F02_mci_emotion_pre_ratings.R

2021-02-24

```
## MCI EMO PRE-RATINGS SCRIPT ##

# Pre-ratings of cloze probability, plausibility, metaphoricity, and imageability of the context stories were conducted
# on five-point rating scales. Script computes analyses of variances testing for potential differences in these ratings
# between semantic conditions. Additionally, pairwise t-tests test differences between each pair of semantic conditions
# (violation - intuitive, MCI - intuitive, MCI - violation). The Bonferroni-Holm-correction was applied to control for
# multiple comparisons.

## SETUP ## ------------------------------------------------------------------------------------------------------------

# Load packages
library(tidyverse)    # Version 1.3.0
library(magrittr)     # Version 1.5
library(emmeans)      # Version 1.4.8
library(huxtable)     # Version 5.0.0

# Load pre-rating data from SPSS file
pilot <- haven::read_sav("FB/gesamt_2.sav")

# Trim whitespace
pilot %<>% mutate(KonzeptNr = KonzeptNr %>% trimws() %>% as.numeric(),
                  VerbBedingung = VerbBedingung %>% trimws())

# Rename conditions
pilot %<>% mutate(semantics = factor(VerbBedingung, levels = c("neutral", "sem", "mci"),
                                     labels = c("int", "vio", "mci")))

# Summarize by participants
avgs <- pilot %>%
  group_by(VP, semantics) %>%
```

```
  summarise(clozeprob = mean(Frage1),
            plausibility = mean(Frage2),
            metaphoricity = mean(Frage3),
            imageability = mean(Frage4)) %>%
  mutate(VP = factor(VP))
```

```
## `summarise()` regrouping output by 'VP' (override with `.groups` argument)
```

```
## ANOVAs ## ------------------------------------------------------------------------------------------------------------

# Semantics is a within subjects factor; data are fully balanced

# Cloze probability
summary(anova_cloze <- aov(clozeprob ~ semantics + Error(VP/semantics), data = avgs))
```

```
##
## Error: VP
##           Df Sum Sq Mean Sq F value Pr(>F)
## Residuals 19  7.689  0.4047
##
## Error: VP:semantics
##           Df Sum Sq Mean Sq F value   Pr(>F)
## semantics  2  16.74   8.369   17.66 3.78e-06 ***
## Residuals 38  18.01   0.474
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
mean(anova_cloze$`VP:semantics`$residuals^2) # Mean squared error of the effect
```

```
## [1] 0.450286
```

```
# Plausibility
summary(anova_plausibility <- aov(plausibility ~ semantics + Error(VP/semantics), data = avgs))
```

```
##
## Error: VP
##           Df Sum Sq Mean Sq F value Pr(>F)
## Residuals 19  5.338   0.281
##
## Error: VP:semantics
##           Df Sum Sq Mean Sq F value   Pr(>F)
```

```
## semantics  2  13.55   6.777   10.74 0.000201 ***
## Residuals 38  23.98   0.631
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
mean(anova_plausibility$`VP:semantics`$residuals^2) # Mean squared error of the effect
```

```
## [1] 0.5994464
```

```
# Imageability
summary(anova_imageability <- aov(imageability ~ semantics + Error(VP/semantics), data = avgs))
```

```
##
## Error: VP
##           Df Sum Sq Mean Sq F value Pr(>F)
## Residuals 19  6.643  0.3497
##
## Error: VP:semantics
##           Df Sum Sq Mean Sq F value   Pr(>F)
## semantics  2  12.43   6.215   14.61 1.96e-05 ***
## Residuals 38  16.16   0.425
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
mean(anova_imageability$`VP:semantics`$residuals^2) # Mean squared error of the effect
```

```
## [1] 0.4041053
```

```
# Metaphoricity
summary(anova_metaphoricity <- aov(metaphoricity ~ semantics + Error(VP/semantics), data = avgs))
```

```
##
## Error: VP
##           Df Sum Sq Mean Sq F value Pr(>F)
## Residuals 19  62.24   3.276
##
## Error: VP:semantics
##           Df Sum Sq Mean Sq F value   Pr(>F)
## semantics  2  5.142  2.5712   8.988 0.000636 ***
## Residuals 38 10.870  0.2861
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
mean(anova_metaphoricity$`VP:semantics`$residuals^2) # Mean squared error of the effect
```

```
## [1] 0.2717558
```

```r
## PAIRWISE TESTS ## ------------------------------------------------------------------------------------------

# Cloze probability
(pairwise_clozeprob <- anova_cloze %>% emmeans(specs = pairwise ~ semantics) %>% summary(adjust = "holm"))
```

```
## Note: re-fitting model with sum-to-zero contrasts
```

```
## $emmeans
##  semantics emmean   SE   df lower.CL upper.CL
##  int         3.47 0.15 56.7     3.10     3.84
##  vio         2.65 0.15 56.7     2.28     3.02
##  mci         2.19 0.15 56.7     1.82     2.56
##
## Warning: EMMs are biased unless design is perfectly balanced
## Confidence level used: 0.95
## Conf-level adjustment: bonferroni method for 3 estimates
##
## $contrasts
##  contrast  estimate    SE df t.ratio p.value
##  int - vio    0.814 0.218 38 3.739   0.0012
##  int - mci    1.278 0.218 38 5.870   <.0001
##  vio - mci    0.464 0.218 38 2.131   0.0396
##
## P value adjustment: holm method for 3 tests
```

```r
# Plausibility
(pairwise_plausibility <- anova_plausibility %>% emmeans(specs = pairwise ~ semantics) %>% summary(adjust = "holm"))
```

```
## Note: re-fitting model with sum-to-zero contrasts
```

```
## $emmeans
##  semantics emmean   SE   df lower.CL upper.CL
##  int         2.84 0.16 51.7     2.44     3.24
##  vio         2.13 0.16 51.7     1.73     2.53
##  mci         1.69 0.16 51.7     1.29     2.08
##
## Warning: EMMs are biased unless design is perfectly balanced
```

```
## Confidence level used: 0.95
## Conf-level adjustment: bonferroni method for 3 estimates
##
## $contrasts
##  contrast  estimate    SE df t.ratio p.value
##  int - vio    0.710 0.251 38 2.826   0.0150
##  int - mci    1.154 0.251 38 4.594   0.0001
##  vio - mci    0.444 0.251 38 1.769   0.0850
##
## P value adjustment: holm method for 3 tests
```

```
# Imageability
(pairwise_imageability <- anova_imageability %>% emmeans(specs = pairwise ~ semantics) %>% summary(adjust = "holm"))
```

```
## Note: re-fitting model with sum-to-zero contrasts
```

```
## $emmeans
##  semantics emmean    SE   df lower.CL upper.CL
##  int         3.65 0.141 56.5     3.30     4.00
##  vio         2.99 0.141 56.5     2.64     3.34
##  mci         2.54 0.141 56.5     2.19     2.89
##
## Warning: EMMs are biased unless design is perfectly balanced
## Confidence level used: 0.95
## Conf-level adjustment: bonferroni method for 3 estimates
##
## $contrasts
##  contrast  estimate    SE df t.ratio p.value
##  int - vio    0.660 0.206 38 3.199   0.0056
##  int - mci    1.108 0.206 38 5.373   <.0001
##  vio - mci    0.448 0.206 38 2.174   0.0360
##
## P value adjustment: holm method for 3 tests
```

```
# Metaphoricity
(pairwise_metaphoricity <- anova_metaphoricity %>% emmeans(specs = pairwise ~ semantics) %>% summary(adjust = "holm"))
```

```
## Note: re-fitting model with sum-to-zero contrasts
```

```
## $emmeans
##  semantics emmean    SE   df lower.CL upper.CL
```

```
##  int         2.30 0.253 25.8     1.65     2.95
##  vio         2.49 0.253 25.8     1.84     3.13
##  mci         2.99 0.253 25.8     2.34     3.64
##
## Warning: EMMs are biased unless design is perfectly balanced
## Confidence level used: 0.95
## Conf-level adjustment: bonferroni method for 3 estimates
##
## $contrasts
##  contrast  estimate    SE df t.ratio p.value
##  int - vio   -0.189 0.169 38 -1.115  0.2720
##  int - mci   -0.693 0.169 38 -4.100  0.0006
##  vio - mci   -0.505 0.169 38 -2.985  0.0099
##
## P value adjustment: holm method for 3 tests
```

```r
## TABLES ## ------------------------------------------------------------------------------------------------------------

# Create a table summarizing the rating data in the paper
map2(
  c("Frage1", "Frage2", "Frage3", "Frage4"),
  c("Cloze probability", "Plausibility", "Metaphoricity", "Imageability"),
  function(old_name, new_name){
    pilot %>%
      # Give proper names to our semantic conditions
      mutate(semantics = fct_recode(semantics, Intuitive = "int", Violation = "vio", MCI = "mci")) %>%
      # Summarize the data (see http://www.cookbook-r.com/Graphs/Plotting_means_and_error_bars_(ggplot2)/)
      Rmisc::summarySEwithin(measurevar = old_name, withinvars = "semantics") %>%
      rename(m = all_of(old_name)) %>%
      # Re-format the confidence interval
      mutate(lower = m - ci, upper = m + ci) %>%
      select(semantics, m, sd, lower, upper) %>%
      mutate(across(-semantics, .fns = ~format(round(.x, 2), nsmall = 2, trim = TRUE))) %>%
      mutate(ci = paste0("[", lower, ", ", upper, "]"), .keep = "unused") %>%
      # Re-shape so that semantic conditions are columns and different stats are rows
      pivot_longer(-semantics, names_to = " ") %>%
      spread(semantics, value) %>%
      # Give proper names to the different stats and order them
      mutate(` ` = factor(` `, levels = c("m", "sd", "ci"), labels = c("M", "SD", "95% CI"))) %>%
```

```
      arrange(` `) %>%
      # Add a header row for the name of the dependent (rating) variable
      bind_rows(c(` ` = new_name, Intuitive = "", Violation = "", MCI = ""), .)
  }) %>%
  # Bind all ratings together
  bind_rows() %>%
  # Convert to huxtable and style
  huxtable() %>%
  set_bold(row = c(1, seq(2, 17, by = 4)), value = TRUE) %>%
  set_italic(row = c(seq(3, 17, by = 4), seq(4, 17, by = 4)), col = 1, value = TRUE) %T>%
  # Export to a Word file
  quick_docx(file = "EEG/tables/table_pilot.docx")
```

```
# System specs and package versions
sessionInfo()
```

```
## R version 4.0.2 (2020-06-22)
## Platform: x86_64-apple-darwin17.0 (64-bit)
## Running under: macOS  10.16
##
## Matrix products: default
## LAPACK: /Library/Frameworks/R.framework/Versions/4.0/Resources/lib/libRlapack.dylib
##
## locale:
## [1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
##
## attached base packages:
## [1] stats     graphics  grDevices datasets  utils     methods   base
##
## other attached packages:
##  [1] huxtable_5.0.0  emmeans_1.4.8   magrittr_1.5    forcats_0.5.0   stringr_1.4.0   dplyr_1.0.0     purrr_0.3.4     readr_1.3.1     ti
##
## loaded via a namespace (and not attached):
##  [1] Rcpp_1.0.5        lubridate_1.7.9   mvtnorm_1.1-1     lattice_0.20-41   assertthat_0.2.1  digest_0.6.25     R6_2.4.1          cell
## [13] httr_1.4.2        highr_0.8         pillar_1.4.6      gdtools_0.2.2     rlang_0.4.7       Rmisc_1.5         readxl_1.3.1      uuid
## [25] rmarkdown_2.3     munsell_0.5.0     broom_0.7.0.9001  compiler_4.0.2    modelr_0.1.8      xfun_0.16         systemfonts_0.3.1 base
## [37] crayon_1.3.4      dbplyr_1.4.4      withr_2.2.0       commonmark_1.7    grid_4.0.2        jsonlite_1.7.0    xtable_1.8-4      gtab
## [49] estimability_1.3  cli_2.0.2         stringi_1.4.6     renv_0.12.0       fs_1.4.2          xml2_1.3.2        ellipsis_0.3.1    gene
## [61] hms_0.5.3         yaml_2.2.1        colorspace_1.4-1  rvest_0.3.5       cpp11_0.2.1       knitr_1.29        haven_2.3.1
```

	Intuitive	Violation	MCI
Cloze probability			
M	3.47	2.65	2.19
SD	1.74	1.73	1.72
95% CI	[3.37, 3.56]	[2.56, 2.75]	[2.09, 2.28]
Plausibility			
M	2.84	2.13	1.69
SD	1.66	1.65	1.90
95% CI	[2.75, 2.93]	[2.04, 2.22]	[1.58, 1.79]
Metaphoricity			
M	2.30	2.49	2.99
SD	1.82	1.85	1.93
95% CI	[2.19, 2.40]	[2.38, 2.59]	[2.88, 3.10]
Imageability			
M	3.65	2.99	2.54
SD	1.76	1.77	1.78
95% CI	[3.55, 3.75]	[2.89, 3.09]	[2.44, 2.64]