dravidian
Wappo−Yukian
Misumalpan
Mangarrayi−Maran
Eastern Daly
Anson Bay
Nakh−Daghestanian
Uto−Aztecan
West Papuan
Northwest Caucasian
Chukotko−Kamchatkan
Huitotoan
Sandawe
Kordofanian
Dogon
Yeniseian
Eskimo−Aleut
Burushaski
Basque
Austro−Asiatic
Solomons East Papuan
East Bird's Head
Turama−Kikorian
Lower Sepik−Ramu
Kwomtari−Baibai
East Bougainville
Trans−New Guinea
Chapacura−Wanhan
Tequistlatecan
Oregon Coast
Iroquoian
Niger−Congo
Mosetenan
Afro−Asiatic
Pama−Nyungan
Guaicuruan
Kiowa−Tanoan
Mixe−Zoque
Oto−Manguean
Western Daly
Songhay
Arawakan
Austronesian
Indo−European


(Intercept)
SVTRUE
Papunesia
Eurasia
Africa
Australia
North America
South America
9.08
3.56
2.37
0.77
0.33
0.31
0.10
1.00
Group levels
0.05 0.1 0.2 0.5 1 2 5 10 20
BLUP