Unified Uncanny Valley Data

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library(tidyverse)

Warning: package 'tidyverse' was built under R version 4.2.2

Warning: package 'ggplot2' was built under R version 4.2.2

Warning: package 'tidyr' was built under R version 4.2.2

Warning: package 'readr' was built under R version 4.2.2

Warning: package 'purrr' was built under R version 4.2.2

Warning: package 'dplyr' was built under R version 4.2.2

Warning: package 'stringr' was built under R version 4.2.2

Warning: package 'forcats' was built under R version 4.2.2

Warning: package 'lubridate' was built under R version 4.2.2

── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──  
✔ dplyr 1.1.0 ✔ readr 2.1.4  
✔ forcats 1.0.0 ✔ stringr 1.5.0  
✔ ggplot2 3.4.1 ✔ tibble 3.1.8  
✔ lubridate 1.9.2 ✔ tidyr 1.3.0  
✔ purrr 1.0.1   
── Conflicts ────────────────────────────────────────── tidyverse\_conflicts() ──  
✖ dplyr::filter() masks stats::filter()  
✖ dplyr::lag() masks stats::lag()  
ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors

library(readxl)

Warning: package 'readxl' was built under R version 4.2.2

library(readr)  
library(haven)

Warning: package 'haven' was built under R version 4.2.3

library(assertthat)

Attaching package: 'assertthat'  
  
The following object is masked from 'package:tibble':  
  
 has\_name

# Data preparation

## Data standardization

This is a template data frame containing *an almost complete superset* of features of Uncanny Valley experiments conducted between 2016 and 2021.

* long format, one observation per row
* If a feature was not measured, and cannot be derived, it is set to NA.

UVA\_0 <- tibble(  
 Exp = factor(),  
 Part = factor(),  
 trial = numeric(),  
 repetition = numeric(),  
 Face = factor(),  
 FaceOrigin = factor(),  
 Set = factor(),  
 Exposure = factor(),  
 Stim = factor(), ## different stim from same face  
 hum\_like = numeric(),  
 morph = numeric(),  
 ancestoral = numeric(),  
 rotation = numeric(),  
 hum\_skull = logical(),  
 hum\_eyes = logical(),  
 Scale = factor(),  
 Item = factor(),  
 rating = numeric(),  
 rt = numeric())  
  
UV\_cols <- colnames(UVA\_0)  
  
summary(UVA\_0)

Exp Part trial repetition Face FaceOrigin Set   
 NULL: NULL: Min. : NA Min. : NA NULL: NULL: NULL:   
 1st Qu.: NA 1st Qu.: NA   
 Median : NA Median : NA   
 Mean :NaN Mean :NaN   
 3rd Qu.: NA 3rd Qu.: NA   
 Max. : NA Max. : NA   
 Exposure Stim hum\_like morph ancestoral rotation   
 NULL: NULL: Min. : NA Min. : NA Min. : NA Min. : NA   
 1st Qu.: NA 1st Qu.: NA 1st Qu.: NA 1st Qu.: NA   
 Median : NA Median : NA Median : NA Median : NA   
 Mean :NaN Mean :NaN Mean :NaN Mean :NaN   
 3rd Qu.: NA 3rd Qu.: NA 3rd Qu.: NA 3rd Qu.: NA   
 Max. : NA Max. : NA Max. : NA Max. : NA   
 hum\_skull hum\_eyes Scale Item rating rt   
 Mode:logical Mode:logical NULL: NULL: Min. : NA Min. : NA   
 1st Qu.: NA 1st Qu.: NA   
 Median : NA Median : NA   
 Mean :NaN Mean :NaN   
 3rd Qu.: NA 3rd Qu.: NA   
 Max. : NA Max. : NA

## Processing Data Sets

### Moll 2015

load("Data Sets/Moll/Data/BM.Rda")  
  
BM <- BM1 |>   
 mutate(Exp = "BM",  
 Part = Participant,  
 Stim = Stimulus,  
 Set = "BM",  
 FaceOrigin = "tech",  
 trial = Trial,  
 repetition = 1,  
 morph = morphLevelNum,  
 hum\_like = NA\_real\_,  
 hum\_skull = NA,  
 hum\_eyes = NA,  
 ancestoral = NA\_real\_,  
 rotation = 0,  
 Exposure = Condition,  
 rating = (Response - 1) /7,  
 rt = RT  
 ) |>   
 select(any\_of(UV\_cols)) |>   
 select(all\_of(UV\_cols))  
  
summary(BM)

Exp Part trial repetition  
 Length:16960 9 : 320 Min. : 1.00 Min. :1   
 Class :character 10 : 320 1st Qu.: 80.75 1st Qu.:1   
 Mode :character 11 : 320 Median :160.50 Median :1   
 12 : 320 Mean :160.50 Mean :1   
 13 : 320 3rd Qu.:240.25 3rd Qu.:1   
 15 : 320 Max. :320.00 Max. :1   
 (Other):15040   
 Face FaceOrigin Set Exposure   
 1 : 848 Length:16960 Length:16960 17ms :4240   
 10 : 848 Class :character Class :character 50ms :4240   
 11 : 848 Mode :character Mode :character 500ms :4240   
 12 : 848 unlimited:4240   
 13 : 848   
 14 : 848   
 (Other):11872   
 Stim hum\_like morph ancestoral rotation  
 Length:16960 Min. : NA Min. :1.00 Min. : NA Min. :0   
 Class :character 1st Qu.: NA 1st Qu.:1.75 1st Qu.: NA 1st Qu.:0   
 Mode :character Median : NA Median :2.50 Median : NA Median :0   
 Mean :NaN Mean :2.50 Mean :NaN Mean :0   
 3rd Qu.: NA 3rd Qu.:3.25 3rd Qu.: NA 3rd Qu.:0   
 Max. : NA Max. :4.00 Max. : NA Max. :0   
 NA's :16960 NA's :16960   
 hum\_skull hum\_eyes Scale Item rating   
 Mode:logical Mode:logical : 0 E1 :2120 Min. :0.0000   
 NA's:16960 NA's:16960 Eeriness:16960 E2 :2120 1st Qu.:0.2529   
 E3 :2120 Median :0.4314   
 E4 :2120 Mean :0.4342   
 E5 :2120 3rd Qu.:0.6057   
 E6 :2120 Max. :0.8571   
 (Other):4240   
 rt   
 Min. : 0.403   
 1st Qu.: 1.388   
 Median : 2.026   
 Mean : 2.506   
 3rd Qu.: 3.057   
 Max. :31.482

### Haeske 2015

load("Data Sets/Haeske/Data/AH.Rda")

Warning: namespace 'MCMCglmm' is not available and has been replaced  
by .GlobalEnv when processing object 'M'

rm(M, P)  
  
AH\_quest <- D$quest  
sample\_n(AH\_quest, 10)

# A tibble: 10 × 4  
 Participant Scale Item response  
 <fct> <chr> <chr> <dbl>  
 1 43 rf rf5 -0.5   
 2 36 rf rf7 -0.75   
 3 31 nars nars7 0.5   
 4 17 nars nars7 -0.5   
 5 14 nars nars4 0   
 6 21 nars nars2 0.5   
 7 9 nars nars5 -0.5   
 8 10 rf rf10 -0.25   
 9 28 hru hru6 0.667  
10 28 hru hru1 -0.333

AH\_part <- D$trait  
sample\_n(AH\_part, 5)

# A tibble: 5 × 6  
 Participant anx arem hru nars rf  
 <fct> <dbl> <dbl> <dbl> <dbl> <dbl>  
1 11 -0.7 0 0.152 -0.409 -1   
2 43 -0.05 0.143 0.394 -0.0909 -0.75   
3 37 0.111 0.143 0.273 0.409 -0.375  
4 10 0 0 -0.182 -0.5 -0.542  
5 38 0.3 0.143 0.9 0.455 -0.854

AH\_exp <- D$exp  
sample\_n(AH\_exp, 10)

File Participant Inventory Scale Item Face morphLevel response RT  
1 016 16 MacDorman Eeriness E5 2 1 -0.76666667 2.059  
2 002 2 MacDorman Eeriness E3 20 2 -0.84000000 1.050  
3 009 9 MacDorman Eeriness E6 20 3 0.67000000 2.343  
4 030 30 MacDorman Eeriness E8 7 1 -0.32666667 2.633  
5 006 6 MacDorman Eeriness E6 10 3 -0.03666667 1.610  
6 037 37 MacDorman Eeriness E5 12 4 0.11000000 2.005  
7 006 6 MacDorman Eeriness E4 19 1 0.62333333 1.524  
8 022 22 MacDorman Eeriness E3 8 3 0.79333333 2.869  
9 019 19 MacDorman Eeriness E1 14 1 0.33333333 2.218  
10 011 11 MacDorman Eeriness E2 2 3 -0.20000000 2.231  
 Trial Condition morphLevelNum Stimulus Anchors  
1 93 5s 1 2\_1 boring\_shocking  
2 235 unlimited 2 20\_2 ordinary\_supernatural  
3 94 5s 3 20\_3 predictable\_thrilling  
4 120 5s 1 7\_1 unemotional\_hairraising  
5 22 100ms 3 10\_3 predictable\_thrilling  
6 29 100ms 4 12\_4 boring\_shocking  
7 236 unlimited 1 19\_1 uninspiring\_spinetingling  
8 203 unlimited 3 8\_3 ordinary\_supernatural  
9 9 100ms 1 14\_1 reassuring\_eerie  
10 170 unlimited 3 2\_3 numbing\_freaky

AH <- AH\_exp |>   
 mutate(Exp = "AH",  
 Part = Participant,  
 Stim = Stimulus,  
 Set = "BM",  
 FaceOrigin = "tech",  
 trial = Trial,  
 repetition = 1,  
 morph = morphLevelNum,  
 hum\_like = NA\_real\_,  
 hum\_skull = NA,  
 hum\_eyes = NA,  
 ancestoral = NA,  
 rotation = 0,  
 Exposure = if\_else(Condition == "5s", "Unlimited", "100ms"),  
 rating = (response + 1)/2,  
 rt = RT  
 )|>   
 select(any\_of(UV\_cols)) |>   
 select(all\_of(UV\_cols))  
  
summary(AH)

Exp Part trial repetition Face   
 Length:11040 1 : 240 Min. : 1.00 Min. :1 1 : 552   
 Class :character 2 : 240 1st Qu.: 60.75 1st Qu.:1 10 : 552   
 Mode :character 3 : 240 Median :120.50 Median :1 11 : 552   
 4 : 240 Mean :120.50 Mean :1 12 : 552   
 5 : 240 3rd Qu.:180.25 3rd Qu.:1 13 : 552   
 6 : 240 Max. :240.00 Max. :1 14 : 552   
 (Other):9600 (Other):7728   
 FaceOrigin Set Exposure Stim   
 Length:11040 Length:11040 Length:11040 Length:11040   
 Class :character Class :character Class :character Class :character   
 Mode :character Mode :character Mode :character Mode :character   
   
   
   
   
 hum\_like morph ancestoral rotation hum\_skull   
 Min. : NA Min. :1.00 Mode:logical Min. :0 Mode:logical   
 1st Qu.: NA 1st Qu.:1.75 NA's:11040 1st Qu.:0 NA's:11040   
 Median : NA Median :2.50 Median :0   
 Mean :NaN Mean :2.50 Mean :0   
 3rd Qu.: NA 3rd Qu.:3.25 3rd Qu.:0   
 Max. : NA Max. :4.00 Max. :0   
 NA's :11040   
 hum\_eyes Scale Item rating   
 Mode:logical : 0 E1 :1380 Min. :0.0000   
 NA's:11040 Eeriness:11040 E2 :1380 1st Qu.:0.3367   
 E3 :1380 Median :0.5167   
 E4 :1380 Mean :0.5169   
 E5 :1380 3rd Qu.:0.6933   
 E6 :1380 Max. :1.0000   
 (Other):2760   
 rt   
 Min. : 0.402   
 1st Qu.: 1.717   
 Median : 2.382   
 Mean : 2.878   
 3rd Qu.: 3.324   
 Max. :59.181

### Daan Keeris

load("Data Sets/Keeris/Data/DK.Rda")

Registered S3 methods overwritten by 'brms':  
 method from  
 coef.brmsfit bayr  
 predict.brmsfit bayr

DK <- D\_$DK1 |>   
 mutate(Exp = "DK",  
 #Part = Participant,  
 repetition = 1,  
 Stim = Stimulus,  
 Set = if\_else(Collection == "Mathur", "MR", "MR\_DK"),  
 Face = if\_else(Set == "BM",  
 str\_extract(Stim, "c[1-9][0-9]\*"),  
 Stim),  
 FaceOrigin = "tech",  
 hum\_like = as.numeric(if\_else(Set == "MR",   
 str\_extract(Stim, "[1-9][0-9]\*"), NA))/80,  
 morph = morphLevel,  
 hum\_skull = NA,  
 hum\_eyes = NA,  
 ancestoral = NA,  
 rotation = 0,  
 Exposure = if\_else(Condition == "short", "33ms", "2000ms"),  
 rating = (response + 1)/2,  
 rt = RT) |>   
 select(all\_of(UV\_cols))  
  
summary(DK)

Exp Part trial repetition  
 Length:5600 1 : 160 Min. : 1.00 Min. :1   
 Class :character 2 : 160 1st Qu.: 40.75 1st Qu.:1   
 Mode :character 3 : 160 Median : 80.50 Median :1   
 4 : 160 Mean : 80.50 Mean :1   
 5 : 160 3rd Qu.:120.25 3rd Qu.:1   
 6 : 160 Max. :160.00 Max. :1   
 (Other):4640   
 Face FaceOrigin Set Exposure   
 Length:5600 Length:5600 Length:5600 Length:5600   
 Class :character Class :character Class :character Class :character   
 Mode :character Mode :character Mode :character Mode :character   
   
   
   
   
 Stim hum\_like morph ancestoral   
 Length:5600 Min. :0.0125 Min. :0.0000 Mode:logical   
 Class :character 1st Qu.:0.2562 1st Qu.:0.2222 NA's:5600   
 Mode :character Median :0.5000 Median :0.5000   
 Mean :0.5000 Mean :0.5000   
 3rd Qu.:0.7438 3rd Qu.:0.7778   
 Max. :0.9875 Max. :1.0000   
 NA's :2800 NA's :2800   
 rotation hum\_skull hum\_eyes Scale   
 Min. :0 Mode:logical Mode:logical Length:5600   
 1st Qu.:0 NA's:5600 NA's:5600 Class :character   
 Median :0 Mode :character   
 Mean :0   
 3rd Qu.:0   
 Max. :0   
   
 Item rating rt   
 Length:5600 Min. :0.0000 Min. : 0.505   
 Class :character 1st Qu.:0.3217 1st Qu.: 1.942   
 Mode :character Median :0.5017 Median : 2.667   
 Mean :0.5205 Mean : 3.298   
 3rd Qu.:0.7333 3rd Qu.: 3.893   
 Max. :1.0000 Max. :57.826

filter(DK, is.na(Face))

# A tibble: 0 × 19  
# … with 19 variables: Exp <chr>, Part <fct>, trial <int>, repetition <dbl>,  
# Face <chr>, FaceOrigin <chr>, Set <chr>, Exposure <chr>, Stim <chr>,  
# hum\_like <dbl>, morph <dbl>, ancestoral <lgl>, rotation <dbl>,  
# hum\_skull <lgl>, hum\_eyes <lgl>, Scale <chr>, Item <chr>, rating <dbl>,  
# rt <dbl>

### Peter Slijkhuis

load("Data Sets/Slijkhuis/Data/PS.Pda")  
  
PS <- PS\_1 |>   
 mutate(Exp = "PS",  
 Part = as.character(Part),  
 Stim = Stimulus,  
 Face = Stim,  
 FaceOrigin = "tech",  
 repetition = 1,  
 morph = NA,  
 hum\_like = huMech,  
 hum\_skull = NA,  
 hum\_eyes = NA,  
 ancestoral = NA,  
 rotation = 0,  
 Exposure = str\_c(as.numeric(Condition) \* 1000, "ms"),  
 rating = (response + 1)/2,  
 rt = RT) |>   
 select(all\_of(UV\_cols))  
  
summary(PS)

Exp Part trial repetition  
 Length:8424 Length:8424 Min. : 1.00 Min. :1   
 Class :character Class :character 1st Qu.: 54.75 1st Qu.:1   
 Mode :character Mode :character Median :108.50 Median :1   
 Mean :108.50 Mean :1   
 3rd Qu.:162.25 3rd Qu.:1   
 Max. :216.00 Max. :1   
 Face FaceOrigin Set Exposure   
 Length:8424 Length:8424 Length:8424 Length:8424   
 Class :character Class :character Class :character Class :character   
 Mode :character Mode :character Mode :character Mode :character   
   
   
   
 Stim hum\_like morph ancestoral rotation  
 Length:8424 Min. :0.0125 Mode:logical Mode:logical Min. :0   
 Class :character 1st Qu.:0.3000 NA's:8424 NA's:8424 1st Qu.:0   
 Mode :character Median :0.6125 Median :0   
 Mean :0.5682 Mean :0   
 3rd Qu.:0.8375 3rd Qu.:0   
 Max. :1.0000 Max. :0   
 hum\_skull hum\_eyes Scale Item   
 Mode:logical Mode:logical Length:8424 Length:8424   
 NA's:8424 NA's:8424 Class :character Class :character   
 Mode :character Mode :character   
   
   
   
 rating rt   
 Min. :0.0000 Min. : 0.408   
 1st Qu.:0.2696 1st Qu.: 1.596   
 Median :0.4750 Median : 2.159   
 Mean :0.4806 Mean : 2.638   
 3rd Qu.:0.7000 3rd Qu.: 3.049   
 Max. :1.0000 Max. :90.556

### Robbin Koopman

load("Data Sets/Koopman/Data/RK.Rda")  
  
RK <- RK\_1 |>   
 mutate(Exp = "RK",  
 Stim = Stimulus,  
 Face = Stim,  
 FaceOrigin = "tech",  
 trial = NA,  
 repetition = repetition,  
 morph = NA,  
 hum\_like = huMech,  
 hum\_skull = NA,  
 hum\_eyes = NA,  
 ancestoral = NA,  
 rotation = 0,  
 Exposure = "2000ms", # <-- check this! perhaps replace with NA or RT.  
 rating = response + 1,  
 rt = RT) |>   
 group\_by(Part) |>   
 arrange(Obs) |>   
 mutate(trial = row\_number()) |>   
 ungroup() |>   
 select(all\_of(UV\_cols))  
  
summary(RK)

Exp Part trial repetition  
 Length:7488 Length:7488 Min. : 1.00 Min. :0   
 Class :character Class :character 1st Qu.: 72.75 1st Qu.:0   
 Mode :character Mode :character Median :144.50 Median :1   
 Mean :144.50 Mean :1   
 3rd Qu.:216.25 3rd Qu.:2   
 Max. :288.00 Max. :2   
 Face FaceOrigin Set Exposure   
 Length:7488 Length:7488 Length:7488 Length:7488   
 Class :character Class :character Class :character Class :character   
 Mode :character Mode :character Mode :character Mode :character   
   
   
   
 Stim hum\_like morph ancestoral rotation  
 Length:7488 Min. :0.0250 Mode:logical Mode:logical Min. :0   
 Class :character 1st Qu.:0.3344 NA's:7488 NA's:7488 1st Qu.:0   
 Mode :character Median :0.6750 Median :0   
 Mean :0.5953 Mean :0   
 3rd Qu.:0.8656 3rd Qu.:0   
 Max. :1.0000 Max. :0   
 hum\_skull hum\_eyes Scale Item   
 Mode:logical Mode:logical Length:7488 Length:7488   
 NA's:7488 NA's:7488 Class :character Class :character   
 Mode :character Mode :character   
   
   
   
 rating rt   
 Min. :0.0000 Min. : 0.470   
 1st Qu.:0.2783 1st Qu.: 1.626   
 Median :0.4917 Median : 2.173   
 Mean :0.4843 Mean : 2.687   
 3rd Qu.:0.6817 3rd Qu.: 2.951   
 Max. :1.0000 Max. :509.292

### UV21

#load("Data Sets/UV21/Data/BA21.Rda")  
D\_raw <-   
 readxl::read\_excel("Data Sets/UV21/Final Dataset Uncanny Valley 16-05-21.xlsx") %>%  
 filter(StartDate != "Start Date")

New names:  
• `S53\_2D\_1` -> `S53\_2D\_1...598`  
• `S54\_2E\_1` -> `S54\_2E\_1...599`  
• `S53\_2D\_1` -> `S53\_2D\_1...608`  
• `S54\_2E\_1` -> `S54\_2E\_1...609`  
• `S54\_2E\_1` -> `S54\_2E\_1...619`

Stimuli <-   
 readxl::read\_excel("Data Sets/UV21/Stimuli.xlsx") %>%   
 mutate(Stimulus = str\_c("S", as.character(Stimulus))) %>%   
 mutate(Set = factor(Set, 1:4, labels = c("Primate", "Human", "Tri23", "RK"))) %>% mutate(hum\_like = rowMeans(select(., starts\_with("H\_like")), na.rm = T)) %>%  
 mutate(valence = rowMeans(select(., starts\_with("E\_valence")), na.rm = T)) |>   
 mutate(repetition = 1) |>   
 rename(ancestoral = AncestoralCloseness) |>   
 mutate(FaceOrigin = if\_else(Set == "RK", # <---- face origin  
 "tech",  
 "bio"))  
  
BA21 <-   
 D\_raw %>%   
 select(Part = ResponseId, matches("^S\\d+")) %>%   
 pivot\_longer(-Part, names\_to = "Trial", values\_to = "response") %>%  
 filter(!is.na(response)) %>%  
 separate(Trial, into = c("Stimulus", "Item", "attempt"), extra = "drop") %>%  
 left\_join(  
 select(Stimuli,   
 Stimulus, Set,   
 valence,   
 ancestoral,  
 hum\_like,  
 FaceOrigin),   
 by = "Stimulus") %>%  
 mutate(Scale = if\_else(str\_detect(Item, "^2"), "Eery", "Display"),  
 response = mascutils::rescale\_unit(as.numeric(response)),  
 repetition = as.numeric(attempt),  
 rating = mascutils::rescale\_centered(response, scale = .999),  
 hum\_like = mascutils::rescale\_unit(hum\_like))

Registered S3 methods overwritten by 'mascutils':  
 method from  
 knit\_print.tbl\_obs bayr  
 print.tbl\_obs bayr

## almost 13,293 observations!!  
BA21 |>   
 group\_by(Part, Stimulus, Scale, FaceOrigin) |>  
 summarize(n()) |>   
 ungroup() |>   
 dim()

`summarise()` has grouped output by 'Part', 'Stimulus', 'Scale'. You can  
override using the `.groups` argument.

[1] 13293 5

UV21 <-   
 BA21 |>   
 mutate(Exp = "UV21",  
 Stim = Stimulus,  
 Face = Stim,  
 trial = NA,  
 repetition = repetition,  
 morph = NA,  
 hum\_like = hum\_like,  
 hum\_skull = NA,  
 hum\_eyes = NA,  
 ancestoral = NA,  
 rotation = 0,  
 Exposure = "2000ms", # <-- check this! perhaps replace with NA or RT.  
 Scale = if\_else(Scale == "Eery",  
 "nErry",  
 Scale),  
 rating = if\_else(Scale == "nEeriness",  
 - ((response - 0.5) \* 2) + 1, # rescaling and reversing  
 response),   
 rt = NA) |>   
 group\_by(Part) |>   
 mutate(trial = row\_number()) |>   
 ungroup() |>   
 select(all\_of(UV\_cols))  
  
summary(UV21)

Exp Part trial repetition  
 Length:13399 Length:13399 Min. : 1.0 Min. :1   
 Class :character Class :character 1st Qu.: 46.0 1st Qu.:1   
 Mode :character Mode :character Median : 96.0 Median :1   
 Mean : 97.8 Mean :1   
 3rd Qu.:148.0 3rd Qu.:1   
 Max. :201.0 Max. :1   
 Face FaceOrigin Set Exposure   
 Length:13399 Length:13399 Primate:10247 Length:13399   
 Class :character Class :character Human : 1524 Class :character   
 Mode :character Mode :character Tri23 : 128 Mode :character   
 RK : 1500   
   
   
 Stim hum\_like morph ancestoral rotation  
 Length:13399 Min. :0.0000 Mode:logical Mode:logical Min. :0   
 Class :character 1st Qu.:0.3237 NA's:13399 NA's:13399 1st Qu.:0   
 Mode :character Median :0.5316 Median :0   
 Mean :0.5714 Mean :0   
 3rd Qu.:0.8500 3rd Qu.:0   
 Max. :1.0000 Max. :0   
 hum\_skull hum\_eyes Scale Item   
 Mode:logical Mode:logical Length:13399 Length:13399   
 NA's:13399 NA's:13399 Class :character Class :character   
 Mode :character Mode :character   
   
   
   
 rating rt   
 Min. :0.0000 Mode:logical   
 1st Qu.:0.5150 NA's:13399   
 Median :0.6800   
 Mean :0.6374   
 3rd Qu.:0.8100   
 Max. :1.0000

## Merging data sets

UVA\_1 <-   
 UVA\_0 |>   
 bind\_rows(BM) |>   
 bind\_rows(AH) |>   
 bind\_rows(DK) |>   
 bind\_rows(PS) |>   
 bind\_rows(RK) |>   
 bind\_rows(UV21) |>   
 mutate(Exp = as.factor(Exp),  
 Part = as.factor(Part),  
 Face = as.factor(Face),  
 FaceOrigin = as.factor(FaceOrigin),  
 Set = as.factor(Set),  
 Exposure = as.factor(Exposure),  
 Stim = as.factor(Stim),  
 Scale = as.factor(Scale),  
 Item = as.factor(Item)  
 ) |>  
 bind\_rows(UVA\_0)  
  
summary(UVA\_1)

Exp Part trial repetition Face   
 AH :11040 10 : 936 Min. : 1.0 Min. :0 7 : 1577   
 BM :16960 11 : 936 1st Qu.: 58.0 1st Qu.:1 16 : 1571   
 DK : 5600 12 : 936 Median :118.0 Median :1 2 : 1571   
 PS : 8424 13 : 936 Mean :124.1 Mean :1 20 : 1571   
 RK : 7488 15 : 936 3rd Qu.:180.0 3rd Qu.:1 3 : 1571   
 UV21:13399 16 : 936 Max. :320.0 Max. :2 10 : 1568   
 (Other):57295 (Other):53482   
 FaceOrigin Set Exposure Stim hum\_like   
 bio :11899 BM :28000 2000ms :26495 66 : 357 Min. :0.000   
 tech:51012 MR :15436 100ms : 9520 1\_1 : 350 1st Qu.:0.316   
 Primate:10247 50ms : 4888 1\_2 : 350 Median :0.571   
 MR\_DK : 2800 17ms : 4240 1\_3 : 350 Mean :0.570   
 PS : 2574 500ms : 4240 1\_4 : 350 3rd Qu.:0.847   
 RK : 2202 unlimited: 4240 10\_1 : 350 Max. :1.000   
 (Other): 1652 (Other) : 9288 (Other):60804 NA's :30800   
 morph ancestoral rotation hum\_skull hum\_eyes   
 Min. :0.00 Min. : NA Min. :0 Mode:logical Mode:logical   
 1st Qu.:1.00 1st Qu.: NA 1st Qu.:0 NA's:62911 NA's:62911   
 Median :2.00 Median : NA Median :0   
 Mean :2.32 Mean :NaN Mean :0   
 3rd Qu.:3.00 3rd Qu.: NA 3rd Qu.:0   
 Max. :4.00 Max. : NA Max. :0   
 NA's :32111 NA's :62911   
 Scale Item rating rt   
 Display : 6664 1 : 6664 Min. :0.0000 Min. : 0.402   
 Eeriness :28000 E1 : 3500 1st Qu.:0.3100 1st Qu.: 1.589   
 nEeriness:21512 E2 : 3500 Median :0.5200 Median : 2.222   
 nErry : 6735 E3 : 3500 Mean :0.5119 Mean : 2.728   
 E4 : 3500 3rd Qu.:0.7100 3rd Qu.: 3.190   
 E5 : 3500 Max. :1.0000 Max. :509.292   
 (Other):38747 NA's :13399

save(UVA\_1, file = "Data/UVA\_1.Rda")

## Checking data

filter(UVA\_1, is.na(Face))

# A tibble: 0 × 19  
# … with 19 variables: Exp <fct>, Part <fct>, trial <dbl>, repetition <dbl>,  
# Face <fct>, FaceOrigin <fct>, Set <fct>, Exposure <fct>, Stim <fct>,  
# hum\_like <dbl>, morph <dbl>, ancestoral <dbl>, rotation <dbl>,  
# hum\_skull <lgl>, hum\_eyes <lgl>, Scale <fct>, Item <fct>, rating <dbl>,  
# rt <dbl>

UVA\_1 |> filter(hum\_like > 1)

# A tibble: 0 × 19  
# … with 19 variables: Exp <fct>, Part <fct>, trial <dbl>, repetition <dbl>,  
# Face <fct>, FaceOrigin <fct>, Set <fct>, Exposure <fct>, Stim <fct>,  
# hum\_like <dbl>, morph <dbl>, ancestoral <dbl>, rotation <dbl>,  
# hum\_skull <lgl>, hum\_eyes <lgl>, Scale <fct>, Item <fct>, rating <dbl>,  
# rt <dbl>

UVA\_1 |> filter(hum\_like < 0)

# A tibble: 0 × 19  
# … with 19 variables: Exp <fct>, Part <fct>, trial <dbl>, repetition <dbl>,  
# Face <fct>, FaceOrigin <fct>, Set <fct>, Exposure <fct>, Stim <fct>,  
# hum\_like <dbl>, morph <dbl>, ancestoral <dbl>, rotation <dbl>,  
# hum\_skull <lgl>, hum\_eyes <lgl>, Scale <fct>, Item <fct>, rating <dbl>,  
# rt <dbl>

Number of participants:

UVA\_1 |>   
 select(Exp, Part) |>   
 n\_distinct()

[1] 277

Number of different stimuli:

UVA\_1 |>   
 select(Stim) |>   
 n\_distinct()

[1] 349

Total encounters between participants and stimuli:

UVA\_1 |>   
 select(Part, Set, Stim) |>   
 n\_distinct()

[1] 19533

Total observations:

dim(UVA\_1)[1]

[1] 62911

UVA\_1 |>   
 group\_by(Exp) |>   
 summarize(n\_Obs = n()) |>   
 knitr::kable()

| Exp | n\_Obs |
| --- | --- |
| AH | 11040 |
| BM | 16960 |
| DK | 5600 |
| PS | 8424 |
| RK | 7488 |
| UV21 | 13399 |

### Checking the ratings

UVA\_1 |>   
 group\_by(Exp, Scale) |>   
 summarize(n\_Resp = n(),  
 n\_Items = n\_distinct(Item),  
 n\_Part = n\_distinct(Part),  
 n\_Stim = n\_distinct(Stim),  
 min\_rating = min(rating),  
 max\_rating = max(rating),  
 min\_hum\_like = min(hum\_like),  
 max\_hum\_like = max(hum\_like))

`summarise()` has grouped output by 'Exp'. You can override using the `.groups`  
argument.

# A tibble: 7 × 10  
# Groups: Exp [6]  
 Exp Scale n\_Resp n\_Items n\_Part n\_Stim min\_rat…¹ max\_r…² min\_h…³ max\_h…⁴  
 <fct> <fct> <int> <int> <int> <int> <dbl> <dbl> <dbl> <dbl>  
1 AH Eeriness 11040 8 46 80 0 1 NA NA  
2 BM Eeriness 16960 8 53 80 0 0.857 NA NA  
3 DK nEeriness 5600 8 35 80 0 1 NA NA  
4 PS nEeriness 8424 8 39 87 0 1 0.0125 1  
5 RK nEeriness 7488 8 26 82 0 1 0.025 1  
6 UV21 Display 6664 1 78 100 0 1 0 1  
7 UV21 nErry 6735 5 78 100 0.5 1 0 1  
# … with abbreviated variable names ¹​min\_rating, ²​max\_rating, ³​min\_hum\_like,  
# ⁴​max\_hum\_like

# Data Exploration

1. rendering the association between *human-likeness and eeriness* ratings
2. *Designometrics*: can test-retest correlation be used to identification of *non-compliant participants*

### Human-likeness in Robots and Eeriness ratings

UVA\_2 is combining observations from all experiments with

* *human-likeness* score compatible with Mathur & Reichlings humano-mechanical scale (huMech)
* *nEeriness ratings* as inverted MacDorman’s Eeriness scale.
* with *at least ‘min\_obs’ responses* per participant and exposure

min\_obs = 25  
  
UVA\_2 <- UVA\_1 |>   
 filter(Exp %in% c("DK", "PS", "RK", "UV21"),  
 Scale == "nEeriness",  
 !is.na(hum\_like)) |>   
 mutate(exposure = if\_else(Exposure == "Unlimited",  
 2.0,  
 as.numeric(str\_extract(Exposure, "[0-9]+"))/1000)) |>   
 group\_by(Exp, Exposure, Part) |>   
 filter(n() >= min\_obs) |>   
 ungroup() |>   
 rename(neeriness = rating)  
  
summary(UVA\_2)

Exp Part trial repetition Face   
 AH : 0 1 : 584 Min. : 1.0 Min. :0 66 : 357   
 BM : 0 2 : 584 1st Qu.: 57.0 1st Qu.:1 64 : 336   
 DK :2800 3 : 584 Median :114.0 Median :1 65 : 336   
 PS :8424 10 : 296 Mean :118.8 Mean :1 67 : 336   
 RK :7488 11 : 296 3rd Qu.:173.0 3rd Qu.:1 72 : 324   
 UV21: 0 12 : 296 Max. :288.0 Max. :2 73 : 324   
 (Other):16072 (Other):16699   
 FaceOrigin Set Exposure Stim hum\_like   
 bio : 0 MR :15436 2000ms :11696 66 : 357 Min. :0.0125   
 tech:18712 PS : 2574 200ms : 2808 64 : 336 1st Qu.:0.3000   
 RK : 702 100ms : 2160 65 : 336 Median :0.6125   
 BM : 0 33ms : 1400 67 : 336 Mean :0.5689   
 Human : 0 50ms : 648 72 : 324 3rd Qu.:0.8375   
 MR\_DK : 0 17ms : 0 73 : 324 Max. :1.0000   
 (Other): 0 (Other): 0 (Other):16699   
 morph ancestoral rotation hum\_skull hum\_eyes   
 Min. : NA Min. : NA Min. :0 Mode:logical Mode:logical   
 1st Qu.: NA 1st Qu.: NA 1st Qu.:0 NA's:18712 NA's:18712   
 Median : NA Median : NA Median :0   
 Mean :NaN Mean :NaN Mean :0   
 3rd Qu.: NA 3rd Qu.: NA 3rd Qu.:0   
 Max. : NA Max. : NA Max. :0   
 NA's :18712 NA's :18712   
 Scale Item neeriness rt   
 Display : 0 nE1 :2357 Min. :0.0000 Min. : 0.408   
 Eeriness : 0 nE4 :2351 1st Qu.:0.2717 1st Qu.: 1.658   
 nEeriness:18712 nE2 :2347 Median :0.4717 Median : 2.236   
 nErry : 0 nE8 :2347 Mean :0.4778 Mean : 2.768   
 nE5 :2341 3rd Qu.:0.6833 3rd Qu.: 3.129   
 nE6 :2327 Max. :1.0000 Max. :509.292   
 (Other):4642   
 exposure   
 Min. :0.033   
 1st Qu.:0.200   
 Median :2.000   
 Mean :1.296   
 3rd Qu.:2.000   
 Max. :2.000

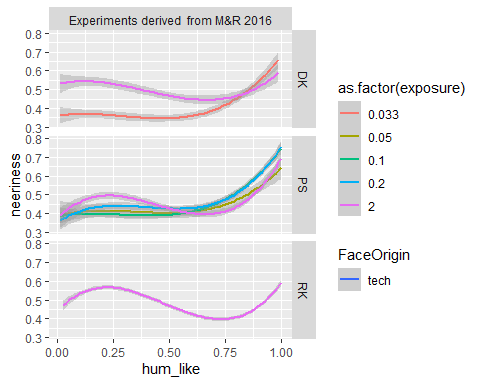
save(UVA\_2, file = "Data/UVA\_2.Rda")

UVA\_2 |> filter(is.na(Face))

# A tibble: 0 × 20  
# … with 20 variables: Exp <fct>, Part <fct>, trial <dbl>, repetition <dbl>,  
# Face <fct>, FaceOrigin <fct>, Set <fct>, Exposure <fct>, Stim <fct>,  
# hum\_like <dbl>, morph <dbl>, ancestoral <dbl>, rotation <dbl>,  
# hum\_skull <lgl>, hum\_eyes <lgl>, Scale <fct>, Item <fct>, neeriness <dbl>,  
# rt <dbl>, exposure <dbl>

#! fig.cap: "Sample average third degree polynomial across exposure times"  
UVA\_2 |>   
 ggplot(aes(x = hum\_like, linetype = FaceOrigin,   
 color = as.factor(exposure), y = neeriness)) +  
 facet\_grid(Exp ~ "Experiments derived from M&R 2016") +  
 stat\_smooth(method = "lm", formula = y ~ poly(x, 3), size = 1)

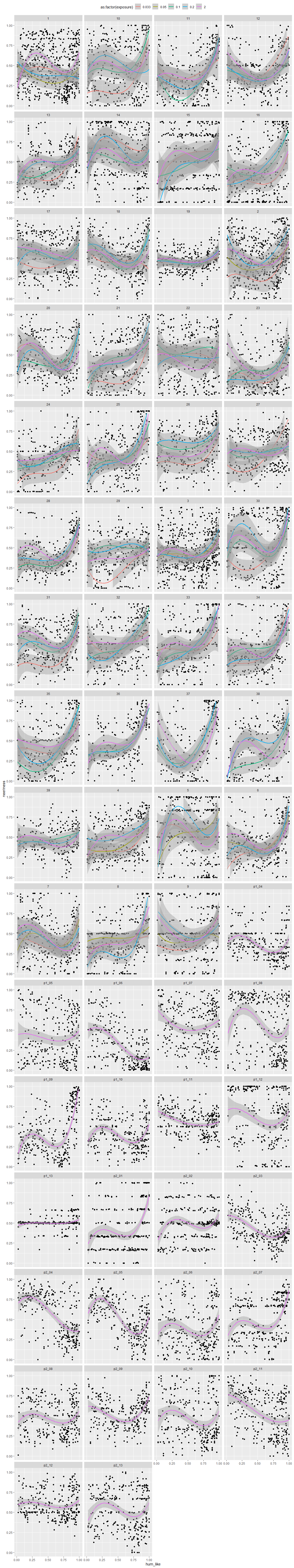
Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.  
ℹ Please use `linewidth` instead.



### Universality of the UVE (long exposure)

#! fig.cap:"Participant-level third degree polynomial across exposure times"  
#! fig-width: 1200  
#! fig-height: 3200  
  
UVA\_2 |>   
 ggplot(aes(x = hum\_like,  
 line\_type = FaceOrigin,  
 y = neeriness)) +  
 facet\_wrap(~Part, ncol = 4) +  
 geom\_point() +  
 geom\_smooth(aes(color = as.factor(exposure)),   
 method = "lm", formula = y ~ poly(x, 3)) +  
 ylim(0,1) +  
 theme(legend.position = "top")

Warning: Removed 15 rows containing missing values (`geom\_smooth()`).



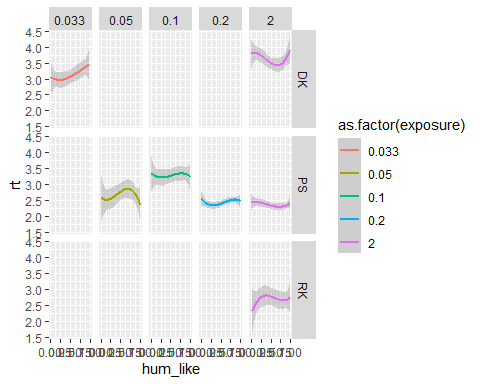
## Response times

Observation:

* long exposure follows UV
* short exposure follows *inverted* Uncanny Valley

Interpretation: **???**

UVA\_2 |>   
 ggplot(aes(x = hum\_like, y = rt, color = as.factor(exposure))) +  
 facet\_grid(~Exp ~ as.factor(exposure)) +  
 geom\_smooth(method = "lm", formula = y ~ poly(x, 3))



## Designometrix

### Cheater detection

In experiments with repeated participant-stimulus encounters, you would always expect a minimum of correlations between repeated ratings. Ergo, we find random-response cheaters by calculating the within-participant correlations between repetitions.

UVA\_3 <-   
 UVA\_2 |>   
 filter(Exp %in% c("DK","PS","RK"),  
 exposure >= .01) |>   
 select(Exp, Part, Stim, exposure, neeriness) |>   
 group\_by(Part, Stim) |>   
 arrange(exposure) |> # <--- short to long in all exps with varying exposure  
 mutate(nth\_exp = row\_number()) |>   
 ungroup() |>   
 pivot\_wider(names\_from = nth\_exp,   
 names\_prefix = 'n\_',  
 values\_from = neeriness)  
  
  
UVA\_3|>   
 group\_by(Part) |>  
 group\_map(  
 ~.x |>   
 select(n\_1, n\_2, n\_3, n\_4) |>   
 corrr::correlate(use = "pairwise.complete.obs", method = "pearson", quiet = T) |>   
 corrr::stretch()) |>  
 bind\_rows() |>   
 filter(r < 0.2)

# A tibble: 178 × 3  
 x y r  
 <chr> <chr> <dbl>  
 1 n\_3 n\_4 -0.153   
 2 n\_4 n\_3 -0.153   
 3 n\_1 n\_2 -0.112   
 4 n\_2 n\_1 -0.112   
 5 n\_3 n\_4 -0.219   
 6 n\_4 n\_3 -0.219   
 7 n\_1 n\_2 -0.217   
 8 n\_2 n\_1 -0.217   
 9 n\_3 n\_4 -0.0785  
10 n\_4 n\_3 -0.0785  
# … with 168 more rows

# library(rstanarm)  
  
#M\_0 <- lme4::lmer(neeriness ~ 1 + (1|Part) + (1|Stim) + (1|Item), data = UVA\_3)  
  
#summary(M\_0)