

The influence of polarity items on inferential judgments

Milica Denić, Vincent Homer, Daniel Rothschild, Emmanuel Chemla

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Statistical analyses

NPI vs. no PI in NM environments

Experiment 1

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Inference direction (Increasing vs. Decreasing).

```
a1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "NM" & Monotonicity == "NM" & PI %in% c("O", "N")))
summary(a1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
## Data: subset(AnDataSet, EXP == "NM" & Monotonicity == "NM" & PI %in%
## c("O", "N"))
##
## AIC      BIC    logLik deviance df.resid
## 17094.4 17138.6 -8539.2 17078.4    1864
##
## Scaled residuals:
##   Min       1Q   Median       3Q      Max
## -3.9996 -0.4312  0.0397  0.4488  3.8100
##
## Random effects:
## Groups Name          Variance Std.Dev. Corr
## subject (Intercept)  240.0    15.49
##           IncreasingU 1399.9    37.41  -0.86
## Residual                454.6    21.32
## Number of obs: 1872, groups: subject, 66
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)   72.3791    2.1489  33.682
## PI0            4.2817    0.9906   4.322
## Quantifier0n  -4.7509    0.9892  -4.803
## IncreasingU  -28.8617    4.7127  -6.124
##
## Correlation of Fixed Effects:
##              (Intr) PI0    Qntfr0
## PI0          -0.236
## Quantifir0n -0.224 -0.005
## IncreasingU -0.796  0.001 -0.001
```

Comparison with a reduced model without the Polarity Item as fixed effect revealed a significant effect of the presence of the negative polarity item on inferences in non-monotonic environments.

```
a2 <- lmer(Irep ~ Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "NM" & Monotonicity == "NM" & PI %in% c("O", "N")))
anova(a1, a2)
```

```
## Data: subset(AnDataSet, EXP == "NM" & Monotonicity == "NM" & PI %in% ...
## Models:
## a2: Irep ~ Quantifier + Increasing + (1 + Increasing | subject)
## a1: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
##   Df  AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## a2  7 17111 17150 -8548.5   17097
## a1  8 17094 17139 -8539.2   17078 18.585     1 1.625e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Experiment 2

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Inference direction (Increasing vs. Decreasing).

```
b1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "NMCons" & Monotonicity == "NM" & PI %in% c("O", "N")))
summary(b1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
## Data:
## subset(AnDataSet, EXP == "NMCons" & Monotonicity == "NM" & PI %in%
##   c("O", "N"))
##
##      AIC      BIC   logLik deviance df.resid
## 15826.6 15870.2 -7905.3 15810.6     1714
##
## Scaled residuals:
##   Min       1Q   Median       3Q      Max
## -4.1239 -0.4575  0.0289  0.4603  3.9644
##
## Random effects:
## Groups Name          Variance Std.Dev. Corr
## subject (Intercept)  405.8    20.14
##           IncreasingU 1627.4    40.34  -0.82
## Residual              468.0    21.63
## Number of obs: 1722, groups: subject, 64
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    68.428     2.742  24.954
## PI0              4.587     1.048   4.377
## Quantifier0n   -5.455     1.047  -5.209
## IncreasingU   -21.102     5.168  -4.083
##
## Correlation of Fixed Effects:
##              (Intr) PI0   Qntfr0
## PI0           -0.199
## Quantifir0n -0.192  0.019
```

```
## IncreasingU -0.782  0.002  0.000
```

Comparison with a reduced model without the Polarity Item as fixed effect revealed a significant effect of the presence of the negative polarity item on inferences in non-monotonic environments.

```
b2 <- lmer(Irep ~ Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "NMCons" & Monotonicity == "NM" & PI %in% c("O", "N")))
anova(b1, b2)
```

```
## Data: subset(AnDataSet, EXP == "NMCons" & Monotonicity == "NM" & PI %in% ...
```

```
## Models:
```

```
## b2: Irep ~ Quantifier + Increasing + (1 + Increasing | subject)
```

```
## b1: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
```

```
##   Df   AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
```

```
## b2  7 15844 15882 -7914.8   15830
```

```
## b1  8 15827 15870 -7905.3   15811 19.044     1 1.278e-05 ***
```

```
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Experiment 3

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts.

```
c1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 | subject), REML = F, subset(AnDataSet,
  EXP == "DD" & Monotonicity == "NM" & PI %in% c("O", "N")))
summary(c1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
```

```
## Formula: Irep ~ PI + Quantifier + Increasing + (1 | subject)
```

```
## Data: subset(AnDataSet, EXP == "DD" & Monotonicity == "NM" & PI %in%
```

```
## c("O", "N"))
```

```
##
```

```
##      AIC      BIC  logLik deviance df.resid
```

```
## 23325.6 23360.4 -11656.8 23313.6     2419
```

```
##
```

```
## Scaled residuals:
```

```
##      Min       1Q   Median       3Q      Max
```

```
## -3.7212 -0.7652  0.0226  0.6685  2.6950
```

```
##
```

```
## Random effects:
```

```
## Groups   Name      Variance Std.Dev.
```

```
## subject (Intercept) 93.94    9.692
```

```
## Residual                832.49   28.853
```

```
## Number of obs: 2425, groups: subject, 91
```

```
##
```

```
## Fixed effects:
```

```
##              Estimate Std. Error t value
```

```
## (Intercept)    76.027     1.549  49.073
```

```
## PIO             2.018     1.175   1.718
```

```
## QuantifierOn  -5.588     1.175 -4.756
```

```
## IncreasingU  -36.429     1.175 -30.995
```

```
##
```

```
## Correlation of Fixed Effects:
```

```
##              (Intr) PIO    Qntfr0
```

```
## PI0          -0.383
## Quantifier -0.374  0.010
## IncreasingU -0.359 -0.016 -0.013
```

Comparison with a reduced model without the Polarity Item as fixed effect revealed a borderline effect of the presence of the negative polarity item on inferences in non-monotonic environments.

```
c2 <- lmer(Irep ~ Quantifier + Increasing + (1 | subject), REML = F, subset(AnDataSet,
  EXP == "DD" & Monotonicity == "NM" & PI %in% c("0", "N")))
anova(c1, c2)
```

```
## Data: subset(AnDataSet, EXP == "DD" & Monotonicity == "NM" & PI %in% ...
## Models:
## c2: Irep ~ Quantifier + Increasing + (1 | subject)
## c1: Irep ~ PI + Quantifier + Increasing + (1 | subject)
##   Df   AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## c2  5 23326 23356 -11658   23316
## c1  6 23326 23360 -11657   23314  2.9502     1  0.08587 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Experiment 4

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Inference direction (Increasing vs. Decreasing), as well as random item intercepts.

```
d1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + Increasing |
  subject), REML = F, subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "NM" &
  PI %in% c("0", "N")))
summary(d1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula:
## Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + Increasing |
##   subject)
## Data:
## subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "NM" & PI %in%
##   c("0", "N"))
##
##           AIC          BIC    logLik deviance df.resid
## 15187.5 15236.3 -7584.8 15169.5     1663
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -3.9965 -0.4308  0.0338  0.4086  4.4607
##
## Random effects:
##   Groups      Name          Variance Std.Dev. Corr
## subject (Intercept) 324.054 18.002
##           IncreasingU 1625.639 40.319 -0.82
## Content (Intercept)  1.106  1.052
## Residual              414.088 20.349
## Number of obs: 1672, groups: subject, 70; Content, 10
##
## Fixed effects:
```

```
##           Estimate Std. Error t value
## (Intercept)    71.902     2.565  28.036
## PI0             3.365     1.207   2.789
## QuantifierOn  -4.989     1.179  -4.232
## IncreasingU   -27.158     4.963  -5.473
##
## Correlation of Fixed Effects:
##           (Intr) PI0    Qntfr0
## PI0          -0.357
## QuantifirOn -0.228  0.034
## IncreasingU -0.725 -0.003  0.000
```

Comparison with a reduced model without the Polarity Item as fixed effect revealed a significant effect of the presence of the negative polarity item on inferences in non-monotonic environments.

```
d2 <- lmer(Irep ~ Quantifier + Increasing + (1 | Content) + (1 + Increasing | subject),
  REML = F, subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "NM" & PI %in%
    c("O", "N")))
anova(d1, d2)
```

```
## Data: subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "NM" & PI %in% ...
## Models:
## d2: Irep ~ Quantifier + Increasing + (1 | Content) + (1 + Increasing |
## d2:   subject)
## d1: Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + Increasing |
## d1:   subject)
##   Df   AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## d2  8 15193 15237 -7588.7   15177
## d1  9 15188 15236 -7584.8   15170 7.7588     1  0.005345 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Meta-analysis

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Inference direction (Increasing vs. Decreasing) and for Polarity item (NPI vs. no PI), as well as random item intercepts.

```
maa1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + PI + Increasing |
  subject), REML = F, subset(AnDataSet, Monotonicity == "NM" & PI %in% c("O", "N")))
summary(maa1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + PI +
##   Increasing | subject)
##   Data: subset(AnDataSet, Monotonicity == "NM" & PI %in% c("O", "N"))
##
##           AIC           BIC    logLik deviance df.resid
## 70470.1 70553.4 -35223.0 70446.1     7679
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -4.1673 -0.4390  0.0259  0.4343  4.2799
##
## Random effects:
```

```

## Groups Name Variance Std.Dev. Corr
## subject (Intercept) 364.1596 19.0830
##          PIO 11.8125 3.4369 -0.53
##          IncreasingU 1521.8145 39.0104 -0.85 0.56
## Content (Intercept) 0.6324 0.7952
## Residual 459.4495 21.4348
## Number of obs: 7691, groups: subject, 291; Content, 12
##
## Fixed effects:
## Estimate Std. Error t value
## (Intercept) 72.2277 1.2608 57.285
## PIO 3.5592 0.5502 6.469
## QuantifierOn -5.1955 0.5117 -10.154
## IncreasingU -28.6787 2.3477 -12.216
##
## Correlation of Fixed Effects:
## (Intr) PIO Qntfr0
## PIO -0.391
## QuantifirOn -0.200 0.013
## IncreasingU -0.783 0.199 -0.001

```

Comparison with a reduced model without the Polarity Item as fixed effect revealed a significant effect of the presence of the negative polarity item on inferences in non-monotonic environments.

```

maa2 <- lmer(Irep ~ Quantifier + Increasing + (1 | Content) + (1 + PI + Increasing |
  subject), REML = F, subset(AnDataSet, Monotonicity == "NM" & PI %in% c("0", "N")))
anova(maa1, maa2)

```

```

## Data: subset(AnDataSet, Monotonicity == "NM" & PI %in% c("0", "N"))
## Models:
## maa2: Irep ~ Quantifier + Increasing + (1 | Content) + (1 + PI + Increasing |
## maa2: subject)
## maa1: Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + PI +
## maa1: Increasing | subject)
## Df AIC BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## maa2 11 70507 70583 -35242 70485
## maa1 12 70470 70553 -35223 70446 38.447 1 5.628e-10 ***
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

NPI vs. no PI in DN environments

Experiment 3

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Quantifier (Every-not vs. No-without), Inference direction (Increasing vs. Decreasing), as well as random item intercepts.

```

e1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + Quantifier +
  Increasing | subject), REML = F, subset(AnDataSet, EXP == "DD" & Monotonicity ==
  "DD" & PI %in% c("0", "N")))
summary(e1)

```

```

## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula:

```

```

## Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + Quantifier +
##   Increasing | subject)
##   Data: subset(AnDataSet, EXP == "DD" & Monotonicity == "DD" & PI %in%
##     c("O", "N"))
##
##       AIC       BIC   logLik deviance df.resid
## 20627.2 20695.2 -10301.6 20603.2    2122
##
## Scaled residuals:
##   Min       1Q   Median       3Q      Max
## -3.4543 -0.6307 -0.0091  0.6735  3.0783
##
## Random effects:
##   Groups   Name                Variance Std.Dev. Corr
##   subject  (Intercept)          332.043  18.222
##            QuantifierNw        295.663  17.195  -0.24
##            IncreasingU          533.315  23.094  -0.76 -0.12
##   Content  (Intercept)           3.721   1.929
##   Residual                   761.158  27.589
## Number of obs: 2134, groups:  subject, 92; Content, 12
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)   39.656     2.374  16.707
## PI0            1.695     1.211   1.400
## QuantifierNw  32.113     2.197  14.616
## IncreasingU   -5.833     2.725  -2.141
##
## Correlation of Fixed Effects:
##              (Intr) PI0    QntfrN
## PI0           -0.261
## QuantifierNw -0.327 -0.009
## IncreasingU  -0.668  0.006 -0.080

```

Comparison with a reduced model without the Polarity Item as fixed effect revealed no significant effect of the presence of the negative polarity item on inferences in double negative environments.

```

e2 <- lmer(Irep ~ Quantifier + Increasing + (1 | Content) + (1 + Quantifier + Increasing |
  subject), REML = F, subset(AnDataSet, EXP == "DD" & Monotonicity == "DD" & PI %in%
  c("O", "N")))
anova(e1, e2)

```

```

## Data: subset(AnDataSet, EXP == "DD" & Monotonicity == "DD" & PI %in% ...
## Models:
## e2: Irep ~ Quantifier + Increasing + (1 | Content) + (1 + Quantifier +
## e2:   Increasing | subject)
## e1: Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + Quantifier +
## e1:   Increasing | subject)
##   Df   AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## e2 11 20627 20690 -10303   20605
## e1 12 20627 20695 -10302   20603 1.9588    1    0.1616

```

Experiment 4 (two models for which convergences was achieved)

Convergence was achieved for two models with comparable random effects structure, which however lead to contradicting results, allowing no inference about the effect of NPI in double negative environments in Experiment 4.

The first one consisted of random subject intercepts and slopes for Inference direction (Increasing vs. Decreasing).

```
f1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in% c("O", "N")))
summary(f1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
## Data:
## subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in%
##   c("O", "N"))
##
##      AIC      BIC   logLik deviance df.resid
## 14576.9 14619.5 -7280.4 14560.9     1513
##
## Scaled residuals:
##   Min       1Q   Median       3Q      Max
## -3.5384 -0.6389  0.0113  0.7188  2.7493
##
## Random effects:
## Groups Name Variance Std.Dev. Corr
## subject (Intercept) 345.8 18.59
##           IncreasingU 562.5 23.72 -0.68
## Residual          720.9 26.85
## Number of obs: 1521, groups: subject, 71
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    32.037     2.967 10.798
## PI0             8.913     1.674  5.325
## QuantifierNw   30.233     1.639 18.449
## IncreasingU     2.697     3.233  0.834
##
## Correlation of Fixed Effects:
##              (Intr) PI0   QntfrN
## PI0          -0.459
## QuantifierNw -0.358  0.141
## IncreasingU  -0.581  0.010  0.008
```

```
f2 <- lmer(Irep ~ Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in% c("O", "N")))
anova(f1, f2)
```

```
## Data: subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in% ...
## Models:
## f2: Irep ~ Quantifier + Increasing + (1 + Increasing | subject)
## f1: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
##   Df  AIC  BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## f2  7 14603 14640 -7294.4 14589
```

```
## f1 8 14577 14620 -7280.4 14561 27.875 1 1.294e-07 ***
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The second one consisted of random subject intercepts and slopes for Quantifier (Every-not vs. No-without).

```
f1_2 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 + Quantifier | subject), REML = F,
  subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in% c("O", "N")))
summary(f1_2)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 + Quantifier | subject)
## Data:
## subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in%
## c("O", "N"))
##
## AIC BIC logLik deviance df.resid
## 14645.2 14687.9 -7314.6 14629.2 1513
##
## Scaled residuals:
## Min 1Q Median 3Q Max
## -3.11299 -0.59802 0.08197 0.62915 2.96222
##
## Random effects:
## Groups Name Variance Std.Dev. Corr
## subject (Intercept) 263.9 16.24
## QuantifierNw 441.0 21.00 -0.70
## Residual 784.7 28.01
## Number of obs: 1521, groups: subject, 71
##
## Fixed effects:
## Estimate Std. Error t value
## (Intercept) 35.069 3.628 9.667
## PI0 5.961 3.482 1.712
## QuantifierNw 29.569 3.328 8.885
## IncreasingU 2.230 1.453 1.535
##
## Correlation of Fixed Effects:
## (Intr) PI0 QntfrN
## PI0 -0.689
## QuantifierNw -0.571 0.100
## IncreasingU -0.214 0.012 0.012
```

```
f2_2 <- lmer(Irep ~ Quantifier + Increasing + (1 + Quantifier | subject), REML = F,
  subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in% c("O", "N")))
anova(f1_2, f2_2)
```

```
## Data: subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in% ...
## Models:
## f2_2: Irep ~ Quantifier + Increasing + (1 + Quantifier | subject)
## f1_2: Irep ~ PI + Quantifier + Increasing + (1 + Quantifier | subject)
## Df AIC BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## f2_2 7 14646 14683 -7315.9 14632
## f1_2 8 14645 14688 -7314.6 14629 2.6202 1 0.1055
```

Meta-analysis

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Polarity Item (NPI vs. no PI) and Inference direction (Increasing vs. Decreasing).

```
mac1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 + PI + Increasing | subject),
  REML = F, subset(AnDataSet, Monotonicity == "DD" & PI %in% c("O", "N")))
summary(mac1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 + PI + Increasing |
##   subject)
##   Data: subset(AnDataSet, Monotonicity == "DD" & PI %in% c("O", "N"))
##
##      AIC      BIC   logLik deviance df.resid
## 35254.1 35322.3 -17616.0 35232.1     3644
##
## Scaled residuals:
##   Min       1Q   Median       3Q      Max
## -3.6995 -0.6652  0.0288  0.7363  3.1884
##
## Random effects:
##   Groups   Name                Variance Std.Dev. Corr
##   subject (Intercept) 409.7      20.24
##           PIO          141.0     11.87  -0.43
##           IncreasingU 560.1     23.67  -0.76  0.18
## Residual                761.5     27.60
## Number of obs: 3655, groups: subject, 163
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)   37.444      1.986  18.849
## PIO             3.896      1.424   2.736
## QuantifierNw  31.451      1.082  29.072
## IncreasingU   -2.245      2.111  -1.063
##
## Correlation of Fixed Effects:
##              (Intr) PIO    QntfrN
## PIO          -0.507
## QuantifierNw -0.309  0.025
## IncreasingU  -0.664  0.118  0.010
```

Comparison with a reduced model without the Polarity Item as fixed effect revealed a significant effect of the presence of the negative polarity item on inferences in double negative environments, suggesting that the results might have been missed/ambiguous in the two experiments for power-related reasons.

```
mac2 <- lmer(Irep ~ Quantifier + Increasing + (1 + PI + Increasing | subject), REML = F,
  subset(AnDataSet, Monotonicity == "DD" & PI %in% c("O", "N")))
anova(mac1, mac2)
```

```
## Data: subset(AnDataSet, Monotonicity == "DD" & PI %in% c("O", "N"))
## Models:
## mac2: Irep ~ Quantifier + Increasing + (1 + PI + Increasing | subject)
## mac1: Irep ~ PI + Quantifier + Increasing + (1 + PI + Increasing |
## mac1:   subject)
##      Df   AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
```

```
## mac2 10 35259 35321 -17620 35239
## mac1 11 35254 35322 -17616 35232 7.1812 1 0.007367 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

PPI vs. no PI in NM environments

Experiment 1

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Inference direction (Increasing vs. Decreasing), as well as by-item intercepts.

```
g1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + Increasing |
  subject), REML = F, subset(AnDataSet, EXP == "NM" & Monotonicity == "NM" & PI %in%
  c("0", "P")))
summary(g1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula:
## Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + Increasing |
##   subject)
##   Data: subset(AnDataSet, EXP == "NM" & Monotonicity == "NM" & PI %in%
##   c("0", "P"))
##
##      AIC      BIC   logLik deviance df.resid
## 17301.2 17351.0 -8641.6 17283.2    1868
##
## Scaled residuals:
##   Min      1Q  Median      3Q      Max
## -3.7885 -0.4603  0.0367  0.4606  3.5131
##
## Random effects:
##   Groups   Name                Variance Std.Dev. Corr
##   subject  (Intercept)          228.181 15.11
##           IncreasingU        1221.549 34.95  -0.83
##   Content  (Intercept)           1.392  1.18
##   Residual                    497.257 22.30
## Number of obs: 1877, groups:  subject, 66; Content, 12
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    76.561     2.149  35.630
## PIP              0.226     1.035   0.218
## Quantifier0n   -6.461     1.032  -6.258
## IncreasingU    -26.908     4.427  -6.078
##
## Correlation of Fixed Effects:
##              (Intr) PIP    Qntfr0
## PIP          -0.233
## Quantifir0n -0.234 -0.001
## IncreasingU  -0.756 -0.004 -0.003
```

Comparison with a reduced model without the Polarity Item as fixed effect revealed no significant effect of the presence of the positive polarity item on inferences in non-monotonic environments.

```
g2 <- lmer(Irep ~ Quantifier + Increasing + (1 | Content) + (1 + Increasing | subject),
  REML = F, subset(AnDataSet, EXP == "NM" & Monotonicity == "NM" & PI %in% c("O",
    "P")))
anova(g1, g2)
```

```
## Data: subset(AnDataSet, EXP == "NM" & Monotonicity == "NM" & PI %in% ...
## Models:
## g2: Irep ~ Quantifier + Increasing + (1 | Content) + (1 + Increasing |
## g2:   subject)
## g1: Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + Increasing |
## g1:   subject)
##   Df   AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## g2  8 17299 17344 -8641.6   17283
## g1  9 17301 17351 -8641.6   17283 0.0477     1     0.8272
```

Experiment 2

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Inference direction (Increasing vs. Decreasing).

```
h1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "NMCons" & Monotonicity == "NM" & PI %in% c("O", "P")))
summary(h1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
## Data:
## subset(AnDataSet, EXP == "NMCons" & Monotonicity == "NM" & PI %in%
## c("O", "P"))
##
##      AIC      BIC   logLik deviance df.resid
## 15992.4 16036.1 -7988.2 15976.4     1725
##
## Scaled residuals:
##   Min       1Q   Median       3Q      Max
## -3.5200 -0.4618  0.0367  0.4239  3.7657
##
## Random effects:
## Groups Name Variance Std.Dev. Corr
## subject (Intercept) 410.6 20.26
##           IncreasingU 1603.9 40.05 -0.80
## Residual          485.5 22.04
## Number of obs: 1733, groups: subject, 64
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    70.199    2.753 25.500
## PIP              1.258    1.063  1.183
## Quantifier0n   -5.775    1.065 -5.420
## IncreasingU   -15.479    5.145 -3.009
##
## Correlation of Fixed Effects:
##              (Intr) PIP    Qntfr0
## PIP          -0.190
```

```
## QuantifierOn -0.186 -0.008
## IncreasingU -0.759 0.000 0.001
```

Comparison with a reduced model without the Polarity Item as fixed effect revealed no significant effect of the presence of the positive polarity item on inferences in non-monotonic environments.

```
h2 <- lmer(Irep ~ Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "NMCons" & Monotonicity == "NM" & PI %in% c("O", "P")))
anova(h1, h2)
```

```
## Data: subset(AnDataSet, EXP == "NMCons" & Monotonicity == "NM" & PI %in% ...
## Models:
## h2: Irep ~ Quantifier + Increasing + (1 + Increasing | subject)
## h1: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
##   Df   AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## h2  7 15992 16030 -7988.9   15978
## h1  8 15992 16036 -7988.2   15976 1.3991     1    0.2369
```

Experiment 3

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Inference direction (Increasing vs. Decreasing).

```
i1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "DD" & Monotonicity == "NM" & PI %in% c("O", "P")))
summary(i1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
##   Data: subset(AnDataSet, EXP == "DD" & Monotonicity == "NM" & PI %in%
##     c("O", "P"))
##
##           AIC          BIC    logLik deviance df.resid
## 22337.6 22384.0 -11160.8 22321.6     2429
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -4.0235 -0.3968  0.0214  0.4544  4.2817
##
## Random effects:
##   Groups   Name                Variance Std.Dev. Corr
## subject (Intercept)  320.2    17.89
##           IncreasingU 1559.0    39.48  -0.84
## Residual                462.2    21.50
## Number of obs: 2437, groups: subject, 91
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)  76.4479    2.0728  36.881
## PIP           1.2071    0.8765   1.377
## QuantifierOn -5.9971    0.8754  -6.851
## IncreasingU  -32.7924    4.2367  -7.740
##
## Correlation of Fixed Effects:
##              (Intr) PIP    Qntfr0
```

```
## PIP          -0.206
## QuantifierOn -0.209 -0.013
## IncreasingU  -0.792 -0.001  0.002
```

Comparison with a reduced model without the Polarity Item as fixed effect revealed no significant effect of the presence of the positive polarity item on inferences in non-monotonic environments.

```
i2 <- lmer(Irep ~ Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "DD" & Monotonicity == "NM" & PI %in% c("O", "P")))
anova(i1, i2)
```

```
## Data: subset(AnDataSet, EXP == "DD" & Monotonicity == "NM" & PI %in% ...
## Models:
## i2: Irep ~ Quantifier + Increasing + (1 + Increasing | subject)
## i1: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
##   Df   AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## i2  7 22338 22378 -11162   22324
## i1  8 22338 22384 -11161   22322 1.8955    1   0.1686
```

Experiment 4

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Inference direction (Increasing vs. Decreasing).

```
j1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "NM" & PI %in% c("O", "P")))
summary(j1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
## Data:
## subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "NM" & PI %in%
##   c("O", "P"))
##
##           AIC          BIC    logLik deviance df.resid
## 15370.9 15414.3 -7677.4 15354.9    1683
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -4.2200 -0.4552  0.0272  0.4554  4.1422
##
## Random effects:
## Groups   Name                Variance Std.Dev. Corr
## subject (Intercept)    306.4    17.50
##           IncreasingU 1574.1    39.67  -0.83
## Residual                419.9    20.49
## Number of obs: 1691, groups: subject, 71
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    75.546     2.317  32.611
## PIP            -1.952     1.199  -1.628
## QuantifierOn  -5.806     1.174  -4.944
## IncreasingU   -27.180     4.864  -5.588
##
```

```
## Correlation of Fixed Effects:
##           (Intr) PIP      Qntfr0
## PIP          -0.121
## Quantifier0n -0.231 -0.096
## IncreasingU  -0.778  0.004 -0.003
```

Comparison with a reduced model without the Polarity Item as fixed effect revealed no significant effect of the presence of the positive polarity item on inferences in non-monotonic environments.

```
j2 <- lmer(Irep ~ Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "NM" & PI %in% c("0", "P")))
anova(j1, j2)
```

```
## Data: subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "NM" & PI %in% ...
## Models:
## j2: Irep ~ Quantifier + Increasing + (1 + Increasing | subject)
## j1: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
##   Df   AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## j2  7 15372 15410 -7678.8   15358
## j1  8 15371 15414 -7677.4   15355 2.6448     1    0.1039
```

Meta-analysis

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Inference direction (Increasing vs. Decreasing).

```
mab1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, Monotonicity == "NM" & PI %in% c("0", "P")))
summary(mab1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
##   Data: subset(AnDataSet, Monotonicity == "NM" & PI %in% c("0", "P"))
##
##           AIC          BIC    logLik deviance df.resid
## 70989.1 71044.8 -35486.6 70973.1     7730
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -4.0743 -0.4373  0.0323  0.4451  4.2332
##
## Random effects:
##  Groups   Name                Variance Std.Dev. Corr
## subject (Intercept)    321.1    17.92
##           IncreasingU 1532.7    39.15  -0.83
## Residual                467.4    21.62
## Number of obs: 7738, groups: subject, 292
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)   74.9570     1.1604  64.595
## PIP             0.4457     0.5096   0.875
## Quantifier0n  -6.0748     0.5088 -11.939
## IncreasingU   -26.3146     2.3541 -11.178
##
```

```
## Correlation of Fixed Effects:
##           (Intr) PIP      Qntfr0
## PIP      -0.189
## Quantifir0n -0.211 -0.023
## IncreasingU -0.777  0.000 -0.001
```

Comparison with a reduced model without the Polarity Item as fixed effect revealed no significant effect of the presence of the positive polarity item on inferences in non-monotonic environments.

```
mab2 <- lmer(Irep ~ Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, Monotonicity == "NM" & PI %in% c("O", "P")))
anova(mab1, mab2)
```

```
## Data: subset(AnDataSet, Monotonicity == "NM" & PI %in% c("O", "P"))
## Models:
## mab2: Irep ~ Quantifier + Increasing + (1 + Increasing | subject)
## mab1: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
##      Df   AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## mab2  7 70988 71037 -35487   70974
## mab1  8 70989 71045 -35487   70973 0.7649     1    0.3818
```

PPI vs. no PI in DN environments

Experiment 3

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Quantifier (Every-not vs. No-without) and Inference direction (Increasing vs. Decreasing).

```
k1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 + Quantifier + Increasing | subject),
  REML = F, subset(AnDataSet, EXP == "DD" & Monotonicity == "DD" & PI %in% c("O",
  "P")))
summary(k1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula:
## Irep ~ PI + Quantifier + Increasing + (1 + Quantifier + Increasing |
##   subject)
## Data: subset(AnDataSet, EXP == "DD" & Monotonicity == "DD" & PI %in%
##   c("O", "P"))
##
##      AIC      BIC  logLik deviance df.resid
## 20524.6 20586.9 -10251.3 20502.6     2119
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -3.3019 -0.6178  0.0161  0.6525  2.8024
##
## Random effects:
## Groups   Name                Variance Std.Dev. Corr
## subject (Intercept)    304.6     17.45
##           QuantifierNw  355.6     18.86  -0.33
##           IncreasingU   582.1     24.13  -0.76 -0.09
## Residual                740.3     27.21
## Number of obs: 2130, groups: subject, 91
##
```

```
## Fixed effects:
##           Estimate Std. Error t value
## (Intercept)  41.142    2.233  18.424
## PIP          4.095    1.191   3.440
## QuantifierNw 32.061    2.344  13.680
## IncreasingU  -5.002    2.818  -1.775
##
## Correlation of Fixed Effects:
##           (Intr) PIP    QntfrN
## PIP       -0.257
## QuantifirNw -0.402 -0.003
## IncreasingU -0.688  0.000 -0.062
```

Comparison with a reduced model without the Polarity Item as fixed effect revealed a significant effect of the presence of the positive polarity item on inferences in double negative environments.

```
k2 <- lmer(Irep ~ Quantifier + Increasing + (1 + Quantifier + Increasing | subject),
  REML = F, subset(AnDataSet, EXP == "DD" & Monotonicity == "DD" & PI %in% c("O",
    "P")))
anova(k1, k2)
```

```
## Data: subset(AnDataSet, EXP == "DD" & Monotonicity == "DD" & PI %in% ...
## Models:
## k2: Irep ~ Quantifier + Increasing + (1 + Quantifier + Increasing |
## k2:   subject)
## k1: Irep ~ PI + Quantifier + Increasing + (1 + Quantifier + Increasing |
## k1:   subject)
##   Df  AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## k2 10 20534 20591 -10257   20514
## k1 11 20525 20587 -10251   20503 11.793     1 0.0005944 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Experiment 4

Convergence was achieved for two models with comparable random effects structure, which however lead to contradicting results, allowing no inference about the effect of PPI in double negative environments in Experiment 4.

The first one consisted of random subject intercepts and slopes for Inference direction (Increasing vs. Decreasing).

```
l1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in% c("O", "P")))
summary(l1)
```

```
## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
## Data:
## subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in%
## c("O", "P"))
##
##           AIC           BIC   logLik deviance df.resid
## 14584.2 14626.8 -7284.1 14568.2     1514
##
## Scaled residuals:
```

```

##      Min      1Q  Median      3Q      Max
## -3.3906 -0.6413  0.1477  0.6632  3.2777
##
## Random effects:
##   Groups   Name      Variance Std.Dev.  Corr
##  subject (Intercept) 296.4    17.22
##           IncreasingU 604.9    24.59   -0.70
## Residual              724.3    26.91
## Number of obs: 1522, groups:  subject, 70
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)   44.9395    2.5088  17.912
## PIP            7.9654    1.6722   4.764
## QuantifierNw  25.8820    1.6261  15.916
## IncreasingU   -0.9944    3.3286  -0.299
##
## Correlation of Fixed Effects:
##              (Intr) PIP   QntfrN
## PIP          -0.179
## QuantifirNw -0.327  0.020
## IncreasingU  -0.656 -0.004  0.009

```

```

12 <- lmer(Irep ~ Quantifier + Increasing + (1 + Increasing | subject), REML = F,
  subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in% c("O", "P")))
anova(l1, 12)

```

```

## Data: subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in% ...
## Models:
## 12: Irep ~ Quantifier + Increasing + (1 + Increasing | subject)
## 11: Irep ~ PI + Quantifier + Increasing + (1 + Increasing | subject)
##   Df  AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## 12  7 14604 14642 -7295.3   14590
## 11  8 14584 14627 -7284.1   14568 22.351    1 2.271e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

The second one consisted of random subject intercepts and slopes for Polarity Item (PPI vs. no PI).

```

l1_2 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 + PI | subject), REML = F,
  subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in% c("O", "P")))
summary(l1_2)

```

```

## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 + PI | subject)
## Data:
## subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in%
##   c("O", "P"))
##
##      AIC      BIC  logLik deviance df.resid
## 14640.6 14683.2 -7312.3 14624.6    1514
##
## Scaled residuals:
##      Min      1Q  Median      3Q      Max
## -3.1695 -0.6305  0.1424  0.6621  2.8090
##

```

```

## Random effects:
## Groups   Name          Variance Std.Dev. Corr
## subject (Intercept) 247.2    15.72
##          PIP          476.0    21.82  -0.88
## Residual          788.9    28.09
## Number of obs: 1522, groups: subject, 70
##
## Fixed effects:
##          Estimate Std. Error t value
## (Intercept)  45.416    2.745  16.547
## PIP           4.949    3.338   1.483
## QuantifierNw 25.113    3.331   7.539
## IncreasingU  -2.164    1.450  -1.493
##
## Correlation of Fixed Effects:
##          (Intr) PIP    QntfrN
## PIP          -0.560
## QuantifierNw -0.586 -0.019
## IncreasingU  -0.264 -0.006  0.007

l2_2 <- lmer(Irep ~ Quantifier + Increasing + (1 + PI | subject), REML = F, subset(AnDataSet,
  EXP == "DDSplit" & Monotonicity == "DD" & PI %in% c("O", "P")))
anova(l1_2, l2_2)

## Data: subset(AnDataSet, EXP == "DDSplit" & Monotonicity == "DD" & PI %in% ...
## Models:
## l2_2: Irep ~ Quantifier + Increasing + (1 + PI | subject)
## l1_2: Irep ~ PI + Quantifier + Increasing + (1 + PI | subject)
##      Df  AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## l2_2  7 14641 14678 -7313.3  14627
## l1_2  8 14641 14683 -7312.3  14625 2.0556    1    0.1517

```

Meta-analysis

The maximal random effects structure for which convergence was achieved consisted of random subject intercepts and slopes for Polarity Item (PPI vs. no PI) and Inference direction (Increasing vs. Decreasing), as well as random item intercepts.

```

mad1 <- lmer(Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + PI + Increasing |
  subject), REML = F, subset(AnDataSet, Monotonicity == "DD" & PI %in% c("O", "P")))
summary(mad1)

## Linear mixed model fit by maximum likelihood ['lmerMod']
## Formula: Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + PI +
##   Increasing | subject)
## Data: subset(AnDataSet, Monotonicity == "DD" & PI %in% c("O", "P"))
##
##      AIC      BIC  logLik deviance df.resid
## 35183.7 35258.1 -17579.8 35159.7    3640
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -3.5020 -0.6356  0.1069  0.6942  2.8618
##
## Random effects:

```

```

## Groups   Name          Variance Std.Dev. Corr
## subject (Intercept) 347.342  18.637
##          PIP          134.079  11.579  -0.54
##          IncreasingU 583.458  24.155  -0.73  0.12
## Content (Intercept)   1.968   1.403
## Residual              758.116  27.534
## Number of obs: 3652, groups:  subject, 161; Content, 12
##
## Fixed effects:
##           Estimate Std. Error t value
## (Intercept)   42.374     1.817  23.315
## PIP            4.659     1.381   3.373
## QuantifierNw  30.494     1.084  28.139
## IncreasingU   -3.290     2.145  -1.534
##
## Correlation of Fixed Effects:
##           (Intr) PIP    QntfrN
## PIP          -0.443
## QuantifierNw -0.319 -0.007
## IncreasingU  -0.650  0.073  0.008

```

Comparison with a reduced model without the Polarity Item as fixed effect revealed a significant effect of the presence of the positive polarity item on inferences in double negative environments, suggesting that the result was ambiguous in Experiment 4 for power reasons.

```

mad2 <- lmer(Irep ~ Quantifier + Increasing + (1 | Content) + (1 + PI + Increasing |
  subject), REML = F, subset(AnDataSet, Monotonicity == "DD" & PI %in% c("O", "P")))
anova(mad1, mad2)

```

```

## Data: subset(AnDataSet, Monotonicity == "DD" & PI %in% c("O", "P"))
## Models:
## mad2: Irep ~ Quantifier + Increasing + (1 | Content) + (1 + PI + Increasing |
## mad2:   subject)
## mad1: Irep ~ PI + Quantifier + Increasing + (1 | Content) + (1 + PI +
## mad1:   Increasing | subject)
##           Df   AIC   BIC logLik deviance Chisq Chi Df Pr(>Chisq)
## mad2  11 35192 35261 -17585   35170
## mad1  12 35184 35258 -17580   35160 10.683     1 0.001081 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```