双向细目表分析报告 2022.08.23 版本

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23 Aug 2022

目录

1 引言

本文为使用 RMarkdown+CTeX 制作的报告。
本文为 ASDA 项目中，用于 IEP 推荐课程的数据计算初稿，具体评价方式使用双向细目表。具体数据可在 SVN 中查阅。
本期参与评分者为陈曦、赵佳欢、王新宇、雷页与张璐，均简单粗暴地认为是具有一定的经验的专家，因此适用德尔菲法。

2 评分者说明 2022.08.03

请在进行打分以前详细阅读该说明。该表将用于评估不同任务项是否能对部分能力进行训练/干预，以及你预期中的训练/干预效果如何。在 2022.08.03 这个版本中，你需要评估该任务项以多大的程度影响到该能力。如果你认为能够起到干预效果，以效果大小进行 0-10 的评分。请明确以下几个注意点：

1. 干预/训练指的是该任务能够在执行多次、或经过适当计划制定后，在一定时间后能稳定、有效地提升该能力水平。请基于这一原则，对每个单元格进行填写；

2. 你需要填写三种分数：10 代表你确定该任务可以完美地干预/训练该能力；0 代表你确定该任务不能干预/训练该能力；中间的区分数字代表你认为这些能力能够以多大的程度影响到该能力。对于你不确定该任务能否干预/训练该能力的项，请填写 999/NA。填写的理由自由，你可以活用你手头的信息来源以确定那些不确定的任务是否能够干预/训练该能力，但是尽量不要在某个格子上停留太久，本表格不为严格论证；你可以活用各种评估方式进行评分，例如先批量给你认为毫无相关的格子打上 0；或是先使用 0/1/999 进行打分，随后再给 1 的格子标上自己认为的权重。

3. 在进行打分以前，你应该先看一遍每个能力对应的定义（见上）。请先确保你明白这些能力代表的是什么，以好进行后续的打分。如果你不同意该对应或觉得有问题，请写作文字以备注注明，并填写 999 以确保数据不会被污染。

请在进行打分以前确保你理解该说明，并尝试着进行预打分。如有任何不明确的地方，请咨询研究员。

3 数据预处理

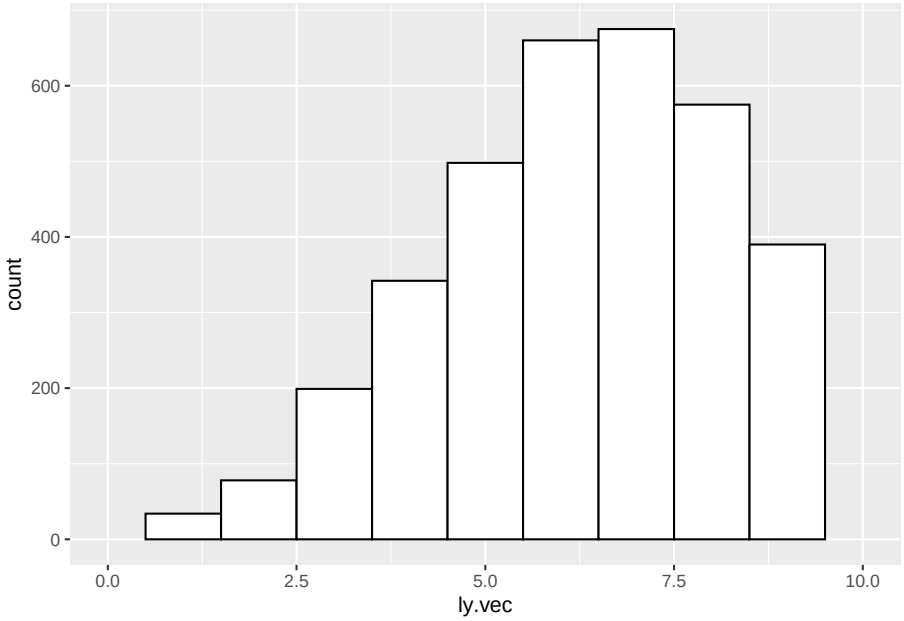
```
library(readxl)       # 数据导入
library(tidyverse)    # 数据预处理
library(ggplot2)      # 可视化
library(car)          # 对 tidyverse 包还不熟，简单用 car 包的 recode
library(matrixStats)  # 一些基础处理包，例如
library(psych)        # 因子分析
library(plotly)       # 抄的源代码，用 plotly 作图好看点
library(reshape2)     # 抄的源代码，一些工作用 reshape2 完成
library(tibble)       # 只用了一些功能，例如 rownames 与 column 的互转
library(NbClust)      # 玩玩 k 均值聚类
#（没有解决的问题：到底用 FA/PCA/Kmeans/层次？用 Kmeans 是因为有直接可借鉴的代码，
# 另外对机器学习也有帮助
library(cluster)      # pam() 围绕中心点的划分
options(scipen = 20)
```

我在外面清理了打分矩阵，消除掉了一些打分的需求说明，并每个人的表格长度和格式尽量一致。如有需求可以观看原 raw sheets 和 tidy sheets 的其他部分。

```
df_ly <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/tidy/双向细目
df_xc <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/tidy/双向细目
df_wxy <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/tidy/双向细
df_zjh <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/tidy/双向细
df_zl <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/tidy/双向细目
# 请用这个文件，有两个 zl 的文件在里面，第一个我也不知道怎么来的
```

观察评分者分数分布情况（此分布已综合各种异质性），重点观察均值、众数而非整个分布形态差异。定性决定是否存在打分者差异，通过个体的漂移 drift/偏差 bias 情况决定。

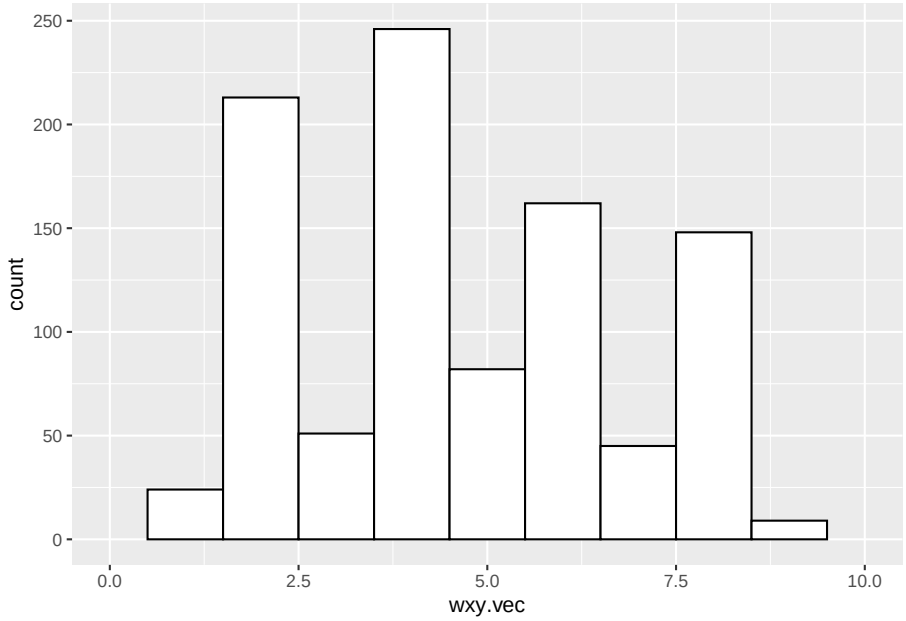
```r
# 本来想检查数据框中是否有缺失值，想到好像不太需要，直接看向量个数即可
# 创建向量（研究了我几个小时）去掉首列，清除名字，解包

ly.vec <- df_ly[,-1] %>% unname() %>% unlist() %>%
  na_if(999) %>% na_if(0) %>% na_if(10)
wxy.vec <- df_wxy[-154,-1] %>% unname() %>% unlist() %>% as.numeric() %>%
  na_if(999) %>% na_if(0) %>% na_if(10) # 不知道为什么格式不是数字
xc.vec <- df_xc[-154,-1] %>% unname() %>% unlist() %>%
  na_if(999) %>% na_if(0) %>% na_if(10)
zjh.vec <- df_zjh[-c(24,129),-1] %>% unname() %>% unlist() %>%
  na_if(999) %>% na_if(0) %>% na_if(10)
zl.vec <- df_zl[,-1] %>% unname() %>% unlist() %>%
  na_if(999) %>% na_if(0) %>% na_if(10) %>%
  car::recode("50 = 0")
# hist.ly <- hist(ly.vec)
# hist.wxy <- hist(wxy.vec)
# hist.xc <- hist(xc.vec)
# hist.zjh <- hist(zjh.vec)
# hist.zl <- hist(zl.vec)  # 弃用的作图
ggplot() + # 直方图
  aes(ly.vec) +
  geom_histogram(binwidth = 1, colour = "black", fill = "white") +
  scale_x_continuous(lim = c(0,10))
```



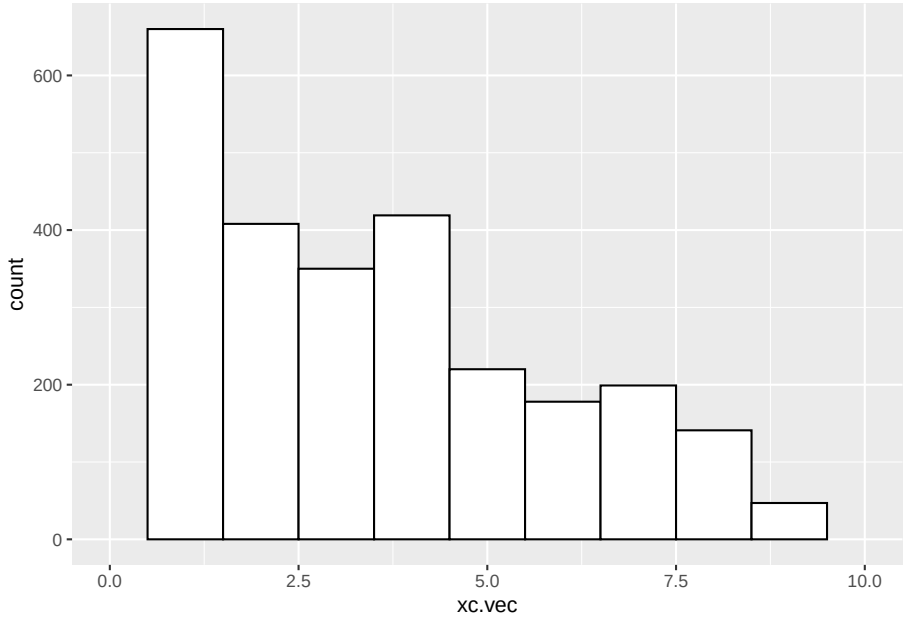

```
  geom_density()
```

```
## geom_density: na.rm = FALSE, orientation = NA, outline.type = upper
## stat_density: na.rm = FALSE, orientation = NA
## position_identity
```

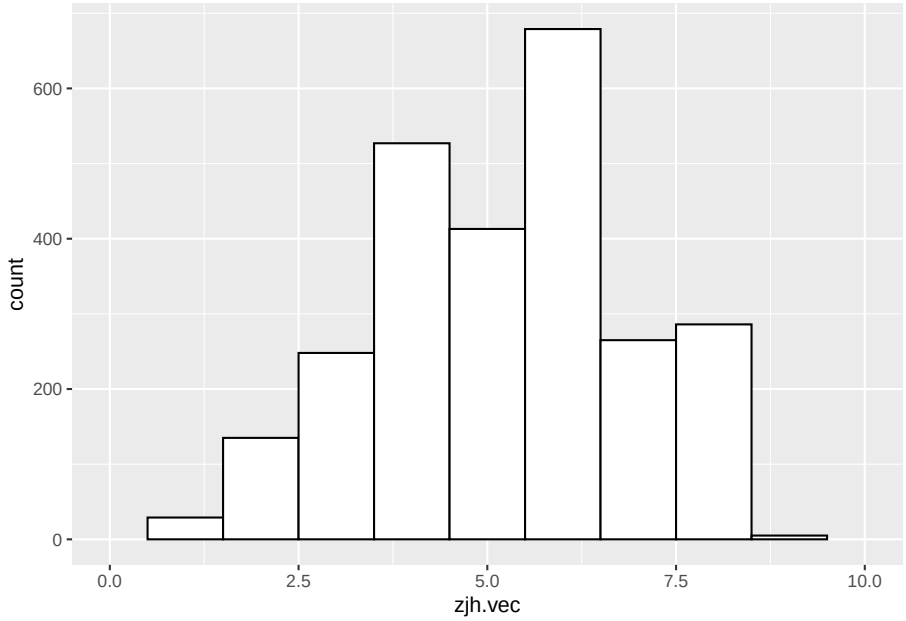
```
ggplot() +
  aes(wxy.vec) +
  geom_histogram(binwidth = 1, colour = "black", fill = "white") +
  scale_x_continuous(lim = c(0,10))
```



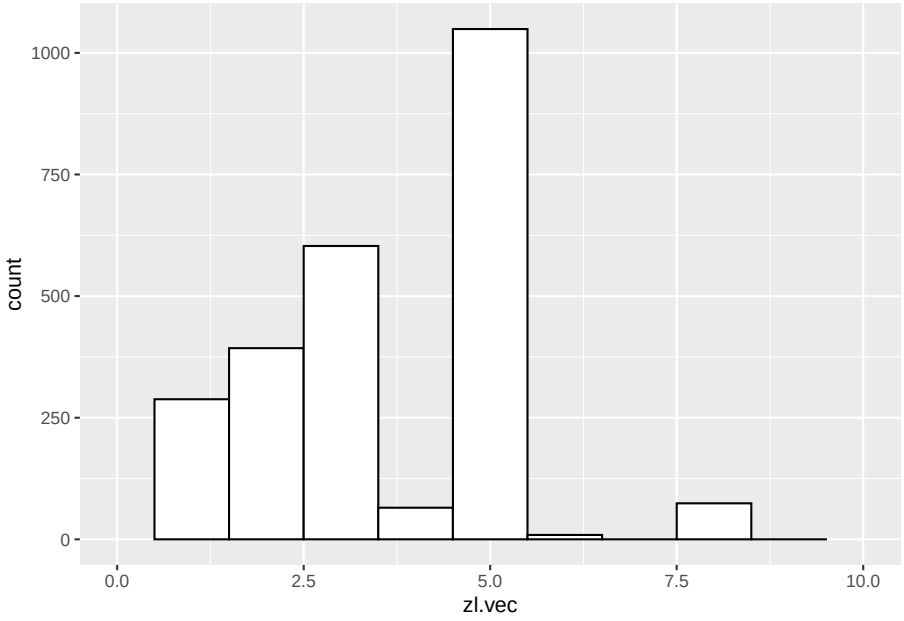

```
ggplot() +
  aes(xc.vec) +
  geom_histogram(binwidth = 1, colour = "black", fill = "white") +
  scale_x_continuous(lim = c(0,10))
```




```
ggplot() +
  aes(zjh.vec) +
  geom_histogram(binwidth = 1, colour = "black", fill = "white") +
  scale_x_continuous(lim = c(0,10))
```



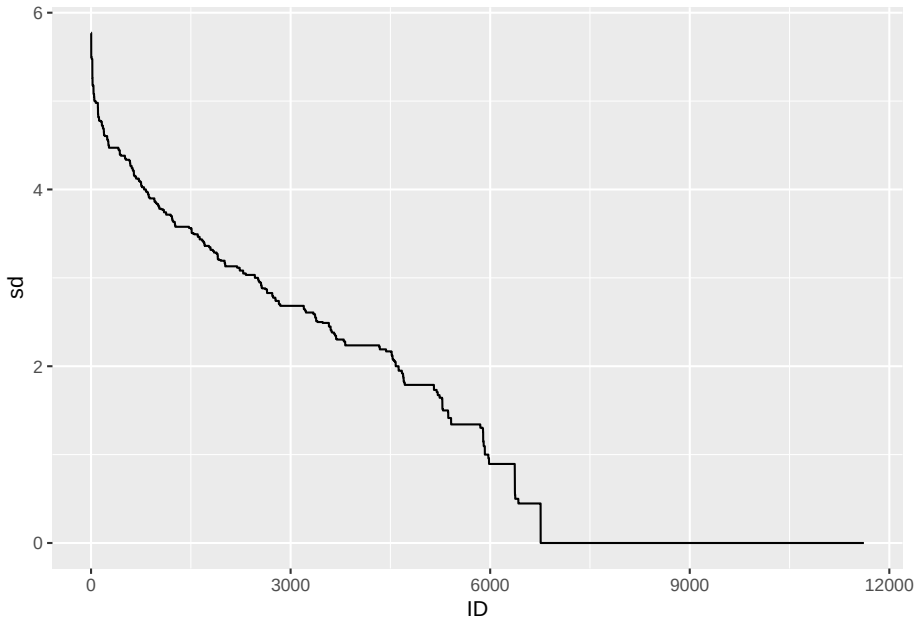

```
ggplot() +
  aes(zl.vec) +
  geom_histogram(binwidth = 1, colour = "black", fill = "white") +
  scale_x_continuous(lim = c(0,10))
```



观察评分者分数分布情况可得可能不存在打分漂移，而是由更广义的打分风格决定每个分布。理想情况下应使用模型（如多面 Rasch 模型）清除打分者差异，但由于样本量过小且这只是一个初步文件，大部分可由定性方式进行主观决策。因此，在第二轮预处理中，采用观察每个格子的标准差并作图的方式，继续进行 EDA。

```
ly.std <- df_ly[,-1] %>% unname() %>% unlist() %>%
  na_if(999)
wxy.std <- df_wxy[-154,-1] %>% unname() %>% unlist() %>% as.numeric() %>%
  na_if(999)
xc.std <- df_xc[-154,-1] %>% unname() %>% unlist() %>%
  na_if(999)
zjh.std <- df_zjh[-c(24,129),-1] %>% unname() %>% unlist() %>%
  na_if(999)
zl.std <- df_zl[,-1] %>% unname() %>% unlist() %>%
  na_if(999) %>% car::recode("50 = 0")
# 转置矩阵并处理成数据框
std_df <- t(data.frame(ly.std, wxy.std, xc.std, zjh.std, zl.std))
```

```r
std_vec <- std_df %>%
  colSds(na.rm = TRUE) %>% # 这里用的是 matrixStats 包
  sort(decreasing = TRUE) %>%
  data.frame() %>%
  mutate(ID = 1:11618) %>%
  rename(sd = ".") # 生成标准差向量并排序，做成新数据框
ggplot(data = std_vec, aes(x = ID, y = sd, group = 1)) +
  geom_line()
```

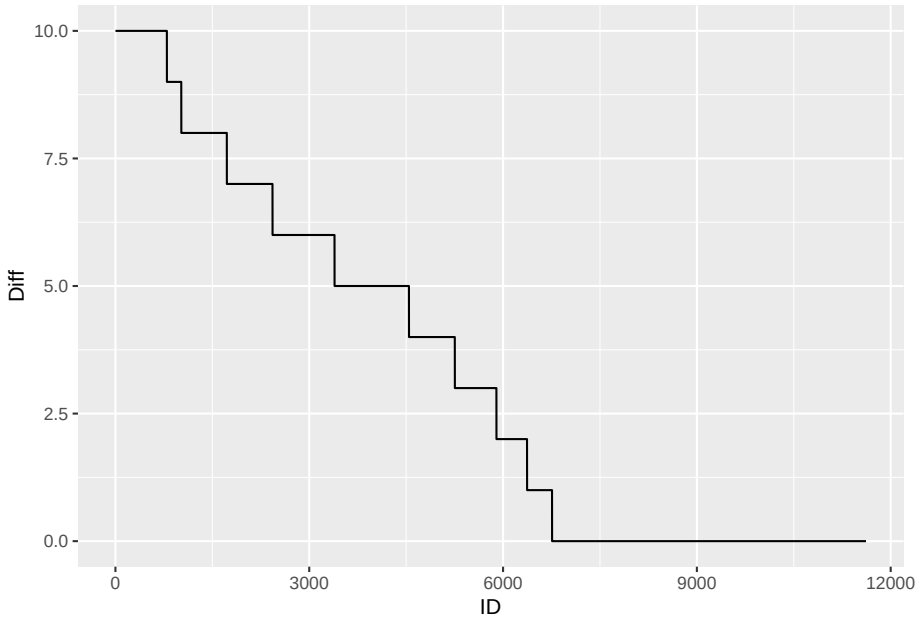



```r
# 其他暂时没有用的函数，备忘
# ggplot() +
#   aes(std_vec) +
#   geom_histogram(binwidth = 1, colour = "black", fill = "white") +
#   scale_x_continuous(lim = c(0,10))
```

（中途发现函数用错了，回去重新改了下图）
根据图，并经过讨论和简单的模拟计算（可见 datasheet），好像前后差异 5 就可以作为标准，不用标准差数据了。下面试一下（如果需要，可以以标准

差 2.5 作为分割值）

```
colMax <- function(data) # 抄一下别人的函数，以后学一下 sapply
  sapply(data, max, na.rm = TRUE)
colMin <- function(data)
  sapply(data, min, na.rm = TRUE)
Max <- std_df %>% data.frame() %>% colMax() %>% as.vector()
Min <- std_df %>% data.frame() %>% colMin() %>% as.vector()
Diff <- Max - Min
Diff <- Diff %>%
  sort(decreasing = TRUE) %>%
  data.frame() %>%
  mutate(ID = 1:11618) %>%
  rename(Diff = ".") # 排序，做成新数据框
ggplot(data = Diff, aes(x = ID, y = Diff, group = 1)) +
  geom_line()
```



经过统计，差值在 5 分以上的有 4500 个格子（笑死）。尝试寻找异质性来源（最大值最小值来源）。

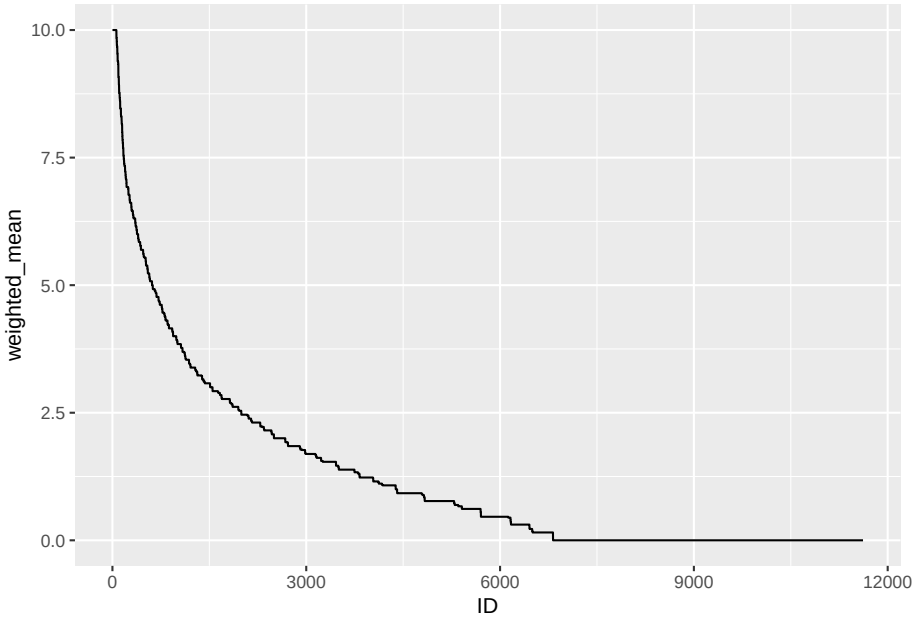
```
# r 不会搞，在 excel 里面做，请见.\data\2_way_specification_matrix\outlier check.xlsx 和
# 该部分标注尚未完成，仅完成了结果查阅（发现雷页的打分趋势比较高）
std_df %>% t() %>% as.data.frame() %>% write.csv("E:\\SDODT CO., Ltd\\ASD\\data\\2_way_
```

4 平均分计算

```
# 重算均分，加入权重
# W_Mean = fucntion(data) # 还是走到了自己写函数的这条不归路
# 我错了，根本写不出来，下面是一些尝试
# means <- data.frame(std_df)
# test <- colSums(means * w)/colSums(w)
# other.w <- vector("numeric", length = 11618) + 1
# wxy.w <- other.w + 1
# zjh.w <- other.w + 0.5
# w <- t(data.frame(other.w, wxy.w, other.w, zjh.w, other.w))
# means <- colSums(std_df * w)/colSums(w) # 计算权重均值
# w2 <- c(1, 2, 1, 1.5, 1)
# test <- weighted.mean(std_df, w2, na.rm = TRUE)


# 耻辱地使用了 excel 函数完成了这一工作，我会回来的
# 计算过程请见.\data\2_way_specification_matrix\weighted_mean.xlsx, source sheet
weighted_mean <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/weig
fig.means <- weighted_mean %>%
  unlist() %>%
  sort(decreasing = TRUE) %>%
  data.frame() %>%
  mutate(ID = 1:11618) %>%
  rename(weighted_mean = ".") # 做有排序的新数据框
means <- weighted_mean %>%
  unlist() %>%
```

```
  data.frame() %>%
  mutate(ID = 1:11618) %>%
  rename(mean = ".") # 做无排序的新数据框
ggplot(data = fig.means, aes(x = ID, y = weighted_mean, group = 1)) +
  geom_line()
```



剩余的工作应在 excel 表内完成……（已完成，请见 outlier check.xlsx 以及简化权重图）

5 聚类、降维

先降维（虽然大概率没用），方法采用因子分析。

```
weight_matrix <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/weig
weight_matrix <- weight_matrix %>% column_to_rownames(., var = '课程')
```

接着做一些虽然被诟病但是还是得做的经典测试（唉，为什么呢）。

```
KMO(weight_matrix)
```

```
## Kaiser-Meyer-Olkin factor adequacy
## Call: KMO(r = weight_matrix)
## Overall MSA =  0.76
## MSA for each item =
##                            1发声                            1提要求
##                            0.81                             0.70
##                            1命名                           1听者反应
##                            0.67                             0.72
##          1视觉感知能力和样本配对                           1独立游戏
##                            0.79                             0.72
##              1社会行为和社会游戏                           1动作模仿
##                            0.83                             0.74
##                            1仿说                 1认知（语言/语前）
##                            0.73                             0.72
##                        1语言表达                           1语言理解
##                            0.85                             0.75
##                          1小肌肉                           1大肌肉
##                            0.80                             0.62
##               1模仿（视觉/动作）                           1情感表达
##                            0.72                             0.62
##                        1社交互动                     1行为特征-非语言
##                            0.87                             0.77
##                    1行为特征-语言                           1问题行为
##                            0.84                             0.79
##                        1个人自理                           1适应行为
##                            0.69                             0.79
##                          2提要求                           2命名
##                            0.64                             0.57
##                        2听者反应          2视觉感知能力和样本配对
##                            0.78                             0.69
##                        2独立游戏              2社会行为和社会游戏
```

```
##                0.58                0.80
##          2动作模仿            2仿说
##                0.69                0.65
##   2认知（语言/语前）          2语言表达
##                0.69                0.86
##          2语言理解            2小肌肉
##                0.82                0.70
##            2大肌肉          2模仿（视觉/动作）
##                0.60                0.69
##          2情感表达            2社交互动
##                0.64                0.88
##   2行为特征-非语言          2行为特征-语言
##                0.70                0.88
##          2问题行为            2个人自理
##                0.82                0.63
##          2适应行为 2功能、特性、类别的听者反应LRFFC
##                0.84                0.81
##            2对话          2教室常规和集体能力
##                0.86                0.83
##          2语言结构            3提要求
##                0.85                0.64
##            3命名            3听者反应
##                0.60                0.70
##   3视觉感知能力和样本配对          3独立游戏
##                0.85                0.72
##   3社会行为和社会游戏          3动作模仿
##                0.85                0.81
##   3认知（语言/语前）          3语言表达
##                0.76                0.83
##          3语言理解            3小肌肉
##                0.80                0.66
##            3大肌肉          3模仿（视觉/动作）
##                0.76                0.82
```

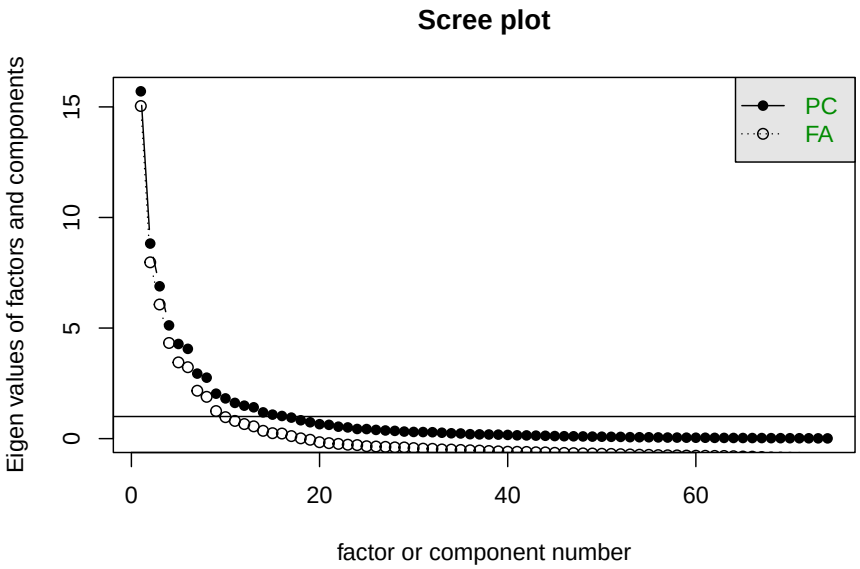
```
##                    3情感表达                    3社交互动
##                         0.68                         0.84
##                3行为特征-非语言                3行为特征-语言
##                         0.59                         0.87
##                    3问题行为                    3个人自理
##                         0.74                         0.63
##                    3适应行为 3功能、特性、类别的听者反应LRFFC
##                         0.75                         0.75
##                      3对话                3教室常规和集体能力
##                         0.89                         0.79
##                    3语言结构                      3阅读
##                         0.85                         0.52
##                      3书写                      3算术
##                         0.61                         0.64
```

```
bartlett.test(weight_matrix)
```

```
##
##  Bartlett test of homogeneity of variances
##
## data:  weight_matrix
## Bartlett's K-squared = 1328.8, df = 73, p-value < 0.00000000000000022
```

KMO 是抽样充分性度量，经验标准是 0.6 以上就能做，0.7 比较适合，0.8 适合，本例中为 0.76，还可以。Bartlett 球形检验用于检查方差同质性，小于 0.05 说明在 NHST 框架下有很大的可能性拒绝 H0。进一步推导说明数据适合做因子分析。

```
scree(weight_matrix)
fa_free <- fa(weight_matrix, fm = "pa", rotate = "varimax")
fa <- fa(weight_matrix, fm = "pa", rotate = "varimax", nfactors = 9)
scree.fa.9 <- scree(weight_matrix)[[1]][-c(13:74)]
```




```
scree.pca.9 <- scree(weight_matrix)[[2]][-c(13:74)]
x <- c(1:12)
scree1 <- data.frame(x, scree.fa.9, scree.pca.9)
```

EFA 得出大概可以降维为 9 个因子。

```
hline <- function(y = 0, color = "black") {
  list(type = "line",
       x0 = 0,
       x1 = 1,
       xref = "paper",
       y0 = y,
       y1 = y,
       line = list(color = color))
  }
fig <- plot_ly(scree1,
               x = ~x,
               y = ~scree.fa.9,
```

```
                name = 'FA',
                type = 'scatter',
                mode = 'lines+markers') %>%
  layout(
    title ='Scree Plot',
    font = list(size = 20),
    margin = list(l=50, r=50, b=100, t=100, pad=4),
    xaxis = list(title = 'Factor or component number'),
    yaxis = list(title = 'Eigen values of factors and components'),
    legend = list(title=list(text='<b> Methods </b>')),
    shapes = list(hline(1))
  )
fig <- fig %>% add_trace(y = ~scree.pca.9, name = 'PC', mode = 'lines+markers')
fig_2 <- style(fig, marker = list(size = 12))
```

```
fa
```

```
## Factor Analysis using method =  pa
## Call: fa(r = weight_matrix, nfactors = 9, rotate = "varimax", fm = "pa")
## Standardized loadings (pattern matrix) based upon correlation matrix
##                                    PA1   PA3   PA2   PA9   PA4   PA5   PA7
## 1发声                             0.01  0.75 -0.11  0.14  0.04 -0.16  0.28
## 1提要求                           0.01  0.68 -0.03 -0.06 -0.07  0.03  0.14
## 1命名                            -0.20  0.60 -0.10  0.09 -0.07 -0.12  0.13
## 1听者反应                        -0.05  0.08  0.18  0.06  0.34 -0.21  0.73
## 1视觉感知能力和样本配对          -0.61 -0.12 -0.14 -0.07 -0.17 -0.02  0.14
## 1独立游戏                        -0.07 -0.08 -0.02 -0.02 -0.20  0.52  0.14
## 1社会行为和社会游戏               0.29  0.32  0.33 -0.03  0.04  0.31  0.61
## 1动作模仿                        -0.09 -0.05  0.04  0.73 -0.24  0.22  0.28
## 1仿说                            -0.10  0.48 -0.10  0.44 -0.03 -0.26  0.20
## 1认知（语言/语前）               -0.49  0.20 -0.26 -0.23  0.14 -0.17  0.35
## 1语言表达                         0.24  0.83  0.06 -0.10  0.02 -0.02  0.18
## 1语言理解                         0.04  0.18 -0.05 -0.09  0.42 -0.11  0.74
## 1小肌肉                          -0.19  0.00 -0.04  0.10 -0.21  0.25  0.33
```

```
## 1大肌肉                          -0.09 -0.10 -0.05  0.25 -0.15  0.59  0.31
## 1模仿（视觉/动作）               -0.28 -0.01 -0.01  0.76 -0.24 -0.05  0.26
## 1情感表达                        -0.03 -0.01  0.76  0.01 -0.18 -0.06  0.20
## 1社交互动                         0.26  0.38  0.47 -0.09  0.07  0.11  0.58
## 1行为特征-非语言                 -0.20 -0.11  0.09  0.30 -0.04  0.20  0.64
## 1行为特征-语言                    0.20  0.71  0.22 -0.03  0.06 -0.14  0.37
## 1问题行为                        -0.02  0.03  0.75 -0.07  0.02 -0.13  0.33
## 1个人自理                        -0.10 -0.01  0.02 -0.02 -0.06  0.03  0.10
## 1适应行为                         0.10  0.16  0.68 -0.04 -0.04  0.19  0.48
## 2提要求                           0.11  0.70 -0.02 -0.07  0.03  0.03 -0.09
## 2命名                            -0.10  0.51 -0.06  0.02  0.21 -0.19 -0.24
## 2听者反应                         0.05 -0.01  0.05  0.00  0.85 -0.18  0.24
## 2视觉感知能力和样本配对          -0.65 -0.16 -0.15 -0.11 -0.02  0.03 -0.09
## 2独立游戏                        -0.11 -0.11 -0.04 -0.01 -0.09  0.61 -0.02
## 2社会行为和社会游戏               0.54  0.17  0.35 -0.02  0.41  0.39  0.06
## 2动作模仿                        -0.05 -0.08  0.03  0.73 -0.04  0.46 -0.02
## 2仿说                            -0.06  0.39 -0.11  0.52  0.15 -0.25 -0.03
## 2认知（语言/语前）               -0.48  0.08 -0.28 -0.32  0.52 -0.19 -0.21
## 2语言表达                         0.34  0.71  0.06 -0.14  0.26 -0.04 -0.14
## 2语言理解                         0.13  0.11 -0.12 -0.20  0.88 -0.10  0.08
## 2小肌肉                          -0.13 -0.11 -0.02  0.17  0.02  0.40 -0.05
## 2大肌肉                          -0.05 -0.15 -0.07  0.30  0.04  0.76 -0.02
## 2模仿（视觉/动作）               -0.33 -0.10 -0.04  0.76  0.00  0.16 -0.08
## 2情感表达                        -0.01 -0.04  0.80  0.10 -0.05 -0.08 -0.02
## 2社交互动                         0.46  0.29  0.53 -0.13  0.49  0.13  0.01
## 2行为特征-非语言                 -0.17 -0.21  0.06  0.34  0.32  0.36  0.24
## 2行为特征-语言                    0.36  0.66  0.21 -0.03  0.35 -0.15 -0.10
## 2问题行为                         0.07  0.01  0.83 -0.07  0.32 -0.12  0.02
## 2个人自理                        -0.10 -0.03  0.06 -0.03  0.02  0.09 -0.02
## 2适应行为                         0.25  0.03  0.73 -0.04  0.31  0.20 -0.09
## 2功能、特性、类别的听者反应LRFFC  0.05  0.02  0.08 -0.17  0.77 -0.22  0.16
## 2对话                             0.51  0.48  0.18 -0.18  0.47 -0.12  0.04
## 2教室常规和集体能力               0.45  0.07  0.46 -0.16  0.47  0.10  0.01
```

```
## 2语言结构                          0.42  0.46 -0.03 -0.23  0.50 -0.15 -0.05
## 3提要求                            0.30  0.42 -0.12 -0.13 -0.14 -0.09 -0.14
## 3命名                              0.11  0.31 -0.22 -0.08 -0.09 -0.31 -0.27
## 3听者反应                          0.39 -0.30 -0.14 -0.10  0.43 -0.35  0.15
## 3视觉感知能力和样本配对           -0.48 -0.27 -0.19 -0.15 -0.18 -0.05 -0.24
## 3独立游戏                         -0.06 -0.15 -0.12 -0.02 -0.18  0.55 -0.12
## 3社会行为和社会游戏                0.84 -0.05  0.09 -0.14  0.06  0.15  0.00
## 3动作模仿                          0.04 -0.19 -0.07  0.65 -0.20  0.36 -0.18
## 3认知（语言/语前）                -0.03 -0.17 -0.48 -0.44  0.10 -0.39 -0.22
## 3语言表达                          0.67  0.33 -0.08 -0.23 -0.12 -0.25 -0.17
## 3语言理解                          0.57 -0.21 -0.33 -0.30  0.33 -0.35  0.06
## 3小肌肉                            0.05 -0.20 -0.13  0.12 -0.16  0.20 -0.17
## 3大肌肉                            0.08 -0.28 -0.14  0.22 -0.12  0.64 -0.14
## 3模仿（视觉/动作）                -0.13 -0.22 -0.14  0.68 -0.22  0.04 -0.19
## 3情感表达                          0.21 -0.15  0.65  0.02 -0.23 -0.16 -0.06
## 3社交互动                          0.84  0.03  0.21 -0.24  0.05 -0.12 -0.01
## 3行为特征-非语言                   0.09 -0.39 -0.10  0.23  0.03  0.21  0.03
## 3行为特征-语言                     0.68  0.34  0.00 -0.15 -0.04 -0.36 -0.05
## 3问题行为                          0.26 -0.16  0.70 -0.14  0.07 -0.24 -0.02
## 3个人自理                         -0.02 -0.12  0.01 -0.07 -0.08 -0.01 -0.09
## 3适应行为                          0.54 -0.13  0.52 -0.16 -0.11 -0.01 -0.11
## 3功能、特性、类别的听者反应LRFFC   0.34 -0.25 -0.16 -0.28  0.39 -0.40  0.09
## 3对话                              0.79  0.15 -0.06 -0.29  0.12 -0.33  0.07
## 3教室常规和集体能力                0.68 -0.11  0.28 -0.25  0.17 -0.09 -0.02
## 3语言结构                          0.70  0.16 -0.22 -0.34  0.13 -0.34  0.01
## 3阅读                              0.20 -0.01 -0.30 -0.23  0.07 -0.18  0.02
## 3书写                              0.01 -0.12 -0.18 -0.04 -0.11  0.06 -0.06
## 3算术                             -0.45 -0.12 -0.20 -0.27 -0.03 -0.10 -0.21
##                                     PA6   PA8   h2    u2 com
## 1发声                              0.01 -0.12 0.72 0.279 1.6
## 1提要求                           -0.01 -0.15 0.51 0.487 1.2
## 1命名                             -0.07 -0.10 0.47 0.531 1.7
## 1听者反应                         -0.06 -0.17 0.76 0.236 2.0
```

```
## 1视觉感知能力和样本配对          0.03  0.44 0.65 0.346 2.4
## 1独立游戏                        0.15  0.15 0.39 0.614 2.0
## 1社会行为和社会游戏             -0.07  0.07 0.78 0.223 3.3
## 1动作模仿                       -0.06  0.07 0.73 0.267 1.8
## 1仿说                            0.01 -0.15 0.58 0.423 3.4
## 1认知（语言/语前）              -0.10  0.20 0.62 0.382 4.5
## 1语言表达                       -0.06  0.05 0.79 0.208 1.3
## 1语言理解                       -0.07 -0.02 0.79 0.213 1.8
## 1小肌肉                          0.61  0.39 0.78 0.220 3.4
## 1大肌肉                         -0.03  0.02 0.55 0.454 2.3
## 1模仿（视觉/动作）              -0.04  0.17 0.81 0.193 1.9
## 1情感表达                       -0.06  0.13 0.67 0.330 1.3
## 1社交互动                       -0.10  0.03 0.81 0.194 3.5
## 1行为特征-非语言                 0.10  0.19 0.65 0.354 2.3
## 1行为特征-语言                  -0.04  0.01 0.75 0.250 2.0
## 1问题行为                        0.00 -0.16 0.72 0.275 1.6
## 1个人自理                        0.72 -0.06 0.55 0.447 1.1
## 1适应行为                       -0.02 -0.12 0.79 0.211 2.3
## 2提要求                         -0.04 -0.02 0.52 0.478 1.1
## 2命名                           -0.11  0.05 0.43 0.569 2.4
## 2听者反应                       -0.09 -0.11 0.83 0.172 1.3
## 2视觉感知能力和样本配对          0.03  0.41 0.67 0.330 2.1
## 2独立游戏                        0.16  0.11 0.45 0.549 1.4
## 2社会行为和社会游戏             -0.05  0.15 0.79 0.206 4.1
## 2动作模仿                       -0.01 -0.05 0.76 0.241 1.8
## 2仿说                           -0.01  0.04 0.52 0.478 2.7
## 2认知（语言/语前）              -0.16  0.25 0.85 0.146 4.8
## 2语言表达                       -0.11  0.29 0.83 0.172 2.4
## 2语言理解                       -0.10  0.03 0.88 0.122 1.3
## 2小肌肉                          0.63  0.39 0.77 0.227 2.8
## 2大肌肉                          0.00 -0.04 0.69 0.305 1.4
## 2模仿（视觉/动作）               0.02  0.10 0.74 0.261 1.6
## 2情感表达                       -0.05  0.18 0.69 0.306 1.2
```

```
## 2社交互动                          -0.11  0.18 0.89 0.109 4.2
## 2行为特征-非语言                    0.20  0.10 0.53 0.467 5.8
## 2行为特征-语言                     -0.07  0.18 0.79 0.208 2.9
## 2问题行为                          -0.01 -0.12 0.83 0.167 1.4
## 2个人自理                           0.80 -0.12 0.67 0.328 1.1
## 2适应行为                           0.03 -0.06 0.76 0.241 1.9
## 2功能、特性、类别的听者反应LRFFC -0.14 -0.07 0.74 0.264 1.5
## 2对话                              -0.14  0.21 0.85 0.151 4.2
## 2教室常规和集体能力                 0.20 -0.13 0.74 0.262 3.9
## 2语言结构                          -0.11  0.21 0.77 0.229 4.2
## 3提要求                            -0.08  0.00 0.35 0.647 3.0
## 3命名                              -0.15  0.02 0.37 0.634 4.9
## 3听者反应                          -0.13 -0.23 0.67 0.331 5.3
## 3视觉感知能力和样本配对             0.05  0.23 0.52 0.485 3.8
## 3独立游戏                           0.22 -0.10 0.45 0.551 2.1
## 3社会行为和社会游戏                -0.06  0.02 0.76 0.236 1.2
## 3动作模仿                           0.01 -0.25 0.73 0.273 2.6
## 3认知（语言/语前）                 -0.20  0.08 0.71 0.291 4.2
## 3语言表达                          -0.16  0.22 0.81 0.192 2.9
## 3语言理解                          -0.17 -0.09 0.84 0.158 4.5
## 3小肌肉                             0.64  0.17 0.61 0.392 2.1
## 3大肌肉                             0.00 -0.26 0.66 0.336 2.5
## 3模仿（视觉/动作）                  0.00 -0.15 0.65 0.348 2.0
## 3情感表达                          -0.08  0.11 0.59 0.413 1.9
## 3社交互动                          -0.16  0.09 0.85 0.147 1.5
## 3行为特征-非语言                    0.15 -0.06 0.30 0.701 3.1
## 3行为特征-语言                     -0.14  0.06 0.75 0.246 2.4
## 3问题行为                          -0.05 -0.18 0.70 0.298 1.9
## 3个人自理                           0.80 -0.22 0.72 0.277 1.3
## 3适应行为                          -0.01 -0.20 0.68 0.321 2.8
## 3功能、特性、类别的听者反应LRFFC -0.19 -0.15 0.66 0.339 5.8
## 3对话                              -0.17  0.16 0.91 0.091 2.1
## 3教室常规和集体能力                 0.21 -0.24 0.76 0.243 2.5
```

```
## 3语言结构                          -0.15  0.14 0.85 0.150 2.7
## 3阅读                              -0.05  0.08 0.23 0.771 3.9
## 3书写                               0.50  0.31 0.41 0.589 2.3
## 3算术                              -0.15 -0.01 0.41 0.590 3.3
##
##                        PA1  PA3  PA2  PA9  PA4  PA5  PA7  PA6  PA8
## SS loadings           8.96 7.11 6.99 5.57 5.50 5.35 4.21 3.99 2.16
## Proportion Var        0.12 0.10 0.09 0.08 0.07 0.07 0.06 0.05 0.03
## Cumulative Var        0.12 0.22 0.31 0.39 0.46 0.53 0.59 0.64 0.67
## Proportion Explained  0.18 0.14 0.14 0.11 0.11 0.11 0.08 0.08 0.04
## Cumulative Proportion 0.18 0.32 0.46 0.57 0.68 0.79 0.88 0.96 1.00
##
## Mean item complexity =  2.6
## Test of the hypothesis that 9 factors are sufficient.
##
## The degrees of freedom for the null model are  2701  and the objective function was
## The degrees of freedom for the model are 2071  and the objective function was  47.54
##
## The root mean square of the residuals (RMSR) is  0.04
## The df corrected root mean square of the residuals is  0.05
##
## The harmonic number of observations is  157 with the empirical chi square  1648.54
## The total number of observations was  157  with Likelihood Chi Square =  5918.13  wi
##
## Tucker Lewis Index of factoring reliability =  0.556
## RMSEA index =  0.109  and the 90 % confidence intervals are  0.106 0.112
## BIC =  -4553.35
## Fit based upon off diagonal values = 0.97
## Measures of factor score adequacy
##                                                 PA1  PA3  PA2  PA9  PA4  PA5
## Correlation of (regression) scores with factors   0.99 0.98 0.99 0.97 0.99 0.97
## Multiple R square of scores with factors          0.99 0.96 0.97 0.94 0.97 0.93
## Minimum correlation of possible factor scores     0.97 0.92 0.95 0.88 0.94 0.86
```

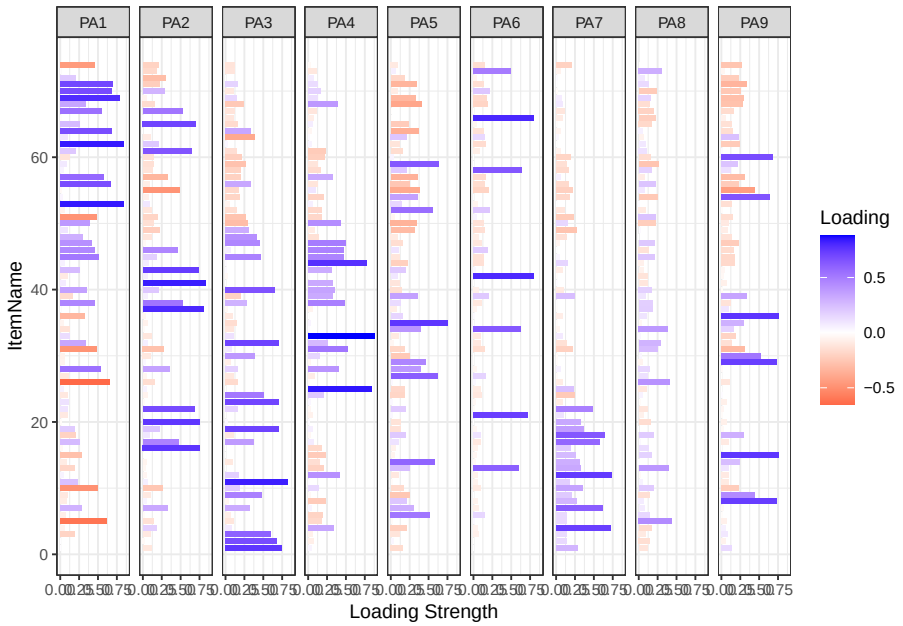
```
##                                                 PA7  PA6  PA8
## Correlation of (regression) scores with factors   0.98 0.96 0.95
## Multiple R square of scores with factors          0.95 0.92 0.90
## Minimum correlation of possible factor scores     0.90 0.84 0.80
```

```
facorrs <- fa[["r"]]
faloadings <- fa[["loadings"]]
Lambda <- unclass(faloadings)
p <- nrow(Lambda)
factors <- ncol(Lambda)
vx <- colSums(faloadings^2)
varex <- rbind(`SS loadings` = vx)
if (is.null(attr(faloadings, "covariance"))) {
  varex <- rbind(varex, `Proportion Var` = vx/p)
  if (factors > 1)
    varex <- rbind(varex, `Cumulative Var` = cumsum(vx/p))
}
tibble::rownames_to_column(as.data.frame(varex), "faloadings")
```

```
##       faloadings       PA1        PA3        PA2        PA9        PA4
## 1    SS loadings 8.9564699 7.10741553 6.98905281 5.57181716 5.49729140
## 2 Proportion Var 0.1210334 0.09604616 0.09444666 0.07529483 0.07428772
## 3 Cumulative Var 0.1210334 0.21707953 0.31152619 0.38682102 0.46110874
##          PA5        PA7       PA6        PA8
## 1 5.34673921 4.20597176 3.9934985 2.15650993
## 2 0.07225323 0.05683746 0.0539662 0.02914203
## 3 0.53336197 0.59019943 0.6441656 0.67330765
```

```
Lambda <- data.frame(Lambda) %>% mutate(ItemName = c(1:74))
Lambda.m <- melt(Lambda, id="ItemName",
                 measure=c("PA1", "PA2", "PA3", "PA4", "PA5",
                           "PA6", "PA7", "PA8", "PA9"),
                 variable.name="Factor", value.name="Loading")
ggplot(Lambda.m, aes(ItemName, abs(Loading), fill=Loading)) +
```

```
  facet_wrap(~ Factor, nrow=1) +
  geom_bar(stat="identity") +
  coord_flip() +
  scale_fill_gradient2(name = "Loading",
                       high = "blue", mid = "white", low = "red",
                       midpoint=0) +
  ylab("Loading Strength") +
  theme_bw(base_size=10)
```




```
# 作图不方便，还是转到 excel 中供观看吧
Lambda %>%
  as.data.frame() %>%
  rownames_to_column(., var = '课程') %>%
  write_excel_csv(
    "E:\\SDODT CO., Ltd\\ASD\\data\\2_way_specification_matrix\\factor loadings.csv")
```

EFA 结果见外。

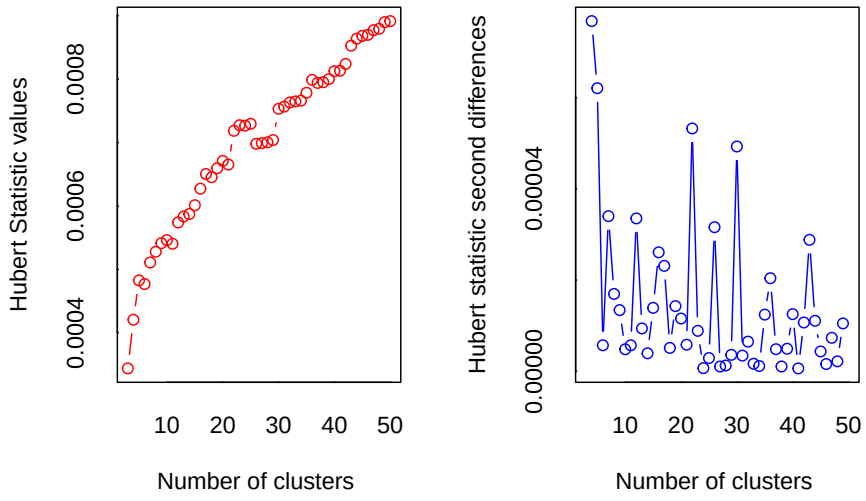
```
set.seed(1111) # 唉，为什么要设种子呢
clust_number <- weight_matrix %>%
  scale() %>%
  NbClust(min.nc = 3, max.nc = 50, method = "kmeans")
```

```
## Warning in pf(beale, pp, df2): 产生了NaNs

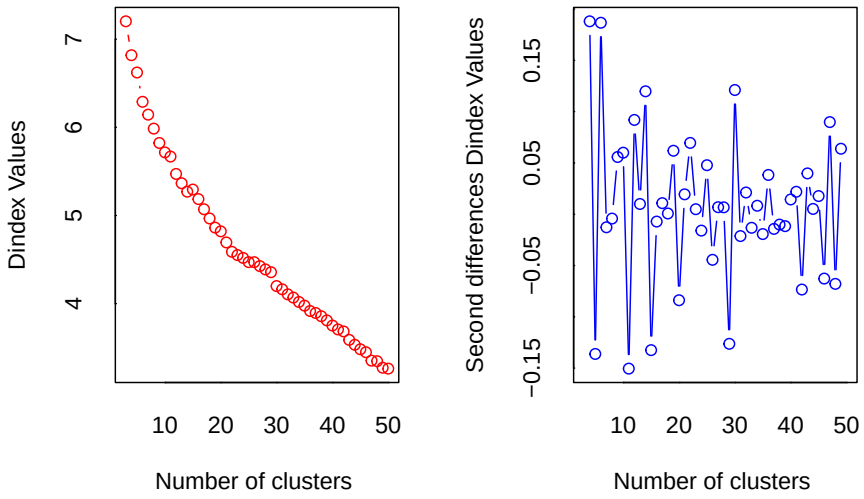
## Warning in pf(beale, pp, df2): 产生了NaNs

## Warning in pf(beale, pp, df2): 产生了NaNs

## Warning in pf(beale, pp, df2): 产生了NaNs
```




```
## *** : The Hubert index is a graphical method of determining the number of clusters.
##                 In the plot of Hubert index, we seek a significant knee that corresp
##                 significant increase of the value of the measure i.e the significant
##                 index second differences plot.
##
```



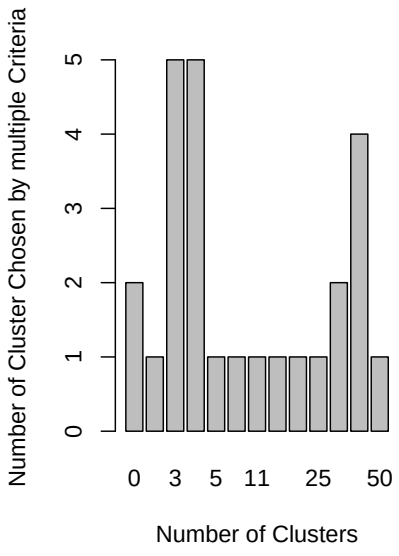

```
## *** : The D index is a graphical method of determining the number of clusters.
##                 In the plot of D index, we seek a significant knee (the significant
##                 second differences plot) that corresponds to a significant increase
##                 the measure.
##
## *******************************************************************
## * Among all indices:
## * 5 proposed 3 as the best number of clusters
## * 5 proposed 4 as the best number of clusters
## * 1 proposed 5 as the best number of clusters
## * 1 proposed 7 as the best number of clusters
## * 1 proposed 11 as the best number of clusters
## * 1 proposed 20 as the best number of clusters
## * 1 proposed 22 as the best number of clusters
## * 1 proposed 25 as the best number of clusters
## * 2 proposed 47 as the best number of clusters
## * 4 proposed 49 as the best number of clusters
## * 1 proposed 50 as the best number of clusters
```

```
##
##                     ***** Conclusion *****
##
## * According to the majority rule, the best number of clusters is  3
##
##
## *******************************************************************
```

```
table(clust_number$Best.n[1,])
```

```
##
##  0  2  3  4  5  7 11 20 22 25 47 49 50
##  2  1  5  5  1  1  1  1  1  1  2  4  1
```

```
barplot(table(clust_number$Best.n[1,]),
        xlab = "Number of Clusters",
        ylab = "Number of Cluster Chosen by multiple Criteria"
)
```



```
set.seed(1111) # 硬是没懂
fit.km <- weight_matrix %>% scale() %>% kmeans(50, nstart = 156)
fit.km$size
```

```
##  [1] 5 1 2 6 4 5 2 2 2 3 6 6 2 7 2 2 2 2 3 3 7 4 2 1 4 4 4 2 2 3 3 3 3 3 6 4 2 2
## [39] 3 2 3 4 4 1 1 4 3 1 4 1
```

```
fit.km$centers
```

```
##           1发声      1提要求        1命名    1听者反应 1视觉感知能力和样本配对
## 1   0.208658303 -0.05748630 -0.225195192 -0.73620523            -0.424010145
## 2   0.822415668 -0.30589041  0.721912720 -0.31269344             0.310908532
## 3  -0.250465217 -0.30589041 -0.393341162 -0.73620523            -0.564403966
## 4  -0.311276279 -0.22826413 -0.333289030  0.07346902            -0.198377218
## 5  -0.448101169 -0.30589041 -0.393341162 -0.41314175            -0.604516487
## 6   1.248527469  0.40482135  0.803698005  2.88295035            -0.586465853
## 7  -0.448101169 -0.30589041 -0.393341162 -0.46170685            -0.694769658
## 8  -0.242863834 -0.30589041 -0.393341162  0.74608603            -0.694769658
## 9  -0.448101169 -0.30589041 -0.393341162 -0.73620523             1.110293760
## 10 -0.448101169 -0.30589041 -0.393341162 -0.66019029            -0.042941201
## 11 -0.425297021 -0.30589041  0.207180159  0.03661329             0.237846441
## 12 -0.311276279 -0.30589041 -0.233202143  0.58829745             3.524566081
## 13  0.540078593  0.14261701  0.127110650 -0.73620523            -0.434038275
## 14 -0.428554757 -0.30589041 -0.393341162 -0.02146738             1.342373342
## 15  1.809509518  0.78087757  5.972184841  0.15178744             0.613901320
## 16  1.467447293 -0.15063784 -0.273236897  0.36601135            -0.694769658
## 17 -0.003420276  0.08224101 -0.153132633  0.17597401            -0.694769658
## 18 -0.448101169 -0.07301156 -0.393341162  0.13796654            -0.378883560
## 19  0.144806688  0.08224101  1.808570349 -0.68552860            -0.032913071
## 20  0.007981798  0.05636558 -0.073063124 -0.73620523            -0.544347706
## 21 -0.448101169 -0.30589041 -0.393341162 -0.70362740             0.059488985
## 22 -0.448101169 -0.30589041 -0.393341162 -0.73620523            -0.418996080
## 23 -0.311276279  0.39274615  0.207180159 -0.50816042            -0.108124047
```

```
## 24  3.246170865  9.78552653  2.369056915 -0.50816042           -0.333756974
## 25 -0.413894947 -0.30589041 -0.393341162 -0.19143152           -0.138208437
## 26 -0.448101169 -0.30589041 -0.393341162 -0.73620523           -0.474150796
## 27 -0.448101169 -0.30589041 -0.393341162 -0.45748379            0.739252946
## 28 -0.448101169 -0.30589041 -0.393341162 -0.73620523           -0.424010145
## 29  0.920147732  1.09138270  0.687597216  1.12616071           -0.243503803
## 30  3.618638621  1.90214612  2.084365326  0.02112877           -0.006171391
## 31 -0.448101169 -0.30589041 -0.393341162 -0.63485198            1.441222053
## 32  0.007981798 -0.30589041  0.007006386 -0.46669773           -0.243503803
## 33  0.099198391 -0.15063784  0.927805745  0.96146168            0.929787418
## 34 -0.265667983 -0.25413955 -0.313271652  0.53071038           -0.694769658
## 35 -0.448101169 -0.30589041 -0.393341162 -0.73620523            0.651506808
## 36 -0.448101169 -0.30589041 -0.393341162 -0.39413801           -0.694769658
## 37 -0.448101169 -0.30589041 -0.393341162 -0.73620523           -0.694769658
## 38 -0.448101169 -0.30589041 -0.393341162 -0.73620523           -0.627079780
## 39 -0.448101169 -0.30589041 -0.393341162  0.15063570           -0.694769658
## 40  0.851735287  0.31511986 -0.093080501  0.30900015           -0.694769658
## 41 -0.402492873 -0.25413955 -0.353306407 -0.48282211           -0.694769658
## 42  0.095397700 -0.13123127 -0.273236897  0.97729813           -0.514263316
## 43 -0.413894947 -0.30589041 -0.393341162  0.30900015           -0.694769658
## 44  0.441260617  3.57542380  0.147128027 -0.73620523           -0.424010145
## 45 -0.037626499  2.48865582 -0.033028369 -0.73620523           -0.514263316
## 46 -0.448101169 -0.18945098  0.207180159 -0.58244774           -0.062997462
## 47 -0.448101169 -0.30589041 -0.393341162  0.33926535           -0.694769658
## 48 -0.448101169 -0.30589041 -0.393341162  2.15236235           -0.694769658
## 49  0.612291729  0.19868044 -0.153132633  3.04553785           -0.491700023
## 50  6.598380674  2.79916095  2.008744122  1.16416818           -0.694769658
##      1独立游戏 1社会行为和社会游戏   1动作模仿       1仿说 1认知（语言/语前）
## 1  -0.38041393         -0.40621455 -0.62756837 -0.25864383       -0.579342392
## 2   0.38831295         -0.92863607 -0.62756837 -0.33555118       -0.779040280
## 3  -0.38041393          0.25804723 -0.62756837 -0.33555118        0.067826690
## 4  -0.30280208          2.04860486  0.79254650  0.02762242       -0.639081076
## 5  -0.34160800          0.38795043 -0.44349156 -0.33555118       -0.919852893
```

```
## 6  -0.38041393          1.53741821 -0.12514696  0.63291175        1.494784732
## 7  -0.38041393         -0.23815960 -0.62756837 -0.33555118       -0.354326680
## 8  -0.38041393          0.12463313 -0.62756837 -0.33555118        0.065835400
## 9  -0.38041393         -0.92863607 -0.62756837 -0.33555118        0.029992190
## 10  0.15232913         -0.52293238 -0.15594674 -0.33555118       -0.686872024
## 11 -0.38041393         -0.38093609  1.49472899 -0.05783019       -0.710767497
## 12 -0.10446069         -0.81628735 -0.20888386 -0.25009857        2.754076200
## 13 -0.38041393          0.56232499 -0.62756837 -0.33555118        0.326694322
## 14 -0.09953295         -0.78418772 -0.44194470 -0.33555118        1.484202451
## 15 -0.38041393         -0.50732839 -0.32438304  2.61256393        2.001368776
## 16 -0.38041393         -0.92863607  1.32148022  4.79160553       -0.651028813
## 17 -0.38041393          0.08250236 -0.62756837 -0.33555118       -0.722715234
## 18 -0.38041393         -0.46519762 -0.62756837 -0.33555118       -0.202988680
## 19 -0.38041393         -0.92863607 -0.30994564  0.21989080       -0.137276127
## 20 -0.38041393         -0.25454378 -0.62756837 -0.16464596       -0.543499181
## 21 -0.38041393         -0.89252398 -0.61519346 -0.33555118       -0.016091938
## 22  0.82688149          0.12931432  0.89076455 -0.33555118       -0.915870314
## 23  6.19072258          0.56700619  0.69345345 -0.14328280       -0.005851021
## 24 -0.38041393          1.59921000 -0.62756837  0.81805908        0.675169982
## 25  1.32273497          0.32475428  3.25248208 -0.20737226       -0.337599849
## 26  0.21461024         -0.39966087  0.48772055 -0.33555118       -0.941757077
## 27  1.16607402          0.15506090  0.50817353 -0.33555118        0.028000900
## 28 -0.38041393         -0.76011300 -0.32438304 -0.33555118       -0.651028813
## 29  0.03351593          4.48516760  1.16988756  0.81805908        0.065835400
## 30 -0.38041393          1.76773307 -0.62756837  0.99845904        1.419912248
## 31  2.98276618          0.30719979 -0.54094399 -0.25009857       -0.483760496
## 32 -0.38041393         -0.92863607 -0.48319440  0.09171188        0.818542824
## 33 -0.38041393          0.53189722  3.35715320  1.07441692        0.245051454
## 34 -0.38041393         -0.11410789 -0.62756837 -0.33555118        0.149469559
## 35 -0.09583715         -0.92863607 -0.62756837 -0.33555118        0.376476560
## 36  0.26635148          0.56700619 -0.28107085 -0.27146172       -0.848166472
## 37 -0.38041393         -0.48626301  0.65014126 -0.33555118       -1.045304130
## 38  1.68923537         -0.38093609 -0.17279037 -0.33555118       -1.045304130
```

```
## 39 -0.38041393         -0.33880532 -0.62756837 -0.33555118       -0.662976550
## 40 -0.38041393          0.01930621 -0.62756837 -0.33555118       -0.471812760
## 41 -0.38041393         -0.78820018  0.06542668 -0.33555118       -0.639081076
## 42 -0.38041393         -0.14921686 -0.58425618 -0.01510389        0.813564601
## 43 -0.38041393         -0.33880532 -0.56260009 -0.33555118       -0.615185602
## 44 -0.38041393          0.16676390 -0.62756837 -0.33555118       -0.400126338
## 45 -0.38041393         -0.04388994 -0.62756837 -0.33555118       -0.758558445
## 46 -0.38041393         -0.42306685 -0.15113427 -0.33555118       -0.310518312
## 47 -0.38041393          0.07626076 -0.62756837 -0.33555118        0.091058401
## 48 -0.38041393          0.63020234 -0.62756837 -0.33555118        0.173365032
## 49 -0.27693146          1.36749078 -0.23775865 -0.01510389       -0.453891154
## 50 -0.38041393         -0.59158993  1.71128994  7.48336280        0.029992190
##       1语言表达     1语言理解      1小肌肉      1大肌肉 1模仿（视觉/动作）
## 1   0.315397888 -0.407960525 -0.50995301 -0.54305877       -0.674783409
## 2  -0.001202995 -0.832985367 -0.60285105 -0.54305877       -0.674783409
## 3   1.428952898 -0.284838249 -0.33447895 -0.54305877       -0.674783409
## 4   0.645239152 -0.402900706 -0.02997983  0.19078544        0.526834349
## 5  -0.158919301 -0.643242134 -0.60285105 -0.28405493       -0.602751827
## 6   0.623431465  3.429912604  0.05569280  0.10349156       -0.213781283
## 7  -0.404255779  0.332881387 -0.60285105 -0.54305877       -0.674783409
## 8  -0.608702843  0.684960498 -0.60285105 -0.54305877       -0.674783409
## 9  -0.608702843 -0.832985367 -0.23125891 -0.32722224        0.081548204
## 10 -0.608702843 -0.782387172  1.19317762 -0.23289368       -0.282611462
## 11 -0.608702843 -0.161409318 -0.60285105 -0.54305877        1.990385133
## 12 -0.554183626  0.469918167  0.82158548  0.52173479        1.077985091
## 13  2.078640236 -0.175208826 -0.20029290 -0.54305877       -0.674783409
## 14 -0.608702843 -0.355916667 -0.20471661 -0.17305328       -0.232303690
## 15  1.926440755  0.343422678 -0.37060596 -0.54305877        0.117563995
## 16  0.413532479 -0.757088074 -0.09191186 -0.54305877        1.774290386
## 17  0.577090130 -0.187858375 -0.60285105 -0.54305877       -0.674783409
## 18 -0.363366366  0.495217265 -0.60285105 -0.54305877       -0.674783409
## 19 -0.254327931 -0.832985367 -0.60285105 -0.54305877       -0.410667608
## 20  0.413532479  0.039833505 -0.60285105 -0.54305877       -0.674783409
```

```
## 21 -0.561972085 -0.681190781 -0.45686842 -0.44439064       -0.479269115
## 22 -0.608702843 -0.832985367 -0.50995301  1.83354128        0.083549081
## 23 -0.281587540  0.001884858  0.92996652  0.88146235        0.729832444
## 24  4.216247876  0.305474032 -0.32415694 -0.28405493       -0.674783409
## 25 -0.608702843  0.029292214  0.78803897  4.50751610        1.576203535
## 26 -0.608702843 -0.832985367 -0.53317752  1.16204984       -0.050509697
## 27 -0.608702843 -0.369168575  3.37112043  0.53612389        0.217607859
## 28 -0.608702843 -0.832985367 -0.32415694 -0.54305877       -0.386657080
## 29  2.008219581  2.127009070  0.97641554  1.96064501        1.053974564
## 30  3.925478717  0.699015552  0.77341613 -0.33521618       -0.674783409
## 31 -0.581443234 -0.149909728  3.54659450  0.17639634       -0.410667608
## 32 -0.199808714 -0.478797999 -0.54091902 -0.08260750       -0.554730772
## 33 -0.145289497  0.342272719  0.17129924 -0.25527673        3.623100996
## 34 -0.445145191  1.115045160 -0.60285105 -0.54305877       -0.674783409
## 35 -0.608702843 -0.693840330 -0.12287787 -0.24088762       -0.134546543
## 36  0.505533658 -0.311191476 -0.55640203 -0.30563858       -0.494704454
## 37 -0.608702843 -0.832985367  0.88351751  1.01096427        0.873895608
## 38 -0.608702843 -0.832985367 -0.32415694 -0.15455301       -0.674783409
## 39 -0.363366366 -0.453498901 -0.60285105 -0.54305877       -0.674783409
## 40  1.006428965  0.324448355 -0.60285105 -0.54305877       -0.674783409
## 41 -0.608702843 -0.630592585  1.17769462  0.11883993       -0.002488642
## 42  0.075059006  1.676895956 -0.60285105 -0.54305877       -0.674783409
## 43 -0.240698127 -0.187858375 -0.60285105 -0.54305877       -0.620759723
## 44  1.026873672 -0.453498901 -0.60285105 -0.54305877       -0.674783409
## 45  0.454421892 -0.529396194 -0.60285105 -0.54305877       -0.674783409
## 46 -0.547368724 -0.548370518 -0.02223833 -0.43514050       -0.242593916
## 47 -0.608702843  0.836755084 -0.60285105 -0.54305877       -0.674783409
## 48  0.863316020  0.988549671 -0.60285105 -0.54305877       -0.674783409
## 49  0.260197181  1.785471250 -0.09191186  0.08286718       -0.512712349
## 50  1.599325452  0.077782152  0.97641554 -0.54305877        3.863206270
##      1情感表达   1社交互动 1行为特征-非语言 1行为特征-语言    1问题行为
## 1  -0.42420827 -0.27739230     -0.739956390    0.263311837 -0.482725166
## 2  -0.51543169 -0.91996568     -0.849805746   -0.838414976 -0.482725166
```

```
## 3  -0.51543169  0.25327223    -0.849805746   1.501854397 -0.482725166
## 4   1.51809037  1.97402117     0.065605556   0.576547891  1.123733993
## 5   0.08322200  0.50596963    -0.849805746  -0.303753434 -0.125734242
## 6  -0.51543169  1.67760311     0.781660620   0.629113942  0.300010490
## 7  -0.51543169 -0.27418344    -0.666723485  -0.503576435 -0.482725166
## 8  -0.51543169 -0.12577386     0.340228947  -0.255147840 -0.304229704
## 9   0.33978787 -0.91996568     0.065605556  -0.838414976 -0.482725166
## 10 -0.51543169 -0.83707024    -0.103915055  -0.838414976 -0.482725166
## 11 -0.06881703 -0.30627200     0.065605556  -0.838414976 -0.482725166
## 12 -0.23035850 -0.79963359     1.286153959  -0.190340380 -0.244731216
## 13 -0.51543169  0.67042349    -0.849805746   1.829492109 -0.482725166
## 14 -0.51543169 -0.74462463    -0.100040298  -0.838414976 -0.227731649
## 15 -0.51543169 -0.41457089    -0.117476704   2.142728164 -0.304229704
## 16 -0.51543169 -0.63116866     0.065605556   0.976193892 -0.006737267
## 17  0.33978787  0.03667446    -0.300558964   0.619752864  0.350253658
## 18 -0.51543169 -0.41457089    -0.300558964  -0.546781408 -0.482725166
## 19 -0.51543169 -0.91996568    -0.849805746  -0.082327948 -0.482725166
## 20 -0.32538290 -0.27017238    -0.483641225  -0.017520488 -0.482725166
## 21 -0.51543169 -0.88902314    -0.849805746  -0.838414976 -0.482725166
## 22 -0.51543169 -0.66325721     0.253773435  -0.838414976 -0.482725166
## 23  0.33978787  0.48791981     0.981016859   1.041001351 -0.185232729
## 24  0.05471468  2.18460233    -0.239531544   2.920417678  0.707244582
## 25 -0.51543169 -0.25212256     2.015092589  -0.197541209 -0.482725166
## 26 -0.51543169 -0.70737898     0.167317923  -0.838414976 -0.482725166
## 27 -0.51543169 -0.53289745     1.425160861  -0.521578507 -0.482725166
## 28  1.19500743 -0.34237163    -0.422613805  -0.449570218  0.707244582
## 29  1.70813916  3.62858745     1.774373321   0.976193892  1.302229456
## 30 -0.14800403  1.58294186    -0.849805746   2.399557726 -0.482725166
## 31  0.75789521  0.24725563     1.306496433  -0.665595084 -0.403393849
## 32 -0.51543169 -0.91996568    -0.646381012  -0.449570218 -0.482725166
## 33  0.71297458  0.35555451     1.754030847  -0.406365245 -0.046402925
## 34 -0.51543169 -0.06560782    -0.361586385  -0.060725461 -0.443059508
## 35 -0.51543169 -0.91996568    -0.849805746  -0.838414976 -0.482725166
```

```
## 36  0.49657812  0.63231832     -0.849805746   -0.255147840  0.052761221
## 37 -0.51543169 -0.91996568     -0.300558964   -0.838414976 -0.482725166
## 38 -0.51543169 -0.45067052     -0.544668645   -0.157936650 -0.482725166
## 39  0.09617987 -0.08967424     -0.849805746   -0.255147840  1.064235506
## 40 -0.28737314  0.16302316     -0.575182355    0.684560324  0.052761221
## 41 -0.51543169 -0.77556717     -0.402271331   -0.665595084  0.032928391
## 42 -0.51543169  0.27733865      0.019834991    0.398327377 -0.482725166
## 43  0.38643621  0.22619751     -0.575182355   -0.060725461  1.034486262
## 44 -0.51543169  0.41572056     -0.849805746    0.328119296 -0.482725166
## 45 -0.51543169 -0.05357461     -0.849805746    0.004081999 -0.482725166
## 46  3.67514414  0.50596963     -0.025935574    0.328119296  1.807966598
## 47 -0.51543169 -0.11507768      0.045263083   -0.089528776 -0.482725166
## 48  1.30903670  0.56011907      0.004578136    1.235423730  3.325178027
## 49  2.03467753  1.64310791      1.652318480    2.094122569  3.622670464
## 50 -0.51543169 -0.05357461      0.614852338    3.179647517 -0.482725166
##      1个人自理   1适应行为     2提要求        2命名     2听者反应
## 1  -0.32066492 -0.28526688  0.10411730 -0.146060959 -0.779491737
## 2  -0.32066492 -0.74820520 -0.37675208  0.694515245 -0.244880032
## 3  -0.32066492 -0.74820520  0.03182975 -0.026122628 -0.844013839
## 4  -0.32066492  1.50933351 -0.28246396 -0.484710366 -0.522625337
## 5  -0.32066492  0.30197894 -0.37675208 -0.484710366 -0.259282287
## 6   0.19266296  0.32626892  0.14654695  0.002098156  1.683997975
## 7  -0.32066492 -0.53388191 -0.37675208 -0.484710366 -0.378020878
## 8  -0.32066492 -0.23382929  0.11826052  0.308999180  4.075796462
## 9   0.75541059 -0.74820520 -0.37675208 -0.220140517 -0.440750700
## 10  0.38077690 -0.45609049 -0.37675208 -0.484710366 -0.736477002
## 11 -0.32066492 -0.54817013 -0.30603599 -0.202502527 -0.279445444
## 12  0.03802692 -0.69105232 -0.37675208 -0.484710366 -0.386846502
## 13 -0.32066492 -0.74820520  2.07473885  2.419678639 -0.203273518
## 14 -0.19768486 -0.47877020 -0.37675208 -0.409118980 -0.009206769
## 15 -0.24892655 -0.36242327  0.64863115  3.642579273  0.281456923
## 16 -0.32066492 -0.40528793  0.33040877  0.044429332  0.486754521
## 17 -0.32066492  0.06622332  0.18897660 -0.220140517  0.365775579
```

```
## 18 -0.32066492 -0.74820520 -0.16460382 -0.484710366  0.325449265
## 19 -0.32066492 -0.57674657  0.42469688  4.030615051 -0.279445444
## 20 -0.32066492 -0.23382929  0.33040877  0.961604807 -0.413866490
## 21 -0.32066492 -0.69921702 -0.37675208 -0.182344824 -0.537114879
## 22 -0.32066492 -0.40052519 -0.37675208 -0.484710366 -0.407145438
## 23 -0.32066492  1.73794502 -0.16460382 -0.378882426 -0.723034897
## 24  1.25757916  1.56648639  5.42196686  0.626482999 -0.602055956
## 25  0.12172168  0.32341127 -0.37675208 -0.484710366 -0.844013839
## 26 -0.32066492 -0.47434766 -0.37675208 -0.484710366 -0.844013839
## 27  2.04670120 -0.15286272 -0.37675208 -0.484710366 -0.548287537
## 28 -0.32066492 -0.10523532 -0.37675208 -0.484710366 -0.844013839
## 29 -0.32066492  3.88117798  0.25969268 -0.167226547  0.204470323
## 30 -0.32066492  0.11861346  1.22090761  0.522614836 -0.216715622
## 31  1.11410243 -0.23382929 -0.37675208 -0.484710366 -0.736477002
## 32 -0.32066492 -0.74820520 -0.14103179 -0.131950568 -0.399202376
## 33 -0.08153703 -0.17667642 -0.14103179 -0.273054487 -0.386982281
## 34 -0.32066492 -0.74820520 -0.32960802  0.291361190  0.930343974
## 35 -0.32066492 -0.74820520 -0.37675208 -0.308330467  0.294899027
## 36 -0.32066492  0.85921951 -0.05852970 -0.405339411  0.486754521
## 37 -0.32066492 -0.36242327 -0.37675208 -0.484710366 -0.521403328
## 38 -0.32066492 -0.19096463  0.04754443 -0.378882426 -0.682708583
## 39  0.15759086  0.28054662 -0.37675208 -0.484710366 -0.225677025
## 40 -0.32066492 -0.19096463  0.68398919  0.573569029  1.777196567
## 41  5.27492773 -0.23382929 -0.32960802 -0.449434386 -0.844013839
## 42 -0.32066492 -0.74820520  0.14968989  1.085070736  2.705821964
## 43  0.10976529  0.96638116 -0.23531991 -0.378882426  1.172301858
## 44  0.25324202  0.02335866  8.81633892  1.631848423 -0.602055956
## 45 -0.32066492 -0.40528793  2.73475564 -0.167226547 -0.844013839
## 46 -0.32066492  0.90208417 -0.27067795  1.155622696 -0.724867912
## 47 -0.32066492 -0.39893761 -0.37675208 -0.484710366  0.676437553
## 48 -0.32066492  0.79492252 -0.09388774 -0.273054487  2.220786021
## 49  0.18150365  3.34536974  0.01218639 -0.325968457  0.970670288
## 50 -0.32066492 -0.40528793  1.03756961  0.044429332  0.043165068
```

```
##    2视觉感知能力和样本配对   2独立游戏 2社会行为和社会游戏   2动作模仿
## 1               -0.47874894 -0.47471973         -0.28327860 -0.70087005
## 2                0.27056632  0.55650350         -1.04062239 -0.70087005
## 3               -0.65057774 -0.47471973          0.41598388 -0.70087005
## 4               -0.31400587 -0.21559184          0.74297712  0.01597090
## 5               -0.66607776 -0.04438235          1.19230700 -0.46381347
## 6               -0.47874894 -0.38587588          0.09539330 -0.06206495
## 7               -0.76572075 -0.47471973          0.09127730 -0.70087005
## 8               -0.76572075 -0.47471973          1.22317699 -0.65096340
## 9                2.58228363 -0.30813752         -0.95830242 -0.45133681
## 10              -0.13686278  0.13402515         -0.61682695 -0.04284165
## 11               0.27056632 -0.47471973         -0.20370262  1.19558258
## 12               1.95121138  0.26564566         -1.01318240 -0.60105675
## 13              -0.13243420 -0.47471973          1.99149678 -0.70087005
## 14               0.95383252 -0.34779995         -0.80542246 -0.52976154
## 15               0.19085193 -0.30813752         -1.04062239 -0.15189692
## 16              -0.76572075 -0.47471973         -0.87598244  1.14567593
## 17              -0.76572075 -0.47471973          0.15301728 -0.70087005
## 18              -0.44686319 -0.47471973         -0.48496254 -0.70087005
## 19               0.05799462 -0.47471973         -0.90342243 -0.26834576
## 20              -0.47343465 -0.47471973          0.05697731 -0.70087005
## 21               0.26487244 -0.45885476         -0.98182241 -0.61531579
## 22              -0.37379166  1.94997693          0.91447708  2.93399750
## 23              -0.52657758  2.88468824          0.37939722  0.39707621
## 24              -0.52657758 -0.47471973          0.02953732 -0.20180357
## 25              -0.25643437  0.37670047         -0.20941928  1.81941569
## 26              -0.52214900  0.19160912         -0.33632925  0.69512981
## 27               0.56063813  1.34534520          0.35653056  0.71592424
## 28              -0.48672038 -0.47471973         -0.83482245 -0.30161686
## 29              -0.28743441 -0.36366492          2.04637677  0.29726292
## 30              -0.37600595 -0.31430723          0.65151048 -0.41252053
## 31               1.43971071  2.15357742          0.16673728 -0.53451455
## 32              -0.23429148 -0.47471973         -1.04062239 -0.53451455
```

```
## 33              0.37685218 -0.17857357         -0.57414252  0.96268489
## 34             -0.76572075 -0.47471973         -0.09394265 -0.70087005
## 35              2.77492674  0.46924615         -0.97202241 -0.33488796
## 36             -0.44686319  0.95511094          2.86957655  0.63413279
## 37             -0.56643477 -0.41919233         -0.54670253  3.56614837
## 38             -0.26750581  4.35616446         -0.13510264  0.14754297
## 39             -0.76572075 -0.47471973         -0.21742262 -0.70087005
## 40             -0.76572075 -0.47471973          1.59361689 -0.70087005
## 41             -0.76572075 -0.47471973         -0.90342243  0.09763632
## 42             -0.52657758 -0.47471973          0.77727711 -0.47629013
## 43             -0.58636337 -0.36366492          1.14085702 -0.05208362
## 44             -0.44686319 -0.47471973          1.42897694 -0.70087005
## 45             -0.52657758 -0.47471973         -0.09394265 -0.70087005
## 46             -0.18779142 -0.39142862         -0.60844251  0.39707621
## 47             -0.76572075 -0.47471973          0.22619060 -0.70087005
## 48             -0.76572075 -0.47471973          2.00521678 -0.70087005
## 49             -0.34722020 -0.30813752          0.01924732 -0.30161686
## 50             -0.36714880 -0.47471973         -0.95830242  0.59670280
##          2仿说 2认知（语言/语前）    2语言表达     2语言理解     2小肌肉
## 1  -0.04008539        -0.66043806  0.49354922 -0.2760598482 -0.58876164
## 2  -0.50588026        -0.81186922 -0.04970303 -0.9217970060 -0.71973881
## 3  -0.50588026        -0.10098405  1.47773387 -0.3507369344 -0.31433329
## 4  -0.19535035        -0.84750008  0.54230263 -0.8339416104 -0.08044549
## 5  -0.50588026        -0.76955757 -0.08792435 -0.5429206124 -0.71973881
## 6  -0.26090666         0.38018104  0.20261425  1.5403504563 -0.21038315
## 7  -0.50588026        -0.48203632 -0.49816644  0.3795610417 -0.71973881
## 8  -0.11771787         1.10106264 -0.14143419  2.9987500237 -0.34551833
## 9  -0.50588026         0.43075707 -0.56951289 -0.0652068987  0.54325532
## 10 -0.50588026        -0.82671541 -0.71220579 -0.8559054593  1.42509896
## 11  0.39983199        -0.62926106 -0.65275041 -0.7460862147 -0.32992581
## 12 -0.24710533         0.93998146 -0.34358246 -0.2958273122 -0.03366793
## 13  1.06402098         1.34008634  3.84802151  0.3154998157  1.17215363
## 14 -0.12880822         1.51749833 -0.45739704 -0.0934461330 -0.37224836
```

```
## 15  0.03754709         0.29046055  0.32231774 -0.3946646322 -0.71973881
## 16  4.69549582        -0.75396907  0.10827839 -0.5923392724  0.35614508
## 17 -0.50588026        -0.81632308  0.50068387 -0.1969899921 -0.71973881
## 18 -0.50588026        -0.30190252 -0.42681999  0.4289797017 -0.71973881
## 19  1.71958413         1.02312013  0.12016947  0.0446123459 -0.71973881
## 20 -0.24710533         1.41802885  2.09408793  1.6260094671 -0.71973881
## 21 -0.23971176         0.55546508 -0.55932054 -0.4982084914 -0.39897840
## 22 -0.50588026        -0.78687813 -0.71220579 -0.3543975759  0.58743413
## 23 -0.11771787        -0.87867709 -0.39114676 -0.7241223658 -0.15840809
## 24  0.11517957        -0.34866802  1.57088063  0.0006846481 -0.71973881
## 25  0.39551907        -1.04668649 -0.54573074 -0.8559054593  0.53286031
## 26 -0.50588026        -1.04668649 -0.71220579 -0.9217970060 -0.62618369
## 27 -0.03145956        -0.22569207 -0.58140396 -0.5191264427  3.73972195
## 28 -0.50588026        -0.75396907 -0.64085934 -0.9217970060 -0.39229589
## 29 -0.04008539        -0.59808405  0.42933742  0.3301423816  0.12225728
## 30 -0.24710533         0.26909853  2.22885345  0.2740125456 -0.35591334
## 31 -0.35061531        -0.65004573 -0.68842364 -0.8998331571  2.33639514
## 32  0.16693455         0.70095776 -0.21278064 -0.5923392724 -0.56381361
## 33  0.89150436        -0.59808405 -0.59329504 -0.7001618034 -0.50144353
## 34 -0.09184038         0.71135010 -0.40303784  1.7358287116 -0.71973881
## 35 -0.50588026         2.31176962 -0.66464149  0.3850520039  0.62121792
## 36 -0.15653411        -0.69161506  0.53635709  0.4783983618  0.44970020
## 37 -0.19535035        -1.15927012 -0.71220579 -0.8229596859  1.24491873
## 38 -0.27298283        -0.53573005 -0.71220579 -0.2299357654  1.01103093
## 39 -0.50588026        -0.76436141 -0.47438429 -0.5044838768 -0.71973881
## 40  2.14915051         0.44634557  3.30103206  2.1915785764 -0.71973881
## 41 -0.35061531        -0.78514607 -0.71220579 -0.8339416104  1.10458605
## 42  0.68879733         1.48557902  0.80985182  2.8861852980 -0.31173454
## 43 -0.35061531        -0.03689799 -0.03441451  1.0549493955 -0.18179687
## 44  0.27044453        -0.03689799  3.21184899  0.0665761948 -0.71973881
## 45 -0.50588026        -0.84750008  0.42933742 -0.5923392724 -0.71973881
## 46 -0.38943155        -0.22396001 -0.35547354 -0.5099748390  0.05209094
## 47 -0.50588026        -0.09001436 -0.67785380  0.8694768937 -0.71973881
```

```
## 48 -0.50588026        -0.47337604  1.10712870  0.3301423816 -0.25196321
## 49 -0.11771787        -0.83191158 -0.31088201  0.1077584115 -0.32212955
## 50  6.17051292        -0.22396001  0.35799097 -0.5923392724 -0.15840809
##         2大肌肉 2模仿（视觉/动作）     2情感表达   2社交互动 2行为特征-非语言
## 1  -0.63131740       -0.836410577 -0.463516891 -0.08791725     -0.967669542
## 2  -0.63131740       -0.836410577 -0.581288026 -1.00036349     -1.099159195
## 3  -0.63131740       -0.836410577 -0.581288026  0.25120467     -1.099159195
## 4  -0.11972094       -0.169876273  1.226171744  1.07444965     -0.039936996
## 5  -0.39212944       -0.727950853 -0.041503660  0.75026010     -1.099159195
## 6  -0.34074832       -0.628167906 -0.365374279  0.25945676      0.507936555
## 7  -0.63131740       -0.836410577 -0.581288026 -0.28125211     -0.880009774
## 8  -0.11307683        0.031267216 -0.581288026  1.26306903      1.749783270
## 9   0.16597579        0.768793339  0.301995482 -0.89426509      0.580986361
## 10 -0.27991781       -0.264385958 -0.581288026 -0.89557494     -0.206328223
## 11 -0.49843520        1.896774469  0.209057402 -0.31661825      0.191387392
## 12 -0.12636505        0.898945008 -0.352288598 -1.00036349     -0.052111964
## 13 -0.34340597       -0.836410577 -0.156003374  1.83482151     -1.099159195
## 14 -0.32379002       -0.179454534 -0.539226906 -0.71743442     -0.097333273
## 15 -0.51172342       -0.576107239 -0.188717578 -1.00036349     -0.587810547
## 16 -0.63131740        1.896774469 -0.581288026 -0.85889895     -0.003412093
## 17 -0.63131740       -0.836410577  0.252924176  0.18440197     -0.368661127
## 18 -0.63131740       -0.836410577 -0.581288026 -0.46987149     -0.441710934
## 19 -0.63131740        0.320493146 -0.581288026 -0.78816669     -0.319961256
## 20 -0.63131740       -0.489339460 -0.057860762  1.14518192     -0.368661127
## 21 -0.39212944       -0.551316445 -0.581288026 -0.94984044     -0.827831341
## 22  4.53115598        1.506319462 -0.385002802 -0.34609002      2.549272822
## 23  0.04638181       -0.012116674  0.007567646 -0.08084403     -0.368661127
## 24 -0.47185876       -0.662875018 -0.581288026  0.34354957     -0.368661127
## 25  1.97538838        0.949559546 -0.036051293 -0.74887098      1.130889073
## 26  1.29768917        0.011985487 -0.581288026 -0.74887098      0.118337585
## 27  0.75508687        0.460285679 -0.316848210 -0.62115995      1.782249851
## 28 -0.63131740       -0.445955570  1.283421601 -0.32840696     -0.514760740
## 29  0.88353966       -0.142268343  0.645494623  1.40453356     -0.076461900
```

```
## 30 -0.24743549       -0.711079340 -0.581288026  0.69197147     -0.677093644
## 31  0.21912867       -0.605029832  0.547352011  0.16671890      1.628033592
## 32 -0.17951792       -0.547184646 -0.483145414 -1.00036349     -0.758260096
## 33 -0.28582368        1.506319462  0.478949585 -0.43450536      0.410536812
## 34 -0.63131740       -0.720720204 -0.581288026 -0.08084403     -0.052111964
## 35  0.29885799        0.421722222 -0.581288026 -0.91784251     -0.173861642
## 36  0.70414869        0.421722222  0.866315500  2.28868689     -0.624335450
## 37  1.60110352        3.111523378 -0.581288026 -1.00036349     -0.076461900
## 38  0.40516375       -0.012116674 -0.581288026 -0.36377309     -0.441710934
## 39 -0.63131740       -0.836410577 -0.054886743 -0.18694243     -1.099159195
## 40 -0.63131740       -0.836410577  0.154781564  2.32405302     -0.551285644
## 41  0.11282291        0.320493146 -0.483145414 -0.85889895     -0.027762028
## 42 -0.24374432       -0.511031405 -0.581288026  1.40551595      0.818398233
## 43 -0.03334751       -0.380879736  1.270038517  1.36916743      0.398361844
## 44 -0.39212944       -0.489339460 -0.286860190  2.18258849     -0.660860354
## 45 -0.63131740       -0.836410577 -0.581288026 -0.08084403     -1.099159195
## 46 -0.43199410        0.009575271  4.301306917  0.66184477      0.179212424
## 47 -0.63131740       -0.836410577 -0.581288026 -0.12013973     -0.027762028
## 48 -0.23267080       -0.836410577  2.362990332  2.18258849      1.530633849
## 49 -0.37219711       -0.467647515  0.791593284  0.53806330      0.635773716
## 50 -0.23267080        2.113693917 -0.090574966 -0.92963122      0.215737327
##    2行为特征-语言   2问题行为   2个人自理   2适应行为
## 1       0.28576715 -0.57320316 -0.37511954 -0.17375698
## 2      -0.80460187 -0.57320316 -0.37511954 -0.83691988
## 3       1.34309469 -0.57320316 -0.37511954 -0.83691988
## 4       0.23253364  0.93661966 -0.37511954  0.87915955
## 5      -0.35028145 -0.23768698 -0.37511954  0.73372909
## 6      -0.02017253 -0.21034862 -0.20735618 -0.52279008
## 7      -0.52007797 -0.57320316 -0.37511954 -0.57514505
## 8      -0.03363388  1.38397457 -0.30889716  0.99550392
## 9      -0.80460187 -0.57320316  1.01555039 -0.61877419
## 10     -0.80460187 -0.57320316  0.27238815 -0.46849604
## 11     -0.74953273 -0.51728380 -0.37511954 -0.45880068
```

```
## 12    -0.63939445 -0.40544507 -0.14334122 -0.77874769
## 13     3.53056340 -0.57320316 -0.37511954 -0.08068148
## 14    -0.72593167 -0.23768698 -0.24267479 -0.40062850
## 15     0.65473040 -0.34952570 -0.24267479 -0.83691988
## 16     1.72857868 -0.57320316 -0.37511954 -0.66240332
## 17     0.70979955  0.26558730 -0.37511954  0.12292116
## 18    -0.55679073 -0.57320316 -0.37511954 -0.83691988
## 19     0.33349374 -0.38680528 -0.33097129 -0.45880068
## 20     2.13241906 -0.01400952 -0.37511954  0.76281518
## 21    -0.67872955 -0.54124924 -0.31835750 -0.77459254
## 22    -0.80460187 -0.57320316  0.06636298 -0.13885367
## 23     0.02143526 -0.57320316 -0.17645241  0.40651056
## 24     0.68226498 -0.23768698  0.81688326 -0.22611194
## 25    -0.53231556 -0.57320316 -0.37511954 -0.35215168
## 26    -0.80460187 -0.57320316 -0.37511954 -0.48303909
## 27    -0.66998841 -0.57320316  1.93162662 -0.23095963
## 28    -0.47418702  0.60110348 -0.37511954 -0.13885367
## 29     0.35185012  0.20966793  0.22088186  1.21364961
## 30     1.41855981 -0.25011350 -0.24267479 -0.54605896
## 31    -0.73117635 -0.49864401  1.01555039 -0.28428413
## 32    -0.07034664 -0.38680528 -0.37511954 -0.83691988
## 33    -0.62103807 -0.49864401 -0.28682304 -0.54605896
## 34    -0.14377216 -0.53592358 -0.37511954 -0.83691988
## 35    -0.80460187 -0.57320316 -0.11023003 -0.66240332
## 36     0.10403898  1.16029711 -0.37511954  2.50070918
## 37    -0.80460187 -0.57320316 -0.24267479 -0.18248281
## 38    -0.06116845 -0.57320316  0.41954899  0.16655030
## 39    -0.30897959  0.95525945  0.28710424  0.47195426
## 40     2.96763439  1.04845839 -0.37511954  0.55921254
## 41    -0.73117635 -0.31224613  5.58489446  0.06474898
## 42     0.68991347  0.10714910 -0.05504472 -0.32548942
## 43     0.62719583  2.86583771  0.61821613  3.26421909
## 44     2.77489239 -0.01400952 -0.37511954  1.34453702
```

```
## 45     0.02143526 -0.57320316 -0.37511954 -0.40062850
## 46     0.20040998  2.39052312 -0.17645241  0.86461650
## 47    -0.16824734 -0.44479573 -0.37511954 -0.41032386
## 48     2.82996154  3.45299103 -0.37511954  2.74066944
## 49     0.69603226  1.88724884  0.15465948  1.12639133
## 50     1.12281812 -0.01400952 -0.37511954 -0.74966160
##    2功能、特性、类别的听者反应LRFFC        2对话 2教室常规和集体能力
## 1                       -0.73588323  0.469890685          0.13280045
## 2                       -0.90302074 -0.788899878         -0.01922153
## 3                       -0.90302074  0.988559019          0.54759934
## 4                        0.16409883  0.724069549          0.46588925
## 5                       -0.02090608  0.340783961          0.04412096
## 6                        1.04279008  0.781898602          0.29045287
## 7                        0.10289949  0.109916033          0.06695172
## 8                        2.32366184  0.865280029          1.26616754
## 9                       -0.34589569 -0.788899878         -0.98326333
## 10                      -0.81016657 -0.788899878         -0.20140987
## 11                      -0.85659365 -0.681310941         -0.92558562
## 12                      -0.28399291 -0.788899878         -0.98326333
## 13                      -0.23240726  3.086543291          1.17244125
## 14                       0.25825940 -0.731262948         -0.93382529
## 15                      -0.36910924 -0.284576736         -0.98326333
## 16                       0.39693771 -0.708208175         -0.98326333
## 17                       0.25765645  0.582859069          0.14145210
## 18                       0.53621897 -0.022328702         -0.29113076
## 19                      -0.02090608 -0.129917639         -0.98326333
## 20                       0.58264606  1.497365034          0.68939039
## 21                      -0.22409996 -0.754317720         -0.81023019
## 22                      -0.90302074 -0.788899878         -0.26950161
## 23                      -0.76373948 -0.788899878         -0.39927647
## 24                       0.25765645  0.542513218         -0.81023019
## 25                      -0.71989167 -0.788899878         -0.23585628
## 26                      -0.90302074 -0.788899878         -0.36563114
```

```
## 27                    -0.90302074 -0.788899878         -0.10367818
## 28                    -0.90302074  0.098708852         -0.46416390
## 29                     0.48979188  0.744242474          0.70380982
## 30                    -0.63477535  1.947146562          0.71983141
## 31                    -0.81016657 -0.762002644         -0.52184162
## 32                    -0.59350683 -0.708208175         -0.34880847
## 33                    -0.87206935 -0.627516473         -0.98326333
## 34                     0.90763567  0.300438109          0.04051610
## 35                     0.67550023 -0.788899878         -0.98326333
## 36                     0.35051062  0.703896623          1.73119411
## 37                    -0.90302074 -0.788899878         -0.42090562
## 38                    -0.90302074 -0.788899878         -0.07483933
## 39                     0.11837518 -0.345095513          0.80474582
## 40                     1.32547946  4.012256437          0.63892239
## 41                    -0.81016657 -0.788899878          1.03545668
## 42                     3.25865180  1.697973572          0.88765754
## 43                     0.88442213 -0.002155776          3.75351898
## 44                     0.07194810  0.623204920         -0.46416390
## 45                    -0.34589569 -0.062674553         -0.98326333
## 46                    -0.50839050  0.088622389         -0.12891219
## 47                     0.78211058  0.346761124          0.23117299
## 48                     1.88260451  1.631851205          1.95830011
## 49                     0.83799504  0.199573481          0.84439925
## 50                    -0.16018734 -0.546824770         -0.98326333
##       2语言结构     3提要求       3命名    3听者反应 3视觉感知能力和样本配对
## 1   0.869766282  0.52545851  0.5707728 -0.66466107           -0.347742652
## 2   0.141137854  0.40964805  0.9874898 -0.06122180            0.521698695
## 3   0.884196423  2.05362421  2.6595023 -0.17231247           -0.342842419
## 4  -0.125913460 -0.32248708 -0.5173215 -0.53414895           -0.377144050
## 5  -0.204623321 -0.15942062 -0.4883828  0.41206389           -0.259538457
## 6   0.668618860 -0.13146637 -0.4478686  0.43415056           -0.665277752
## 7   0.315736316 -0.19824597  0.4601628  1.12067776           -0.788763625
## 8   0.838282338 -0.15942062 -0.1700573  2.19280133           -0.788763625
```

```
## 9  -0.735914883 -0.36907750 -0.3436894 -0.41618607          3.974262884
## 10 -0.630968402 -0.36907750 -0.5173215 -0.28734719          0.766243658
## 11 -0.735914883 -0.36907750 -0.1314724 -0.08488609          0.563700693
## 12 -0.696559952 -0.36907750 -0.2858120 -0.73744667          0.578401392
## 13  3.158036854  1.14511107  1.3218923 -0.59103885         -0.342842419
## 14 -0.411875585 -0.36907750 -0.4015668 -0.26224871          0.691806785
## 15 -0.047203599  0.15506469  2.2029143 -0.44253948         -0.083130068
## 16 -0.617850091  0.53943564  0.2350842  0.86760138         -0.788763625
## 17  0.287313311  0.81897814  0.1772068  2.85540130         -0.788763625
## 18 -0.027526134  1.30817753  0.9296125  2.85540130         -0.259538457
## 19  0.379141482  0.39966439  4.8073953 -0.46387319          0.181482516
## 20  3.461944373  0.09682667  0.3315464 -0.60944440         -0.553552439
## 21 -0.713426351 -0.36907750  0.1080546  0.39592915          1.328137046
## 22 -0.735914883 -0.36907750 -0.5173215 -0.61634648         -0.453097662
## 23 -0.657205022 -0.36907750 -0.4594441 -0.78889856         -0.744661528
## 24  0.247958380  2.56611880  0.2350842 -0.74748606         -0.612355236
## 25 -0.735914883 -0.36907750 -0.5173215 -0.83031106         -0.475148711
## 26 -0.735914883 -0.36907750 -0.5173215 -0.38167566         -0.355093001
## 27 -0.735914883 -0.36907750 -0.5173215 -0.67846523          0.237835196
## 28 -0.263655717 -0.15942062  1.6820181 -0.58560084          0.666605586
## 29  0.011828797 -0.15942062 -0.4015668 -0.33336108         -0.656457333
## 30  1.661820699  0.08129653 -0.1829190 -0.61557959         -0.514350575
## 31 -0.735914883 -0.36907750 -0.5173215 -0.66466107          1.563348231
## 32 -0.657205022 -0.27589667  0.0614521 -0.34089062         -0.288939855
## 33 -0.657205022 -0.27589667 -0.5173215 -0.63705273         -0.009626572
## 34  0.851400648 -0.18271583  0.0614521  0.75716805         -0.700559430
## 35 -0.617850091 -0.36907750 -0.3051045 -0.31453722          2.129325147
## 36  0.011828797 -0.29919188 -0.5173215 -0.08488609         -0.634406284
## 37 -0.735914883 -0.36907750 -0.5173215 -0.37477358         -0.435946846
## 38 -0.735914883  0.25989313 -0.4015668 -0.70607356         -0.061079019
## 39 -0.276774027 -0.18271583 -0.3629818  0.49488889         -0.053728670
## 40  2.491189420  0.39966439  0.1193295  0.95042637         -0.788763625
## 41 -0.735914883 -0.32248708 -0.4787366 -0.83031106         -0.788763625
```

```
## 42  1.829807948 -0.17689203  0.2640228  1.44162462           -0.568253138
## 43  0.011828797 -0.26424906 -0.4305054  0.55700764           -0.656457333
## 44  1.271186574  5.64108636  0.8717351 -0.83031106           -0.524151041
## 45 -0.027526134  8.71605391  1.5662634 -0.58183607           -0.435946846
## 46 -0.312849380 -0.29919188 -0.4883828 -0.75689799           -0.347742652
## 47  0.368938352  0.21589107 -0.0886003  3.83549710           -0.641756634
## 48  1.389251365 -0.36907750 -0.5173215  1.19890137           -0.788763625
## 49 -0.007848668 -0.19436344 -0.4305054  0.14288265           -0.590304187
## 50 -0.735914883  0.05023626 -0.4015668 -0.33336108           -0.612355236
##       3独立游戏 3社会行为和社会游戏   3动作模仿 3认知（语言/语前）
## 1  -0.459907937         0.510231292 -0.64376130         0.86638245
## 2   0.839899452        -1.095463174 -0.64376130        -0.75581516
## 3  -0.459907937         2.044126411 -0.64376130         1.50232462
## 4  -0.323816992         0.131652922 -0.44758461        -0.89390546
## 5  -0.328677383         2.752329051  0.17754559        -0.59882829
## 6  -0.413248184        -0.142490036 -0.50848722        -0.34038140
## 7  -0.459907937         1.143370979 -0.64376130         1.32086912
## 8  -0.459907937         0.412323092 -0.64376130         0.37797887
## 9   0.006689588        -1.017136615 -0.49882479         0.63744327
## 10  1.458326330         0.001108656  0.89149210        -0.32975410
## 11 -0.459907937        -0.338306434  1.50613027        -0.60900337
## 12 -0.071076667        -1.082408747 -0.62765724        -0.19182531
## 13 -0.459907937         1.110734913 -0.64376130         0.64253081
## 14 -0.409915345        -0.972378581 -0.51953000         0.54368723
## 15 -0.401583246        -1.095463174 -0.30557611        -0.59882829
## 16 -0.459907937        -0.899646776  1.53028635        -0.81250486
## 17 -0.459907937         1.841782800 -0.64376130         0.43902932
## 18 -0.459907937         0.764792609 -0.64376130         1.84318962
## 19 -0.459907937        -0.886592349 -0.22505582         0.69340618
## 20 -0.459907937        -0.103326756 -0.64376130         0.07272663
## 21 -0.176616583        -0.815725462 -0.46431609         2.24001753
## 22  0.871839164         0.277427351  1.74769112        -0.95665175
## 23  1.756430304        -0.155544462 -0.18479568        -0.99565620
```

```
## 24 -0.459907937        -0.273034301 -0.45051262        -0.96513098
## 25  0.137920141        -0.420984469  1.10621286        -0.97632356
## 26  2.378560336         0.751738183  2.51263381        -0.84472593
## 27  0.784352128        -0.014121508  0.24464583        -0.38176004
## 28 -0.459907937         0.196925054  0.99885248         0.22535275
## 29 -0.459907937         0.353578173 -0.23310785        -1.05670665
## 30 -0.403743420         0.497176865 -0.55071564         0.09759904
## 31  1.309274343         0.249142761 -0.48272073        -0.62935352
## 32 -0.459907937        -1.095463174 -0.38609639         1.84318962
## 33 -0.343258556        -0.729939231  0.30637805        -0.80232979
## 34 -0.459907937         0.144707348 -0.48272073         1.21233499
## 35  0.298313040        -1.082408747 -0.40220045         1.30899820
## 36  0.239988350         1.381614264  0.16546755        -0.78197964
## 37 -0.401583246        -0.449269060  4.50148481        -1.20933277
## 38  5.839158642        -0.233871022  0.29832602        -0.81250486
## 39 -0.304375429         0.810483102 -0.09622337        -0.59882829
## 40 -0.459907937         0.823537529 -0.64376130         0.10325186
## 41  0.275336647        -0.886592349  0.28669531        -0.84303008
## 42 -0.459907937         0.170816201 -0.52298087         0.49668807
## 43 -0.372420901         0.314414893 -0.25726394        -0.64461613
## 44 -0.459907937         0.314414893 -0.64376130        -0.65987874
## 45 -0.459907937         1.254333605 -0.64376130        -0.23252561
## 46 -0.430745592        -0.801738577 -0.16063960        -0.69040397
## 47 -0.459907937         1.632911975 -0.61155318         1.30051897
## 48 -0.459907937         1.097680486 -0.64376130        -0.72092919
## 49 -0.372420901        -0.380733320 -0.47466870        -0.90408053
## 50 -0.459907937        -1.095463174  0.12923342        -0.59882829
##        3语言表达   3语言理解      3小肌肉      3大肌肉 3模仿（视觉/动作）
## 1   2.3338399326  1.27767021 -0.56058127 -0.62214211        -0.76297095
## 2   0.0535336403  0.24811516 -0.67978003 -0.62214211        -0.76297095
## 3   3.2150624395  0.26120614  1.04197989 -0.34116493        -0.76297095
## 4   0.3388500905 -0.71860319 -0.15473786 -0.20067635        -0.62484351
## 5   0.8117283297  0.35460523 -0.06250072  0.54499384         0.20861477
```

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## 6  -0.6310139060  0.30843436 -0.46030294 -0.45269126        -0.67446210
## 7  -0.0005095871  2.69310700 -0.67978003 -0.62214211        -0.76297095
## 8  -0.5902165677  1.65514352 -0.50949608 -0.34981038        -0.40893557
## 9  -0.4900776465  0.14842233  0.81020452  0.27266212         1.18422362
## 10 -0.5568369273 -0.28626526  4.54226106  0.66891198         0.55810550
## 11 -0.5457103805 -0.66477455 -0.14054753 -0.42761945         2.51185628
## 12 -0.5790900209 -0.73975015 -0.39597345 -0.38871492         0.01885717
## 13  2.2025466803 -0.10534123  0.30408278 -0.45355580        -0.76297095
## 14 -0.4900776465 -0.56755345 -0.54598550 -0.47763956        -0.28249437
## 15 -0.3565590848 -0.80319104 -0.59463806 -0.62214211        -0.49744442
## 16  0.1775151618 -0.51770703  0.51220761 -0.62214211         2.51185628
## 17  2.7477474737  1.89304686 -0.46692509 -0.42761945        -0.76297095
## 18  1.7129786209  3.00326247 -0.67978003 -0.62214211        -0.32042673
## 19  0.4445522851 -0.23222302 -0.67978003 -0.62214211         0.26963223
## 20  0.9229937977  0.29645108 -0.67978003 -0.62214211        -0.76297095
## 21 -0.4519294860  0.24811516 -0.10811249 -0.07747866        -0.26985025
## 22 -0.6903554890 -0.65692454  0.01554609  2.63935446         0.66054629
## 23 -0.5902165677 -0.86663194 -0.55206707 -0.38871492        -0.40893557
## 24  0.2442744426 -0.48598658 -0.50949608 -0.62214211        -0.67446210
## 25 -0.6903554890 -0.87544317 -0.31792664  0.98158914         0.33109671
## 26 -0.6903554890 -0.38377626  0.25441663  4.41599473         1.58251342
## 27 -0.6903554890 -0.69745622  2.77320004  0.20998260         0.09507312
## 28 -0.0561423211  0.43390635  0.08649774 -0.42761945         0.78593382
## 29 -0.0895219615 -0.42254569 -0.59463806  0.27266212        -0.58595326
## 30  0.8896141573  0.01919089 -0.29506444 -0.62214211        -0.59250947
## 31 -0.6681023954 -0.90892586  1.59067262  0.23375759        -0.61545621
## 32 -0.3120528976  0.06383448 -0.59463806 -0.10341502        -0.49744442
## 33 -0.6458493017 -0.88008910 -0.65139937 -0.54433304         0.77118235
## 34 -0.1340281487  2.06222257 -0.59463806 -0.49246033        -0.37943262
## 35 -0.6458493017 -0.43311918  0.22840103  0.07813946         0.03360865
## 36  0.1191007911 -0.12120146  0.12906873  0.12677013        -0.23191789
## 37 -0.6903554890 -0.77147060  1.32105636  1.94555698         3.92799778
## 38 -0.6903554890 -0.70802971  0.72506255  0.66170744         0.03360865
```

```
## 39 -0.0895219615  0.12727537 -0.11216687  0.02626675        -0.32042673
## 40  1.6462193400  1.02073460 -0.67978003 -0.62214211        -0.76297095
## 41 -0.6903554890 -0.93007283  1.06563044  0.05220311         0.21062633
## 42 -0.0542878966  1.40931006 -0.48348048 -0.42329672        -0.58595326
## 43 -0.2146956131  0.06912122 -0.36049763 -0.29145359        -0.51957163
## 44  1.2790432955 -0.61286837 -0.67978003 -0.46652398        -0.76297095
## 45  3.2484420799 -0.48598658 -0.67978003 -0.62214211        -0.76297095
## 46 -0.6569758485 -0.77147060 -0.27535565 -0.50542851        -0.27617231
## 47  0.1330089746  2.87990518  0.05811708  0.05220311        -0.34992968
## 48  0.6114504872 -0.29566391 -0.42435411 -0.38871492        -0.76297095
## 49 -0.4233183656 -0.40668547 -0.53078158 -0.48597625        -0.63020768
## 50 -0.2230405232 -0.86663194 -0.16892818 -0.62214211         0.91869709
##      3情感表达   3社交互动 3行为特征-非语言 3行为特征-语言  3问题行为
## 1  -0.16038325  1.48590427      -0.83524426     1.78437227 -0.2471583
## 2  -0.60178329 -1.03148391      -1.11796455    -0.83807066 -0.6314958
## 3  -0.16707113  1.52752329      -1.11796455     2.68235046 -0.6314958
## 4   1.07018657  0.53766556      -0.34571932     0.16931139  0.8417980
## 5   1.45473964  2.69735515      -0.92163102     0.51458346  0.3613761
## 6  -0.50146510 -0.06637263      -0.30121705    -0.26938725 -0.5318527
## 7  -0.60178329  1.03446915      -0.41116383     1.72912874 -0.2186889
## 8  -0.60178329  0.33519466       0.29563690    -0.47248846  0.4574605
## 9   0.30108043 -0.93024846       0.84537079    -0.83807066 -0.6314958
## 10 -0.60178329 -0.74652487       2.17462154    -0.83807066 -0.6314958
## 11  0.38847886 -0.37907768       0.51814824    -0.74058207 -0.5247354
## 12 -0.37606736 -1.00898715      -0.67294187    -0.83807066 -0.3539187
## 13 -0.31197518  0.79637837      -1.11796455     1.73183676 -0.6314958
## 14 -0.53012744 -0.83865449      -0.42238289    -0.79628984 -0.2654601
## 15 -0.60178329 -0.93024846      -1.11796455     0.06369875 -0.6314958
## 16 -0.60178329 -0.86275816       0.17783678     1.94035401 -0.6314958
## 17  1.65537603  2.34303108       1.00243762     3.13458917  1.7385855
## 18 -0.60178329  1.33067658       0.53123714     1.42853894 -0.5033833
## 19 -0.43458631 -0.89650331      -0.80383090     0.60801002 -0.2898625
## 20 -0.26738932  0.04836088      -0.33263041     0.41303285 -0.2898625
```

```
## 21 -0.60178329 -0.80973007      -0.24287794    -0.64309349 -0.4850815
## 22 -0.60178329 -0.59092223       0.98498575    -0.83807066 -0.6314958
## 23  0.05028495 -0.52530667      -0.88236431    -0.20439486 -0.5674396
## 24 -0.50146510 -0.12036487      -0.96089772     0.13681519 -0.5033833
## 25 -0.30361533 -0.68278403       0.39380366    -0.75412215 -0.4891486
## 26 -0.60178329 -0.54217924       2.25460927    -0.83807066 -0.6314958
## 27 -0.50425172 -0.71840391       0.94571904    -0.80286645 -0.5532048
## 28  5.56778551  0.95947993       0.53123714     0.23430377  1.6745292
## 29  0.35123953  0.08210603      -0.41116383    -0.20439486 -0.4393271
## 30 -0.55348194  0.50579514      -0.96671501     1.00338039 -0.6314958
## 31  0.68563350 -0.15411002       1.94483858    -0.83807066 -0.5033833
## 32 -0.53490450 -1.00898715       0.08621446    -0.05816198 -0.6314958
## 33  0.08980424 -0.58154858       0.16474787    -0.80557446 -0.5460875
## 34 -0.60178329  0.16084472       0.84537079     0.33179236 -0.6314958
## 35 -0.60178329 -1.02023553      -0.54205285    -0.83807066 -0.6314958
## 36  0.71489298  1.22944113      -0.96089772    -0.19220878  0.6176011
## 37 -0.60178329 -1.03148391       0.21710348    -0.83807066 -0.6314958
## 38 -0.60178329 -0.32283577       0.68830396    -0.03378983  0.2652917
## 39  1.16594485  0.40830915      -0.38498602     0.21805568  3.2545834
## 40 -0.15035143  1.26318628      -0.52896395     1.16044533  0.6496292
## 41 -0.56834390 -0.80651625      -0.85618651    -0.67558968 -0.5460875
## 42 -0.60178329  0.34175622       0.41343702     0.01360045 -0.3040972
## 43  0.60089503  0.55453813      -0.01849676     0.16118734  1.5464167
## 44 -0.40114691  1.12820568      -0.80383090     0.81923528 -0.2471583
## 45 -0.30082872  2.00557958       0.45270372     2.33030835  0.6496292
## 46  1.70553512  0.03148831      -0.17556359    -0.18002271  1.8987261
## 47 -0.60178329  1.37691993       1.11296613     0.34442977  1.4799880
## 48  1.45473964  1.09446053       0.76683738     1.50165538  3.2118792
## 49  0.56213573 -0.21316403       0.04432997     0.23430377  1.3542480
## 50 -0.50146510 -0.89650331       0.06003665     0.62425811 -0.6314958
##       3个人自理     3适应行为 3功能、特性、类别的听者反应LRFFC       3对话
## 1  -0.378638372  0.701167930                    -0.28526298  1.87353434
## 2  -0.378638372 -0.407999783                    -0.85639524 -0.80404803
```

```
## 3  -0.378638372 -0.148475300 -0.28350023  2.40213741
## 4  -0.378638372  0.494346881 -0.08599167  0.26209116
## 5  -0.378638372  2.688326933  0.63092835  0.73398884
## 6  -0.317710492 -0.690681836  0.18362955  0.25315812
## 7  -0.378638372 -0.162449696  2.86081202  2.09724879
## 8  -0.378638372  0.214858976  0.98788601  0.13974732
## 9   1.303801941 -0.749374296 -0.57876150 -0.80404803
## 10  1.781531906 -0.452806574 -0.75063001 -0.80404803
## 11 -0.378638372 -0.483860786 -0.81673328 -0.69918188
## 12 -0.191700559 -0.875143853 -0.53909954 -0.80404803
## 13 -0.378638372 -0.511809577 -0.51265823  1.64477077
## 14 -0.271816765 -0.647560845 -0.21356239 -0.77408628
## 15 -0.254013163 -0.833220667 -0.67791641 -0.52440497
## 16 -0.378638372 -0.665527924  0.45244952 -0.73413727
## 17 -0.378638372  2.185248705  1.82078722  3.26825414
## 18 -0.316325768 -0.413988810  3.16929395  1.88751649
## 19 -0.378638372 -0.455911996 -0.20858319 -0.26806549
## 20 -0.378638372 -0.092577719 -0.03671468  0.71068525
## 21 -0.004762747 -0.443933943  1.18336283 -0.46448145
## 22 -0.378638372 -0.369736558 -0.85639524 -0.80404803
## 23 -0.378638372 -0.036680138 -0.85639524 -0.76909265
## 24 -0.254013163 -0.372065624 -0.42011365 -0.10494037
## 25 -0.378638372 -0.523454906 -0.85639524 -0.74384710
## 26  0.036778989 -0.036680138 -0.85639524 -0.80404803
## 27  1.220718468 -0.227663540 -0.85639524 -0.80404803
## 28 -0.378638372  1.053322690 -0.57876150  0.66407807
## 29 -0.191700559  0.634090833 -0.18214188  0.06983655
## 30 -0.217087176 -0.344116834 -0.80351262  1.15215879
## 31  1.116864128 -0.316168043 -0.82995393 -0.75744086
## 32 -0.295554900 -0.875143853 -0.61842347 -0.80404803
## 33 -0.337096636 -0.679502319 -0.85639524 -0.75744086
## 34 -0.378638372 -0.847195062  1.10026157  1.17675703
## 35 -0.295554900 -0.819246272  0.35990494 -0.80404803
```

```
## 36 -0.378638372  1.200053840                    -0.06315599  0.17470270
## 37 -0.254013163 -0.204372881                    -0.85639524 -0.80404803
## 38 -0.129387955  0.424474904                    -0.85639524 -0.80404803
## 39  1.739990170  3.317174719                     0.65075933 -0.04668139
## 40 -0.378638372  0.005243047                     0.65075933  1.87003880
## 41  5.229496003 -0.288219253                    -0.80351262 -0.78074445
## 42 -0.243627729 -0.749374296                     1.64451184  0.68155576
## 43  0.337956576  1.451592954                     0.28388618 -0.24476190
## 44 -0.378638372  0.298705347                    -0.26146580 -0.06998498
## 45 -0.378638372  1.221015433                    -0.14247992  0.41939039
## 46 -0.347482070  0.256782162                    -0.64816994 -0.18358998
## 47  0.022931744  0.304916190                     2.56775418  1.22077492
## 48 -0.378638372  1.556400919                     0.84906914  0.69903345
## 49 -0.098231653  0.529282869                     0.07566088 -0.09620152
## 50 -0.129387955 -0.875143853                    -0.30112777 -0.80404803
##    3教室常规和集体能力   3语言结构      3阅读        3书写       3算术
## 1           0.68398697  2.49960498  1.1425547  0.176101321 -0.39169415
## 2           0.10572196  1.39459987  7.3552840 -0.351910195 -0.39169415
## 3           1.14981156  2.47258069  1.1425547  0.974495544 -0.39169415
## 4           0.28095378 -0.27171652 -0.4106276 -0.351910195 -0.39169415
## 5           1.83613619  0.20786940 -0.4106276 -0.351910195 -0.39169415
## 6          -0.03154297  0.22651996  0.1433046 -0.351910195 -0.39169415
## 7           0.99891749  2.73711420  3.2931149 -0.103209119 -0.39169415
## 8           0.36856969  0.15648519 -0.4106276 -0.351910195 -0.39169415
## 9          -1.03328488 -0.76843051  1.2022925  1.197688818  1.08942293
## 10         -0.05328469 -0.54005626 -0.1716765  4.906948457 -0.39169415
## 11         -0.94566897 -0.74559309 -0.4106276 -0.351910195 -0.39169415
## 12         -1.03328488 -0.76843051 -0.0522009 -0.007554859  0.53647256
## 13          0.70686446  1.58192113  0.6248273  0.477093392 -0.39169415
## 14         -0.99573520 -0.51395635 -0.3935596 -0.335512322  0.35309616
## 15         -0.94566897 -0.46012528 -0.4106276 -0.351910195 -0.39169415
## 16         -1.03328488 -0.66566210 -0.4106276 -0.351910195 -0.39169415
## 17          1.28853675  1.54385875 -0.4106276 -0.351910195 -0.39169415
```

```
## 18          0.76284129  1.69801137  0.2736415 -0.122339971 -0.27320478
## 19         -1.03328488 -0.06047034 -0.4106276 -0.237125083  0.04276686
## 20          0.31015908  1.60666167  0.9434288 -0.122339971  0.08226332
## 21         -0.71411263 -0.38671927 -0.3764917 -0.351910195  1.63955213
## 22         -0.40780463 -0.76843051 -0.4106276 -0.351910195 -0.39169415
## 23         -0.52949339 -0.73417437 -0.4106276 -0.351910195 -0.39169415
## 24         -0.94566897 -0.15182004 -0.4106276 -0.351910195 -0.39169415
## 25         -0.41753973 -0.76843051 -0.4106276 -0.351910195 -0.39169415
## 26         -0.31045362 -0.76843051 -0.4106276 -0.351910195 -0.39169415
## 27         -0.24960923 -0.76843051 -0.4106276  3.174543525 -0.39169415
## 28          0.17143389  0.12222906 -0.4106276 -0.351910195 -0.39169415
## 29         -0.24474168 -0.39161300 -0.4106276 -0.351910195 -0.39169415
## 30          0.26797364  1.03699479  0.4035763 -0.241376383 -0.39169415
## 31         -0.59520533 -0.76843051 -0.4106276  1.025511150 -0.39169415
## 32         -0.39076820 -0.76843051 -0.4106276 -0.351910195  5.37478835
## 33         -0.91646366 -0.76843051 -0.4106276 -0.351910195 -0.39169415
## 34          0.31015908  1.19558802  2.5364363 -0.198863379 -0.39169415
## 35         -1.03328488 -0.74559309  0.1270124  0.394193033  1.68186976
## 36          0.89426515 -0.32310073 -0.4106276 -0.351910195 -0.39169415
## 37         -0.46378146 -0.76843051 -0.4106276 -0.351910195 -0.39169415
## 38         -0.15712577 -0.76843051 -0.4106276 -0.351910195 -0.39169415
## 39          3.20148413 -0.04905163 -0.4106276 -0.351910195 -0.35219769
## 40          0.14952991  1.03001669 -0.2911520 -0.237125083 -0.39169415
## 41          1.44916592 -0.76843051 -0.4106276 -0.351910195 -0.39169415
## 42          0.44766739  0.82828611  0.4012632 -0.253067460 -0.33244946
## 43          1.74852028 -0.11756390 -0.3210209 -0.294517639 -0.33244946
## 44         -0.77043715  0.29350974 -0.4106276 -0.351910195 -0.39169415
## 45         -0.94566897  0.97863249 -0.4106276 -0.351910195 -0.39169415
## 46         -0.37616555 -0.46868931 -0.4106276 -0.351910195 -0.39169415
## 47          1.22363608  1.48993705  0.6248273 -0.130842572 -0.39169415
## 48          0.98188106  0.49904657 -0.4106276 -0.351910195 -0.39169415
## 49          0.31380975 -0.24602442 -0.3508898 -0.294517639 -0.33244946
## 50         -0.94566897 -0.76843051 -0.4106276 -0.351910195 -0.39169415
```

```
# weight_matrix_type <- aggregate(
#            weight_matrix, by = list(cluster = fit.km$cluster), mean)
weight_matrix_type <- tibble(row.names(weight_matrix), fit.km$cluster)
write_excel_csv(weight_matrix_type, "E:\\SDODT CO., Ltd\\ASD\\data\\2_way_specification
```

结果已导出，人工制定分为几类可能存在一些困难。后续等待手动分层以后再相应改 centers 数量。下面本来想尝试一些其他方法的聚类，后面放弃。

```
# pam 怎么还是要设置中心个数，告辞
# set.seed(1112)
# fit.pam <- pam(weight_matrix, k = ..., stand = TRUE)
# weight_matrix_type2 <-

# 分层还是爬吧
# 基础 stats 包就能做
# set.seed(1113)
# clust_number_average <- weight_matrix %>%
#   scale() %>%
#   NbClust(distance = "euclidean", min.nc = 3, max.nc = 70, method = "average")
# table(clust_number_average$Best.nc[1,])
# barplot(table(clust_number_average$Best.n[1,]),
#         xlab = "Number of Clusters",
#         ylab = "Number of Cluster Chosen by multiple Criteria"
# )
#
#
# d_hier <- weight_matrix %>% scale() %>% dist()
# fit.average <- hclust(d_hier, method = "average")
# plot(fit.average, hang = -1, cex = .8, main = "Average Linkage Clustering")
# cutree <- cutree(fit.average, k = 70)
# table(cutree)
# fig.average2 <- as.dendrogram(fig.average)
# dev.new()
```

```
# pdf("E:/SDODT Co., Ltd/ASD/images/hi-cluster.pdf", width = 40, height = 15)
# fit.average %>% plot(cex = 0.1, main = "ALC/n70 Cluster Solution")
# graphics.off()
# rect.hclust(fit.average, k = 70)

# pca 和 efa 不做了
```

6 重新分析

本部分是去除雷页数据以后进行的四人分析，权重不变。

```
# re-import
df_xc <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/tidy/双向细目
```

```
## New names:
## * `` -> `...1`
```

```
df_wxy <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/tidy/双向细
```

```
## New names:
## * `` -> `...1`
```

```
df_zjh <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/tidy/双向细
```

```
## New names:
## * `` -> `...1`
```

```
df_zl <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/tidy/双向细目
```

```
## New names:
## * `` -> `...1`
```

```
# basic vector create (是不是好像没用)
wxy.vec <- df_wxy[-154,-1] %>%
  unname() %>% unlist() %>% as.numeric() %>%
  na_if(999) %>% na_if(0) %>% na_if(10)
```

```
## Warning in length_x %in% c(1L, n): 强制改变过程中产生了NA
```

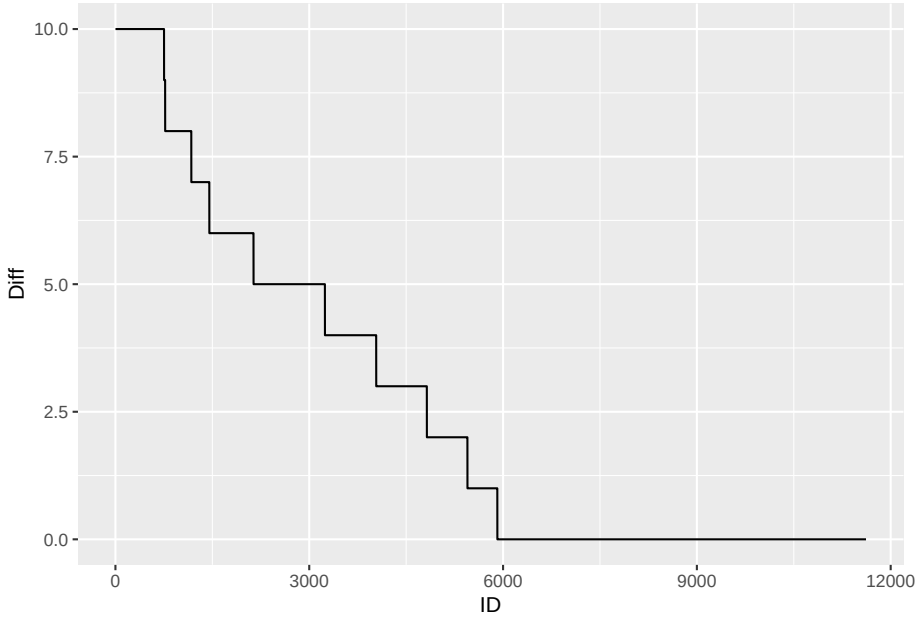
```
xc.vec <- df_xc[-154,-1] %>%
  unname() %>% unlist() %>%
  na_if(999) %>% na_if(0) %>% na_if(10)
zjh.vec <- df_zjh[-c(24,129),-1] %>%
  unname() %>% unlist() %>%
  na_if(999) %>% na_if(0) %>% na_if(10)
zl.vec <- df_zl[,-1] %>%
  unname() %>% unlist() %>%
  na_if(999) %>% na_if(0) %>% na_if(10) %>% car::recode("50 = 0")
wxy.std <- df_wxy[-154,-1] %>%
  unname() %>% unlist() %>% as.numeric() %>%
  na_if(999)
```

```
## Warning in length_x %in% c(1L, n): 强制改变过程中产生了NA
```

```
xc.std <- df_xc[-154,-1] %>% unname() %>% unlist() %>%
  na_if(999)
zjh.std <- df_zjh[-c(24,129),-1] %>% unname() %>% unlist() %>%
  na_if(999)
zl.std <- df_zl[,-1] %>% unname() %>% unlist() %>%
  na_if(999) %>% car::recode("50 = 0")
# 转置矩阵并处理成数据框
std_df_re <- t(data.frame(wxy.std, xc.std, zjh.std, zl.std))
std_vec_re <- std_df_re %>%
  colSds(na.rm = TRUE) %>% # 这里用的是 matrixStats 包
  sort(decreasing = TRUE) %>%
```

```
  data.frame() %>%
  mutate(ID = 1:11618) %>%
  rename(sd = ".") # 生成标准差向量并排序，做成新数据框

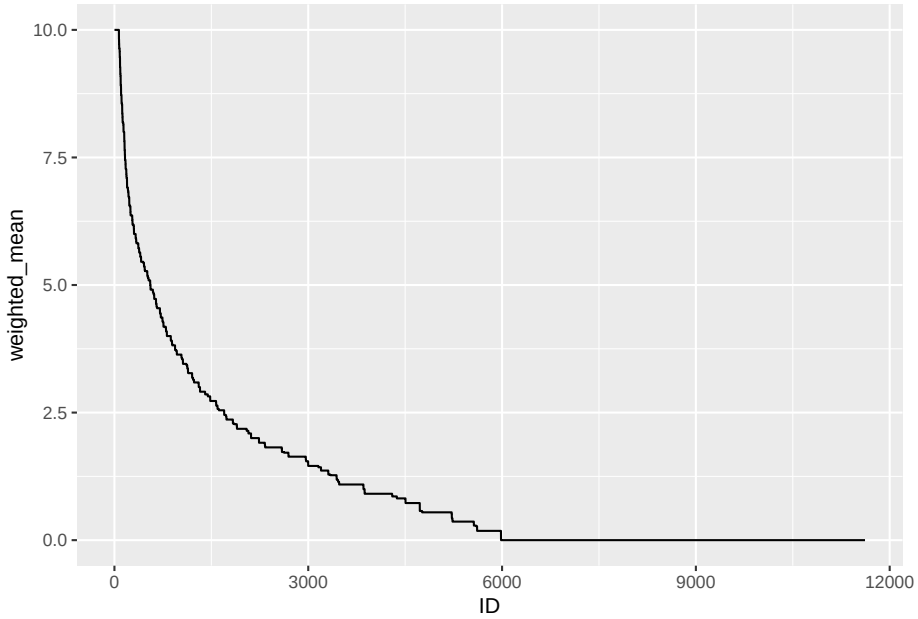

# calculate diff cells number（其实 excel 已经做过了）
colMax <- function(data) # 预防起见，还是再创建一次函数吧
  sapply(data, max, na.rm = TRUE)
colMin <- function(data)
  sapply(data, min, na.rm = TRUE)
Max <- std_df_re %>% data.frame() %>% colMax() %>% as.vector()
Min <- std_df_re %>% data.frame() %>% colMin() %>% as.vector()
Diff_re <- Max - Min
Diff_re <- Diff_re %>%
  sort(decreasing = TRUE) %>%
  data.frame() %>%
  mutate(ID = 1:11618) %>%
  rename(Diff = ".") # 排序，做成新数据框
ggplot(data = Diff_re, aes(x = ID, y = Diff, group = 1)) +
  geom_line()
```



差值大于 5（包含 5）的仍有大约两千个，和 excel 统计结果一致。

```
# 复用原 outlier check.xlsx 完成该任务
# 权重计算
# 计算过程请见.\data\2_way_specification_matrix\weighted_mean.xlsx
# 中的 recalculate sheet
weighted_mean2 <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/wei
                             sheet = "outcome_re",
                             range = "A1:A11619")
fig.means2 <- weighted_mean2 %>%
  unlist() %>%
  sort(decreasing = TRUE) %>%
  data.frame() %>%
  mutate(ID = 1:11618) %>%
  rename(weighted_mean = ".") # 做有排序的新数据框
means2 <- weighted_mean2 %>%
  unlist() %>%
  data.frame() %>%
```

```
  mutate(ID = 1:11618) %>%
  rename(mean = ".") # 做无排序的新数据框
ggplot(data = fig.means2, aes(x = ID, y = weighted_mean, group = 1)) +
  geom_line()
```




```
weight_matrix2 <- read_excel("E:/SDODT Co., Ltd/ASD/data/2_way_specification_matrix/wei
                             sheet = "final2")
weight_matrix2 <- weight_matrix2 %>% column_to_rownames(., var = '课程')
KMO(weight_matrix2)
```

```
## Kaiser-Meyer-Olkin factor adequacy
## Call: KMO(r = weight_matrix2)
## Overall MSA =  0.74
## MSA for each item =
##                          1发声                        1提要求
##                           0.78                           0.75
##                          1命名                       1听者反应
##                           0.71                           0.68
```

```
##          1视觉感知能力和样本配对                  1独立游戏
##                              0.76                       0.69
##            1社会行为和社会游戏                  1动作模仿
##                              0.80                       0.69
##                        1仿说          1认知（语言/语前）
##                              0.68                       0.72
##                      1语言表达                  1语言理解
##                              0.82                       0.77
##                        1小肌肉                    1大肌肉
##                              0.78                       0.60
##          1模仿（视觉/动作）                  1情感表达
##                              0.67                       0.65
##                      1社交互动          1行为特征-非语言
##                              0.84                       0.79
##          1行为特征-语言                  1问题行为
##                              0.86                       0.77
##                      1个人自理                  1适应行为
##                              0.67                       0.79
##                        2提要求                    2命名
##                              0.66                       0.61
##                      2听者反应          2视觉感知能力和样本配对
##                              0.75                       0.68
##                      2独立游戏            2社会行为和社会游戏
##                              0.61                       0.77
##                      2动作模仿                  2仿说
##                              0.63                       0.63
##          2认知（语言/语前）                  2语言表达
##                              0.70                       0.86
##                      2语言理解                  2小肌肉
##                              0.78                       0.71
##                        2大肌肉          2模仿（视觉/动作）
##                              0.58                       0.61
##                      2情感表达                  2社交互动
```

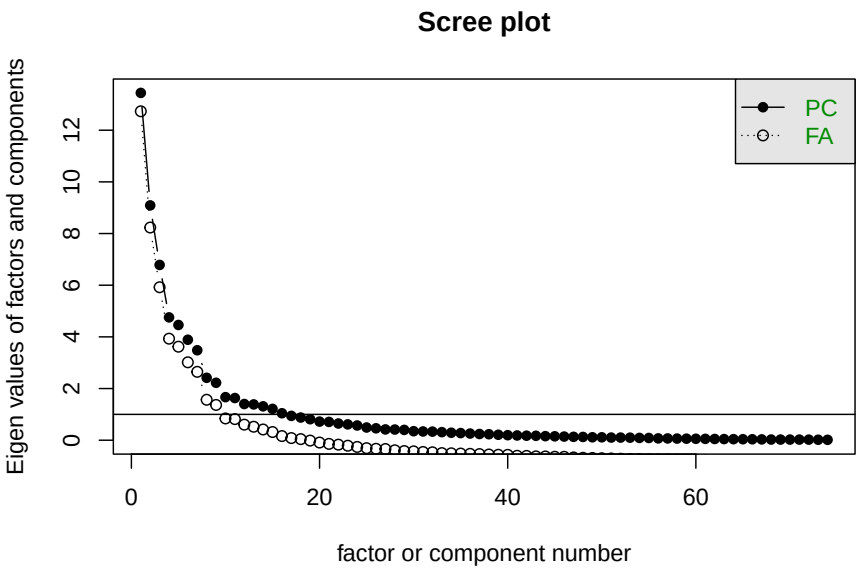
```
##                0.62                0.87
##  2行为特征-非语言  2行为特征-语言
##                0.70                0.86
##      2问题行为      2个人自理
##                0.81                0.67
##  2适应行为 2功能、特性、类别的听者反应LRFFC
##                0.81                0.79
##        2对话  2教室常规和集体能力
##                0.86                0.83
##    2语言结构      3提要求
##                0.84                0.59
##        3命名      3听者反应
##                0.59                0.65
##  3视觉感知能力和样本配对      3独立游戏
##                0.82                0.70
##  3社会行为和社会游戏      3动作模仿
##                0.80                0.75
##  3认知（语言/语前）      3语言表达
##                0.72                0.83
##    3语言理解      3小肌肉
##                0.73                0.62
##      3大肌肉  3模仿（视觉/动作）
##                0.71                0.72
##    3情感表达      3社交互动
##                0.63                0.82
##  3行为特征-非语言  3行为特征-语言
##                0.61                0.86
##      3问题行为      3个人自理
##                0.71                0.63
##  3适应行为 3功能、特性、类别的听者反应LRFFC
##                0.75                0.75
##        3对话  3教室常规和集体能力
##                0.86                0.80
```

```
##                 3语言结构                 3阅读
##                      0.82                 0.42
##                    3书写                 3算术
##                      0.59                 0.64
```

```
bartlett.test(weight_matrix2)
```

```
##
##  Bartlett test of homogeneity of variances
##
## data:  weight_matrix2
## Bartlett's K-squared = 1193, df = 73, p-value < 0.00000000000000022
```

```
scree(weight_matrix2)
fa_free2 <- fa(weight_matrix2, fm = "pa", rotate = "varimax")
fa2 <- fa(weight_matrix2, fm = "pa", rotate = "varimax", nfactors = 9)
scree2.fa.9 <- scree(weight_matrix2)[[1]][-c(13:74)]
```



```
scree2.pca.9 <- scree(weight_matrix2)[[2]][-c(13:74)]
x <- c(1:12)
scree2 <- data.frame(x, scree2.fa.9, scree2.pca.9)
hline <- function(y = 0, color = "black") {
  list(type = "line",
       x0 = 0,
       x1 = 1,
       xref = "paper",
       y0 = y,
       y1 = y,
       line = list(color = color))
  }
fig2 <- plot_ly(scree2,
                x = ~x,
                y = ~scree2.fa.9,
                name = 'FA',
                type = 'scatter',
                mode = 'lines+markers') %>%
  layout(
    title ='Scree Plot',
    font = list(size = 20),
    margin = list(l=50, r=50, b=100, t=100, pad=4),
    xaxis = list(title = 'Factor or component number'),
    yaxis = list(title = 'Eigen values of factors and components'),
    legend = list(title=list(text='<b> Methods </b>')),
    shapes = list(hline(1))
  )
fig2 <- fig2 %>% add_trace(y = ~scree2.pca.9, name = 'PC', mode = 'lines+markers')
fig_22 <- style(fig, marker = list(size = 12))
fa2
```

```
## Factor Analysis using method =  pa
## Call: fa(r = weight_matrix2, nfactors = 9, rotate = "varimax", fm = "pa")
```

```
## Standardized loadings (pattern matrix) based upon correlation matrix
##                                  PA1   PA3   PA2   PA7   PA5   PA4   PA6
## 1发声                          -0.01 -0.05  0.86  0.13 -0.05  0.09 -0.02
## 1提要求                         0.01 -0.04  0.73  0.17 -0.01 -0.09  0.00
## 1命名                          -0.14 -0.09  0.67  0.08 -0.08 -0.05 -0.08
## 1听者反应                      -0.09  0.27  0.44 -0.15 -0.21  0.51 -0.08
## 1视觉感知能力和样本配对        -0.46 -0.11 -0.12 -0.13 -0.36 -0.05  0.12
## 1独立游戏                      -0.14 -0.02 -0.07 -0.06  0.15 -0.18  0.21
## 1社会行为和社会游戏             0.09  0.38  0.54  0.02  0.08  0.11 -0.01
## 1动作模仿                      -0.10  0.06  0.07 -0.21  0.16 -0.08 -0.11
## 1仿说                          -0.06 -0.06  0.59 -0.03 -0.03  0.04 -0.03
## 1认知（语言/语前）             -0.41 -0.23  0.27 -0.02 -0.38  0.19 -0.05
## 1语言表达                       0.12  0.07  0.82  0.34 -0.04 -0.06 -0.05
## 1语言理解                      -0.03  0.15  0.44 -0.06 -0.19  0.57 -0.04
## 1小肌肉                        -0.17  0.02  0.14 -0.12 -0.10 -0.07  0.59
## 1大肌肉                        -0.08  0.03  0.06 -0.12  0.27 -0.04 -0.05
## 1模仿（视觉/动作）             -0.29 -0.02  0.10 -0.23 -0.11 -0.08 -0.08
## 1情感表达                      -0.09  0.73  0.12 -0.09 -0.11 -0.12 -0.04
## 1社交互动                       0.10  0.56  0.59  0.07 -0.09  0.11 -0.10
## 1行为特征-非语言               -0.18  0.03  0.14 -0.24  0.00  0.25  0.18
## 1行为特征-语言                  0.14  0.32  0.69  0.19 -0.17  0.11 -0.06
## 1问题行为                      -0.04  0.76  0.25 -0.11 -0.12  0.11 -0.08
## 1个人自理                      -0.08  0.00  0.04 -0.08 -0.11 -0.01  0.70
## 1适应行为                      -0.02  0.73  0.40 -0.07 -0.03  0.06 -0.08
## 2提要求                         0.10 -0.10  0.53  0.48 -0.02 -0.17 -0.01
## 2命名                          -0.07 -0.14  0.26  0.50 -0.13 -0.01 -0.12
## 2听者反应                      -0.08  0.06  0.05  0.39 -0.02  0.78 -0.09
## 2视觉感知能力和样本配对        -0.59 -0.16 -0.23  0.00 -0.23  0.00  0.11
## 2独立游戏                      -0.24 -0.06 -0.16  0.06  0.33 -0.15  0.22
## 2社会行为和社会游戏             0.26  0.36 -0.02  0.57  0.34  0.15  0.06
## 2动作模仿                      -0.18  0.03 -0.05  0.02  0.57 -0.03 -0.07
## 2仿说                          -0.03 -0.13  0.21  0.28 -0.06  0.06 -0.02
## 2认知（语言/语前）             -0.51 -0.35 -0.15  0.43 -0.28  0.30 -0.13
```

```
## 2语言表达                          0.21 -0.01  0.36  0.78 -0.13 -0.06 -0.08
## 2语言理解                         -0.04 -0.03 -0.03  0.55 -0.03  0.73 -0.07
## 2小肌肉                           -0.23 -0.01 -0.17  0.16  0.24 -0.03  0.63
## 2大肌肉                           -0.15 -0.03 -0.12  0.11  0.65 -0.01  0.01
## 2模仿（视觉/动作）                -0.43 -0.09 -0.15  0.02  0.17 -0.01 -0.03
## 2情感表达                         -0.09  0.72 -0.08  0.11 -0.06 -0.14 -0.03
## 2社交互动                          0.22  0.54  0.05  0.70  0.03  0.18 -0.07
## 2行为特征-非语言                  -0.26 -0.06 -0.08  0.04  0.36  0.41  0.28
## 2行为特征-语言                     0.26  0.22  0.27  0.72 -0.12  0.10 -0.08
## 2问题行为                          0.00  0.81 -0.02  0.28 -0.02  0.22 -0.07
## 2个人自理                         -0.13  0.04 -0.03 -0.01  0.02  0.01  0.78
## 2适应行为                          0.03  0.72 -0.13  0.40  0.10  0.10  0.02
## 2功能、特性、类别的听者反应LRFFC   0.01  0.10  0.01  0.47 -0.13  0.61 -0.14
## 2对话                              0.34  0.14  0.27  0.70 -0.11  0.22 -0.11
## 2教室常规和集体能力                0.22  0.56 -0.03  0.41  0.04  0.30  0.11
## 2语言结构                          0.27  0.00  0.16  0.72 -0.17  0.21 -0.11
## 3提要求                            0.40 -0.19  0.22  0.21 -0.12 -0.24 -0.05
## 3命名                              0.26 -0.29  0.08  0.17 -0.22 -0.18 -0.15
## 3听者反应                          0.41 -0.14 -0.14 -0.10 -0.01  0.58 -0.11
## 3视觉感知能力和样本配对           -0.40 -0.18 -0.23 -0.19 -0.07 -0.08  0.14
## 3独立游戏                         -0.17 -0.12 -0.10 -0.13  0.46 -0.16  0.27
## 3社会行为和社会游戏                0.73  0.08 -0.12  0.11  0.27  0.01  0.06
## 3动作模仿                         -0.07 -0.07 -0.06 -0.24  0.73 -0.13 -0.05
## 3认知（语言/语前）                 0.09 -0.51 -0.24 -0.07 -0.28  0.14 -0.17
## 3语言表达                          0.75 -0.14  0.00  0.27 -0.25 -0.23 -0.14
## 3语言理解                          0.62 -0.23 -0.20 -0.08 -0.09  0.46 -0.14
## 3小肌肉                           -0.01 -0.11 -0.10 -0.13  0.33 -0.11  0.66
## 3大肌肉                            0.01 -0.09 -0.11 -0.18  0.80 -0.06  0.01
## 3模仿（视觉/动作）                -0.20 -0.17 -0.10 -0.31  0.36 -0.11 -0.05
## 3情感表达                          0.20  0.58 -0.15 -0.08 -0.05 -0.23 -0.05
## 3社交互动                          0.81  0.22 -0.10  0.19 -0.09 -0.01 -0.10
## 3行为特征-非语言                   0.02 -0.22 -0.14 -0.27  0.47  0.26  0.25
## 3行为特征-语言                     0.78  0.03  0.08  0.18 -0.25 -0.03 -0.16
```

```
## 3问题行为                          0.28  0.66 -0.15 -0.03 -0.07  0.09 -0.09
## 3个人自理                         -0.03  0.01 -0.05 -0.17  0.05 -0.04  0.78
## 3适应行为                          0.49  0.53 -0.16 -0.04  0.04 -0.15 -0.03
## 3功能、特性、类别的听者反应LRFFC   0.46 -0.13 -0.18 -0.01 -0.20  0.45 -0.19
## 3对话                              0.83 -0.08  0.00  0.19 -0.28  0.11 -0.15
## 3教室常规和集体能力                0.58  0.41 -0.13  0.08 -0.05  0.14  0.13
## 3语言结构                          0.78 -0.17 -0.03  0.19 -0.32  0.08 -0.16
## 3阅读                              0.15 -0.19 -0.13 -0.09 -0.20  0.06 -0.05
## 3书写                             -0.03 -0.21 -0.09 -0.04 -0.04 -0.11  0.53
## 3算术                             -0.43 -0.27 -0.18 -0.09 -0.19 -0.03 -0.19
##                                     PA8   PA9   h2   u2 com
## 1发声                             -0.06  0.09 0.79 0.21 1.1
## 1提要求                           -0.01 -0.03 0.58 0.42 1.2
## 1命名                             -0.03  0.06 0.50 0.50 1.3
## 1听者反应                          0.22  0.17 0.68 0.32 4.0
## 1视觉感知能力和样本配对            0.36  0.08 0.54 0.46 3.6
## 1独立游戏                          0.50 -0.02 0.38 0.62 2.2
## 1社会行为和社会游戏                0.51  0.00 0.73 0.27 3.0
## 1动作模仿                          0.37  0.69 0.71 0.29 2.1
## 1仿说                             -0.15  0.36 0.51 0.49 1.9
## 1认知（语言/语前）                 0.28 -0.03 0.57 0.43 4.8
## 1语言表达                          0.06 -0.08 0.82 0.18 1.5
## 1语言理解                          0.38  0.12 0.74 0.26 3.3
## 1小肌肉                            0.55  0.13 0.74 0.26 2.6
## 1大肌肉                            0.66  0.22 0.58 0.42 1.7
## 1模仿（视觉/动作）                 0.15  0.76 0.77 0.23 1.7
## 1情感表达                          0.15 -0.02 0.61 0.39 1.3
## 1社交互动                          0.30 -0.04 0.79 0.21 2.8
## 1行为特征-非语言                   0.57  0.42 0.71 0.29 3.4
## 1行为特征-语言                     0.14  0.05 0.71 0.29 2.0
## 1问题行为                          0.11 -0.01 0.70 0.30 1.4
## 1个人自理                          0.15  0.08 0.54 0.46 1.2
## 1适应行为                          0.28 -0.02 0.79 0.21 2.0
```

```
## 2提要求                                -0.09  0.01 0.58 0.42 2.4
## 2命名                                  -0.22  0.04 0.43 0.57 2.5
## 2听者反应                              -0.08  0.04 0.79 0.21 1.6
## 2视觉感知能力和样本配对                 0.19 -0.09 0.54 0.46 2.2
## 2独立游戏                               0.40 -0.09 0.44 0.56 4.3
## 2社会行为和社会游戏                     0.25 -0.05 0.73 0.27 3.7
## 2动作模仿                               0.28  0.44 0.64 0.36 2.7
## 2仿说                                  -0.12  0.51 0.42 0.58 2.4
## 2认知（语言/语前）                     -0.08 -0.23 0.84 0.16 5.2
## 2语言表达                               0.00 -0.03 0.81 0.19 1.7
## 2语言理解                              -0.05 -0.07 0.85 0.15 1.9
## 2小肌肉                                 0.36  0.06 0.70 0.30 2.7
## 2大肌肉                                 0.47  0.09 0.70 0.30 2.1
## 2模仿（视觉/动作）                      0.06  0.60 0.61 0.39 2.3
## 2情感表达                               0.03  0.10 0.59 0.41 1.3
## 2社交互动                               0.02 -0.08 0.87 0.13 2.4
## 2行为特征-非语言                        0.34  0.29 0.66 0.34 5.6
## 2行为特征-语言                         -0.09  0.07 0.75 0.25 2.0
## 2问题行为                              -0.12 -0.03 0.81 0.19 1.5
## 2个人自理                               0.04  0.02 0.62 0.38 1.1
## 2适应行为                              -0.09 -0.03 0.73 0.27 1.8
## 2功能、特性、类别的听者反应LRFFC       -0.07 -0.09 0.66 0.34 2.2
## 2对话                                  -0.03 -0.06 0.78 0.22 2.3
## 2教室常规和集体能力                    -0.13 -0.06 0.66 0.34 3.1
## 2语言结构                              -0.06 -0.07 0.71 0.29 1.8
## 3提要求                                -0.09 -0.04 0.37 0.63 4.0
## 3命名                                  -0.22 -0.05 0.34 0.66 6.2
## 3听者反应                              -0.22 -0.14 0.63 0.37 2.8
## 3视觉感知能力和样本配对                -0.08 -0.26 0.39 0.61 4.2
## 3独立游戏                               0.13 -0.18 0.43 0.57 3.5
## 3社会行为和社会游戏                     0.07 -0.21 0.69 0.31 1.6
## 3动作模仿                              -0.05  0.24 0.68 0.32 1.6
## 3认知（语言/语前）                     -0.19 -0.42 0.67 0.33 4.1
```

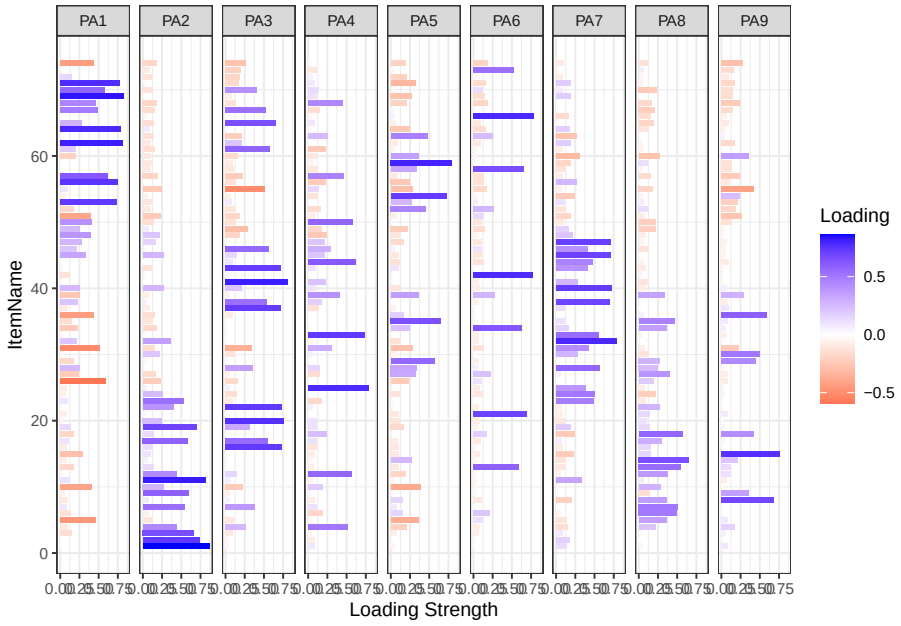
```
## 3语言表达                          -0.03 -0.11 0.81 0.19 2.0
## 3语言理解                          -0.16 -0.24 0.81 0.19 3.2
## 3小肌肉                            -0.06 -0.13 0.62 0.38 1.9
## 3大肌肉                             0.12 -0.13 0.73 0.27 1.3
## 3模仿（视觉/动作）                 -0.27  0.36 0.52 0.48 5.4
## 3情感表达                          -0.06 -0.01 0.47 0.53 1.8
## 3社交互动                          -0.05 -0.17 0.80 0.20 1.5
## 3行为特征-非语言                    0.03  0.05 0.50 0.50 3.7
## 3行为特征-语言                     -0.12 -0.06 0.76 0.24 1.5
## 3问题行为                          -0.19 -0.09 0.60 0.40 1.8
## 3个人自理                          -0.16 -0.07 0.68 0.32 1.2
## 3适应行为                          -0.21 -0.16 0.64 0.36 2.9
## 3功能、特性、类别的听者反应LRFFC -0.17 -0.23 0.63 0.37 4.2
## 3对话                              -0.01 -0.15 0.87 0.13 1.5
## 3教室常规和集体能力                -0.24 -0.14 0.64 0.36 2.8
## 3语言结构                          -0.05 -0.18 0.84 0.16 1.9
## 3阅读                              -0.05 -0.10 0.14 0.86 5.1
## 3书写                               0.06 -0.16 0.38 0.62 1.7
## 3算术                              -0.13 -0.28 0.48 0.52 4.4
##
##                        PA1  PA3  PA2  PA7  PA5  PA4  PA6  PA8  PA9
## SS loadings           8.02 7.23 6.04 6.02 4.55 4.19 4.07 3.88 3.48
## Proportion Var        0.11 0.10 0.08 0.08 0.06 0.06 0.05 0.05 0.05
## Cumulative Var        0.11 0.21 0.29 0.37 0.43 0.49 0.54 0.59 0.64
## Proportion Explained  0.17 0.15 0.13 0.13 0.10 0.09 0.09 0.08 0.07
## Cumulative Proportion 0.17 0.32 0.45 0.58 0.67 0.76 0.85 0.93 1.00
##
## Mean item complexity =  2.6
## Test of the hypothesis that 9 factors are sufficient.
##
## The degrees of freedom for the null model are  2701  and the objective function was
## The degrees of freedom for the model are 2071  and the objective function was  41.37
##
```

```
## The root mean square of the residuals (RMSR) is  0.04
## The df corrected root mean square of the residuals is  0.05
##
## The harmonic number of observations is  157 with the empirical chi square  1634.18
## The total number of observations was  157  with Likelihood Chi Square =  5150.16  wi
##
## Tucker Lewis Index of factoring reliability =  0.582
## RMSEA index =  0.097  and the 90 % confidence intervals are  0.094 0.101
## BIC =  -5321.33
## Fit based upon off diagonal values = 0.97
## Measures of factor score adequacy
##                                                  PA1  PA3  PA2  PA7  PA5  PA4
## Correlation of (regression) scores with factors   0.99 0.98 0.98 0.98 0.96 0.97
## Multiple R square of scores with factors          0.97 0.97 0.96 0.96 0.93 0.95
## Minimum correlation of possible factor scores     0.94 0.94 0.92 0.92 0.86 0.89
##                                                  PA6  PA8  PA9
## Correlation of (regression) scores with factors   0.95 0.95 0.95
## Multiple R square of scores with factors          0.91 0.91 0.90
## Minimum correlation of possible factor scores     0.82 0.82 0.80
```

```
facorrs2 <- fa2[["r"]]
faloadings2 <- fa2[["loadings"]]
Lambda2 <- unclass(faloadings2)
p2 <- nrow(Lambda2)
factors2 <- ncol(Lambda2)
vx2 <- colSums(faloadings2^2)
varex2 <- rbind(`SS loadings` = vx2)
if (is.null(attr(faloadings2, "covariance"))) {
  varex <- rbind(varex2, `Proportion Var` = vx/p)
  if (factors > 1)
    varex2 <- rbind(varex2, `Cumulative Var` = cumsum(vx/p))
}
tibble::rownames_to_column(as.data.frame(varex), "faloadings2")
```

```
##      faloadings2       PA1        PA3        PA2        PA7        PA5
## 1    SS loadings 8.0211213 7.23321735 6.04066987 6.01722405 4.55315025
## 2 Proportion Var 0.1210334 0.09604616 0.09444666 0.07529483 0.07428772
##          PA4        PA6       PA8        PA9
## 1 4.19047307 4.06618508 3.8784693 3.47966777
## 2 0.07225323 0.05683746 0.0539662 0.02914203
```

```
Lambda2 <- data.frame(Lambda2) %>% mutate(ItemName = c(1:74))
Lambda.m2 <- melt(Lambda2, id="ItemName",
                  measure=c("PA1", "PA2", "PA3", "PA4", "PA5",
                            "PA6", "PA7", "PA8", "PA9"),
                  variable.name="Factor", value.name="Loading")
ggplot(Lambda.m2, aes(ItemName, abs(Loading), fill=Loading)) +
  facet_wrap(~ Factor, nrow=1) +
  geom_bar(stat="identity") +
  coord_flip() +
  scale_fill_gradient2(name = "Loading",
                       high = "blue", mid = "white", low = "red",
                       midpoint=0) +
  ylab("Loading Strength") +
  theme_bw(base_size=10)
```




```
# 作图不方便，还是转到 excel 中供观看吧
Lambda2 %>%
  as.data.frame() %>%
  rownames_to_column(., var = '课程') %>%
  write_excel_csv(
    "E:\\SDODT CO., Ltd\\ASD\\data\\2_way_specification_matrix\\factor loadings2.csv")
```