Data and Analysis Underlying the Research into The Artificial Social Agent Questionnaire (ASAQ) - Development and evaluation of a validated instrument for capturing human interaction experience with an artificial social agent

Siska Fitrianie, Merijn Bruijnes, Amal Abdulrahman and Willem-Paul Brinkman

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Corresponding author: Siska Fitrianie, s.fitrianie@tudelft.nl

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This document provides links to files underlying the data and analysis presented in the paper:

Validating claims and replicating findings on the impact of artificial social agents (ASA), such as virtual agents, conversational agents and social robots, require a standardised measurement instrument that researchers can employ in different settings and for various agents. Such an instrument would allow researchers to evaluate their agents and establish insights beyond their specific study context. Therefore, we present the long and short versions of the ASA questionnaire (ASAQ) for evaluating human-ASA interaction on 19 constructs, such as the agent's believability, sociability, and coherence. It has been developed by an international workgroup with more than 100 ASA-researchers over multiple years who identified community-relevant constructs and associated questionnaire items and examined the questionnaire's reliability, validity, and interpretability. The result is a questionnaire that can capture more than 80% of the constructs that studies in the intelligent virtual agent community investigate, with acceptable levels of reliability, content validity, construct validity, and cross-validity. We suggest that ASA-researchers use the ASAQ short version to report their agent's psychographic information and the ASAQ long version to analyse any constructs in depth that are specifically relevant to their agent or study. Finally, this paper gives clear instructions for practical use, such as sample size estimations, and how to present results.

Requirements:

1. Pdf reader to read .pdf file
2. Text editor to read .csv file
3. R (v4.2.1)

Input: 1. data/constructASAQdesc.csv 2. data/itemASAQdesc.csv 3. data/1stReliabilityAnalysis/result_part_1.csv 4. data/1stReliabilityAnalysis/result_part_2.csv 5. data/constructDefining/expertReview.csv 6. data/predictiveValidation/scoreExpertA.csv 7. data/predictiveValidation/scoreExpertB.csv 8. data/predictiveValidation/scoreExpertC.csv 9. data/contentValidation/q431_expertGeneratedItems.csv 10. data/contentValidation/qTargets_vs_Distractors.csv 11. data/constructValidation/result_all.csv 12. data/crossValidation/result_all.csv

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Libraries:

```
library(ltm)
library(psych)
library(MBESS)
library(dplyr)
library(stringi)
library(lavaan)
library(factoextra)
library(lattice)
library(boot)
library(nFactors)
library(Rcsdp)
```

```r
library(GPArotation)
library(pwr)
library(knitr)
library(kableExtra)
library(distributions3)
library(rlist)
```

Dataset

!! Important note:

- For all datasets, all questionnaire-item data (with the column name) starting with "R_" have been reversed.

```r
########################### All Purposes Variables ######################################
# ASAQ's 7 points Likert-scales
scoreASAQ <- c(-3, -2, -1, 0, 1, 2, 3)

# 29 agents of the ASAQ Representative Set 2024 (14 agents in the Study Mid 2021 and 15
# in the Study 2022). Note:
# -SAM is the short name used to call Samantha (from the movie HER),
# -POPPIE is the name we used in the dataset for POPPY (from the Semaine project)
# -ROBOT BOSS is one of Double Robot agents,
# -SARAH is one of the Soul Machine agents, and
# -MARCUS is one of characters in the movie Terminator,
# More info about other ASAs see: https://osf.io/7wmjh/
# ASAs used in study Mid 2021:
name14ASAs <- c("AIBO", "AMY", "CHAPPIE", "DEEPBLUE","DOG","FURBY", "HAL 9000",
                "iCAT", "MARCUS", "NAO", "POPPIE", "SARAH", "SIM SENSEI", "SIRI")
# ASAs used in study 2024:
name15ASAs <- c("ALEXA", "ALICE", "C3PO", "EFFIE", "THE FISH", "FURHAT", "GEMINOID",
                "KITT", "LOLA", "PARO", "ROBOT BOSS", "SAM", "THE AMBIENT LIGHT TV",
                "THE NEGOTIATOR", "THE ZOMBIE")
name29ASAs <- c("AIBO", "ALEXA", "ALICE", "AMY", "CHAPPIE", "C3PO", "DEEPBLUE", "DOG",
                 "EFFIE", "THE FISH", "FURBY", "FURHAT", "GEMINOID", "HAL 9000", "iCAT",
                 "KITT", "LOLA", "MARCUS", "NAO", "PARO", "POPPIE", "ROBOT BOSS", "SAM",
                 "SARAH", "SIM SENSEI", "SIRI", "THE AMBIENT LIGHT TV",
                 "THE NEGOTIATOR", "THE ZOMBIE")

#probabilities used in calculating percentiles
probs<-c(.05, .10, .20, .25, .30, .40, .50, .60, .70, .75, .80, .90, .95)
probTitle<-c("q5th", "q10th", "q20th", "q25th", "q30th", "q40th", "q50th", "q60th",
             "q70th", "q75th", "q80th", "q90th", "q95th")

probsSML<-c(.25, .50, .75)
probTitleSML<-c("Small_q25th", "Medium_q50th", "Large_q75th")

# Description ASAQ's constructs/dimensions
# CID = construct/dimension's id used before study Mid 2021.
#  It uses notation "C<construct-number>D<dimension-number>"
# CABR = construct/dimension's id used after study Mid 2021. They are the abbreviation
```

```
#  of the construct/dimension' name
# CNAME = construct/dimension's name (see Table 1 for the complete version)
# NUM_ITEM = the number of items in the construct/dimension
# SHORT_ITEM_ID = the ids of 24 representative items that are used to establish the
#  short version of ASAQ. This id used before study Mid 2021
# SHORT_ITEM_REF = the ids of the short version of ASAQ that are corresponding to
#  the long version of ASAQ
constructASAQdesc <- read.csv2("data/constructASAQdesc.csv",
                               header = TRUE, sep =";", na.strings = "NNN")

# Description ASAQ's items
# ITEM_ID = item's id used before study Mid 2021
#  It used notation "C<construct-number>D<dimension-number>Q<item-number>"
# ITEM_REF = item's id used after study Mid 2021. It uses notation
#  <construct-abbreviation><item-number>
itemASAQdesc <- read.csv2("data/itemASAQdesc.csv",
                               header = TRUE, sep =";")

########################## Construct Definition dataset (n=13) ##########################
# Expert voting on classifiying 189 constructs found in IVA proceedings 2013-2018
#  into 7 concepts
# No = IVA construct id [C1__ .. C189]
# Construct = construct's name
# AProp, ASoc, ARole, IntQ, HImpr, AImpr, HAttr = the number of voters classifying the
#  corresponding construct into concept,  respectively Agent's Properties, Agent's
#  Social Trait, Agent's Role (Performance), Interaction Quality, Human's Impression
#  of the Interaction, Impression of the agent's after the Interaction, and
#  Human's Attributes (to Support the Interaction)
# Other = the number of voters classifying the corresponding construct other than the
#  7 concepts
# nVoters = the total number of voters for the corresponding construct
# SingleCls = the concept that holds the majority (>= 50%) voters for the corresponding
#  construct
# PairCls_1 = the concept that holds the first largest number of voters but below 50%
#  voters for the corresponding construct
# PairCls_2 = the concept that holds the second largest number of voters but below 50%
#  voters for the corresponding construct
constructDefData = read.csv2("data/constructDefining/expertReview.csv", header = TRUE,
                           sep =";")

######################### Content Validation dataset (n=31) ############################
# In the content validation study, experts (n=31) were asked by 223 questions. In each
#  question, they asked whether each item presented was intended for the questioned
#  construct/dimension. In a question, at most two target items (i.e., items that are
#  intended for the questioned construct/dimension) and two random distractor items
#  (i.e., items that should not be for the questioned construct/dimension).
#  See the following dataset, which contained 431 expert-generated-questionnaire items,
#  the construct/dimension id and name of each target item.
# QUESTIONID = to the question id. It's composed by C?? is the construct id, D?? is the
#  dimension id, and S* is the number of questions [1..223]
# CONID = the construct id of the target. It uses the notation before study Mid 2021.
# CONNAME = the construct name of the target
# DIMID = the dimension id of the target. It uses the dimensional and notation
```

```
#  before study Mid 2021.
# DIMNAME = the dimension name of the target
# ITEMID = the item id of the target. It uses the notation before study Mid 2021.
# ITEMQID = the id of the (YES or NO) questions in qualtrics of the target items;
#  It's composed by <QUESTIONID>_1 or _3;
# ITEMRID = the reference id the target items C??D??S*_1_TRGT and C??D??S*_2_TRGT
# ITEMQ = the questionnaire item statement
contentValItems <-
  read.csv("data/contentValidation/q431_expertGeneratedItems.csv", header = TRUE,
           sep =";")

# The result of the content validity study with 31 experts. It contained the list of
#  pairing of one target item and one distractor item in a (qualtrics) question,
#  and the answer of the experts for both items.
# PRID = anonymous id of the experts. An expert was asked to answer 233 questions
#  It was allowed not to answer.
# QUESTIONID = to the question id (i.e. task number). It's composed by C?? is the
#  construct id, D?? is the dimension id, and S* is the number of questions [1..223]
# TRGT_ITEMID = the item id of the target. It uses the notation before study Mid 2021.
# TRGT_ITEMQID = the id of the (YES or NO) questions in qualtrics of the target items;
#  It's composed by <QUESTIONID>_1 or _3.
# TRGT_ITEMRID = the reference id of the target items C??D??S*_1_TRGT and C??D??S*_2_TRGT
# TRGT_ITEMQ = the questionnaire item statement
# DSTR_ITEMID = the item id of the distractor. It uses the notation before study Mid 2021.
# DSTR_ITEMQID = the id of the (YES or NO) questions in qualtrics of the distractor items;
#  It's composed by <QUESTIONID>_2 or _4;
# DSTR_ITEMRID = the reference id of the distractor items C??D??S*_1_DSTR and
#  C??D??S*_2_DSTR
# DSTR_ITEMQ = the questionnaire item statement
# TRGT_ANS = the answer of the expert for the target item
# DSTR_ANS = the answer of the expert for the distractor item
contentValData <- read.csv("data/contentValidation/qTargets_vs_Distractors.csv",
           header = TRUE, sep =";")

######################## Study Early '21 dataset (n=192) ####################
# The Study Early '21 with 192 crowd-workers on Prolific
# PRID = Anonymous id of the participant
# STARTDATE = starting datetime of the data entry
# ENDDATE = ending datetime of the data entry
# RECORDDATE = datetime when the data was recorded
# GROUP = group of participants, i.e., one of four groups - 1stPOV_part_1,
#  1stPOV_part_2, 3rdPOV_part_1,  and 3rdPOV_part_2
# CheckScore = the number of attention-check-correct answers given by participants
# C01D01Q?? .. C19D00Q?? = the participant's rates on the questionnaire items. The id
#  of items was based the notation before Study Mid 2021
reliabilityData_part_1_raw = read.csv2("data/1stReliabilityAnalysis/result_part_1.csv",
                                       header = TRUE, sep =";")
reliabilityData_part_2_raw = read.csv2("data/1stReliabilityAnalysis/result_part_2.csv",
                                       header = TRUE, sep =";")

# Read obtained data based on conditions: 1st Person of View and 3rd Person of View from
# both parts
reliabilityData_part_1 <-
```

```r
  reliabilityData_part_1_raw[7:ncol(reliabilityData_part_1_raw)]
reliabilityData_part_2 <-
  reliabilityData_part_2_raw[7:ncol(reliabilityData_part_2_raw)]
reliabilityData_1stPOV_part_1 =
  reliabilityData_part_1_raw[reliabilityData_part_1_raw$GROUP == '1stPOV_part_1',]
reliabilityData_1stPOV_part_2 =
  reliabilityData_part_2_raw[reliabilityData_part_2_raw$GROUP == '1stPOV_part_2',]
reliabilityData_3rdPOV_part_1 =
  reliabilityData_part_1_raw[reliabilityData_part_1_raw$GROUP == '3rdPOV_part_1',]
reliabilityData_3rdPOV_part_2 =
  reliabilityData_part_2_raw[reliabilityData_part_2_raw$GROUP == '3rdPOV_part_2',]
reliabilityData_1stPOV_part_1 =
  reliabilityData_1stPOV_part_1[7:ncol(reliabilityData_1stPOV_part_1)]
reliabilityData_1stPOV_part_2 =
  reliabilityData_1stPOV_part_2[7:ncol(reliabilityData_1stPOV_part_2)]
reliabilityData_3rdPOV_part_1 =
  reliabilityData_3rdPOV_part_1[7:ncol(reliabilityData_3rdPOV_part_1)]
reliabilityData_3rdPOV_part_2 =
  reliabilityData_3rdPOV_part_2[7:ncol(reliabilityData_3rdPOV_part_2)]
reliabilityData <- cbind(reliabilityData_part_1, reliabilityData_part_2)

####################### Study Mid 2021 Dataset (n=532) ############################
# The Study Mid 2021 study involving 532 crowd-workers on Prolific
# PRID = Anonymous id of the participant
# STARTDATE = starting datetime of the data entry
# ENDDATE = ending datetime of the data entry
# RECORDDATE = datetime when the data was recorded
# GROUP = group of participants, i.e. 14 agents
# CheckScore = the number of attention-check-correct answers given by participants
# C01D01Q?? .. C19D00Q?? = the participant's rates on the questionnaire items. The id
#  of items was based the notation before Study Mid 2021
constructValData_raw <-
  read.csv2("data/constructValidation/result_all.csv", header = TRUE, sep =";")
constructValData <-
  cbind(constructValData_raw$GROUP, constructValData_raw[, 7:ncol(constructValData_raw)])
names(constructValData) <-
  c("ASA", colnames(constructValData_raw[, 7:ncol(constructValData_raw)]))

########################## Study '22 dataset (n=534) #############################
# The Cross Validation study involving 534 crowd-workers on Prolific
# PRID = Anonymous id of the participant
# STARTDATE = starting datetime of the data entry
# ENDDATE = ending datetime of the data entry
# RECORDDATE = datetime when the data was recorded
# GROUP = group of participants, i.e. 15 agents
# CheckScore = the number of attention-check-correct answers given by participants
# C01D01Q?? .. C19D00Q?? = the participant's rates on the questionnaire items. The id
#  of items was based the notation before Study Mid 2021
crossValData_raw <- read.csv2("data/crossValidation/result_all.csv", header = TRUE,
                              sep =";")
crossValData <- cbind(crossValData_raw$GROUP,
                      crossValData_raw[, 7:ncol(crossValData_raw)])
names(crossValData) <- c("ASA", colnames(crossValData_raw[, 7:ncol(crossValData_raw)]))
```

```r
########################### Predictive Validity dataset (n=3) ###########################
# Three experts' prediction on the scores of ASAQ constructs for 54 agents.
# One dataset file per expert
# ASA = the agent's name
# C1D1 .. C19 = the participant's rates on the questionnaire items. The id
#  of constructs was based the notation before Study Mid 2021
predictiveValData_expertA = read.csv("data/predictiveValidation/scoresExpertA.csv",
                                     header = TRUE, sep =";")
predictiveValData_expertB = read.csv("data/predictiveValidation/scoresExpertB.csv",
                                     header = TRUE, sep =";")
predictiveValData_expertC = read.csv("data/predictiveValidation/scoresExpertC.csv",
                                     header = TRUE, sep =";")
```

Functions

```r
################################## ALL PURPOSES ##########################################

# Convert to numeric and return a subset of a dataframe starting from startCol
# to ncol(data)
convertToNumeric <- function(data, startCol){
  return(as.data.frame(sapply(data[startCol:ncol(data)], as.numeric)))
}

# Standardize data. The observed data was standardized to allow us to compare the
# ratings between different ASAs. Standardization procedure:
# 1. calculate the mean and the standard deviation per item per ASA.
# 2. for each observed value of an item, subtract it by the mean based on its
#  corresponding ASA
# 3. for each observed value of an item, divide it by the standard deviation based on
#  its corresponding ASA
getStandardize <- function(agents, data){
  d_M = data.frame()
  d_SD = data.frame()
  row = 1
  for (agent in agents){
    d_M[row,1] <- agent
    d_SD[row,1] <- agent
    for(j in 2:ncol(data)){
      d<-data[data[,1]==agent,j]
      if (length(d)==0) {
        print(j)
        print(paste("agent ", agent, " is empty", sep=" "))
      }
      M <- mean(d)
      std <- sd(d)
      d_M[row,j] <- M
      d_SD[row,j] <- std
    }
    row = row + 1
  }
```

```r
  d_standard = data.frame()
  for(col in 2:ncol(data)){
    newCol = col - 1
    for (row in 1:nrow(data)){
        M = d_M[d_M[,1]==data[row,1], col]
        std = d_SD[d_SD[,1]==data[row,1], col]
        d_standard[row,newCol] <- (data[row, col] - M)/std
    }
  }
  names(d_standard) <- colnames(data[c(2:ncol(data))])
  return(d_standard)
}

# Get data of individual constructs/dimensions
# INPUT
# arr: the number of columns of items of each construct/dimension in the dataset
# d: data
# inc: the order of the constructs/dimensions [1..26] (see the variable constructs)
#
# OUTPUT
# data of items of the i-th construct/dimension in inc
getDataColWise <- function(arr, d, inc){
  dat <- data.frame()
  end <- 0
  for(i in 1:inc){
    begin <- end + 1
    end <- end + arr[i]
  }
  dat <- d[begin:end]
  return(convertToNumeric(dat, 1))
}

# Get data of individual constructs/dimensions
# INPUT
# arr: the number of columns of items of each construct/dimension in the dataset
# d: data
# inc: the order of the constructs/dimensions [1..26] or [1 ..24]
#       (see the variable constructs)
#
# OUTPUT
# data of items of the i-th construct/dimension in inc
getDataRowWise <- function(arr, d, inc){
  dat <- data.frame()
  end <- 0
  for(i in 1:inc){
    begin <- end + 1
    end <- end + arr[i]
  }
  dat <- d[begin:end,]
  return(dat)
}

# Extract 90 items of the long ASAQ from data
```

```r
# INPUT
#  data_ori = dataset from study before Mid 2021
#  itemDesc = description of ASAQ items containing the list of ASAQ items' id
#   (ids used before study Mid 2021) and ref (ids used after study Mid 2021)
#  startCol = the starting column number to read the dataset
# OUTPUT
#  dataset of 90 items of ASAQ, with description
getLongASAQ <- function(data_ori, itemId, itemRef, startCol){
  # adding additional columns to the ASAQ items, e.g. ASAs
  startCols = colnames(data_ori)[1:startCol-1]
  longASAQCols = c(startCols, itemId)

  dat <- data.frame()
  for (col in longASAQCols){
    if (nrow(dat) == 0) dat <- data_ori[col]
    else dat <- cbind(dat, data_ori[col])
  }

  names(dat) <- c(startCols, itemRef)
  return(dat)
}

# Extract 24 items of the short ASAQ from data
# INPUT
#  data_ori = dataset from study before Mid 2021
#  constructDesc = description of ASAQ construct/dimension containing short_item_id
#   and short_item_ref
#  startCol = the starting column number to read the dataset
# OUTPUT
#  dataset of 90 items of ASAQ, with description
getShortASAQ <- function(data_ori, constructDesc, startCol){
  # adding additional columns to the ASAQ items, e.g. ASAs
  startCols = colnames(data_ori)[1:startCol-1]
  shortASAQCols = c(startCols, constructDesc$SHORT_ITEM_ID)

  dat <- data.frame()
  for (col in shortASAQCols){
    if (nrow(dat) == 0) dat <- data_ori[col]
    else dat <- cbind(dat, data_ori[col])
  }

  names(dat) <- c(startCols, constructDesc$SHORT_ITEM_REF)
  return(dat)
}

# Display a dataframe for the manuscript purposes
# INPUT
# data_ori = the data to be displayed
# idConstructs, abrConstructs and nameConstructs = the list of ASAQ
#  constructs/dimensions' ids, abbreviations and names
# type = [0 = displays the data,
#         1 = before displaying it is necessary to transpose the data,
#         2 = displaying data combining from both short and long versions of ASAQ]
```

```r
# showDesc = displaying (1) or not (0) data description, i.e., min, max, mean, sd, median
#
# OUTPUT
# Displaying a table starts with the columns construct id, construct abbreviation, and
#  construct name, and then continues with the data that is corresponding to 24 ASAQ
#  constructs/dimensions.
# If showDesc == 1 then displaying the data description underneath the table
showTable <- function(data_ori, abrConstructs, nameConstructs, type,
                      showDesc, showMean, showSD, showMedian, showMin, showMax){
  dat <- data.frame(matrix(nrow = length(abrConstructs), ncol = 0))
  data <- data.frame()
  if (type == 0)
    data <- convertToNumeric(data_ori, 2)
  if (type == 1){
    headers <- data_ori[, 1]
    data_ori <- convertToNumeric(data_ori, 2)
    for(i in 1:length(headers)){
      for (j in 1:length(abrConstructs)){
        data[j, headers[i]] <- data_ori[i, j]
      }
    }
    colnames(data) <- headers
  }
  if (type == 2){
    data <- convertToNumeric(data_ori, 2)
    n = ncol(data)/2
    h1 <- paste("LONG", colnames(data)[1:n], sep = "_")
    n = n + 1
    h2 <- paste("SHORT", colnames(data)[n:ncol(data)], sep = "_")
    colnames(data) <- c(h1,h2)
  }
  data <- round(data,2)

  dat[, "CABR"] <- abrConstructs
  dat[, "CNAME"] <- nameConstructs
  dat <- cbind(dat, format(data, nsmall=2))

  print(dat)

  if (showDesc == 1){
    # Do data description
    rows = showMean + showSD + showMedian + showMin + showMax
    i = 1
    desc <- data.frame(matrix(nrow = rows, ncol = ncol(dat)))
    if (showMean == 1){
      vals = round(apply(data, 2, mean, na.rm=TRUE), 2)
      desc [i, ] <- c("","Mean:", format(vals, nsmall=2))
      i = i + 1
    }
    if (showSD == 1){
      vals = round(apply(data, 2, sd, na.rm=TRUE), 2)
      desc [i, ] <- c("","SD:", format(vals, nsmall = 2))
      i = i + 1
```

```
    }
    if (showMedian == 1){
      vals = round(apply(data,2,median,na.rm=TRUE),2)
      desc [i, ] <- c("","Median:", format(vals, nsmall=2))
      i = i + 1
    }
    if (showMin == 1){
      vals = apply(data, 2, min, na.rm=TRUE)
      desc [i, ] <- c("","Min:", format(vals, nsmall = 2))
      i = i + 1
    }
    if (showMax == 1){
      vals = apply(data, 2, max, na.rm=TRUE)
      desc [i, ] <- c("","Max:", format(vals, nsmall = 2))
      i = i + 1
    }

    # for printing purpose
    colnames(desc) <- c("", "Description", names(data))
    print(desc)
  }
}

# Display a dataframe of sample sizes for the manuscript purposes
# INPUT
# data_ori = the data to be displayed
# idConstructs, abrConstructs and nameConstructs = the list of ASAQ
#  constructs/dimensions' ids, abbreviations and names
# type = [0 = displays the data,
#         1 = before displaying it is necessary to transpose the data,
#         2 = displaying data combining from both short and long versions of ASAQ]
#
# OUTPUT
# Displaying a table starts with the columns construct id, construct abbreviation, and
#  construct name, and then continues with the data that is corresponding to 24 ASAQ
#  constructs/dimensions.
showTableSample <- function(data_ori, abrConstructs, nameConstructs, type){
  data <- data.frame()
  if (type == 0)
    data <- convertToNumeric(data_ori, 2)
  if (type == 1){
    headers <- data_ori[, 1]
    data_ori <- convertToNumeric(data_ori, 2)
    for(i in 1:length(headers)){
      for (j in 1:length(abrConstructs)){
        data[j, headers[i]] <- data_ori[i, j]
      }
    }
    colnames(data) <- headers
  }
  if (type == 2){
    data <- convertToNumeric(data_ori, 2)
    n = ncol(data)/2
```

```r
    h1 <- paste("LONG", colnames(data)[1:n], sep = "_")
    n = n + 1
    h2 <- paste("SHORT", colnames(data)[n:ncol(data)], sep = "_")
    colnames(data) <- c(h1,h2)
  }
  data <- round(data,0)

  dat <- data.frame(matrix(nrow = length(abrConstructs), ncol = 0))
  dat[, "CABR"] <- abrConstructs
  dat[, "CNAME"] <- nameConstructs
  dat <- cbind(dat, data)

  print(dat)

  desc <- data.frame(matrix(nrow = 1, ncol = ncol(dat)))
  desc [1, ] <- c("","Max:", round(apply(data, 2, max, na.rm=TRUE),0))
  colnames(desc)<-c("","Description",names(data))
  print(desc)
}

# Display the dataframe of the ASAQ constructs/dimensions scores of the ASAQ
# representative set 2024 for the manuscript purposes
# INPUT
# data_mean = the data to be displayed (the constructs/dimensions scores of the ASAs)
# data_sd = the data to be displayed (the standard deviation of the constructs/dimensions
#  scores of the ASAs)
# data_sum = the ASAQ score of the ASAs
# data_samples = the sample size of each ASA's dataset
# idConstructs, abrConstructs and nameConstructs = the list of ASAQ
#  constructs/dimensions' ids, abbreviations and names
# showDesc = displaying (1) or not (0) data description, i.e., min, max, mean, sd, median
#
# OUTPUT
# Displaying a table starts with the columns construct id, construct abbreviation, and
#  construct name, and then continues with the data that is corresponding to 24 ASAQ
#  constructs/dimensions.
# If showDesc == 1 then displaying the data description underneath the table
showTableASA <- function(data_mean, data_sd, data_sum, data_samples,
                         abrConstructs, nameConstructs){
  d_mean <- convertToNumeric(data_mean, 2)
  d_sd <- convertToNumeric(data_sd, 2)

  headers <- c()
  for(h in data_mean[,1]){
    h_mean <- paste0(h, "_M")
    h_sd <- paste0(h, "_SD")
    headers <- c(headers, h_mean, h_sd)
  }

  data <- data.frame(matrix(nrow = length(abrConstructs), ncol = length(headers)))
  col = 1
  for(i in 1:length(data_mean[,1])){
    for (j in 1:length(abrConstructs)){
```

```
      data[j, col] <- d_mean[i, j]
    }
    col = col + 1
    for (j in 1:length(abrConstructs)){
      data[j, col] <- d_sd[i, j]
    }
    col = col + 1
  }
  data <- format(round(data,2), nsmall=2)
  colnames(data) <- headers

  dat <- data.frame(matrix(nrow = length(abrConstructs), ncol = 0))
  dat[, "CABR"] <- abrConstructs
  dat[, "CNAME"] <- nameConstructs
  dat <- cbind(dat, format(data, nsmall=2))

  print(dat)

  col = 1
  val_samples<-c()
  val_sums <- c()
  for(h in data_mean[,1]){
    val_samples[col] <- data_samples[data_samples$ASA==h,2]
    val_sums[col] <- data_sum[data_sum$ASA==h,2]
    col = col + 1
  }

  desc <- data.frame(matrix(nrow = 2, ncol = length(data_mean[,1])+2))
  desc[1,]<-c("","Sample Size",val_samples)
  desc[2,]<-c("","ASAQ score",val_sums)
  colnames(desc)<-c("","Description",data_mean[,1])

  print(desc)
}
```

```
################################ Construct Definition ####################################
# Calculating the total number of single-concept and pair-of-concepts constructs based
#  on the expert's voting
# INPUT
# data: expertReview.csv
#
# OUTPUT
# the table of the number of constructs classified into seven anchor points
calcExpertVotingClassification <- function(data){
  dat<-data.frame()
  anchorPoints <- c("Agent's properties", "Agent's social traits", "Agent's role",
                    "Impression of the agent after the interaction",
                    "Interaction quality", "Human's impression of the interaction",
                    "Human's attributes")
  abbr= c("AProp", "ASoc", "ARole", "AImpr", "IntQ", "HImpr", "HAttr")

  # calculate the number of constructs classified in 7 concepts and Other
  for (i in 1:length(anchorPoints)){
    dat[i, "AnchorPoint"] <- anchorPoints[i]
```

```
    single <- length(which(data$SingleCls == abbr[i]))
    pair <- length(which(data$PairCls_1 == abbr[i])) +
      length(which(data$PairCls_2 == abbr[i]))
    dat[i, "SingleAnchor"] <- single
    dat[i, "PairAnchors"] <- pair
  }
  return(dat)
}
```

```
################################### Study Early '21 ################################
# Calculate Cronbach's alpha of construct/dimension
# INPUT
# arr: the number of columns of items of each construct/dimension in the dataset
# d: data
# constructs: construct-ids
#
# OUTPUT
# table of the cronbach's alpha coefficients of all constructs/dimensions in the dataset
calcAlpha <- function(arr, data, constructs){
  dat <- data.frame()
  for(i in 1:length(constructs)){
    d <- getDataColWise(arr, data, i)
    a <- cronbach.alpha(d, standardized=TRUE)
    dat[i,"CONSTRUCTID"] <- constructs[i]
    dat[i, "std.a"] <- round(a$alpha, 2)
  }
  return(dat)
}

# Calculate the cronbach's alpha coefficient for the reliability data 1stPOV only,
# 3rdPOV only and the combination data of 1stPOV and 3rdPOV
# INPUT
# all: the results of the Study Early '21 from the combination data of 1stPOV and
#  3rd POV
# a1stPOV_part1,  a1stPOV_part2,  a3rdPOV_part1,  a3rdPOV_part2: the results of
#  the Study Early '21 of each part of dataset
#
# OUTPUT
# the aggregation of all results of the Study Early '21
getAlphaReliability <- function(all, a1stPOV_part1,  a1stPOV_part2,  a3rdPOV_part1,
                                a3rdPOV_part2){
 a1stPOV <- rbind(a1stPOV_part1, a1stPOV_part1)
 a3rdPOV <- rbind(a3rdPOV_part1, a3rdPOV_part1)
 diff <- abs(a1stPOV[2]-a3rdPOV[2])
 dat <- cbind(all, a1stPOV[2], a3rdPOV[2], diff)
 names(dat)<-c("CONSTRUCTID", "std.a_all", "std.a_1stPOV", "std.a_3rdPOV",
              "abs_diff_1st_3rd")
 return(dat)
}
```

```
############################### Content Validation ########################################
# Calculate agreement coefficient of ASAQ items
# INPUT
# itemDesc: description of the long ASAQ's 90 items
```

```r
# targetVsDistractor: the pairing of target items and distractors and the experts'
#  answers for both corresponding pair-items
# Calculation:
# tp: true positive (if target is classified as YES)
# fn: false negative (if target is classified as NO)
# tn: true negative (if distractor is seen as a YES)
# fp: false positive (if distractor is seen as a NO)
#
# OUTPUT
# The calculation of tp, fn, tn, fp, TPRs and FPRs for each ASAQ item
calcItemAgreementCoeff <- function(itemDesc, targetVsDistractor){
  dat <- data.frame()

  for (row in 1:nrow(itemDesc)){
    dat[row, "ITEM_REF"] <- itemDesc[row, "ITEM_REF"]
    item = itemDesc[row, "ITEM_ID"]
    # Calculate TPR_s
    d_trgt <- targetVsDistractor[targetVsDistractor$TRGT_ITEMID == item,]
    TP <- length(which(d_trgt$TRGT_ANS == 1))  #if target is classified as YES
    FN <- length(which(d_trgt$TRGT_ANS == 0)) #if target is classified as NO
    dat[row,"TP"] <- TP
    dat[row,"FN"] <- FN
    APos <- TP + FN
    dat[row,"APos"] <- APos
    dat[row,"TPR_s"] <- round(((TP - (0.5 * APos)) / APos) + 0.5, 2)

    # Calculate FPR_s
    d_dstr <- targetVsDistractor[targetVsDistractor$DSTR_ITEMID == item,]
    FP <- length(which(d_dstr$DSTR_ANS == 1))  # if distractor is seen as a YES
    TN <- length(which(d_dstr$DSTR_ANS == 0))  # if distractor is seen as a NO
    dat[row,"FP"] <- FP
    dat[row,"TN"] <- TN
    ANeg <- FP + TN
    dat[row,"ANeg"] <- ANeg
    dat[row,"FPR_s"] <- round(((FP - (0.5 * ANeg)) / ANeg) + 0.5, 2)
  }

  return(dat)
}

# Calculate agreement coefficient of ASAQ construct/dimensions
# INPUT
# constructDesc: description of the long ASAQ's construct/dimension
# itemAgreementCoeffs: TPRs and FPRs values of all ASAQ items
#
# OUTPUT
#  TPRs and FPRs values of all ASAQ constructs/dimensions
calcConstructAgreementCoeff <- function(constructDesc, itemAgreementCoeffs){
  dat <- data.frame()
  coeffs <- convertToNumeric(itemAgreementCoeffs, 2)

  for (row in 1:nrow(constructDesc)){
    d <- getDataRowWise(constructDesc$NUM_ITEMS, coeffs, row)
```

```r
    dat[row, "CABR"] <- constructDesc[row, "CABR"]
    dat[row, "M_TPRs"] <- round(mean(d[, "TPR_s"]), 2)
    dat[row, "SD_TPRs"] <- round(sd(d[, "TPR_s"]), 2)
    dat[row, "M_FPRs"] <- round(mean(d[, "FPR_s"]), 2)
    dat[row, "SD_FPRs"] <- round(sd(d[, "FPR_s"]), 2)
  }

  return(dat)
}
```

```r
############################### Study Mid 2021 (n=532) ############################
################################ Study 2022 (n=534) ###############################
# Run CFA based on the list of factorial models
# INPUT
# modelNames = name used to distinguish the model
# factorialModels = the list of factorial models
# longASAQ_data_std = standardized long ASAQ dataset
#
# OUTPUT
# CFI coeffiecient of cfa of the factorial models
getCFIcoefficient <- function(modelNames, factorialModels, longASAQ_data_std){
  dat <- data.frame()

  for (i in 1:length(modelNames)){
    dat[i, "Model"] <- modelNames[i]
    set.seed(1234)
    dat[i, "CFI"] <-
      format(round(fitMeasures(cfa(factorialModels[i], data=longASAQ_data_std),
                         "cfi"), 2), nsmall = 2)
  }

  return(dat)
}

# Calculate predicted latent scores of long ASAQ constructs/dimensions
# INPUT
# individualConstructModels = the list of individual construct models
# longASAQ_data_std = standardized long ASAQ dataset
#
# OUTPUT:
# Predicted latent scores of long ASAQ constructs/dimensions
getPredictedData_longASAQ <- function(individualConstructModels, longASAQ_data_std){

  dat <- NULL
  for (i in 1:length(individualConstructModels)){
    set.seed(1234)
    fit <- cfa(individualConstructModels[i], data=longASAQ_data_std)
    pred <- data.frame(lavPredict(fit, type="lv"))
    if (is.null(dat)) dat <- pred
    else dat <- cbind(dat, pred)
  }

  return(dat)
}
```

```
# Maximum Likelihood Factor Analysis
# INPUT
# predictedData_longASAQ: predicted latent scores of long ASAQ constructs/dimensions
# nfactors: the number of intended factors
#
# OUTPUT
# Display the results of EFA
getEFA <- function(predictedData_longASAQ, nfactors){
  set.seed(1234)
  data_cor <- cor(predictedData_longASAQ)
  factors_data <- fa(data_cor,  nfactors, rotate = "promax", SMC=FALSE, fm="ml",
                     max.iter=100)
  return(factors_data)
}

# Run CFA factorial models of the long ASAQ and returning the factor loading scores
# INPUT
# modelNames = name used to distinguish the model
# factorialModels = predefined factorial models based on the EFA results
# longASAQ_data_std = standardized long ASAQ dataset
#
# OUTPUT
# Factor loadings of items based on the factorial models
printStdFactorLoadingModels_longASAQ <- function(modelNames, factorialModels,
                                             longASAQ_data_std, printing){
  dat <- list()
  for (i in 1:length(factorialModels)){
    set.seed(1234)
    fit <- cfa(factorialModels[i], data=longASAQ_data_std)
    loadings <- round(data.frame(inspect(fit, what="std")$lambda),2)
    ccov <- round(data.frame(lavInspect(fit, what="std")$psi),2)
    dat <- list.append(dat, loadings)

    if (printing == 1){
      cat("\n\n", modelNames[i] , "(CFI = ",
          format(round(fitMeasures(fit, "cfi"), 2), nsmall = 2),
          ")\n")
      for (j in 1:ncol(loadings)){
          d <- loadings[j]
          d <- d %>% dplyr::filter(d[,1]>0.0)
          print(format(d, nsmall=2))
          cat("\n")
      }
      cat("Covariance Matrix \n")
      print(ccov)
      cat("\n")
    }
  }
  return(dat)
}

# Return only factor loadings scores of all models
# INPUT
```

```r
# loading_models = factor loadings of items resulted from
#  getStdFactorLoadingModels_longASAQ()
#
# OUTPUT
# Factor loadings of all items
getStdFactorLoadings <- function(loading_models){
  dat <- NULL
  for (i in 1:length(loading_models)){
    loading_model <- loading_models[[i]]
    for (j in 1:ncol(loading_model)){
      d <- loading_model[j]
      d <- d[d[,1]>0.0,]
      if (is.null(dat)) dat <- d
      else dat <- c(dat, d)
    }
  }
  return(dat)
}

# Run CFA factorial models of the long ASAQ and returning the covariance matrix
# INPUT
# modelNames = name used to distinguish the model
# factorialModels = predefined factorial models based on the EFA results
# longASAQ_data_std = standardized long ASAQ dataset
#
# OUTPUT
# Covariance matrix based on the factorial models
getStdCovarianceMatrixModels_longASAQ <- function(modelNames, factorialModels,
                                              longASAQ_data_std, printing){
  dat <- list()
  for (i in 1:length(factorialModels)){
    set.seed(1234)
    fit <- cfa(factorialModels[i], data=longASAQ_data_std)
    ccov <- round(data.frame(lavInspect(fit, what="std")$psi),2)
    dat <- list.append(dat, c)

    if (printing == 1){
      cat("\n", modelNames[i] , "\n")
      print(format(ccov, nsmall=2))
      cat("\n")
    }
  }
  return(dat)
}
```

```r
############################### Predictive Validation ####################################
# Calculate the constructs' score of each ASA by calculating the median of the the score
# of each construct/dimension per ASA given by the experts. The calculation results in
# one score for each construct/dimension per ASA
# INPUT:
# d_expertA, d_expertB, d_expertC = data containing the scores of all ASAQ
#  constructs/dimensions given by respectively expertA, expertB and expertC with one of
#  the columns is "ASA" containing the list of ASAs followed columns of the number of
#  ASAQ constructs/dimensions
```

```r
# constructs: the list of ASAQ constructs/dimensions
#
# OUTPUT:
# the constructs'/dimensions' score of each ASA
getPredictiveValScores_medianBase<- function(d_expertA, d_expertB, d_expertC,
                                             constructs){
  dat <- data.frame()
  A <- convertToNumeric(d_expertA, 2)
  B <- convertToNumeric(d_expertB, 2)
  C <- convertToNumeric(d_expertC, 2)

  id26constructs <- colnames(A)
  for (row in 1:nrow(A)){
    col = 1
    for (construct in constructs){
      dat[row, "ASA"] <- d_expertA[row, "ASA"]
      if (id26constructs[col] == "C3D1" | id26constructs[col] == "C11D1" |
          id26constructs[col] == "C3D2" | id26constructs[col] == "C11D2") {
        # ignore
        col = col + 1
      }
      else
        dat[row, construct] <- median(c(A[row, col], B[row, col], C[row, col]))
      col = col + 1
    }
  }
  return(dat)
}

# Calculate construct/dimension scores for ASAQ Representative Set 2024 based on median
# INPUT
# agents: a list of agents used in the Study Mid 2021 and Study 2022
# data: the constructs'/dimensions' score of each ASA calculating based on the median of
#  the scores
# constructs: the list of 24 ASAQ constructs/dimensions
#
# OUTPUT
# the constructs'/dimensions' score of each ASA
get29ASAPredictiveValData_medianBase<- function(agents, data, constructs){
  dat <- data.frame()

  row <- 1
  for(agent in agents){
      d <- data[data$ASA == agent,]
      dat[row, "ASA"] <- agent
      for (construct in constructs){
        if (construct == "PF" | construct == "UAL")
          dat[row, construct] <- ""
        else
          dat[row, construct] <- d[,construct]
      }
    row <- row + 1
  }
```

```r
  return(dat)
}

# Calculate the correlation between the scores of ASAQ constructs/dimensions of the ASAQ
# Representative Set 2024 of the experts' (predictive analysis) and the ASAQ long and
# short version
# INPUT
# data = dataset with one column "ASA" containing the list of ASAs followed with columns
#  containing scores of all ASAQ's constructs/dimensions, which are calculated based on
# constructs = the id of 24 constructs/dimensions
#
# OUTPUT
# dataframe containing the ASAQ-scores of the ASAs based on the mean of
# the ASAQ's constructs/dimensions
calcCorrPredictiveAndASAQConstructsScores <- function(pred_constructScores,
                                                       long_constructScores,
                                                       short_constructScores,
                                                       constructs){
  dat <- data.frame()

  pred_constructScores <- convertToNumeric(pred_constructScores, 2)
  long_constructScores <- convertToNumeric(long_constructScores, 2)
  short_constructScores <- convertToNumeric(short_constructScores, 2)
  tasks <- c("PRED_LONG", "PRED_SHORT")

  for (i in 1:length(tasks)){
    dat[i, "COR"] <- tasks[i]
    for(construct in constructs){
      if (construct == "PF" | construct == "UAL"){
        dat[i, construct] <- ""
      }
      else if (i == 1)
        dat[i, construct] <- round(cor(cbind(pred_constructScores[, construct],
                                              long_constructScores[, construct]),
                                        method = "spearman",
                                        use = "complete.obs")[1, 2], 2)
      else if (i == 2)
        dat[i, construct] <- round(cor(cbind(pred_constructScores[, construct],
                                              short_constructScores[, construct]),
                                        method = "spearman",
                                        use = "complete.obs")[1, 2], 2)
    }
  }

  return(dat)
}
```

```r
################ ASAQ CONSTRUCT SCORES based on COMBINED dataset (n=1066) ###############
############################## ASAQ Representative Set 2024 ##############################
# Get the score of all ASAQ constructs/dimensions of the short version of ASAQ.
# The score of each construct/dimension is taken from a representative item of the
# construct/dimension. This results in one score for each construct/dimension for each
# individual participant
# INPUT
```

```r
# selectedItems: representative items of all ASAQ constructs/dimensions
# data: data of the long version of ASAQ,
#  with one of the columns is "ASA" containing the list of ASAs followed columns of 90
#  questionnaire items
# constructs: the list of ASAQ constructs/dimensions
#
# OUTPUT
# the constructs'/dimensions' scores  of the short version of ASAQ
getShortASAQConstructsScore <- function(selectedItems, data, constructs){
  dat <- data[, names(data) %in% c("ASA", selectedItems)]
  names(dat) <- c("ASA", constructs)
  return(dat)
}

# Calculate the score of all ASAQ constructs/dimensions of the long version of ASAQ by
# calculating the mean of items in each construct/dimension. The calculation results in
# one score for each construct/dimension for each individual participant
# INPUT
# arr: the number of columns of items of each construct/dimension in the dataset
# data: data of the long version of ASAQ,
#  with one of the columns is "ASA" containing the list of ASAs followed columns of 90
#  questionnaire items
# constructs: the list of ASAQ constructs/dimensions
#
# OUTPUT
# the constructs'/dimensions' scores of the long version of ASAQ
getLongASAQConstructsScore <- function(arr, data, constructs){
  d <- data[, names(data)!="ASA"]
  d <- convertToNumeric(d, 1)

  dat <- data.frame()
  end <- 0
  for(i in 1:length(arr)){
    begin <- end + 1
    end <- end + arr[i]
    if (begin == end)
      dat[1:nrow(data), i] <- d[begin]
    else
      dat[1:nrow(data), i] <- rowMeans(d[begin:end])
  }

  dat <- cbind(data$ASA,dat)
  names(dat) <- c("ASA", constructs)
  return(dat)
}

# Calculate the constructs' score of each ASA by calculating the mean of each
# construct/dimension per ASA. The calculation results in one score for each
# construct/dimension per ASA
# INPUT:
# agents: the list of ASAs in the study
# data: data containing the scores of all ASAQ constructs/dimensions given by the
#  participants (n=the number of participants) with one of the columns is "ASA"
```

```r
#  containing the list of ASAs followed columns of the number of ASAQ
#  constructs/dimensions
# constructs: the list of ASAQ constructs/dimensions
#
# OUTPUT:
# the constructs'/dimensions' score of each ASA
calcASAQscores <- function(agents, data){
  d_scoreASA <- data.frame()

  row <- 1
  for(agent in agents){
    d <- data[data$ASA == agent,]
    d_scoreASA[row, 1:ncol(data)] <-
      c(agent, colMeans(convertToNumeric(d,2)))
    row <- row + 1
  }

  names(d_scoreASA) <- colnames(data)
  return(d_scoreASA)
}

# Calculate the standard deviation of the ASAs' score
# based on the constructs/dimensions' score
# INPUT:
# agents: the list of ASAs in the study
# data: data containing the scores of all ASAQ constructs/dimensions given by the
#  participants (n=the number of participants) with one of the columns is "ASA"
#  containing the list of ASAs followed columns of the number of ASAQ
#  constructs/dimensions
# constructs: the list of ASAQ constructs/dimensions
#
# OUTPUT:
# the standard deviation of each ASA's score
calcASAQscores_StdDev <- function(agents, data){
  d_scoreASA <- data.frame()

  row <- 1
  for(agent in agents){
    d <- data[data$ASA == agent,]
    d_scoreASA[row, 1:ncol(data)] <-
      c(agent, sapply(convertToNumeric(d,2), sd))
    row <- row + 1
  }

  names(d_scoreASA) <- colnames(data)
  return(d_scoreASA)
}

# Calculate the total ASAQ-Scores of the ASAQ Representative Set 2024 based on the ASAQ
# long version
# INPUT:
# longASAQscores = the scores of all ASAQ constructs/dimensions of the ASAQ Representative
#  Set 2024. It has one column "ASA" containing the list of the ASAQ
```

```r
#  Representative Set 2024 followed by the scores of 24 ASAQ constructs/dimensions.
#  The input data is calculated by calculating
#  the mean the scores given by the participants (n=1066)
#
# OUTPUT:
# the total ASAQ-Scores of the ASAQ Representative Set 2024
calcTotalLongASAQscore <- function(longASAQscores){
  dat = data.frame(matrix(nrow = nrow(longASAQscores), ncol = 0))
  dat$ASA <- longASAQscores$ASA
  dat$ASAQ_SCORE <- round(rowSums(convertToNumeric(longASAQscores,2)),0)
  return(dat)
}

# Get the number of sample per ASA
# INPUT:
# data = raw dataset containing groups of participants based on ASA
# agents = the list of ASAs in the study
#
# OUTPUT:
# the number of sample of ASAs
getSampleASA <- function(agents, data){
  dat = data.frame()
  row = 1
  for (agent in agents){
    d <- data[data$ASA == agent,]
    dat[row, "ASA"] <- agent
    dat[row, "N"] <- nrow(d)
    row <- row + 1
  }
  return(dat)
}
```

```r
########################### Concurrent Validity Short Version ###########################
# Calculate the corelation and delta Score between the long and short version of ASAQ
# INPUT
# data = dataset (constructValData, crossValData and combinedData) with one column "ASA"
#  containing the list of ASAs followed with columms containing scores of all ASAQ's
#  constructs/dimensions, which are calculated based on the mean of the scores of items
#  of the constructs/dimensions
# constructs = the id of 24 constructs/dimensions
#
# OUTPUT
# dataframe containing the correlation and delta Mean between the long and short ASAQ
# versions
getCorDiffLongShortASAQ <- function(longASAQ_constructValData,
                                    shortASAQ_constructValData,
                                    longASAQ_crossValData,
                                    shortASAQ_crossValData,
                                    longASAQ_combinedData,
                                    shortASAQ_combinedData,
                                    constructs){
  dat <- data.frame()

  # constructs/dimensions scores
```

```r
  longASAQ_constructValData <-
    convertToNumeric(longASAQ_constructValData, 2)
  shortASAQ_constructValData <-
    convertToNumeric(shortASAQ_constructValData,2)
  longASAQ_crossValData <-
    convertToNumeric(longASAQ_crossValData, 2)
  shortASAQ_crossValData <-
    convertToNumeric(shortASAQ_crossValData, 2)
  longASAQ_combinedData <-
    convertToNumeric(longASAQ_combinedData, 2)
  shortASAQ_combinedData <-
    convertToNumeric(shortASAQ_combinedData, 2)

    for(i in 1:length(constructs)){
      dat[i, "CID"] <- constructs[i]
      dat[i, "COR_StudyM21"] <-
        round(cor(cbind(longASAQ_constructValData[, i],
                              shortASAQ_constructValData[, i]),
                        method = "spearman",
                        use = "complete.obs")[1, 2], 2)
      dat[i, "DM_StudyM21"] <-
        round(abs(mean(longASAQ_constructValData[, i])-
                  mean(shortASAQ_constructValData[, i])), 2)
      dat[i, "COR_Study22"] <-
        round(cor(cbind(longASAQ_crossValData[,i],
                              shortASAQ_crossValData[, i]), method = "spearman",
                        use = "complete.obs")[1, 2], 2)
      dat[i, "DM_Study22"] <-
        round(abs(mean(longASAQ_crossValData[, i])-
                  mean(shortASAQ_crossValData[, i])), 2)
      dat[i, "COR_COMB"] <-
        round(cor(cbind(longASAQ_combinedData[, i],
                       shortASAQ_combinedData[, i]), method = "spearman",
                        use = "complete.obs")[1, 2], 2)
      dat[i, "DM_COMB"] <-
        round(abs(mean(longASAQ_combinedData[, i])-
                  mean(shortASAQ_combinedData[, i])), 2)
    }

  return(dat)
}
```

```r
################################### Interpretability ###################################
# Calculate the frequency of 7-points of the participants' answer scale per
# construct/dimension of the short and long version of ASAQ
# INPUT
# arr = a list of the number of items for each individual ASAQ's construct/dimension
# data = with one column "ASA" containing the list of ASAs followed with columns
#  containing participants' answers for all ASAQ's items/constructs/dimensions
# shortASAQdata = shortASAQConstructScore_combinedData, longASAQdata = combinedData
# constructs = the id of 24 constructs/dimensions
#
# OUTPUT
# The frequency of 7-points of the participants' answer scale per construct/dimension
```

```
# of the short and long version of ASAQ
calcFreqShortASAQConstructsScore <- function(shortASAQdata, scores, constructs){
   dat <- data.frame()
   title <- c("Min3", "Min2", "Min1", "Zero", "Plus1", "Plus2", "Plus3")
   shortASAQdata <- convertToNumeric(shortASAQdata, 2)

   for(i in 1:length(constructs)){
     dat[i,"CID"] <- constructs[i]
     for(j in 1:length(scores)){
       dat[i, title[j]] <-
         length(which(round(shortASAQdata[,i]) == scores[j]))
     }
   }
   return(dat)
}
calcFreqLongASAQConstructsScore <- function(arr, longASAQdata, scores, constructs){
   dat <- data.frame()
   title <- c("Min3", "Min2", "Min1", "Zero", "Plus1", "Plus2", "Plus3")
   longASAQdata <- convertToNumeric(longASAQdata, 2)

   end <- 0
   for(i in 1:length(arr)){
     begin <- end + 1
     end <- end + arr[i]
     d<- longASAQdata[begin:end]
     dat[i, "CID"] <- constructs[i]
     for(j in 1:length(scores)){
       dat[i, title[j]] <-
         length(which(d == scores[j]))
     }
   }
   return(dat)
}

# Calculate the relative frequency of 7-points of the participants' answer scale per
# construct/dimension of the short and long version of ASAQ
# INPUT
# arr = a list of the number of items for each individual ASAQ's construct/dimension
# data = with one column "ASA" containing the list of ASAs followed with columns
#  containing participants' answers for all ASAQ's items/constructs/dimensions
# shortASAQdata = shortASAQConstructScore_combinedData, longASAQdata = combinedData
# constructs = the id of 24 constructs/dimensions
#
# OUTPUT
# The relative frequency of 7-points of the participants' answer scale per
# construct/dimension of the short and long version of ASAQ
calcRelFreqShortASAQConstructsScore <- function(shortASAQdata, scores, constructs){
   dat <- data.frame()
   title <- c("Min3", "Min2", "Min1", "Zero", "Plus1", "Plus2", "Plus3")
   shortASAQdata <- convertToNumeric(shortASAQdata, 2)

   for(i in 1:length(constructs)){
     dat[i,"CID"] <- constructs[i]
```

```
    for(j in 1:length(scores)){
      dat[i, title[j]] <-
        round(length(which(round(shortASAQdata[,i]) == scores[j])) /
                nrow(shortASAQdata),2)
    }
  }
  return(dat)
}
calcRelFreqLongASAQConstructsScore <- function(arr, longASAQdata, scores, constructs){
  dat <- data.frame()
  title <- c("Min3", "Min2", "Min1", "Zero", "Plus1", "Plus2", "Plus3")
  longASAQdata <- convertToNumeric(longASAQdata, 2)

  end <- 0
  for(i in 1:length(arr)){
    begin <- end + 1
    end <- end + arr[i]
    d<- longASAQdata[begin:end]
    dat[i, "CID"] <- constructs[i]
    for(j in 1:length(scores)){
      dat[i, title[j]] <-
        round(length(which(d == scores[j])) / (nrow(longASAQdata)*ncol(d)),2)
    }
  }
  return(dat)
}

# Drawing the frequency of total scores of the participants' answer scale for the short
# and long version of ASAQ
# INPUT
# data = (the sum of) participants' rate of all constructs/dimensions of the short
# and long version of ASAQ. The data contains a columns of the list of the ASAQ
# constructs/dimensions following (the sum of) the rates
# title = the title of the plot
#
# OUTPUT
# the bar chart of participants' total score
drawBarPlotFreqTotalASAQscore <-  function(data, title, colStart){

  data <- convertToNumeric(data, colStart)
  xx <- barplot(table(rowSums(data)), col = "steelblue",
                ylim =c(0, max(table(rowSums(data)))))
  title(main = title,
      xlab = 'Sum of Item Scores', ylab = 'Frequency')
}

# Drawing the histogram of the ASAQ scores of the short and long version of ASAQ
# INPUT
# data = the ASAQ scores of all constructs/dimensions of the short and long version of
#  ASAQ. The dataset has a column containing the list of ASAs followed by columns of all
#  ASAQ constructs/dimensions
# title = the title of the plot
#
```

```r
# OUTPUT
# the histogram of the ASAQ scores
drawHistogramASAQScore <- function(data, title, startCol){

  data <- as.matrix(convertToNumeric(data, startCol))
  h<-hist(data,
          main=title,
          xlab="ASAQ Scores",
          xlim=c(min(data)-0.5,max(data)+0.5),
          col="steelblue",
          breaks = seq(min(data)-0.5,max(data)+0.5,1),
          freq = FALSE
  )
}

# Calculate the sum of item scores of long ASAQ constructs/dimensions
# INPUT:
# arr = the number of items of each construct/dimension
# longASAQscore = 90 items of long ASAQ
# constructs = the id of 24 ASAQ constructs/dimensions
#
# OUTPUT:
# the sum of item scores of ASAQ constructs/dimensions
calcSumLongConstructASAQscore <- function(arr, longASAQdata, constructs){
  dat <- data.frame(matrix(nrow = nrow(longASAQdata), ncol = 0))
  longASAQdata <- convertToNumeric(longASAQdata, 2)

  end <- 0
  for(i in 1:length(arr)){
    begin <- end + 1
    end <- end + arr[i]
    d<- longASAQdata[begin:end]
    dat[, constructs[i]] <- rowSums(d)
  }

  return(dat)
}

# Calculate the relative frequency of lowest and highest extreme of each long ASAQ
#  constructs/dimensions
# INPUT:
# arr = the number of items of each construct/dimension
# sumASAQscores = the sum of item scores of long ASAQ constructs/dimensions
# constructs = the id of 24 ASAQ constructs/dimensions
#
# OUTPUT:
# The relative frequency of lowest and highest extreme of each long ASAQ
#  constructs/dimensions
calcRelFreqExtrmLongASAQConstructScores <- function(arr, sumASAQscores, constructs){
  dat <- data.frame()

  for(i in 1:length(constructs)){
    dat[i, "CID"] <- constructs[i]
```

```
    dat[i, "ITEM_NUM"] <- arr[i]
    dat[i, "fRelLowEXTRM"] <-
      round(length(which(sumASAQscores[,i] == (arr[i] * -3))) /
              nrow(sumASAQscores), 2)
    dat[i, "fRelHighEXTRM"] <-
      round(length(which(sumASAQscores[,i] == (arr[i] * 3))) /
              nrow(sumASAQscores), 2)
    dat[i, "SumfRelEXTRM"] <-
      round(length(which(sumASAQscores[,i] == (arr[i] * -3))) /
              nrow(sumASAQscores), 2) +
      round(length(which(sumASAQscores[,i] == (arr[i] * 3))) /
              nrow(sumASAQscores), 2)
  }

  return(dat)
}

# Calculate the percentile scores of ASAQ-Scores of the ASAQ Representative Set 2024 based
# on the short and long
# versions of ASAs
# INPUT:
# data = the scores of all ASAQ constructs/dimensions of the ASAQ Representative Set 2024.
#  It has one column "ASA" containing the list of the ASAQ Representative Set 2024
#  followed by the scores of 24 ASAQ constructs/dimensions. The input data is calculated
#  by calculating the mean of the scores given by the participants (n=1066)
# probs = the percentile
# constructs = the id of 24 ASAQ constructs/dimensions
# header = the header of the output dataframe
# OUTPUT:
# the percentile scores of ASAQ-Scores of the ASAQ Representative Set 2024
calcPercentileASAQscore <- function(data, probs, constructs, header){
  dat = data.frame()
  data <- convertToNumeric(data, 2)

  row <- 1
  for (i in 1:length(constructs)){
    dat[row, "CID"] <- constructs[i]
    for (j in 1:length(probs)){
      dat[row, header[j]] <- round(quantile(data[, i], probs[j]), 2)
    }
    row = row + 1
  }
  return(dat)
}

# Calculate the percentile of the total ASAQ-Scores of the ASAQ Representative Set 2024
# based on the short and long versions of ASAQ
# INPUT:
# shortASAQscore, longASAQscore = the scores of all ASAQ constructs/dimensions of
#  ASAQ Representative Set 2024. It has one column "ASA" containing the list of the ASAQ
#  Representative Set 2024 followed by the scores of 24 ASAQ constructs/dimensions.
#  The input data is calculated by calculating the mean of the scores given by the
#  participants (n=1066)
```

```r
# probs = the percentile
# constructs = the id of 24 ASAQ constructs/dimensions
# header = the header of the output dataframe
#
# OUTPUT:
# the percentile total ASAQ-Scores of the ASAQ Representative Set 2024
calcPercentileTotalASAQscore <- function(longASAQscore, shortASAQscore, probs,
                                          header){
  dat = data.frame()
  dat[1, "ASAQ"] <- "Long"
  longASAQscore <- rowSums(convertToNumeric(longASAQscore, 2))
  for (j in 1:length(probs)){
      dat[1, header[j]] <- round(quantile(longASAQscore, probs[j]),2)
  }
  dat[2, "ASAQ"] <- "Short"
  shortASAQscore <- rowSums(convertToNumeric(shortASAQscore, 2))
  for (j in 1:length(probs)){
      dat[2, header[j]] <- round(quantile(shortASAQscore, probs[j]),2)
  }
  return(dat)
}

# Calculate the absolute difference of ASAQ-scores of all combinations of
# the ASAQ Representative Set 2024 for each construct and dimension based on the short
# and long versions of the ASAQ
# INPUT:
# agents = the names of the ASAQ Representative Set 2024
# data = the scores of all ASAQ constructs/dimensions of the ASAQ Representative Set 2024.
#  It has one column "ASA" containing the list of the ASAQ Representative Set 2024
#  followed by the scores of 24 ASAQ constructs/ dimensions. The input data is
#  calculated using the mean of the scores given by the participants (n=1066)
# constructs = the id of 24 ASAQ constructs/dimensions
#
# OUTPUT:
# the difference of ASAQ-scores of all combinations of the ASAQ Representative Set 2024
# for each construct and dimension based on the short and long version of the ASAQ
calcDiffTwoASAQscore <- function(agents, data, constructs){
  dat <- data.frame()

  row <- 1
  for (i in 1:length(agents)){
    agent1 = agents[i]
    for (j in i:length(agents)){
      agent2 = agents[j]
      if (agent1 != agent2){
        dat[row, "ASA"] <- paste(agent1, agent2, sep="_")
        for(construct in constructs){
           score1 <- as.numeric(data[data$ASA == agent1, construct])
           score2 <- as.numeric(data[data$ASA == agent2, construct])
           dat[row, construct] <- round(abs(score1 - score2), 2)
        }
        row <- row + 1
      }
```

```
    }
  }

  return(dat)
}
```

```
##################################### Sample Size ########################################
# Calculate the effect size of ASAQ based on the scores of all ASAQ constructs/
# dimensions of the ASAQ Representative Set 2024 based on the short and long version of
# the ASAQ. The caculation of the effect size is based on Cohen's d (Wikipedia
# "Effect Size" https://en.wikipedia.org/wiki/Effect_size#Cohen's_d)
#
# INPUT:
# agents = the names of the ASAQ Representative Set 2024
# data = the scores of all ASAQ constructs/dimensions of the ASAQ Representative Set 2024.
#  It has one column "ASA" containing followed by the scores of 24 ASAQ
#  constructs/dimensions from given by participants. In particular, the long version
#  data is by calculating the mean of the scores of the construct/dimension's items
#  given by the participants (n=1066)
# constructs = the id of 24 ASAQ constructs/dimensions
#
# OUTPUT:
# the effect size for each construct and dimension based on the short and long version
# of the ASAQ
calcEffectSizeASAQConstructScore <- function(agents, constructScoreData, constructs){
  dat <- data.frame()

  row <- 1
  for (i in 1:length(agents)){
    agent1 = agents[i]
    for (j in i:length(agents)){
      agent2 = agents[j]
      if (agent1 != agent2){
        dat[row, "ASA"] <- paste(agent1, agent2, sep="_")
        d_agent1 <- as.data.frame(sapply(
          constructScoreData[constructScoreData$ASA == agent1,
                             2:ncol(constructScoreData)], as.numeric))
        d_agent2 <- as.data.frame(sapply(
          constructScoreData[constructScoreData$ASA == agent2,
                             2:ncol(constructScoreData)], as.numeric))
        n1 <- nrow(d_agent1)
        n2 <- nrow(d_agent2)
        M1 <- apply(d_agent1, 2 , mean)
        M2 <- apply(d_agent2, 2 , mean)
        V1 <- apply(d_agent1, 2 , var)
        V2 <- apply(d_agent2, 2 , var)
        for(i in 1:length(constructs)){
           diff <- abs(M1[i] - M2[i])
           #s = pooled standard deviation of two independent sample
           s <- sqrt((((n1-1)*V1[i])+((n2-1)*V2[i]))/(n1+n2-2))
           dat[row, constructs[i]]<- (diff / s)
        }
        row <- row + 1
      }
```

```
    }
  }

  return(dat)
}

# Calculate minimum sample size for comparing two or more agents based on the power
# analysis
# INPUT:
# percentileEffectSizeASAQConstructScore = the percentile scores of all ASAQ
#  constructs/dimensions of the ASAQ Representative Set 2024. It has one column "CID"
#  containing the list of 24 ASAQ constructs/dimensions followed by the percentile
#  scores of the ASAQ constructs/dimensions
# constructs = the id of 24 ASAQ constructs/dimensions
# header = the header of the output dataframe (the string version of the percentile -
#  probs)
#
# OUTPUT:
# the minimum sample size per ASAQ construct/dimension
calcSamplePowerAnalysisASAQConstructScore <-
  function(percentileEffectSizeASAQConstructScore, constructs, headers){
  dat <- data.frame()

  percentileEffectSizeASAQConstructScore <-
    convertToNumeric(percentileEffectSizeASAQConstructScore, 2)

  for (i in 1:length(constructs)){
    dat[i,"CID"] <- constructs[i]

    for (header in headers){
        effectSize <- percentileEffectSizeASAQConstructScore[i, header]
        pwr <- pwr.t.test(d = effectSize, power = 0.80, sig.level = 0.05,
                          type = "two.sample", alternative = "two.sided")
        dat[i, header] <- round(pwr$n,0)
    }
  }

  return(dat)
}

# Calculate maximum sample size for comparing two ASAas based on the power analysis
# INPUT:
# sampleSizeLongASAQ = minimum sample size for the long ASAQ
# sampleSizeShortASAQ = minimum sample size for the short ASAQ
#
# OUTPUT:
# the maximum sample size per percentile in interest for both long and short versions of
# ASAQ
getMaxSamplePowerAnalysis <- function(sampleSizeLongASAQ, sampleSizeShortASAQ){
  dat <- data.frame(matrix(nrow = 2, ncol = 4))
  sampleSizeLong <- convertToNumeric(sampleSizeLongASAQ, 2)
  sampleSizeShort <- convertToNumeric(sampleSizeShortASAQ, 2)
```

```r
  dat[1,] <- c("Long ASAQ", apply(convertToNumeric(sampleSizeLongASAQ,2), 2, max))
  dat[2,] <- c("Short ASAQ", apply(convertToNumeric(sampleSizeShortASAQ,2), 2, max))
  names(dat) <- c("Version", colnames(sampleSizeLong))

  return(dat)
}

# Calculate minimum sample size for evaluating an ASA based on the confident interval
# INPUT:
# agents = the list of the ASAQ Representative Set 2024
# constructScoreData = the ASAQ scores of 24 ASAQ constructs/dimensions given by the
#  participants (shape: 1066 x 24)
# ASAQscoreData = the ASAQ scores of all ASAQ constructs/dimensions of the ASAQ
#  Representative Set 2024 (shape: 29 x 24). Both constructScoreData and ASAQscoreData
#  have one column "ASA" then followed by the column of the scores of 24 ASAQ
#  constructs/dimensions
# probs = the percentile distance of interest, e.g., 5th, 10th, 20th or 25th
# constructs = the id of 24 ASAQ constructs/dimensions
# Note: Calculate the std_err using mean of difference in percentile
#
# OUTPUT:
# the minimum sample size per ASAQ construct/dimension
calcSampleConfIntervASAQConstructScore <-
  function(agents, constructScoreData, ASAQscoreData, probs, constructs){

  ##calculate variance of agents
  d_N <- c() #the number of samples with the same agent

  #the variance of constructs/dimension per agents
  d_vars <- data.frame(matrix(nrow = length(agents), ncol = length(constructs)))
  for (i in 1:length(agents)){
    d_agent <- as.data.frame(sapply(constructScoreData[
      constructScoreData$ASA == agents[i], 2:ncol(constructScoreData)],
      as.numeric))
    d_N[i] <- nrow(d_agent)
    d_vars[i,] <- apply(d_agent, 2 , var)
  }

  ##calculate s_pooled
  d_s_pooled <- c() #the s_pooled of constructs/dimension
  for (j in 1:length(constructs)){
    V_pooled <- 0
    N <- 0
    for(k in 1:length(agents)){
      V_pooled <- V_pooled + ((d_N[k] - 1) * d_vars[k, j])
    }
    d_s_pooled[j]<- sqrt(V_pooled / (nrow(constructScoreData) - length(agents)))
  }

  ##calculate percentile (probs) of the ASAQ scores the ASAQ constructs/dimensions
  d_perc = data.frame()
  ASAQscoreData <- convertToNumeric(ASAQscoreData, 2)
  for (p in 1:length(constructs)){
```

```
    for (q in 1:length(probs)){
      d_perc[p, q] <- quantile(ASAQscoreData[, p], probs[q])
    }
  }

  ##calculate std_err
  d_stdErr = c()
  diffPerc = c()             #the difference of percentile scores
  nDiff = ncol(d_perc) - 1     #the number of difference in the interest
  for (r in 1:length(constructs)){
    for(n in 1:(nDiff)){
      perc1 <- d_perc[r, n]
      perc2 <- d_perc[r, n + 1]
      diffPerc[n] <- abs(perc2 - perc1)
    }
    d_stdErr[r]<-mean(diffPerc)
  }

  #calculate minimal sample size based on the confident interval
  Z <- Normal(0,1)
  d_samples = data.frame()
  confs = c(0.90, 0.95, 0.975, 0.99)              #choices confidence interval
  headers <- c("90CI", "95CI", "97.5CI", "99CI")  #table headers
  for (m in 1:length(constructs)){
    d_samples[m,"CID"] <- constructs[m]
    for (l in 1:length(confs)){
      zScore <- quantile(Z, (1-confs[l]) / 2)
      sampleSize = ((zScore * d_s_pooled[m]) /d_stdErr[m])^2
      d_samples[m, headers[l]] <- round(sampleSize, 0)
    }
  }
  return(d_samples)
}

# Calculate maximum sample size for evaluating an ASA based on the confident interval
# INPUT:
# long5thData, short5thData, long10thData, short10thData, long20thData, short20thData,
#  long25thData, short25thData = minimum sample size for evaluating an ASA based on the
#  confident interval calculated on respectively on the 5th, 10th, 20th and 25th
#  percentiles
#
# OUTPUT:
# the maximum sample size per percentile in interest for both long and short versions of
# ASAQ
getMaxSampleSizeConfidenceIntervalASAQConstructScore <-
  function(long5thData, short5thData, long10thData, short10thData,
           long20thData, short20thData, long25thData, short25thData){

  long5thData <- convertToNumeric(long5thData,2)
  short5thData <- convertToNumeric(short5thData,2)
  long10thData <- convertToNumeric(long10thData,2)
  short10thData <- convertToNumeric(short10thData,2)
  long20thData <- convertToNumeric(long20thData,2)
```

```r
  short20thData <- convertToNumeric(short20thData,2)
  long25thData <- convertToNumeric(long25thData,2)
  short25thData <- convertToNumeric(short25thData,2)

  #table headers
  headers <- c("PERC", "LONG_90CI", "LONG_95CI", "LONG_97.5CI", "LONG_99CI",
               "SHORT_90CI","SHORT_95CI", "SHORT_97.5CI", "SHORT_99CI")

  percs <- c("5%", "10%", "20%", "25%")
  dat <- data.frame(matrix(nrow = 4,  ncol = length(headers)))
  dat[1, ] <- c(percs[1], apply(long5thData, 2, max),  apply(short5thData, 2, max))
  dat[2, ] <- c(percs[2], apply(long10thData, 2, max),  apply(short10thData, 2, max))
  dat[3, ] <- c(percs[3], apply(long20thData, 2, max),  apply(short20thData, 2, max))
  dat[4, ] <- c(percs[4], apply(long25thData, 2, max),  apply(short25thData, 2, max))
  colnames(dat) <- headers

  return(dat)
}
```

---

1 Introduction

- Previous work: Publications, documents and result data

2 The ASA Questionnaire

3 Creation of the Questionnaire

3.1 Constructs and Dimensions

Table 2: The number of constructs classified into the single anchor points and anchor pairs.

```r
calcExpertVotingClassification(constructDefData)
```

```
##                                     AnchorPoint SingleAnchor PairAnchors
## 1                          Agent's properties            4          24
## 2                       Agent's social traits           27          30
## 3                                Agent's role            9          23
## 4 Impression of the agent after the interaction            1           2
## 5                         Interaction quality           12          32
## 6         Human's impression of the interaction           23          49
## 7                          Human's attributes            2           6
```

```r
unclassified = length(which(constructDefData$SingleCls == "None"))
other = length(which(constructDefData$SingleCls == "Other"))
```

... This left us with 177 (93.70%) for detailed grouping, (189 starting - 1 unclassified - 11 out of scope = 177).

3.2 Questionnaire Items

4 Characteristics of the ASAQ

4.1 Reliability of the ASAQ

```r
# Study Early '21: Reliability Analysis (n=192)
longASAQ_reliabilityData <-
  getLongASAQ(reliabilityData, itemASAQdesc$ITEM_ID, itemASAQdesc$ITEM_REF, 1)
longASAQ_reliabilityData_1stPOV_part_1 <-
  getLongASAQ(reliabilityData_1stPOV_part_1, itemASAQdesc$ITEM_ID[1:44],
              itemASAQdesc$ITEM_REF[1:44], 1)
longASAQ_reliabilityData_1stPOV_part_1 <-
  getLongASAQ(reliabilityData_1stPOV_part_1, itemASAQdesc$ITEM_ID[1:44],
              itemASAQdesc$ITEM_REF[1:44], 1)
longASAQ_reliabilityData_1stPOV_part_2 <-
  getLongASAQ(reliabilityData_1stPOV_part_2, itemASAQdesc$ITEM_ID[45:90],
              itemASAQdesc$ITEM_REF[45:90], 1)
longASAQ_reliabilityData_3rdPOV_part_1 <-
  getLongASAQ(reliabilityData_3rdPOV_part_1, itemASAQdesc$ITEM_ID[1:44],
              itemASAQdesc$ITEM_REF[1:44], 1)
longASAQ_reliabilityData_3rdPOV_part_2 <-
  getLongASAQ(reliabilityData_3rdPOV_part_2, itemASAQdesc$ITEM_ID[45:90],
              itemASAQdesc$ITEM_REF[45:90], 1)
alpha_reliabilityData <- getAlphaReliability(
  calcAlpha(constructASAQdesc$NUM_ITEMS, longASAQ_reliabilityData,
            constructASAQdesc$CABR),
  calcAlpha(constructASAQdesc$NUM_ITEMS[1:12], longASAQ_reliabilityData_1stPOV_part_1,
            constructASAQdesc$CABR[1:12]),
  calcAlpha(constructASAQdesc$NUM_ITEMS[13:24], longASAQ_reliabilityData_1stPOV_part_2,
            constructASAQdesc$CABR[13:24]),
  calcAlpha(constructASAQdesc$NUM_ITEMS[1:12], longASAQ_reliabilityData_3rdPOV_part_1,
            constructASAQdesc$CABR[1:12]),
  calcAlpha(constructASAQdesc$NUM_ITEMS[13:24], longASAQ_reliabilityData_3rdPOV_part_2,
            constructASAQdesc$CABR[13:24]))

# Study Mid 2021: Construct Validity (n=532)
longASAQ_constructValData <-
  getLongASAQ(constructValData, itemASAQdesc$ITEM_ID, itemASAQdesc$ITEM_REF, 2)
longASAQ_constructValData_std <-
  getStandardize(name14ASAs, longASAQ_constructValData)
alpha_constructValData <-
  calcAlpha(constructASAQdesc$NUM_ITEMS, longASAQ_constructValData_std,
            constructASAQdesc$CABR)

# Study 2022: Cross Validity (n=534)
longASAQ_crossValData <-
  getLongASAQ(crossValData, itemASAQdesc$ITEM_ID, itemASAQdesc$ITEM_REF, 2)
```

```r
longASAQ_crossValData_std <-
  getStandardize(name15ASAs, longASAQ_crossValData)
alpha_crossValData <-
  calcAlpha(constructASAQdesc$NUM_ITEMS, longASAQ_crossValData_std,
            constructASAQdesc$CABR)

# Combination of study Mid 2021 and study 2022
combinedData_std = rbind(longASAQ_constructValData_std, longASAQ_crossValData_std)
alpha_combinedData <-
  calcAlpha(constructASAQdesc$NUM_ITEMS, combinedData_std, constructASAQdesc$CABR)

alphas <-
  cbind(alpha_reliabilityData[,1:4], alpha_constructValData$std.a,
        alpha_crossValData$std.a, alpha_combinedData$std.a)
names(alphas) <-
  c("CID", "STUDYE21_all", "STUDYE21_1stPOV", "STUDYE21_3rdPOV", "STUDYM21",
    "STUDY22", "COMBINED_DATA")
```

... We combine the data of these last two to efficiently reach a large n, see Table 3. The combined studies have values ranging from 0.60 to 0.86, with an average of 0.72, which is classified as a respectable reliability ... The differences in reliability between the first-person and third-person perspectives are not substantial, see Table 3 (column Study Early '21). The mean absolute difference between the two perspectives seems small (M = 0.12, SD = 0.12) and ...

Table 3: Reliability analysis results (Cronbach's alpha) of three studies.

```r
showTable(alphas, constructASAQdesc$CABR, constructASAQdesc$CNAME,
          0, 0, 0, 0, 0, 0, 0)
```

```
##    CABR                      CNAME STUDYE21_all STUDYE21_1stPOV
## 1   HLA       Human-Like Appearance         0.86            0.88
## 2   HLB         Human-Like Behavior         0.82            0.83
## 3    NA         Natural Appearance         0.70            0.66
## 4    NB           Natural Behavior         0.56            0.58
## 5   AAS    Agent’s Appearance Suit.         0.77            0.74
## 6    AU           Agent’s Usability         0.80            0.77
## 7    PF                 Performance         0.53            0.72
## 8    AL         Agent's Likeability         0.84            0.84
## 9    AS         Agent's Sociability         0.56            0.66
## 10  APP      Agent's Personality Pr.         0.55            0.38
## 11  UAA   User Acceptance of the A.         0.65            0.74
## 12   AE        Agent's Enjoyability         0.76            0.79
## 13   UE            User's Engagement         0.65            0.88
## 14   UT                 User's Trust         0.62            0.83
## 15  UAL         User Agent Alliance         0.72            0.66
## 16   AA       Agent's Attentiveness         0.79            0.58
## 17   AC           Agent's Coherence         0.75            0.74
## 18   AI       Agent's Intentionality         0.70            0.77
## 19   AT                    Attitude         0.74            0.72
## 20   SP             Social Presence         0.71            0.84
## 21  IIS Interaction Impact on Self.         0.79            0.66
## 22  AEI  Agent's Emotional Int. Pr.         0.87            0.38
## 23  UEP      User's Emotion Presence         0.81            0.74
## 24  UAI         User Agent Interplay         0.70            0.79
##    STUDYE21_3rdPOV STUDYM21 STUDY22 COMBINED_DATA
```

```
## 1           0.84     0.83     0.86             0.84
## 2           0.80     0.84     0.85             0.84
## 3           0.73     0.73     0.73             0.73
## 4           0.55     0.60     0.60             0.60
## 5           0.80     0.73     0.72             0.72
## 6           0.83     0.72     0.81             0.77
## 7           0.30     0.68     0.64             0.66
## 8           0.84     0.80     0.80             0.80
## 9           0.47     0.71     0.66             0.69
## 10          0.64     0.60     0.61             0.60
## 11          0.51     0.65     0.67             0.66
## 12          0.74     0.70     0.77             0.74
## 13          0.84     0.70     0.65             0.68
## 14          0.80     0.66     0.67             0.67
## 15          0.73     0.77     0.78             0.77
## 16          0.55     0.72     0.70             0.71
## 17          0.80     0.67     0.69             0.68
## 18          0.83     0.68     0.73             0.70
## 19          0.30     0.78     0.81             0.79
## 20          0.84     0.71     0.62             0.67
## 21          0.47     0.72     0.73             0.73
## 22          0.64     0.86     0.85             0.86
## 23          0.51     0.64     0.69             0.66
## 24          0.74     0.67     0.61             0.64
```

4.2 Content Validity of the ASAQ

```
items_contentValData <- calcItemAgreementCoeff(itemASAQdesc, contentValData)
construct_contentValData <-
  calcConstructAgreementCoeff(constructASAQdesc, items_contentValData)
```

Table 4 shows the average TPR_s and FPR_s of the ASAQ constructs. The TPR_s ranges from 0.81 to 1.00 with an average of 0.95 (SD = 0.04), while FPR_s ranges from 0.00 to 0.25 with an average of 0.12, (SD = 0.06). . . .

Table 4: The average TPR_s and FPR_s for each ASAQ construct or dimension.

```
showTable(construct_contentValData,constructASAQdesc$CABR,constructASAQdesc$CNAME,
          0, 0, 0, 0, 0, 0, 0)
```

```
##    CABR                     CNAME M_TPRs SD_TPRs M_FPRs SD_FPRs
## 1   HLA      Human-Like Appearance   0.96    0.05   0.06    0.08
## 2   HLB        Human-Like Behavior   0.98    0.04   0.21    0.07
## 3    NA        Natural Appearance   0.92    0.05   0.08    0.08
## 4    NB           Natural Behavior   0.97    0.05   0.22    0.03
## 5   AAS     Agent’s Appearance Suit.   0.93    0.12   0.07    0.06
## 6    AU          Agent’s Usability   0.94    0.05   0.03    0.06
## 7    PF                Performance   0.91    0.09   0.13    0.12
## 8    AL        Agent's Likeability   0.81    0.05   0.11    0.07
## 9    AS        Agent's Sociability   0.95    0.05   0.13    0.12
## 10  APP     Agent's Personality Pr.   0.97    0.05   0.14    0.10
## 11  UAA    User Acceptance of the A.   0.96    0.07   0.08    0.08
## 12   AE       Agent's Enjoyability   0.96    0.05   0.17    0.05
## 13   UE          User's Engagement   0.89    0.11   0.12    0.06
```

```
## 14   UT                 User's Trust   0.97    0.06   0.04    0.07
## 15  UAL          User Agent Alliance   0.97    0.05   0.19    0.07
## 16   AA       Agent's Attentiveness   1.00    0.00   0.20    0.05
## 17   AC           Agent's Coherence   0.96    0.05   0.14    0.10
## 18   AI      Agent's Intentionality   0.95    0.06   0.10    0.07
## 19   AT                    Attitude   1.00    0.00   0.15    0.09
## 20   SP             Social Presence   0.93    0.06   0.25    0.04
## 21  IIS Interaction Impact on Self.   0.95    0.06   0.00    0.00
## 22  AEI  Agent's Emotional Int. Pr.   1.00    0.00   0.10    0.07
## 23  UEP     User's Emotion Presence   0.98    0.04   0.11    0.04
## 24  UAI        User Agent Interplay   0.95    0.05   0.04    0.07
```

4.3 Construct Validity of the ASAQ

We took two sequential analyses: 1. Convergent validity analysis. 2. Discriminant validity analysis.

Both analyses are reported in:

- Siska Fitrianie, Merijn Bruijnes, Fengxiang Li, Amal Abdulrahman, and Willem-Paul Brinkman. 2022. The Artificial-Social-Agent Questionnaire: Establishing the long and short questionnaire versions. In ACM International Conference on Intelligent Virtual Agents (IVA'22), September, 2022, Faro, Portugal. ACM, New York, NY, USA. DOI: https://doi.org/10.1145/3514197.3549612
- Related scripts and dataset can be found at:
  - Siska Fitrianie, Merijn Bruijnes, Fengxiang Li, Amal Abdulrahman, and Willem-Paul Brinkman. 2022. Data and analysis underlying the research into the Artificial-Social-Agent Questionnaire: Establishing the long and short questionnaire versions. (2022). https://doi.org/10.4121/19758436 4TU.ResearchData.

4.4 Cross-Validity of the ASAQ

Using the obtained data (n=534), we again took two sequential analyses:

1. Convergent validity analysis.

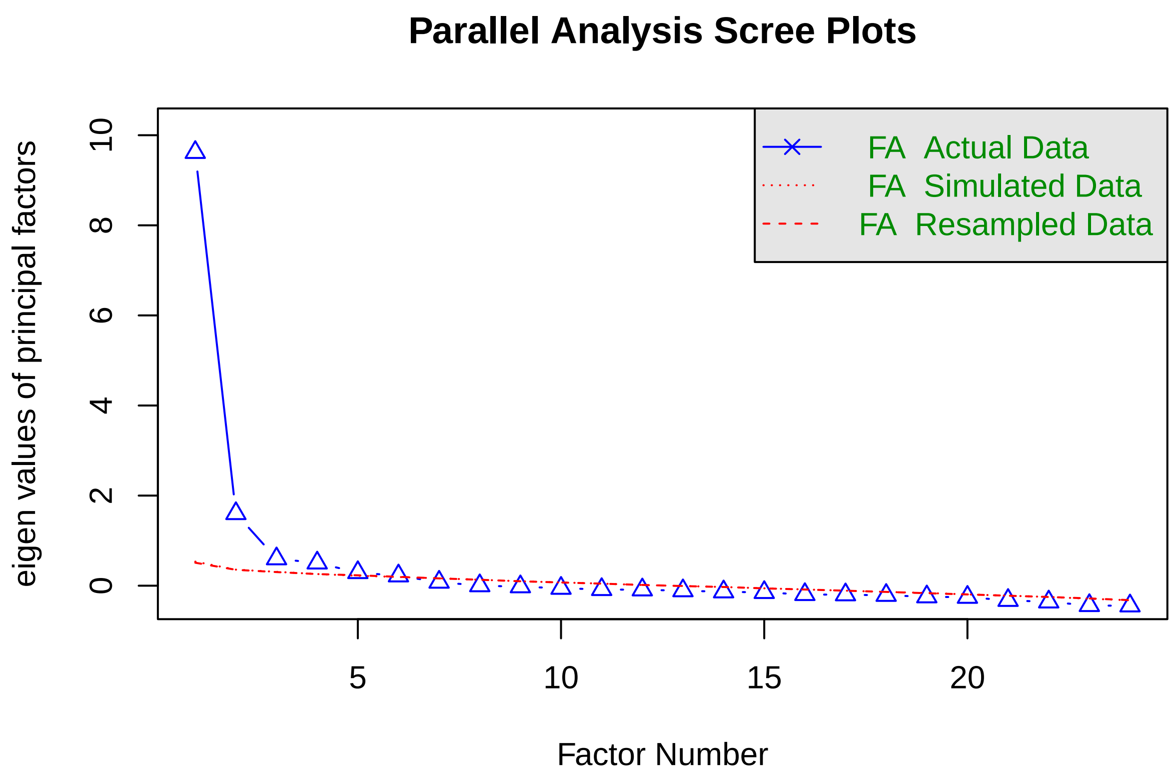
```r
individualFactorialModel_longASAQ <-
  c('C_HLA =~ HLA1 + HLA2 + HLA3 + HLA4',
    'C_HLB =~ HLB1 + HLB2 + HLB3 + HLB4  + HLB5',
    'C_NA =~ NA1 + NA2 +  NA3 + NA4 + NA5',
    'C_NB =~ NB1 +  NB2 +  NB3',
    'C_AAS =~ AAS1 + AAS2 + AAS3',
    'C_AU =~ AU1 + AU2 + AU3',
    'C_PF =~ PF1 +  PF2 +  PF3',
    'C_AL =~ AL1 +  AL2 + R_AL3 + AL4 + AL5',
    'C_AS =~  AS1 + AS2 + AS3',
    'C_APP =~  APP1 + R_APP2 +  APP3',
    'C_UAA =~  UAA1 + UAA2 + R_UAA3',
    'C_AE =~ R_AE1 + AE2 + AE3 + R_AE4',
    'C_UE =~ UE1 + UE2 +  UE3',
    'C_UT =~  UT1 +  UT2 + UT3',
    'C_UAL =~ UAL1 + UAL2 +  UAL3 + UAL4 +  UAL5 + UAL6',
    'C_AA =~ AA1 + AA2 + AA3',
    'C_AC =~ R_AC1 + R_AC2 + R_AC3 + R_AC4',
    'C_AI =~ AI1 + AI2 +  R_AI3 +  AI4',
    'C_AT =~ AT1 + AT2 +  R_AT3',
```

```
    'C_SP =~  SP1 +  SP2 + SP3',
    'C_IIS =~  IIS1 + IIS2 + IIS3 + IIS4',
    '
     C_AEI =~ AEI1 + AEI2 +  R_AEI3 + AEI4 + R_AEI5
     C_UEP =~ UEP1 + UEP2 + UEP3 +  UEP4
    ',
    'C_UAI =~  UAI1 + UAI2 + UAI3 + UAI4'
  )

convergentValmodels <-
  c("Human-Like Appearance", "Human-Like Behavior", "Natural Appearance",
    "Natural Behavior", "Agent’s Appearance Suit.", "Agent’s Usability",
    "Performance", "Agent’s Likeability", "Agent’s Sociability",
    "Agent’s Personality Pr.", "User Acceptance of the A.", "Agent’s Enjoyability",
    "User’s Engagement", "User’s Trust", "User Agent Alliance", "Agent’s Attentiveness",
    "Agent’s Coherence", "Agent’s Intentionality", "Attitude", "Social Presence",
    "Interaction Impact on Self.", "User's and Agent's Emotional State",
    "User Agent Interplay")

# CFI scores of convergent validation of the long ASAQ
cfi_convergentVal_crossValData <-
  getCFIcoefficient(convergentValmodels, individualFactorialModel_longASAQ,
                    longASAQ_crossValData_std)
```

… The 24 CFAs (i.e. 16 constructs and 8 dimensions) as part of the convergence analysis, showed good model fit with, on average, a CFI score of 0.99 (SD = 0.02, range [0.94 .. 1.00]). …

2. Discriminant validity analysis.

```
# Retrieve predicted scores of long ASAQ constructs/dimensions based on
# their individual CFA result
predicted_crossValData <-
  getPredictedData_longASAQ(individualFactorialModel_longASAQ, longASAQ_crossValData_std)

# Determine Number of Factors to Extract
parallel_crossValData <-
  fa.parallel(predicted_crossValData, fm='ml', fa='fa')
```




```
## Parallel analysis suggests that the number of factors =  6  and the number of components =  NA
```

Note: The suggestion of parallel analysis may vary between 5 to 6 factors. In this study we took 6 factorial models (the largest) because we try to avoid the co-linearity issue between constructs when we run the factor analysis, while at the same time we still allow the association between these constructs.

```
# Maximum Likelihood Factor Analysis
efa_crossValData <- getEFA(predicted_crossValData, 6)

# Factorial models based on efa_crossValData
factorialModels_crossValData <- c(
  '
  C_HLB =~ HLB1 + HLB2 + HLB3 + HLB4  + HLB5
  C_NB =~ NB1 +  NB2 +  NB3
  C_AS =~  AS1 + AS2 + AS3
  C_APP =~  APP1 + R_APP2 +  APP3
  C_SP =~  SP1 +  SP2 + SP3
  C_AEI =~ AEI1 + AEI2 +  R_AEI3 + AEI4 + R_AEI5
  C_UEP =~ UEP1 + UEP2 + UEP3 +  UEP4
  C_UAI =~  UAI1 + UAI2 + UAI3 + UAI4
  ',
  '
  C_UAA =~  UAA1 + UAA2 + R_UAA3
  C_AE =~ R_AE1 + AE2 + AE3 + R_AE4
  C_AT =~ AT1 + AT2 +  R_AT3
  C_IIS =~  IIS1 + IIS2 + IIS3 + IIS4
  ',
  '
  C_UE =~ UE1 + UE2 +  UE3
  C_AA =~ AA1 + AA2 + AA3
```

```
  C_UEP =~ UEP1 + UEP2 + UEP3 +  UEP4
  C_UAI =~  UAI1 + UAI2 + UAI3 + UAI4
  ',
  '
  C_AU =~ AU1 + AU2 + AU3
  C_PF =~ PF1 +  PF2 +  PF3
  C_UT =~  UT1 +  UT2 + UT3
  C_UAL =~ UAL1 + UAL2 +  UAL3 + UAL4 +  UAL5 + UAL6
  C_AC =~ R_AC1 + R_AC2 + R_AC3 + R_AC4
  C_AI =~ AI1 + AI2 +  R_AI3 +  AI4
  ',
  '
  C_HLA =~ HLA1 + HLA2 + HLA3 + HLA4
  C_NA =~ NA1 + NA2 +  NA3 + NA4 + NA5
  C_AAS =~ AAS1 + AAS2 + AAS3
  ',
  '
  C_AAS =~ AAS1 + AAS2 + AAS3
  C_AL =~ AL1 +  AL2 + R_AL3 + AL4 + AL5
  C_AE =~ R_AE1 + AE2 + AE3 + R_AE4
  C_AC =~ R_AC1 + R_AC2 + R_AC3 + R_AC4
  '
)
distriminantValModels_crossValData <- c(
  "FACTORIAL MODEL 1", "FACTORIAL MODEL 2", "FACTORIAL MODEL 3", "FACTORIAL MODEL 4",
  "FACTORIAL MODEL 5", "FACTORIAL MODEL 6"
)
```

Figure 4: Confirmatory factor analysis diagrams. Links between constructs that are of marginal and moderate concern “rho” > .80 … are shown.

```
loadings_discriminantVal_crossValData <-
  printStdFactorLoadingModels_longASAQ(distriminantValModels_crossValData,
                                       factorialModels_crossValData,
                                       longASAQ_crossValData_std, 1)
```

```
##
##
##  FACTORIAL MODEL 1 (CFI =  0.93 )
##      C_HLB
## HLB1  0.68
## HLB2  0.62
## HLB3  0.76
## HLB4  0.79
## HLB5  0.77
##
##     C_NB
## NB1 0.44
## NB2 0.70
## NB3 0.64
##
##     C_AS
## AS1 0.68
## AS2 0.58
## AS3 0.62
```

```
##
##        C_APP
## APP1    0.62
## R_APP2  0.54
## APP3    0.60
##
##     C_SP
## SP1 0.72
## SP2 0.68
## SP3 0.42
##
##        C_AEI
## AEI1    0.72
## AEI2    0.76
## R_AEI3  0.73
## AEI4    0.75
## R_AEI5  0.67
##
##      C_UEP
## UEP1  0.59
## UEP2  0.71
## UEP3  0.52
## UEP4  0.57
##
##      C_UAI
## UAI1  0.53
## UAI2  0.44
## UAI3  0.54
## UAI4  0.63
##
## Covariance Matrix
##       C_HLB C_NB C_AS C_APP C_SP C_AEI C_UEP C_UAI
## C_HLB  1.00 0.90 0.74  0.71 0.69  0.58  0.51  0.54
## C_NB   0.90 1.00 0.85  0.82 0.76  0.75  0.57  0.63
## C_AS   0.74 0.85 1.00  0.78 0.92  0.63  0.66  0.74
## C_APP  0.71 0.82 0.78  1.00 0.83  0.75  0.68  0.63
## C_SP   0.69 0.76 0.92  0.83 1.00  0.66  0.54  0.61
## C_AEI  0.58 0.75 0.63  0.75 0.66  1.00  0.52  0.56
## C_UEP  0.51 0.57 0.66  0.68 0.54  0.52  1.00  0.76
## C_UAI  0.54 0.63 0.74  0.63 0.61  0.56  0.76  1.00
##
##
##
##  FACTORIAL MODEL 2 (CFI =  0.93 )
##        C_UAA
## UAA1    0.79
## UAA2    0.71
## R_UAA3  0.45
##
##      C_AE
## R_AE1 0.59
## AE2   0.60
## AE3   0.78
## R_AE4 0.68
```

```
##
##       C_AT
## AT1   0.83
## AT2   0.75
## R_AT3 0.72
##
##      C_IIS
## IIS1  0.77
## IIS2  0.73
## IIS3  0.46
## IIS4  0.56
##
## Covariance Matrix
##       C_UAA C_AE C_AT C_IIS
## C_UAA  1.00 0.87 0.88  0.88
## C_AE   0.87 1.00 0.92  0.83
## C_AT   0.88 0.92 1.00  0.82
## C_IIS  0.88 0.83 0.82  1.00
##
##
##
##  FACTORIAL MODEL 3 (CFI =  0.93 )
##     C_UE
## UE1 0.64
## UE2 0.62
## UE3 0.59
##
##     C_AA
## AA1 0.66
## AA2 0.62
## AA3 0.70
##
##      C_UEP
## UEP1  0.62
## UEP2  0.69
## UEP3  0.53
## UEP4  0.56
##
##      C_UAI
## UAI1  0.52
## UAI2  0.43
## UAI3  0.57
## UAI4  0.62
##
## Covariance Matrix
##       C_UE C_AA C_UEP C_UAI
## C_UE  1.00 0.71  0.55  0.49
## C_AA  0.71 1.00  0.49  0.65
## C_UEP 0.55 0.49  1.00  0.75
## C_UAI 0.49 0.65  0.75  1.00
##
##
##
##  FACTORIAL MODEL 4 (CFI =  0.96 )
```

```
##     C_AU
## AU1 0.80
## AU2 0.77
## AU3 0.72
##
##     C_PF
## PF1 0.66
## PF2 0.52
## PF3 0.64
##
##     C_UT
## UT1 0.56
## UT2 0.59
## UT3 0.76
##
##      C_UAL
## UAL1  0.56
## UAL2  0.62
## UAL3  0.51
## UAL4  0.69
## UAL5  0.60
## UAL6  0.67
##
##       C_AC
## R_AC1 0.70
## R_AC2 0.62
## R_AC3 0.62
## R_AC4 0.49
##
##       C_AI
## AI1   0.53
## AI2   0.79
## R_AI3 0.70
## AI4   0.52
##
## Covariance Matrix
##       C_AU C_PF C_UT C_UAL C_AC C_AI
## C_AU  1.00 0.69 0.61  0.57 0.52 0.44
## C_PF  0.69 1.00 0.96  0.89 0.77 0.72
## C_UT  0.61 0.96 1.00  0.89 0.66 0.70
## C_UAL 0.57 0.89 0.89  1.00 0.50 0.71
## C_AC  0.52 0.77 0.66  0.50 1.00 0.54
## C_AI  0.44 0.72 0.70  0.71 0.54 1.00
##
##
##
##  FACTORIAL MODEL 5 (CFI =  0.97 )
##      C_HLA
## HLA1  0.79
## HLA2  0.86
## HLA3  0.76
## HLA4  0.72
##
##     C_NA
```

```
## NA1 0.54
## NA2 0.69
## NA3 0.53
## NA4 0.72
## NA5 0.50
##
##      C_AAS
## AAS1  0.66
## AAS2  0.60
## AAS3  0.78
##
## Covariance Matrix
##       C_HLA C_NA C_AAS
## C_HLA  1.00 0.72  0.39
## C_NA   0.72 1.00  0.61
## C_AAS  0.39 0.61  1.00
##
##
##
##  FACTORIAL MODEL 6 (CFI =  0.94 )
##      C_AAS
## AAS1  0.70
## AAS2  0.57
## AAS3  0.77
##
##       C_AL
## AL1   0.59
## AL2   0.86
## R_AL3 0.82
## AL4   0.52
## AL5   0.61
##
##       C_AE
## R_AE1 0.71
## AE2   0.68
## AE3   0.60
## R_AE4 0.70
##
##       C_AC
## R_AC1 0.72
## R_AC2 0.65
## R_AC3 0.57
## R_AC4 0.47
##
## Covariance Matrix
##       C_AAS C_AL C_AE C_AC
## C_AAS  1.00 0.70 0.62 0.54
## C_AL   0.70 1.00 0.93 0.56
## C_AE   0.62 0.93 1.00 0.63
## C_AC   0.54 0.56 0.63 1.00
```

```r
# CFI scores of discriminant validation of the long ASAQ
cfi_discriminantVal_crossValData <-
  getCFIcoefficient(distriminantValModels_crossValData, factorialModels_crossValData,
```

```
                    longASAQ_crossValData_std)
```

. . . The factor loadings of the items ranged from 0.42 to 0.86 (M= 0.64, SD= 0.10) in the six CFA, while the CFI scores ranged from 0.93 to 0.97 (M= 0.94, SD= 0.02), see Figure 4. All CFIs are above the .90 threshold considered an indication for a good fit to the data . . .

4.5 Predictive Validity of the ASAQ

```
# The constructs'/dimensions' score of each ASA
predictiveValScores_medianBase <-
  getPredictiveValScores_medianBase(predictiveValData_expertA, predictiveValData_expertB,
                                    predictiveValData_expertC,
                                    constructASAQdesc$CABR)
predictiveVal29ASA_medianBase <-
  get29ASAPredictiveValData_medianBase(name29ASAs,
                                       predictiveValScores_medianBase,
                                       constructASAQdesc$CABR)


# Combined dataset of Study Mid 2021 and Study 2022
combinedData <- rbind(longASAQ_constructValData, longASAQ_crossValData)

# Calculate the score of all ASAQ constructs/dimensions of the long version of ASAQ by
# calculating the mean of items in each construct/dimension. The calculation results in
# one score for each construct/dimension for each individual participant
longASAQConstructsScore_combinedData =
  getLongASAQConstructsScore(constructASAQdesc$NUM_ITEMS,
                             combinedData,
                             constructASAQdesc$CABR)

# Calculate the constructs' score of each ASA by calculating the mean of each
# construct/dimension per ASA The calculation results in one score for each
# construct/dimension per ASA
longASAQscores_combinedData <-
  calcASAQscores(name29ASAs, longASAQConstructsScore_combinedData)

# Get the score of all ASAQ constructs/dimensions of the short version of ASAQ.
# The score of each construct/dimension is taken from a representative item of the
# construct/dimension.
# for PF: only for APF (since the representative for the short version is PF1)
# for UAL: only for TUAL (since the representative for the short version is UAL1)
shortASAQConstructsScore_combinedData =
  getShortASAQConstructsScore(constructASAQdesc$SHORT_ITEM_REF,
                              combinedData,
                              constructASAQdesc$CABR)

# Calculate the constructs' score of each ASA by calculating the mean of
# each construct/dimension per ASA. The calculation results in one score for each
# construct/dimension per ASA
shortASAQscores_combinedData <-
  calcASAQscores(name29ASAs, shortASAQConstructsScore_combinedData)
```

```r
# The correlation between the scores of ASAQ constructs/dimensions of the ASAQ
# Representative Set 2024 of the experts' predictive analysis (i.e. the median of ASAQ
# constructs/dimensions' scores from 3 experts) and the ASAQ long and short versions
# (i.e., calculated using the mean of items of each ASAQ construct/dimension)
corrPredictiveAndASAQConstructsScores <-
  calcCorrPredictiveAndASAQConstructsScores(predictiveVal29ASA_medianBase,
                                           longASAQscores_combinedData,
                                           shortASAQscores_combinedData,
                                           constructASAQdesc$CABR)
```

... Thus excluding the constructs Performance and User Agent Alliance, the Spearman correlations for the long ASAQ version range from 0.10 to 0.92 with a median of 0.50. According to Hinkle (2003) we can classify this as a moderate correlation ...

Table 5: The correlation (rho) between the median of expert predictions and the mean ASAQ scores of 29 agents.

```r
showTable(corrPredictiveAndASAQConstructsScores, constructASAQdesc$CABR,
          constructASAQdesc$CNAME, 1, 0, 0, 0, 0, 0, 0)
```

```
##    CABR                        CNAME PRED_LONG PRED_SHORT
## 1   HLA        Human-Like Appearance      0.92       0.91
## 2   HLB          Human-Like Behavior      0.58       0.57
## 3    NA           Natural Appearance      0.74       0.72
## 4    NB             Natural Behavior      0.50       0.48
## 5   AAS     Agent’s Appearance Suit.      0.58       0.52
## 6    AU            Agent’s Usability      0.35       0.45
## 7    PF                  Performance        NA         NA
## 8    AL          Agent's Likeability      0.64       0.66
## 9    AS          Agent's Sociability      0.50       0.54
## 10  APP      Agent's Personality Pr.      0.61       0.38
## 11  UAA    User Acceptance of the A.      0.41       0.32
## 12   AE         Agent's Enjoyability      0.67       0.46
## 13   UE            User's Engagement      0.41       0.43
## 14   UT                 User's Trust      0.32       0.34
## 15  UAL          User Agent Alliance        NA         NA
## 16   AA        Agent's Attentiveness      0.39       0.54
## 17   AC            Agent's Coherence      0.10       0.09
## 18   AI        Agent's Intentionality      0.53       0.34
## 19   AT                     Attitude      0.45       0.49
## 20   SP              Social Presence      0.71       0.74
## 21  IIS Interaction Impact on Self.      0.25       0.18
## 22  AEI   Agent's Emotional Int. Pr.      0.41       0.46
## 23  UEP      User's Emotion Presence      0.51       0.46
## 24  UAI           User Agent Interplay      0.47       0.50
```

4.6 Concurrent Validity of the Long and Short ASAQ Versions

```r
# Calculate the score of all ASAQ constructs/dimensions of the long version of ASAQ by
# calculating the mean of items in each construct/dimension. The calculation results in
# one score for each construct/dimension for each individual participant
longASAQConstructsScore_constructValData =
  getLongASAQConstructsScore(constructASAQdesc$NUM_ITEMS,
```

```
                              longASAQ_constructValData,
                              constructASAQdesc$CABR)
longASAQConstructsScore_crossValData =
  getLongASAQConstructsScore(constructASAQdesc$NUM_ITEMS,
                              longASAQ_crossValData,
                              constructASAQdesc$CABR)

# Get the score of all ASAQ constructs/dimensions of the short version of ASAQ.
# The score of each construct/dimension is taken from a representative item of the
# construct/dimension. This results in one score for each construct/dimension for each
# individual participant
shortASAQConstructsScore_constructValData =
  getShortASAQConstructsScore(constructASAQdesc$SHORT_ITEM_REF,
                              longASAQ_constructValData,
                              constructASAQdesc$CABR)
shortASAQConstructsScore_crossValData =
  getShortASAQConstructsScore(constructASAQdesc$SHORT_ITEM_REF,
                              longASAQ_crossValData,
                              constructASAQdesc$CABR)


# Calculate the constructs' score of each ASA by calculating the mean of each
# construct/dimension per ASA. The calculation results in one score for each
# construct/dimension per ASA
longASAQscores_constructValData <-
  calcASAQscores(name29ASAs, longASAQConstructsScore_constructValData)
longASAQscores_crossValData <-
  calcASAQscores(name29ASAs, longASAQConstructsScore_crossValData)

shortASAQscores_constructValData <-
  calcASAQscores(name29ASAs, shortASAQConstructsScore_constructValData)
shortASAQscores_crossValData <-
  calcASAQscores(name29ASAs, shortASAQConstructsScore_crossValData)

# The corelation and SMD between the long (based on the MEAN of the construct/dimension
# scores) and short version of ASAQ
corDiffLongShortASAQ <-
  getCorDiffLongShortASAQ(longASAQConstructsScore_constructValData,
                          shortASAQConstructsScore_constructValData,
                          longASAQConstructsScore_crossValData,
                          shortASAQConstructsScore_crossValData,
                          longASAQConstructsScore_combinedData,
                          shortASAQConstructsScore_combinedData,
                          constructASAQdesc$CABR)
```

… Combining these datasets shows an average correlation of 0.81 over all constructs (range [0.70 .. 0.92]). This can be interpreted as high concurrent validity … Likewise, the absolute mean differences between the means of the constructs and dimensions of the long version and the representative item of the short version shows an acceptable variation, with a mean of the absolute mean differences of 0.21, (range [0.00 .. 0.58], SD = 0.17).

Table 6: Correlation (rho) and absolute standardised mean difference (Delta M) between the long and short versions of ASAQ.

```r
showTable(corDiffLongShortASAQ, constructASAQdesc$CABR, constructASAQdesc$CNAME,
          0, 0, 0, 0, 0, 0, 0)
```

```
##    CABR                       CNAME COR_StudyM21 DM_StudyM21 COR_Study22
## 1   HLA       Human-Like Appearance         0.92        0.03        0.93
## 2   HLB         Human-Like Behavior         0.87        0.15        0.82
## 3    NA         Natural Appearance         0.83        0.09        0.82
## 4    NB            Natural Behavior         0.85        0.61        0.85
## 5   AAS     Agent’s Appearance Suit.         0.85        0.08        0.85
## 6    AU           Agent’s Usability         0.83        0.11        0.85
## 7    PF                 Performance         0.78        0.13        0.73
## 8    AL         Agent's Likeability         0.87        0.10        0.86
## 9    AS         Agent's Sociability         0.86        0.53        0.84
## 10  APP      Agent's Personality Pr.         0.74        0.39        0.79
## 11  UAA    User Acceptance of the A.         0.80        0.05        0.82
## 12   AE        Agent's Enjoyability         0.80        0.48        0.77
## 13   UE           User's Engagement         0.83        0.07        0.72
## 14   UT                User's Trust         0.82        0.09        0.80
## 15  UAL         User Agent Alliance         0.69        0.43        0.71
## 16   AA       Agent's Attentiveness         0.79        0.19        0.76
## 17   AC           Agent's Coherence         0.73        0.01        0.79
## 18   AI      Agent's Intentionality         0.75        0.25        0.76
## 19   AT                    Attitude         0.88        0.00        0.90
## 20   SP             Social Presence         0.85        0.07        0.81
## 21  IIS Interaction Impact on Self.         0.77        0.24        0.77
## 22  AEI  Agent's Emotional Int. Pr.         0.86        0.38        0.83
## 23  UEP      User's Emotion Presence         0.74        0.07        0.77
## 24  UAI          User Agent Interplay         0.78        0.36        0.73
##    DM_Study22 COR_COMB DM_COMB
## 1        0.03     0.92    0.03
## 2        0.21     0.85    0.18
## 3        0.02     0.82    0.05
## 4        0.53     0.85    0.57
## 5        0.00     0.85    0.04
## 6        0.20     0.84    0.16
## 7        0.35     0.75    0.24
## 8        0.19     0.87    0.15
## 9        0.64     0.85    0.58
## 10       0.32     0.77    0.35
## 11       0.12     0.81    0.09
## 12       0.10     0.78    0.29
## 13       0.05     0.77    0.01
## 14       0.16     0.81    0.13
## 15       0.56     0.70    0.50
## 16       0.18     0.78    0.18
## 17       0.04     0.76    0.03
## 18       0.35     0.76    0.30
## 19       0.00     0.89    0.00
## 20       0.05     0.83    0.06
## 21       0.26     0.77    0.25
## 22       0.24     0.85    0.31
## 23       0.10     0.76    0.08
## 24       0.37     0.76    0.36
```

4.7 Interpretability of the ASAQ

```
# Calculate the mean, standard deviation, and relative frequency of how often the 1066
# (532 + 534)  participants use one of the seven points on the answer scale for each
# of the representative items of the long and short versions of the ASAQ
freqLongASAQConstructsScore_combinedData <-
  calcFreqLongASAQConstructsScore(constructASAQdesc$NUM_ITEMS, combinedData, scoreASAQ,
                        constructASAQdesc$CABR)
freqShortASAQConstructsScore_combinedData <-
  calcFreqShortASAQConstructsScore(shortASAQConstructsScore_combinedData,
                                   scoreASAQ,
                                   constructASAQdesc$CABR)
relFreqLongASAQConstructsScore_combinedData <-
  calcRelFreqLongASAQConstructsScore(constructASAQdesc$NUM_ITEMS, combinedData, scoreASAQ,
                        constructASAQdesc$CABR)
relFreqShortASAQConstructsScore_combinedData <-
  calcRelFreqShortASAQConstructsScore(shortASAQConstructsScore_combinedData,
                                   scoreASAQ,
                                   constructASAQdesc$CABR)


# Calculate the sum of item scores of long ASAQ constructs/dimensions
sumLongConstructASAQscore_combinedData <-
  calcSumLongConstructASAQscore (constructASAQdesc$NUM_ITEMS,
                                 combinedData,
                                 constructASAQdesc$CABR)

# Calculate relative frequency of extreme scores of
# long ASAQ constructs/dimensions
relFreqExtrmLongASAQConstructScores <-
  calcRelFreqExtrmLongASAQConstructScores(constructASAQdesc$NUM_ITEMS,
                                     sumLongConstructASAQscore_combinedData,
                                     constructASAQdesc$CABR)
```

... The percentage ranges from 2% to 28% with an average of 8.50%, which is lower than 15%, a cut-off point suggested to indicate a floor or ceiling effect ...

... Consequently, this is reflected in an average of (mean of 10.00% (score -3) + 19.21% (score 3) =) 29.21% extreme scores for the short ASAQ. Consequently, the short version is less capable of capturing extreme experiences because of potential floor and ceiling effects.

However, to investigate the impact of potential floor and ceiling effects on the total ASAQ performance, we computed the range of sum of the item scores for both the long and short versions. Where, in theory, the total score of the long version can range from 0 to 0, the scores of our 1066 participants range from -225 to 255 (M = 50.50, SD = 76.76, ruling out floor or ceiling effects. Similarly, for the short version of the ASAQ, the sum of item scores can range from -72 to 72, while the score of our participants ranges from -67 to 69 (M = 15.75, SD = 22.15). Furthermore, the bell-shaped curves suggest that there are no holes in the distribution of the sum of item scores for both the long and short versions ...

Table 7: The relative frequency (RF) of the lowest, highest and sum of extreme scores for each ASAQ construct and dimension, based on the long ASAQ version.

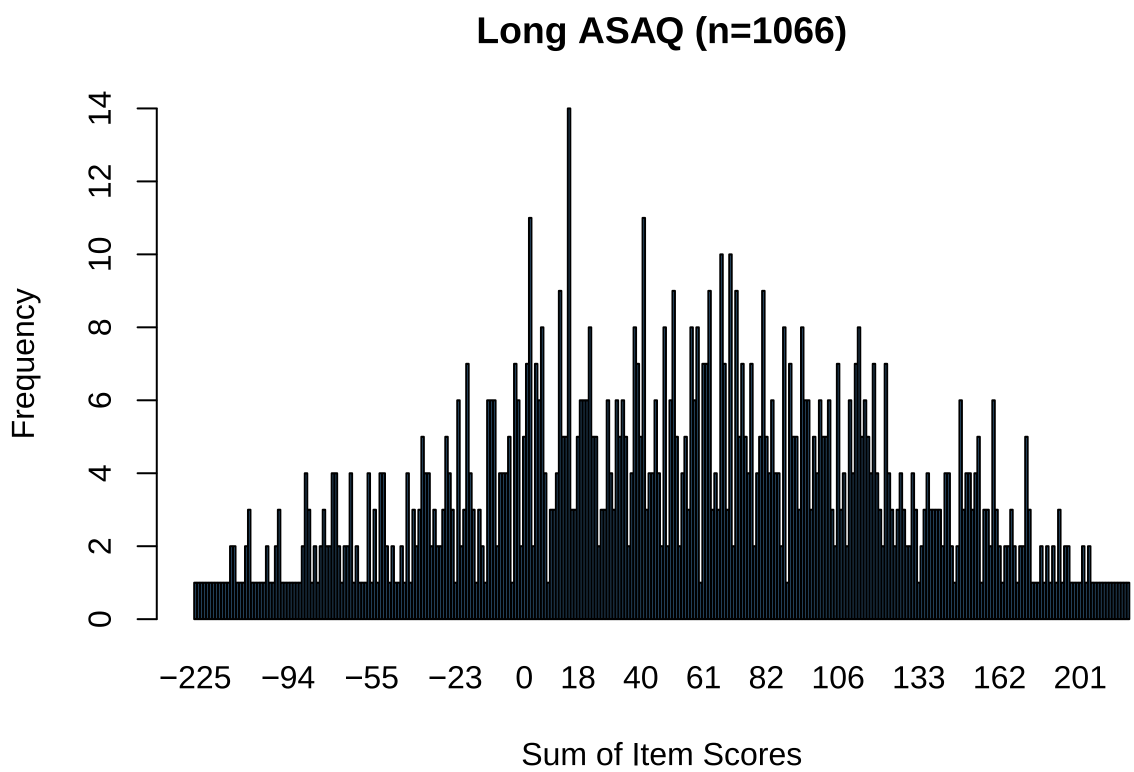
```
showTable(relFreqExtrmLongASAQConstructScores, constructASAQdesc$CABR,
          constructASAQdesc$CNAME, 0, 0, 0, 0, 0, 0, 0)
```

```
##    CABR                       CNAME ITEM_NUM fRelLowEXTRM fRelHighEXTRM
```

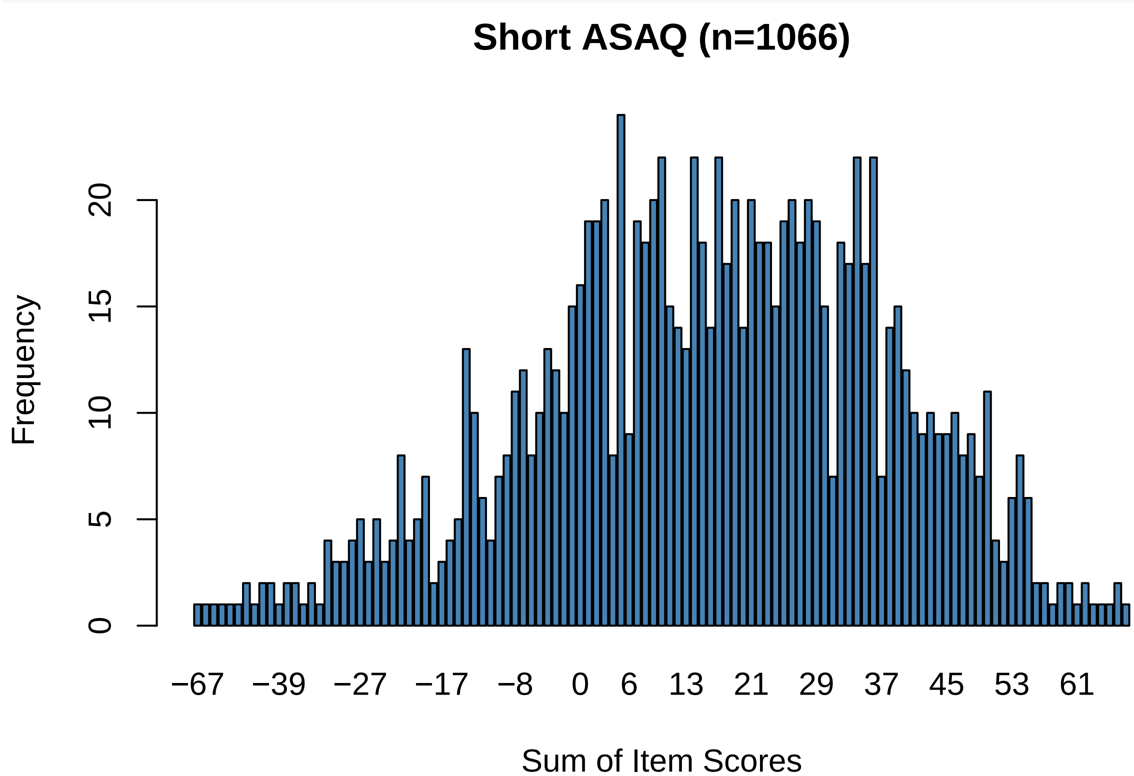
```
## 1   HLA       Human-Like Appearance     4.00          0.23            0.05
## 2   HLB         Human-Like Behavior     5.00          0.03            0.02
## 3    NA          Natural Appearance     5.00          0.02            0.01
## 4    NB            Natural Behavior     3.00          0.06            0.02
## 5   AAS    Agent’s Appearance Suit.     3.00          0.00            0.12
## 6    AU            Agent’s Usability     3.00          0.01            0.11
## 7    PF                 Performance     3.00          0.00            0.06
## 8    AL         Agent's Likeability     5.00          0.00            0.05
## 9    AS         Agent's Sociability     3.00          0.02            0.03
## 10  APP     Agent's Personality Pr.     3.00          0.03            0.02
## 11  UAA   User Acceptance of the A.     3.00          0.01            0.10
## 12   AE        Agent's Enjoyability     4.00          0.00            0.09
## 13   UE           User's Engagement     3.00          0.00            0.17
## 14   UT                User's Trust     3.00          0.01            0.02
## 15  UAL         User Agent Alliance     6.00          0.01            0.01
## 16   AA       Agent's Attentiveness     3.00          0.00            0.16
## 17   AC           Agent's Coherence     4.00          0.00            0.11
## 18   AI      Agent's Intentionality     4.00          0.01            0.03
## 19   AT                    Attitude     3.00          0.01            0.15
## 20   SP              Social Presence     3.00          0.05            0.01
## 21  IIS Interaction Impact on Self.     4.00          0.01            0.02
## 22  AEI  Agent's Emotional Int. Pr.     5.00          0.12            0.00
## 23  UEP     User's Emotion Presence     4.00          0.00            0.03
## 24  UAI        User Agent Interplay     4.00          0.00            0.02
##    SumfRelEXTRM
## 1          0.28
## 2          0.05
## 3          0.03
## 4          0.08
## 5          0.12
## 6          0.12
## 7          0.06
## 8          0.05
## 9          0.05
## 10         0.05
## 11         0.11
## 12         0.09
## 13         0.17
## 14         0.03
## 15         0.02
## 16         0.16
## 17         0.11
## 18         0.04
## 19         0.16
## 20         0.06
## 21         0.03
## 22         0.12
## 23         0.03
## 24         0.02
```

Figure 5: Range sum of scores of each item of the long and short versions of ASAQ.

```
# Drawing the histogram of the ASAQ constructs' scores
drawBarPlotFreqTotalASAQscore(sumLongConstructASAQscore_combinedData,
                              "Long ASAQ (n=1066)", 1)
```




```
drawBarPlotFreqTotalASAQscore(shortASAQConstructsScore_combinedData,
                              "Short ASAQ (n=1066)", 2)
```




```
# Calculate percentile score of the long and short ASAQ
percentileLongASAQScore_combinedData <-
```

```r
  calcPercentileASAQscore(longASAQscores_combinedData, probs,
                          constructASAQdesc$CABR, probTitle)
percentileShortASAQScore_combinedData <-
  calcPercentileASAQscore(shortASAQscores_combinedData, probs,
                          constructASAQdesc$CABR, probTitle)

percentileTotalASAQscore <-
  calcPercentileTotalASAQscore(longASAQscores_combinedData, shortASAQscores_combinedData,
                               probs, probTitle)
```

Table 9: The percentile of ASAQ scores of the ASAQ Representative Set 2024 (n =29).

```r
percentileTotalASAQscore
```

```
##    ASAQ  q5th q10th q20th q25th q30th q40th q50th q60th q70th q75th q80th q90th
## 1  Long -0.72  2.68  9.36 10.37 12.54 13.58 14.32 16.41 17.82 19.28 20.45 24.91
## 2 Short -0.05  6.21  9.81 11.57 12.79 14.07 14.95 17.88 19.67 20.85 21.81 25.86
##   q95th
## 1 27.69
## 2 30.20
```

```r
# Calculate the percentile difference score observed between the mean scores
# of all combinations of the ASAQ Representative Set 2024 for each construct
# and dimension based on the short and long version of the ASAQ
percentileDiffLongTwoASAQscore_combinedData <-
  calcPercentileASAQscore(calcDiffTwoASAQscore(name29ASAs,
                                               longASAQscores_combinedData,
                                               constructASAQdesc$CABR),
                          probs, constructASAQdesc$CABR, probTitle
                          )
percentileDiffShortTwoASAQscore_combinedData <-
  calcPercentileASAQscore(calcDiffTwoASAQscore(name29ASAs,
                                               shortASAQscores_combinedData,
                                               constructASAQdesc$CABR),
                          probs, constructASAQdesc$CABR, probTitle)
```

5 Using the ASAQ

5.1 Choosing the Long or Short Version

5.2 Sample Size

```r
# Power analysis:
effectSizeLongASAQConstructScore_combinedData <-
  calcEffectSizeASAQConstructScore(name29ASAs,
                                   longASAQConstructsScore_combinedData,
                                   constructASAQdesc$CABR)
effectSizeShortASAQConstructScore_combinedData <-
  calcEffectSizeASAQConstructScore(name29ASAs,
                                   shortASAQConstructsScore_combinedData,
                                   constructASAQdesc$CABR)
```

```r
# Calculate the percentile scores of the effect size
percentileEffectSizeLongASAQConstructScore_combinedData <-
  calcPercentileASAQscore(effectSizeLongASAQConstructScore_combinedData,
                          probs, constructASAQdesc$CABR, probTitle)
percentileEffectSizeShortASAQConstructScore_combinedData <-
  calcPercentileASAQscore(effectSizeShortASAQConstructScore_combinedData,
                          probs, constructASAQdesc$CABR, probTitle)

# Calculate minimum sample size for comparing two or more agents:
samplePowerAnalysisLongASAQConstructScore_combinedData <-
  calcSamplePowerAnalysisASAQConstructScore(
    calcPercentileASAQscore(effectSizeLongASAQConstructScore_combinedData,
                          probsSML, constructASAQdesc$CABR, probTitleSML),
    constructASAQdesc$CABR, probTitleSML)
samplePowerAnalysisShortASAQConstructScore_combinedData <-
  calcSamplePowerAnalysisASAQConstructScore(
    calcPercentileASAQscore(effectSizeShortASAQConstructScore_combinedData,
                          probsSML, constructASAQdesc$CABR, probTitleSML),
    constructASAQdesc$CABR, probTitleSML)

# Get max sample size for studies comparing two ASAs based on the power analysis
maxSamplePowerAnalysisASAQConstructScore_combinedData <-
  getMaxSamplePowerAnalysis(samplePowerAnalysisLongASAQConstructScore_combinedData,
                            samplePowerAnalysisShortASAQConstructScore_combinedData)
```

Table 10: Most conservative sample size estimations for studies comparing two ASAs with .80 power and .05 alpha level.

```r
maxSamplePowerAnalysisASAQConstructScore_combinedData
```

```
##      Version Small_q25th Medium_q50th Large_q75th
## 1  Long ASAQ         485          116          41
## 2 Short ASAQ         614          154          53
```

```r
# Calculate minimum sample size for evaluating an ASA:
probs5th <- c(.05, .10, .15, .20, .25, .30, .35, .40, .45, .50, .55, .60, .65, .70,
              .75, .80, .85, .90, .95)
sampleConfIntervLongASAQConstructScore_combinedData_p5th <-
  calcSampleConfIntervASAQConstructScore(
    name29ASAs,
    longASAQConstructsScore_combinedData,
    longASAQscores_combinedData,
    probs5th,
    constructASAQdesc$CABR)
sampleConfIntervShortASAQConstructScore_combinedData_p5th <-
  calcSampleConfIntervASAQConstructScore(
    name29ASAs,
    shortASAQConstructsScore_combinedData,
    shortASAQscores_combinedData,
    probs5th,
    constructASAQdesc$CABR)

probs10th <- c(.10, .20, .30, .40, .50, .60, .70, .80, .90)
sampleConfIntervLongASAQConstructScore_combinedData_p10th <-
  calcSampleConfIntervASAQConstructScore(
```

```r
    name29ASAs,
    longASAQConstructsScore_combinedData,
    longASAQscores_combinedData,
    probs10th,
    constructASAQdesc$CABR)
sampleConfIntervShortASAQConstructScore_combinedData_p10th <-
  calcSampleConfIntervASAQConstructScore(
    name29ASAs,
    shortASAQConstructsScore_combinedData,
    shortASAQscores_combinedData,
    probs10th,
    constructASAQdesc$CABR)

probs20th <- c(.20, .40, .60, .80)
sampleConfIntervLongASAQConstructScore_combinedData_p20th <-
  calcSampleConfIntervASAQConstructScore(
    name29ASAs,
    longASAQConstructsScore_combinedData,
    longASAQscores_combinedData,
    probs20th,
    constructASAQdesc$CABR)
sampleConfIntervShortASAQConstructScore_combinedData_p20th <-
  calcSampleConfIntervASAQConstructScore(
    name29ASAs,
    shortASAQConstructsScore_combinedData,
    shortASAQscores_combinedData,
    probs20th,
    constructASAQdesc$CABR)

probs25th <- c(.25, .50, .75)
sampleConfIntervLongASAQConstructScore_combinedData_p25th <-
  calcSampleConfIntervASAQConstructScore(
    name29ASAs,
    longASAQConstructsScore_combinedData,
    longASAQscores_combinedData,
    probs25th,
    constructASAQdesc$CABR)
sampleConfIntervShortASAQConstructScore_combinedData_p25th <-
  calcSampleConfIntervASAQConstructScore(
    name29ASAs,
    shortASAQConstructsScore_combinedData,
    shortASAQscores_combinedData,
    probs25th,
    constructASAQdesc$CABR)

# Calculate maximum sample size for evaluating an ASA based on the confident interval
maxSampleSizeConfidenceIntervalASAQConstructScore_combinedData <-
  getMaxSampleSizeConfidenceIntervalASAQConstructScore(
   sampleConfIntervLongASAQConstructScore_combinedData_p5th,
   sampleConfIntervShortASAQConstructScore_combinedData_p5th,
   sampleConfIntervLongASAQConstructScore_combinedData_p10th,
   sampleConfIntervShortASAQConstructScore_combinedData_p10th,
   sampleConfIntervLongASAQConstructScore_combinedData_p20th,
```

```
  sampleConfIntervShortASAQConstructScore_combinedData_p20th,
  sampleConfIntervLongASAQConstructScore_combinedData_p25th,
  sampleConfIntervShortASAQConstructScore_combinedData_p25th)
```

Table 11: Sample size for studies investigating a single ASA (and comparing it with the ASAQ representative set 2024) that are interested in all ASAQ constructs, for the various error margins (percentiles), specific confidence intervals (CI), and for both ASAQ versions. In bold are the suggested sample sizes considered appropriate in most studies. . . .

```
maxSampleSizeConfidenceIntervalASAQConstructScore_combinedData
```

```
##   PERC LONG_90CI LONG_95CI LONG_97.5CI LONG_99CI SHORT_90CI SHORT_95CI
## 1   5%       689       979        1280      1691        871       1237
## 2  10%       201       286         374       493        350        497
## 3  20%        70       100         130       172         76        108
## 4  25%        46        66          86       114         68         97
##   SHORT_97.5CI SHORT_99CI
## 1         1618       2137
## 2          650        859
## 3          141        186
## 4          126        167
```

5.3 Reporting and Visualising Your Results

6 Discussion and Conclussion

```
# registered participants active in the past 90 days (retrieved on 17-07-2024)
activeTotal = 216627
man = 65603 # Man including Trans Male/Trans Man
woman = 94475 # Woman including Trans Female/Trans Woman
nonBinary = 3340 #Non-binary (would like to give more detailed)
notSay = 1138 #Rather not say
genderUnknown = activeTotal - man - woman - nonBinary - notSay
age18to25 = 59734
age26to35 = 79101
age36to45 = 40597
age46to55 = 22222
age56to65 = 10780
ageOlder65 = 4063
ageUnknown = activeTotal-age18to25-age26to35-age36to45-age46to55- age56to65-ageOlder65
```

. . . Although we refrained from collecting demographic data such as gender and age, the gender distribution of participants registered on this platform was 30.3% (Men), 43.6% (Women), 1.5% (non-Binary), and 24.6% (not reported), and the age distribution was 27.6% (18-25 years), 36.5% (26-35 years), 18.7% (36-45 years), 10.3% (46-55 years), 5.0% (56-65 years), 1.9% (older than 65) and 0.1% (not reported). . . .

6.1 Future Work

Acknowledgement

Appendix A The Artificial-Social-Agent Questionnaire

Appendix B The Short Version of The Artificial-Social-Agent Questionnaire

Appendix C Artificial Social Agents used in Studies

Table C.1: The stimuli used in studies: 26 ASAs, a dog, a fish and a zombie.

```
calcTotalLongASAQscore(longASAQscores_combinedData)
```

```
##                      ASA ASAQ_SCORE
## 1                   AIBO         19
## 2                  ALEXA         10
## 3                  ALICE         12
## 4                    AMY          9
## 5                CHAPPIE         18
## 6                   C3PO         18
## 7               DEEPBLUE          7
## 8                    DOG         29
## 9                  EFFIE         -1
## 10              THE FISH         32
## 11                 FURBY         13
## 12                FURHAT         14
## 13              GEMINOID         18
## 14              HAL 9000         14
## 15                  iCAT         -2
## 16                  KITT         16
## 17                  LOLA         16
## 18                MARCUS         25
## 19                   NAO         23
## 20                  PARO         19
## 21                POPPIE         14
## 22            ROBOT BOSS          0
## 23                   SAM         25
## 24                 SARAH         22
## 25            SIM SENSEI         17
## 26                  SIRI         13
## 27 THE AMBIENT LIGHT TV           3
## 28        THE NEGOTIATOR         14
## 29            THE ZOMBIE         10
```

Appendix D Statistical Analysis based on the Combined Studies Mid-2021 and 2022

Table D.1: The relative frequency of how often a score was used (on items, n=1066) based on the long version of the ASAQ.

```
showTable(relFreqLongASAQConstructsScore_combinedData, constructASAQdesc$CABR,
          constructASAQdesc$CNAME, 0, 1, 1, 1, 1, 1, 1)
```

```
##     CABR                      CNAME Min3 Min2 Min1 Zero Plus1 Plus2 Plus3
## 1    HLA       Human-Like Appearance 0.37 0.09 0.08 0.07  0.15  0.12  0.12
## 2    HLB         Human-Like Behavior 0.16 0.11 0.12 0.11  0.24  0.16  0.11
## 3     NA         Natural Appearance 0.22 0.10 0.11 0.13  0.19  0.13  0.11
## 4     NB           Natural Behavior 0.26 0.10 0.10 0.12  0.18  0.12  0.12
## 5    AAS    Agent’s Appearance Suit. 0.03 0.03 0.04 0.14  0.23  0.25  0.27
## 6     AU           Agent’s Usability 0.03 0.03 0.05 0.16  0.23  0.26  0.24
## 7     PF                 Performance 0.02 0.03 0.06 0.19  0.22  0.26  0.22
## 8     AL         Agent's Likeability 0.11 0.06 0.07 0.16  0.17  0.18  0.25
## 9     AS         Agent's Sociability 0.11 0.10 0.11 0.17  0.22  0.17  0.12
## 10   APP     Agent's Personality Pr. 0.15 0.09 0.12 0.15  0.19  0.16  0.13
## 11   UAA    User Acceptance of the A. 0.04 0.04 0.07 0.20  0.18  0.21  0.26
## 12    AE        Agent's Enjoyability 0.05 0.05 0.08 0.13  0.19  0.22  0.29
## 13    UE           User's Engagement 0.02 0.02 0.04 0.08  0.20  0.29  0.36
## 14    UT                User's Trust 0.08 0.06 0.07 0.31  0.19  0.17  0.12
## 15   UAL          User Agent Alliance 0.08 0.07 0.09 0.21  0.25  0.18  0.12
## 16    AA       Agent's Attentiveness 0.03 0.02 0.05 0.08  0.21  0.25  0.36
## 17    AC           Agent's Coherence 0.02 0.03 0.06 0.14  0.16  0.24  0.34
## 18    AI      Agent's Intentionality 0.09 0.06 0.08 0.16  0.21  0.20  0.19
## 19    AT                    Attitude 0.04 0.05 0.08 0.15  0.19  0.21  0.28
## 20    SP             Social Presence 0.18 0.12 0.14 0.18  0.19  0.12  0.07
## 21   IIS Interaction Impact on Self. 0.06 0.06 0.08 0.30  0.20  0.18  0.12
## 22   AEI  Agent's Emotional Int. Pr. 0.31 0.12 0.11 0.14  0.15  0.10  0.07
## 23   UEP     User's Emotion Presence 0.08 0.07 0.08 0.16  0.24  0.20  0.16
## 24   UAI         User Agent Interplay 0.07 0.06 0.08 0.18  0.25  0.20  0.16
##     Description Min3 Min2 Min1 Zero Plus1 Plus2 Plus3
## 1         Mean: 0.11 0.07 0.08 0.16  0.20  0.19  0.19
## 2           SD: 0.10 0.03 0.03 0.06  0.03  0.05  0.09
## 3       Median: 0.08 0.06 0.08 0.16  0.20  0.19  0.16
## 4          Min: 0.02 0.02 0.04 0.07  0.15  0.10  0.07
## 5          Max: 0.37 0.12 0.14 0.31  0.25  0.29  0.36
```

Table D.2: The relative frequency of how often a score was used (n=1066) based on the short version of the ASAQ.

```
showTable(relFreqShortASAQConstructsScore_combinedData, constructASAQdesc$CABR,
          constructASAQdesc$CNAME, 0, 1, 1, 1, 1, 1, 1)
```

```
##     CABR                      CNAME Min3 Min2 Min1 Zero Plus1 Plus2 Plus3
## 1    HLA       Human-Like Appearance 0.39 0.08 0.08 0.06  0.14  0.11  0.13
## 2    HLB         Human-Like Behavior 0.14 0.10 0.12 0.09  0.26  0.18  0.12
## 3     NA         Natural Appearance 0.21 0.12 0.14 0.11  0.18  0.12  0.12
## 4     NB           Natural Behavior 0.15 0.09 0.11 0.10  0.23  0.17  0.15
## 5    AAS    Agent’s Appearance Suit. 0.04 0.03 0.04 0.13  0.22  0.25  0.29
## 6     AU           Agent’s Usability 0.02 0.03 0.04 0.16  0.21  0.27  0.27
## 7     PF                 Performance 0.02 0.02 0.04 0.15  0.20  0.30  0.27
```

```
## 8    AL         Agent's Likeability 0.09 0.05 0.06 0.19  0.16  0.19  0.26
## 9    AS         Agent's Sociability 0.17 0.15 0.13 0.20  0.18  0.11  0.07
## 10   APP     Agent's Personality Pr. 0.09 0.06 0.11 0.17  0.25  0.19  0.13
## 11   UAA   User Acceptance of the A. 0.04 0.03 0.04 0.23  0.19  0.21  0.26
## 12   AE        Agent's Enjoyability 0.06 0.07 0.11 0.16  0.17  0.19  0.25
## 13   UE           User's Engagement 0.01 0.02 0.03 0.08  0.21  0.32  0.33
## 14   UT                User's Trust 0.06 0.07 0.10 0.22  0.24  0.19  0.13
## 15   UAL         User Agent Alliance 0.12 0.10 0.09 0.30  0.20  0.12  0.07
## 16   AA       Agent's Attentiveness 0.03 0.03 0.04 0.10  0.26  0.26  0.28
## 17   AC           Agent's Coherence 0.02 0.02 0.06 0.14  0.16  0.26  0.34
## 18   AI      Agent's Intentionality 0.07 0.05 0.08 0.15  0.16  0.22  0.27
## 19   AT                    Attitude 0.03 0.05 0.08 0.14  0.23  0.20  0.27
## 20   SP             Social Presence 0.17 0.10 0.13 0.21  0.19  0.13  0.07
## 21   IIS Interaction Impact on Self. 0.05 0.05 0.06 0.25  0.24  0.20  0.15
## 22   AEI  Agent's Emotional Int. Pr. 0.25 0.12 0.12 0.13  0.16  0.12  0.10
## 23   UEP     User's Emotion Presence 0.08 0.07 0.08 0.15  0.23  0.20  0.18
## 24   UAI        User Agent Interplay 0.09 0.08 0.09 0.23  0.23  0.17  0.10
##    Description Min3 Min2 Min1 Zero Plus1 Plus2 Plus3
## 1        Mean: 0.10 0.07 0.08 0.16  0.20  0.20  0.19
## 2          SD: 0.09 0.04 0.03 0.06  0.04  0.06  0.09
## 3      Median: 0.08 0.06 0.08 0.15  0.21  0.19  0.16
## 4         Min: 0.01 0.02 0.03 0.06  0.14  0.11  0.07
## 5         Max: 0.39 0.15 0.14 0.30  0.26  0.32  0.34
```

Table D.3 - Table D.6: The ASAQ scores of the ASAQ Representative Set 2024 (n=29) based on the long version of ASAQ (n=1066).

```r
showTableASA(longASAQscores_combinedData,
             calcASAQscores_StdDev(name29ASAs, longASAQConstructsScore_combinedData),
             calcTotalLongASAQscore(longASAQscores_combinedData),
             getSampleASA(name29ASAs, combinedData),
             constructASAQdesc$CABR, constructASAQdesc$CNAME)
```

```
##    CABR                       CNAME AIBO_M AIBO_SD ALEXA_M ALEXA_SD ALICE_M
## 1   HLA       Human-Like Appearance  -2.54    0.78   -2.47     0.90    0.96
## 2   HLB         Human-Like Behavior  -1.59    1.11   -0.34     1.35    0.21
## 3    NA           Natural Appearance   0.04    1.47   -1.30     1.02    0.11
## 4    NB            Natural Behavior  -0.30    1.30   -1.06     1.23   -1.09
## 5   AAS     Agent’s Appearance Suit.   2.06    0.81    1.13     1.36    1.44
## 6    AU            Agent’s Usability   1.78    0.77    2.02     0.97    1.62
## 7    PF                  Performance   1.56    0.95    1.78     0.77    1.05
## 8    AL         Agent's Likeability   1.48    1.23    0.77     1.19    0.77
## 9    AS         Agent's Sociability   0.93    1.36   -0.03     1.24    0.01
## 10  APP     Agent's Personality Pr.   0.32    1.14   -0.53     1.40   -0.64
## 11  UAA   User Acceptance of the A.   1.82    0.98    1.94     1.00    0.98
## 12   AE        Agent's Enjoyability   1.96    0.97    1.30     1.13    0.95
## 13   UE           User's Engagement   2.19    0.97    1.54     1.06    1.93
## 14   UT                User's Trust  -0.09    1.12    1.01     1.12    0.73
## 15  UAL         User Agent Alliance   0.36    1.17    0.60     0.99    0.48
## 16   AA       Agent's Attentiveness   1.85    0.96    1.80     0.98    2.13
## 17   AC           Agent's Coherence   1.76    0.89    1.89     0.89    1.65
## 18   AI      Agent's Intentionality   0.13    1.42    0.61     1.06    0.44
## 19   AT                    Attitude   2.37    0.67    1.71     0.86    1.08
## 20   SP             Social Presence   0.03    1.45   -0.77     1.41   -0.98
## 21  IIS Interaction Impact on Self.   1.06    1.16    0.74     0.92    0.16
```

```
## 22  AEI  Agent's Emotional Int. Pr.  -0.69    1.58   -1.71     1.45   -1.46
## 23  UEP     User's Emotion Presence   1.51    0.90   -0.38     1.15   -0.33
## 24  UAI        User Agent Interplay   1.30    1.22    0.13     1.09    0.25
##    ALICE_SD AMY_M AMY_SD CHAPPIE_M CHAPPIE_SD C3PO_M C3PO_SD DEEPBLUE_M
## 1      1.58  0.88   1.38     -1.09       1.54  -0.31    1.72      -1.96
## 2      1.34  0.09   1.51      0.31       1.09   0.42    1.29      -0.55
## 3      1.18 -0.25   1.18     -0.92       1.16  -0.64    1.18      -1.10
## 4      1.14 -0.85   1.40      0.16       1.36   0.04    1.28      -1.14
## 5      1.08  1.21   1.27      0.95       1.28   1.61    0.84       1.09
## 6      1.25  1.28   0.83      0.75       1.09   1.07    1.31       0.80
## 7      1.38  0.87   1.08      1.13       0.85   1.15    1.28       1.92
## 8      1.06  0.08   1.28      1.27       0.98   1.44    1.26       0.33
## 9      1.42 -0.28   1.25      0.63       1.07   0.42    1.20      -1.23
## 10     1.57 -0.44   1.22      0.77       1.42   1.31    1.38      -1.31
## 11     1.09  0.63   0.98      1.39       1.13   0.48    1.51       1.34
## 12     1.12  0.31   1.09      1.82       0.88   1.10    1.38       1.18
## 13     0.92  1.31   0.93      2.04       0.77   1.43    0.94       1.80
## 14     1.20  0.61   0.93      0.07       1.14   1.20    1.12       1.18
## 15     1.06  0.10   1.04      0.65       0.89   0.70    1.06       0.63
## 16     1.04  1.66   1.11      1.15       1.19   1.73    0.91       1.32
## 17     0.94  1.50   1.01      1.05       0.95   1.33    1.07       2.11
## 18     1.35  0.33   1.44      0.18       1.39   1.41    0.97       1.54
## 19     1.33  0.36   1.05      1.86       1.04   0.03    1.72       1.47
## 20     1.32 -0.46   1.41      0.25       1.21  -0.27    1.21      -1.21
## 21     0.97 -0.10   0.81      0.88       0.98   0.48    1.15       0.83
## 22     1.36 -0.92   1.40      0.26       1.37   0.86    1.20      -2.17
## 23     1.27  0.30   1.03      1.18       1.20   0.13    0.96      -0.40
## 24     0.91  0.69   0.95      1.02       1.12   0.61    0.89       0.17
##    DEEPBLUE_SD DOG_M DOG_SD EFFIE_M EFFIE_SD THE FISH_M THE FISH_SD FURBY_M
## 1         1.56 -1.91   1.28    0.62     1.68      -1.87        1.24   -2.14
## 2         1.61 -0.62   1.47   -0.19     1.65      -0.16        1.61   -0.14
## 3         1.20  1.70   0.82   -0.35     1.51       1.85        1.06   -0.85
## 4         1.55  1.89   1.00   -1.41     1.37       2.21        0.84   -0.61
## 5         1.27  1.85   0.96    0.67     1.49       2.14        0.86    1.80
## 6         1.25  0.42   1.07    0.85     1.44       0.81        1.26    1.92
## 7         0.97  1.28   1.50    0.58     1.33       1.69        0.76    1.16
## 8         1.07  2.31   0.79   -0.32     1.51       2.10        0.74    0.91
## 9         1.62  1.48   1.04   -0.53     1.52       1.22        0.82    0.73
## 10        1.43  1.47   1.04   -0.60     1.42       1.39        0.86    0.74
## 11        1.06  1.99   0.89    0.03     1.35       1.58        0.93    1.02
## 12        0.98  2.29   0.76    0.06     1.46       2.32        0.75    1.44
## 13        1.01  2.33   0.60    0.81     1.49       1.78        0.93    1.50
## 14        1.23  0.21   1.12    0.11     1.12       0.05        1.10   -0.46
## 15        1.25  1.03   1.17   -0.17     1.33       1.14        0.83   -0.06
## 16        1.49  1.91   1.18    0.53     1.48       1.98        0.94    1.14
## 17        0.88  1.07   1.10    0.68     1.43       1.74        1.16    1.41
## 18        1.31  0.21   1.05   -0.11     1.38       1.42        0.93   -0.49
## 19        1.06  2.50   0.82    0.31     1.26       2.32        0.82    1.56
## 20        1.58  0.48   1.05   -0.97     1.48       0.54        1.22   -0.12
## 21        1.07  1.41   1.04   -0.15     1.26       1.22        1.05    0.63
## 22        1.27  1.10   1.27   -1.21     1.69       1.15        0.95   -0.15
## 23        1.35  1.51   0.91   -0.19     1.43       1.55        1.02    1.03
## 24        1.07  1.58   1.08   -0.18     1.41       1.68        0.71    1.03
##    FURBY_SD FURHAT_M FURHAT_SD GEMINOID_M GEMINOID_SD HAL 9000_M HAL 9000_SD
```

```
## 1       1.22    -0.76      1.77       2.09        1.21      -2.08         1.15
## 2       1.71    -0.29      1.53       0.14        1.26       0.23         1.49
## 3       1.28    -0.82      1.40       0.75        1.07      -1.20         1.16
## 4       1.41    -1.09      1.19      -0.74        1.37      -0.36         1.35
## 5       1.14     0.79      1.68       1.90        0.87       1.39         0.99
## 6       0.98     1.71      1.00       1.27        1.13       1.39         1.00
## 7       1.07     1.50      0.79       1.37        0.98       1.18         1.29
## 8       1.59     0.69      1.26       0.87        1.40       0.36         1.45
## 9       1.43     0.15      1.21       0.59        1.20       0.05         1.39
## 10      1.43    -0.54      1.04      -0.13        1.54       0.29         1.34
## 11      1.34     1.05      1.48       1.10        1.13       1.36         1.11
## 12      1.37     1.23      1.04       1.29        1.31       0.86         1.26
## 13      1.11     2.01      0.81       1.72        0.94       2.12         1.02
## 14      1.37     1.04      1.00       0.30        1.37       0.41         1.40
## 15      1.32     0.83      0.95       0.59        0.92       0.84         1.08
## 16      1.30     2.13      0.86       1.75        0.90       2.10         0.79
## 17      1.27     2.04      0.82       1.25        0.98       1.61         1.21
## 18      1.32     0.76      1.14       0.52        1.53       1.80         0.98
## 19      1.28     1.46      1.40       1.28        1.04       0.41         1.71
## 20      1.75    -0.27      1.38      -0.02        1.20      -0.26         1.17
## 21      1.33     0.29      0.95       0.54        1.02       0.75         1.15
## 22      1.76    -1.48      1.15      -1.18        1.39      -1.06         1.33
## 23      1.24     0.81      1.24       0.06        1.22       0.80         1.21
## 24      1.10     0.55      1.07       0.55        1.07       0.68         1.00
##     iCAT_M iCAT_SD KITT_M KITT_SD LOLA_M LOLA_SD MARCUS_M MARCUS_SD NAO_M NAO_SD
## 1    -2.21    1.23  -2.01    1.31   1.14    1.55     1.69      1.13 -0.93   1.55
## 2    -1.28    1.31   0.52    1.38   0.58    1.52     1.70      0.97  0.74   1.25
## 3    -1.50    1.07  -0.94    1.31   0.62    1.21     0.67      1.21 -0.57   1.33
## 4    -1.88    0.97  -0.22    1.37  -0.57    1.25     1.21      1.13 -0.36   1.51
## 5     0.49    1.49   1.31    0.98   1.45    1.24     1.41      1.02  1.74   0.94
## 6     1.19    1.25   1.60    1.18   1.75    1.18     0.65      1.25  1.00   1.15
## 7     0.94    1.04   1.11    1.17   1.22    1.10     1.09      0.87  1.31   1.01
## 8    -0.57    1.28   1.21    1.22   0.59    1.55     0.41      1.09  1.74   1.33
## 9    -0.35    1.56   0.44    1.42   0.45    1.32     0.75      1.07  0.97   1.13
## 10   -0.52    1.45   0.89    1.39  -0.20    1.40     1.35      1.10  1.06   1.26
## 11    0.66    1.27   0.92    1.44   0.46    1.25     0.76      1.09  1.57   1.23
## 12    0.47    1.18   1.34    0.99   0.64    1.47     0.71      1.19  1.91   1.06
## 13    1.67    1.02   1.44    1.08   1.28    1.12     2.08      0.89  2.11   0.73
## 14   -0.03    1.01   0.99    1.36   1.08    1.06     0.31      0.97  0.51   1.17
## 15   -0.26    1.08   0.98    1.04   0.68    1.11     1.07      0.84  0.94   1.14
## 16    1.38    1.23   1.72    1.08   2.22    0.82     1.96      0.94  1.59   1.16
## 17    1.68    0.90   1.76    1.06   1.95    0.90     1.04      1.08  1.61   0.86
## 18    0.07    1.22   1.50    0.98   0.68    1.40     1.63      0.96  0.82   1.05
## 19    1.10    1.43   0.21    1.48   0.33    1.12    -0.01      1.24  1.90   0.99
## 20   -1.12    1.35  -0.41    1.37   0.05    1.19     0.75      1.50  0.40   1.46
## 21   -0.08    1.03   0.80    1.27  -0.06    1.22     0.24      0.84  1.12   1.34
## 22   -1.84    1.27  -1.07    1.67  -1.42    1.32     0.78      1.36  0.07   1.80
## 23    0.26    1.22   0.72    1.12   0.33    1.14     1.24      0.93  0.99   1.05
## 24    0.06    1.24   1.06    1.06   0.54    0.97     1.40      0.88  1.14   1.27
##     PARO_M PARO_SD POPPIE_M POPPIE_SD ROBOT BOSS_M ROBOT BOSS_SD SAM_M SAM_SD
## 1    -2.41    1.02     0.64      1.42         -1.18          1.58 -1.31   1.69
## 2    -1.09    1.25     0.51      1.50         -0.06          1.42  1.58   1.18
## 3     0.38    1.35    -0.31      1.35         -1.24          1.12 -0.41   1.43
## 4    -0.48    1.16    -0.38      1.37         -0.68          1.46  0.42   1.22
```

```
## 5    1.99    0.89     0.70      1.21         0.24          1.66  0.35   1.32
## 6    1.77    0.93     0.84      1.53         1.25          1.43  1.99   0.92
## 7    1.62    1.00     0.94      1.19         0.41          1.28  1.54   0.88
## 8    1.57    1.22     0.22      1.24        -0.71          1.45  1.38   1.20
## 9    1.25    1.00     0.75      1.24        -0.25          1.59  1.51   1.20
## 10   0.04    1.29    -0.04      1.22         0.05          1.38  0.41   1.27
## 11   2.05    0.95     1.35      1.23         0.01          1.15  1.44   1.22
## 12   2.03    0.93     1.03      1.26        -0.29          1.48  1.86   0.94
## 13   1.84    0.93     1.99      1.04         0.67          1.68  2.25   0.65
## 14  -0.04    0.96     0.32      1.15         0.28          1.17  0.79   1.02
## 15   0.56    0.99     0.22      1.13         0.15          1.37  0.77   1.01
## 16   1.40    1.11     1.50      1.24         0.84          1.24  2.16   0.90
## 17   1.46    1.02     1.22      1.34         0.85          1.00  1.87   0.98
## 18  -0.66    1.14     0.44      1.24         0.51          1.40  1.13   1.20
## 19   2.41    0.93     1.68      1.36        -0.63          1.52  1.41   1.35
## 20   0.23    0.91     0.04      1.45        -0.59          1.37  0.10   1.21
## 21   1.45    1.09     0.21      1.18        -0.68          1.47  0.90   1.20
## 22  -0.87    1.40    -0.73      1.60        -0.26          1.54 -0.06   1.60
## 23   1.88    0.92     0.49      1.19         0.49          1.44  1.72   0.70
## 24   0.91    1.00     0.68      1.34         0.68          1.14  1.22   1.23
##     SARAH_M SARAH_SD SIM SENSEI_M SIM SENSEI_SD SIRI_M SIRI_SD
## 1      1.66     1.14         1.28          1.42  -1.76    1.23
## 2      0.71     1.21         0.92          1.40  -0.28    1.42
## 3      0.87     1.21         0.61          1.29  -0.70    1.07
## 4     -0.32     1.35        -0.36          1.10  -0.81    1.08
## 5      1.74     0.92         1.55          1.29   0.80    1.23
## 6      1.71     1.10         1.25          1.01   2.21    0.73
## 7      1.72     0.88         1.04          1.21   2.07    0.90
## 8      0.77     1.18         0.61          1.27   0.77    1.08
## 9      0.04     1.37         0.13          1.43  -0.14    1.59
## 10    -0.17     1.34         0.01          1.17  -0.64    1.32
## 11     1.51     0.96         0.74          1.20   2.13    0.78
## 12     1.11     1.08         0.86          1.06   1.53    1.04
## 13     1.67     0.70         1.04          1.35   1.56    0.99
## 14     1.30     0.86         0.48          1.02   1.17    1.04
## 15     0.79     0.82         0.32          1.00   0.57    1.18
## 16     2.04     0.91         1.76          1.14   1.79    0.95
## 17     1.92     0.84         1.58          1.00   2.08    0.80
## 18     1.36     0.89         0.85          1.15   0.79    1.05
## 19     1.73     0.85         0.92          1.07   2.03    0.80
## 20     0.06     1.32        -0.06          1.50  -0.99    1.40
## 21     0.78     0.85         0.36          1.03   0.93    1.03
## 22    -1.36     1.47        -0.65          1.24  -1.91    1.11
## 23     0.15     1.03         0.36          1.01  -0.62    1.34
## 24     0.40     1.08         0.95          1.15   0.05    1.05
##     THE AMBIENT LIGHT TV_M THE AMBIENT LIGHT TV_SD THE NEGOTIATOR_M
## 1                    -2.19                    1.07             0.99
## 2                    -1.37                    1.17             0.65
## 3                    -0.84                    1.18             0.39
## 4                    -0.96                    1.39            -0.35
## 5                     1.81                    1.05             1.53
## 6                     1.29                    1.05             0.89
## 7                     0.95                    1.17             0.53
## 8                     1.06                    1.17             0.04
```

```
## 9                    -0.95                    1.14            -0.24
## 10                   -0.80                    1.44             0.08
## 11                    1.33                    1.26             0.52
## 12                    1.63                    1.16             0.63
## 13                    1.56                    1.32             2.25
## 14                   -0.30                    1.38             0.40
## 15                   -0.20                    1.46             0.35
## 16                    0.25                    1.60             1.40
## 17                    1.56                    1.12             1.48
## 18                   -0.06                    1.51             1.49
## 19                    1.67                    1.25             0.11
## 20                   -1.43                    1.25            -0.32
## 21                    0.93                    1.25             0.09
## 22                   -1.50                    1.41            -1.11
## 23                    0.44                    1.42             0.98
## 24                   -0.51                    1.55             0.80
##    THE NEGOTIATOR_SD THE ZOMBIE_M THE ZOMBIE_SD
## 1               1.35         1.79          1.25
## 2               1.26         0.52          1.12
## 3               1.22         0.41          1.11
## 4               1.40         0.75          1.23
## 5               0.92         1.01          1.27
## 6               1.31        -0.62          1.21
## 7               1.11         0.18          0.92
## 8               1.19        -0.60          1.37
## 9               1.35        -0.64          1.31
## 10              1.23         1.04          1.18
## 11              1.06        -0.26          1.50
## 12              1.31        -0.35          1.17
## 13              0.75         2.18          0.86
## 14              1.13        -0.41          1.18
## 15              1.05        -0.14          1.22
## 16              1.22         1.87          0.91
## 17              1.22         0.20          1.04
## 18              0.99         1.16          1.29
## 19              1.35        -0.54          1.52
## 20              1.25        -0.18          1.20
## 21              0.88        -0.68          1.34
## 22              1.33         0.35          1.41
## 23              1.24         1.76          0.90
## 24              0.79         0.86          1.00
##    Description AIBO ALEXA ALICE AMY CHAPPIE C3PO DEEPBLUE DOG EFFIE THE FISH
## 1  Sample Size   39    37    35  39      38   36       39  39    34       37
## 2   ASAQ score   19    10    12   9      18   18        7  29    -1       32
##   FURBY FURHAT GEMINOID HAL 9000 iCAT KITT LOLA MARCUS NAO PARO POPPIE
## 1    39     34       35       37   36   36   37     36  36   37     38
## 2    13     14       18       14   -2   16   16     25  23   19     14
##   ROBOT BOSS SAM SARAH SIM SENSEI SIRI THE AMBIENT LIGHT TV THE NEGOTIATOR
## 1         34  36    39         38   39                   35             36
## 2          0  25    22         17   13                    3             14
##   THE ZOMBIE
## 1         35
## 2         10
```

Table D.7 - Table D.10: The ASAQ scores of the ASAQ Representative Set 2024 (n=29) based on the short version of ASAQ (n=1066).

```
showTableASA(shortASAQscores_combinedData,
             calcASAQscores_StdDev(name29ASAs, shortASAQConstructsScore_combinedData),
             calcTotalLongASAQscore(shortASAQscores_combinedData),
             getSampleASA(name29ASAs, combinedData),
             constructASAQdesc$CABR, constructASAQdesc$CNAME)
```

```
##    CABR                          CNAME AIBO_M AIBO_SD ALEXA_M ALEXA_SD ALICE_M
## 1   HLA       Human-Like Appearance  -2.59    0.88   -2.70     0.81    1.34
## 2   HLB         Human-Like Behavior  -1.77    1.42    0.03     1.80    0.77
## 3    NA         Natural Appearance  -0.56    2.21   -1.03     1.98   -0.20
## 4    NB           Natural Behavior   0.69    1.88   -0.89     1.87   -0.40
## 5   AAS    Agent’s Appearance Suit.   2.00    1.19    1.49     1.66    1.51
## 6    AU          Agent’s Usability   1.95    0.86    2.22     0.98    1.60
## 7    PF                Performance   1.90    1.07    2.30     0.88    0.66
## 8    AL        Agent's Likeability   1.44    1.65    1.30     1.63    0.71
## 9    AS        Agent's Sociability   0.54    1.82   -1.00     1.67   -0.71
## 10  APP    Agent's Personality Pr.   0.82    1.65    0.03     1.88   -0.37
## 11  UAA  User Acceptance of the A.   1.74    1.09    2.05     1.25    0.77
## 12   AE       Agent's Enjoyability   1.41    1.45    0.54     1.76    0.03
## 13   UE          User's Engagement   2.31    1.26    1.54     1.24    1.51
## 14   UT               User's Trust   0.21    1.59    1.30     1.24    0.60
## 15  UAL        User Agent Alliance  -0.13    1.59   -0.08     1.64   -0.37
## 16   AA      Agent's Attentiveness   1.69    1.08    1.62     1.26    1.97
## 17   AC         Agent's Coherence   1.92    1.18    2.22     1.00    1.54
## 18   AI     Agent's Intentionality   0.59    2.09    1.14     1.90    1.11
## 19   AT                   Attitude   2.33    0.77    1.51     1.35    0.97
## 20   SP            Social Presence  -0.13    2.00   -0.81     1.85   -1.14
## 21  IIS Interaction Impact on Self.   1.28    1.45    1.22     1.40    0.57
## 22  AEI  Agent's Emotional Int. Pr.   0.05    2.26   -1.49     1.85   -0.86
## 23  UEP     User's Emotion Presence   1.82    1.10   -0.27     1.64   -0.34
## 24  UAI        User Agent Interplay   1.33    1.56   -0.65     1.62   -0.86
##    ALICE_SD AMY_M AMY_SD CHAPPIE_M CHAPPIE_SD C3PO_M C3PO_SD DEEPBLUE_M
## 1      1.68  1.13   1.67     -1.21       1.76  -0.19    2.10      -2.10
## 2      1.42  0.44   1.82      0.42       1.69   0.64    1.84      -0.90
## 3      1.62 -0.46   1.82     -1.13       1.60  -0.97    1.78      -1.15
## 4      2.05 -0.18   1.92      0.89       1.59   0.33    1.62      -0.87
## 5      1.67  1.13   1.59      0.87       1.70   1.19    1.60       1.18
## 6      1.26  1.51   1.10      0.71       1.37   1.28    1.56       1.28
## 7      1.85  0.90   1.48      1.29       1.04   1.53    1.34       2.51
## 8      1.62 -0.05   1.97      1.47       1.50   1.92    1.42       0.85
## 9      1.93 -1.05   1.54      0.13       1.47  -0.31    1.69      -1.54
## 10     1.90  0.03   1.56      0.68       1.54   1.39    1.71      -0.56
## 11     1.55  0.36   1.20      1.71       1.27   1.19    1.56       1.59
## 12     1.74 -0.26   1.79      1.47       1.47   1.42    1.70       0.33
## 13     1.22  1.10   1.23      2.13       0.91   0.78    1.64       1.69
## 14     1.82  0.33   1.36     -0.08       1.51   1.17    1.83       1.56
## 15     1.61 -0.23   1.51     -0.03       1.53   1.00    1.53       0.46
## 16     1.29  1.23   1.55      1.11       1.43   2.22    0.93       1.49
## 17     1.44  1.31   1.56      1.45       1.33   1.56    1.42       2.00
## 18     1.79  0.82   1.68      0.53       1.93   1.78    1.53       1.72
## 19     1.32  0.44   1.25      2.00       1.29   0.00    1.93       1.38
## 20     1.48 -0.18   1.86      0.42       1.59  -0.11    1.75      -1.38
```

```
## 21     1.31  0.51   1.39      1.21       1.34   0.94    1.49       1.10
## 22     1.96 -0.36   2.05      0.53       1.77   1.14    1.59      -2.41
## 23     1.53  0.03   1.46      1.55       1.52  -0.53    1.83      -0.03
## 24     1.80  0.38   1.33      0.79       1.32   0.31    1.58      -1.00
##    DEEPBLUE_SD DOG_M DOG_SD EFFIE_M EFFIE_SD THE FISH_M THE FISH_SD FURBY_M
## 1         1.60 -2.13   1.36    0.85     2.03      -2.19        1.56   -2.69
## 2         2.05 -0.51   2.00    0.18     1.82      -0.41        2.03    0.00
## 3         1.83  2.10   1.39   -0.56     2.05       2.16        1.01   -1.10
## 4         2.30  2.28   0.92   -1.00     1.71       2.57        0.87    0.21
## 5         1.54  2.28   1.23    0.44     1.91       2.14        1.23    1.87
## 6         1.41  0.74   1.53    1.03     1.45       1.24        1.40    2.18
## 7         0.79  1.23   1.80    0.71     1.51       1.62        1.11    1.51
## 8         1.37  2.62   0.75   -0.38     2.15       2.51        0.84    0.85
## 9         1.73  1.18   1.30   -1.09     1.75       0.43        1.32    0.00
## 10        1.96  1.21   1.44   -0.38     1.84       1.43        1.07    1.33
## 11        1.09  2.08   1.06   -0.15     1.64       1.62        1.42    1.00
## 12        1.66  2.03   1.39   -0.15     2.16       2.27        1.12    0.82
## 13        1.28  2.36   0.87    0.79     1.74       2.08        1.04    1.74
## 14        1.65  1.05   1.49    0.24     1.52       0.57        1.64   -0.59
## 15        1.79  0.82   1.70   -0.56     1.46       0.41        1.54   -0.54
## 16        1.67  1.87   1.28    0.29     1.92       1.68        1.25    0.90
## 17        1.19  1.33   1.81    0.62     1.97       1.65        1.44    1.13
## 18        1.90 -0.54   1.82    0.09     2.09       1.57        1.26   -0.62
## 19        1.46  2.49   0.97    0.47     1.50       2.19        1.31    1.54
## 20        1.90  1.03   1.61   -1.09     1.86       0.81        1.41    0.00
## 21        1.59  1.31   1.42   -0.03     1.82       0.76        1.42    0.90
## 22        1.14  1.51   1.54   -0.94     1.98       1.43        1.63    0.79
## 23        2.08  2.26   0.97   -0.15     1.88       1.70        1.08    1.10
## 24        1.86  1.26   1.58   -0.79     1.57       1.38        1.01    1.05
##    FURBY_SD FURHAT_M FURHAT_SD GEMINOID_M GEMINOID_SD HAL 9000_M HAL 9000_SD
## 1      0.80    -0.65      2.01       2.20        1.39      -2.14        1.58
## 2      2.20    -0.35      1.67       0.77        1.52       0.54        1.97
## 3      1.92    -0.97      1.88       0.71        1.89      -1.62        1.69
## 4      2.00    -0.82      1.80      -0.09        1.69       0.00        2.00
## 5      1.26     0.74      1.91       1.94        0.97       1.70        1.10
## 6      1.21     1.74      1.05       1.43        1.29       1.65        1.16
## 7      1.23     1.97      0.94       1.54        1.17       1.43        1.39
## 8      2.06     0.97      1.51       0.43        2.08       0.41        1.79
## 9      2.09    -0.47      1.46      -0.40        1.75      -0.38        1.80
## 10     1.74    -0.15      1.64       0.14        1.78       0.73        1.74
## 11     1.69     0.74      1.78       1.03        1.27       1.92        1.23
## 12     1.99     1.06      1.43       0.89        1.76       0.54        1.92
## 13     1.31     1.97      1.36       1.57        1.12       1.97        1.28
## 14     1.85     0.82      1.38       0.40        1.79       0.76        1.80
## 15     1.85     0.35      1.70       0.00        1.24       0.51        1.98
## 16     1.73     1.82      1.03       1.66        1.14       2.24        1.06
## 17     1.73     2.09      1.06       1.57        1.31       1.27        1.50
## 18     2.21     1.35      1.76       0.97        1.71       2.30        1.08
## 19     1.50     1.41      1.60       1.26        1.24       0.49        1.77
## 20     2.27    -0.26      1.54       0.20        1.45      -0.14        1.51
## 21     1.65     0.56      1.56       0.69        1.23       0.95        1.51
## 22     2.09    -1.26      1.69      -1.29        1.62      -0.92        1.79
## 23     1.73     1.00      1.81       0.23        1.65       0.65        1.64
## 24     1.82    -0.03      1.77       0.17        1.38       0.14        1.46
```

```
##    iCAT_M iCAT_SD KITT_M KITT_SD LOLA_M LOLA_SD MARCUS_M MARCUS_SD NAO_M NAO_SD
## 1   -2.19    1.51  -2.28    1.58   1.11    1.76     1.67      1.45 -1.17   1.75
## 2   -1.22    1.81   1.06    1.51   0.65    1.64     1.97      1.13  0.97   1.59
## 3   -1.81    1.62  -0.92    2.13   0.49    1.84     0.61      2.11 -0.89   1.89
## 4   -1.64    1.73   0.53    1.86   0.14    1.93     1.67      1.24  0.50   2.05
## 5    0.64    1.66   1.28    1.50   1.62    1.40     0.97      1.52  2.00   1.15
## 6    1.25    1.52   1.83    1.30   1.92    1.14     0.25      1.68  1.06   1.15
## 7    0.75    1.42   1.64    1.29   1.54    1.46     1.42      1.08  0.69   1.60
## 8   -0.75    1.75   1.72    1.45   0.41    2.15     0.58      1.57  2.00   1.60
## 9   -1.22    1.91  -0.25    2.01  -0.19    1.49     0.08      1.68  0.50   1.48
## 10   0.28    1.99   1.42    1.46   0.30    1.76     1.56      1.32  1.31   1.33
## 11   0.50    1.48   1.50    1.87   0.35    1.69     0.72      1.49  1.56   1.56
## 12  -0.50    1.73   1.69    1.12   0.27    1.81     1.31      1.88  1.75   1.61
## 13   1.39    1.34   1.61    1.36   1.32    1.27     2.06      1.04  1.78   1.12
## 14  -0.11    1.62   1.31    1.56   0.84    1.59     0.42      1.18  0.17   1.48
## 15  -0.86    1.71   0.83    1.48  -0.22    1.69     1.14      1.33  0.67   1.53
## 16   0.92    1.75   1.75    1.30   1.95    1.05     1.78      1.10  1.56   1.27
## 17   1.31    1.58   1.69    1.39   1.76    1.32     1.17      1.48  2.00   1.15
## 18  -0.08    1.87   1.69    1.49   1.11    1.93     1.83      1.30  1.14   1.69
## 19   1.11    1.53   0.67    1.79   0.24    1.59    -0.06      1.47  2.03   1.11
## 20  -1.14    1.90  -0.19    1.69  -0.08    1.86     0.53      1.65  0.50   1.90
## 21  -0.06    1.35   1.03    1.75   0.49    1.66     0.33      1.51  1.39   1.42
## 22  -1.83    1.54  -1.28    1.80  -1.22    1.58     0.69      1.88  0.47   2.25
## 23   0.44    1.46   0.78    1.84   0.54    1.71     1.39      1.38  1.00   1.47
## 24  -0.22    1.73   0.56    1.78  -0.38    1.53     1.22      1.42  1.19   1.62
##    PARO_M PARO_SD POPPIE_M POPPIE_SD ROBOT BOSS_M ROBOT BOSS_SD SAM_M SAM_SD
## 1   -2.62    1.01     0.95      1.54        -0.97          1.99 -1.75   1.86
## 2   -1.59    1.74     0.87      1.80         0.12          1.89  1.78   1.40
## 3    0.54    1.79    -0.18      1.72        -1.24          1.69 -0.42   2.41
## 4    0.54    1.61     0.45      1.81        -0.47          1.81  1.11   1.94
## 5    1.95    1.56     0.87      1.55         0.24          1.79  0.42   1.89
## 6    2.05    1.03     0.68      1.86         1.06          1.76  2.22   0.96
## 7    1.76    1.42     0.92      1.65         0.88          1.79  1.97   1.16
## 8    1.62    1.53     0.13      1.77        -0.65          2.12  1.72   1.34
## 9    0.84    1.57     0.42      1.65        -0.62          1.94  1.06   1.67
## 10   0.73    1.71     0.16      1.42         0.21          1.79  1.03   1.72
## 11   2.03    1.19     1.53      1.45         0.47          1.71  1.89   1.28
## 12   1.30    1.70    -0.13      2.20        -0.24          1.88  1.75   1.36
## 13   2.27    0.90     1.84      1.48         1.44          1.85  2.36   0.83
## 14   0.68    1.65     0.18      1.57         0.32          1.82  0.86   1.48
## 15  -0.11    1.74    -0.26      1.50        -0.41          1.83 -0.06   1.62
## 16   0.95    1.39     1.00      1.61         0.59          1.60  1.75   1.11
## 17   1.73    1.17     1.18      1.75         0.91          1.68  2.25   0.97
## 18  -0.38    1.38     0.61      1.76         0.79          1.82  1.53   1.58
## 19   2.49    1.02     1.63      1.57        -0.59          1.78  1.47   1.44
## 20   0.65    1.38     0.05      1.68        -0.50          1.81  0.58   1.65
## 21   1.65    1.48     0.37      1.76        -0.32          1.87  1.17   1.58
## 22  -0.30    1.98    -0.21      1.85        -0.06          2.01  0.42   2.06
## 23   2.05    0.97     0.61      1.62         0.62          1.81  1.69   1.37
## 24   0.62    1.57     0.37      1.73         0.62          1.72  1.25   1.20
##    SARAH_M SARAH_SD SIM SENSEI_M SIM SENSEI_SD SIRI_M SIRI_SD
## 1     1.87     1.26         1.42          1.57  -1.72    1.61
## 2     0.87     1.40         1.21          1.61  -0.03    1.77
## 3     1.00     1.56         0.71          1.74  -0.28    1.65
```

```
## 4     0.36     1.75         0.50          1.80  -0.46    1.85
## 5     1.85     1.01         1.66          1.49   0.90    1.68
## 6     1.72     1.30         1.45          1.33   2.26    0.88
## 7     1.87     1.10         1.26          1.37   2.28    0.89
## 8     0.59     1.73         0.53          1.57   1.38    1.29
## 9    -0.46     1.76        -0.26          1.73  -0.87    2.10
## 10    0.18     1.37         0.32          1.56   0.33    1.59
## 11    1.31     1.15         0.58          1.33   2.36    0.96
## 12    0.41     1.85         0.66          1.76   0.97    1.74
## 13    1.59     0.91         1.11          1.27   1.38    1.33
## 14    1.49     1.00         0.37          1.75   1.49    1.05
## 15    0.41     1.35        -0.79          1.23   0.03    1.72
## 16    1.79     1.15         1.61          1.31   1.36    1.58
## 17    2.08     1.09         1.61          1.35   2.10    1.14
## 18    1.69     1.28         1.24          1.75   1.87    1.40
## 19    1.62     1.04         0.84          1.42   2.05    0.97
## 20    0.03     1.71         0.05          1.80  -0.95    1.78
## 21    1.08     1.18         0.71          1.52   1.28    1.30
## 22   -0.90     1.82         0.16          1.60  -1.67    1.56
## 23    0.05     1.62        -0.45          1.74  -0.64    1.84
## 24   -0.10     1.19         0.79          1.61  -1.03    1.56
##    THE AMBIENT LIGHT TV_M THE AMBIENT LIGHT TV_SD THE NEGOTIATOR_M
## 1                   -2.20                    1.57             0.81
## 2                   -1.43                    1.72             0.72
## 3                   -0.60                    1.82             0.33
## 4                   -0.86                    2.03             0.25
## 5                    2.03                    0.89             1.72
## 6                    2.00                    1.19             1.03
## 7                    2.06                    1.30             1.17
## 8                    2.00                    1.28             0.03
## 9                   -1.69                    1.51            -0.64
## 10                  -0.49                    2.21             0.33
## 11                   1.57                    1.48             0.56
## 12                   1.86                    1.44             0.67
## 13                   1.74                    1.54             2.22
## 14                   0.66                    1.81             0.25
## 15                  -0.77                    1.85            -0.28
## 16                   0.17                    1.98             1.50
## 17                   1.69                    1.53             1.14
## 18                   0.69                    1.79             1.42
## 19                   1.46                    1.40             0.03
## 20                  -1.69                    1.66            -0.72
## 21                   1.34                    1.55             0.39
## 22                  -1.26                    1.74            -0.67
## 23                   0.66                    1.85             1.17
## 24                  -0.66                    1.88             0.81
##    THE NEGOTIATOR_SD THE ZOMBIE_M THE ZOMBIE_SD
## 1               1.79         2.00          1.35
## 2               1.54         1.37          1.35
## 3               1.77         0.29          1.58
## 4               1.79         1.74          1.31
## 5               1.26         0.60          1.72
## 6               1.50        -0.34          1.53
## 7               1.44         0.63          1.21
```

```
## 8               1.61         -0.54          2.06
## 9               1.57         -1.11          1.83
## 10              1.47          0.86          1.77
## 11              1.08         -0.20          1.80
## 12              1.84          1.00          1.39
## 13              0.93          2.20          0.90
## 14              1.40         -0.37          1.68
## 15              1.65         -0.80          1.71
## 16              1.38          1.29          1.23
## 17              1.78         -0.09          1.56
## 18              1.42          1.17          1.52
## 19              1.30         -0.40          1.70
## 20              1.65         -0.23          1.55
## 21              1.46         -0.51          1.90
## 22              1.96          0.23          2.06
## 23              1.83          2.31          0.93
## 24              1.51          1.31          1.18
##    Description AIBO ALEXA ALICE AMY CHAPPIE C3PO DEEPBLUE DOG EFFIE THE FISH
## 1  Sample Size   39    37    35  39      38   36       39  39    34       37
## 2   ASAQ score   21    12    10   9      19   20        7  32    -2       32
##   FURBY FURHAT GEMINOID HAL 9000 iCAT KITT LOLA MARCUS NAO PARO POPPIE
## 1    39     34       35       37   36   36   37     36  36   37     38
## 2    13     14       18       15   -5   20   15     25  24   21     14
##   ROBOT BOSS SAM SARAH SIM SENSEI SIRI THE AMBIENT LIGHT TV THE NEGOTIATOR
## 1         34  36    39          38   39                   35             36
## 2          2  28    22          17   14                    8             14
##   THE ZOMBIE
## 1         35
## 2         12
```

Table D.11: The percentile scores of the ASAQ constructs/dimensions based on the long version of the ASAQ representative set 2024 (n=1066).

```r
showTable(percentileLongASAQScore_combinedData, constructASAQdesc$CABR,
          constructASAQdesc$CNAME, 0, 1, 1, 1, 1, 1, 1)
```

```
##    CABR                      CNAME  q5th q10th q20th q25th q30th q40th q50th
## 1   HLA      Human-Like Appearance -2.45 -2.25 -2.11 -2.01 -1.94 -1.67 -1.09
## 2   HLB        Human-Like Behavior -1.34 -1.13 -0.42 -0.29 -0.24 -0.12  0.14
## 3    NA         Natural Appearance -1.28 -1.21 -0.93 -0.85 -0.83 -0.63 -0.35
## 4    NB           Natural Behavior -1.30 -1.10 -1.00 -0.85 -0.78 -0.60 -0.38
## 5   AAS   Agent’s Appearance Suit.  0.41  0.63  0.80  0.95  1.04  1.23  1.41
## 6    AU          Agent’s Usability  0.51  0.73  0.83  0.85  0.93  1.21  1.27
## 7    PF                Performance  0.46  0.57  0.94  0.95  1.04  1.12  1.16
## 8    AL        Agent's Likeability -0.59 -0.37  0.16  0.33  0.38  0.63  0.77
## 9    AS        Agent's Sociability -0.83 -0.55 -0.26 -0.24 -0.09  0.04  0.15
## 10  APP    Agent's Personality Pr. -0.74 -0.64 -0.53 -0.52 -0.35 -0.12  0.04
## 11  UAA  User Acceptance of the A.  0.02  0.37  0.59  0.66  0.75  0.99  1.10
## 12   AE       Agent's Enjoyability -0.15  0.26  0.64  0.71  0.86  1.04  1.18
## 13   UE          User's Engagement  0.91  1.23  1.44  1.50  1.55  1.67  1.78
## 14   UT               User's Trust -0.37 -0.13  0.02  0.07  0.15  0.30  0.40
## 15  UAL        User Agent Alliance -0.18 -0.15  0.13  0.22  0.33  0.50  0.59
## 16   AA      Agent's Attentiveness  0.65  1.08  1.35  1.40  1.44  1.67  1.75
## 17   AC          Agent's Coherence  0.75  1.00  1.16  1.25  1.36  1.48  1.58
## 18   AI     Agent's Intentionality -0.34 -0.07  0.16  0.21  0.38  0.52  0.68
```

```
## 19   AT                    Attitude -0.33  0.02  0.27  0.33  0.38  1.08  1.41
## 20   SP             Social Presence -1.18 -1.02 -0.85 -0.59 -0.44 -0.27 -0.18
## 21  IIS Interaction Impact on Self. -0.47 -0.11  0.03  0.16  0.22  0.38  0.63
## 22  AEI  Agent's Emotional Int. Pr. -1.88 -1.74 -1.46 -1.42 -1.30 -1.10 -0.92
## 23  UEP     User's Emotion Presence -0.39 -0.34  0.10  0.15  0.28  0.37  0.49
## 24  UAI        User Agent Interplay -0.09  0.06  0.22  0.40  0.54  0.62  0.68
##    q60th q70th q75th q80th q90th q95th
## 1  -0.40  0.78  0.96  1.05  1.67  1.75
## 2   0.29  0.51  0.52  0.61  0.78  1.31
## 3  -0.02  0.39  0.41  0.61  0.78  1.37
## 4  -0.36 -0.31 -0.22  0.09  0.84  1.62
## 5   1.51  1.69  1.74  1.81  1.92  2.03
## 6   1.37  1.67  1.71  1.76  1.94  2.01
## 7   1.27  1.45  1.54  1.58  1.73  1.87
## 8   0.85  1.15  1.27  1.41  1.61  1.96
## 9   0.45  0.69  0.75  0.83  1.22  1.39
## 10  0.25  0.61  0.77  0.95  1.32  1.37
## 11  1.35  1.42  1.51  1.58  1.95  2.02
## 12  1.30  1.49  1.63  1.84  1.97  2.19
## 13  1.91  2.02  2.08  2.11  2.20  2.25
## 14  0.50  0.77  0.99  1.02  1.17  1.19
## 15  0.65  0.74  0.79  0.83  0.99  1.05
## 16  1.80  1.90  1.96  2.01  2.13  2.15
## 17  1.64  1.75  1.76  1.87  1.97  2.06
## 18  0.81  1.15  1.36  1.41  1.51  1.59
## 19  1.55  1.70  1.73  1.88  2.33  2.40
## 20 -0.03  0.04  0.06  0.15  0.41  0.52
## 21  0.78  0.86  0.90  0.93  1.14  1.33
## 22 -0.70 -0.20 -0.06  0.14  0.79  1.00
## 23  0.81  1.01  1.18  1.35  1.58  1.74
## 24  0.85  0.99  1.03  1.09  1.32  1.51
##    Description  q5th q10th q20th q25th q30th q40th q50th q60th q70th q75th
## 1        Mean: -0.42 -0.20  0.05  0.14  0.24  0.43  0.60  0.77  1.01  1.10
## 2          SD:  0.85  0.89  0.89  0.87  0.87  0.87  0.80  0.73  0.65  0.64
## 3      Median: -0.36 -0.12  0.15  0.22  0.36  0.51  0.66  0.81  1.00  1.10
## 4         Min: -2.45 -2.25 -2.11 -2.01 -1.94 -1.67 -1.09 -0.70 -0.31 -0.22
## 5         Max:  0.91  1.23  1.44  1.50  1.55  1.67  1.78  1.91  2.02  2.08
##   q80th q90th q95th
## 1  1.20  1.47  1.65
## 2  0.61  0.53  0.46
## 3  1.22  1.54  1.68
## 4  0.09  0.41  0.52
## 5  2.11  2.33  2.40
```

Table D.12: The percentile scores of the ASAQ constructs/dimensions based on the short version of the ASAQ representative set 2024 (n=1066).

```r
showTable(percentileShortASAQScore_combinedData, constructASAQdesc$CABR,
          constructASAQdesc$CNAME, 0, 1, 1, 1, 1, 1, 1)
```

```
##    CABR                       CNAME  q5th q10th q20th q25th q30th q40th q50th
## 1   HLA       Human-Like Appearance -2.66 -2.60 -2.20 -2.19 -2.13 -1.74 -1.17
## 2   HLB         Human-Like Behavior -1.53 -1.26 -0.45 -0.35 -0.02  0.13  0.44
## 3    NA          Natural Appearance -1.47 -1.17 -1.06 -0.97 -0.95 -0.59 -0.46
## 4    NB            Natural Behavior -0.96 -0.88 -0.61 -0.46 -0.31  0.03  0.25
```

```
## 5   AAS    Agent’s Appearance Suit.  0.43  0.57  0.82  0.87  0.93  1.18  1.49
## 6    AU           Agent’s Usability  0.42  0.71  1.03  1.06  1.13  1.28  1.45
## 7    PF                 Performance  0.67  0.70  0.89  0.92  1.19  1.31  1.51
## 8    AL         Agent's Likeability -0.61 -0.41  0.09  0.41  0.41  0.58  0.85
## 9    AS         Agent's Sociability -1.41 -1.14 -1.02 -0.87 -0.68 -0.47 -0.38
## 10  APP     Agent's Personality Pr. -0.44 -0.37  0.03  0.14  0.17  0.28  0.33
## 11  UAA   User Acceptance of the A.  0.05  0.36  0.53  0.58  0.73  1.01  1.31
## 12   AE       Agent's Enjoyability -0.25 -0.16  0.17  0.33  0.46  0.66  0.89
## 13   UE           User's Engagement  0.92  1.10  1.39  1.44  1.52  1.59  1.74
## 14   UT                User's Trust -0.27 -0.09  0.20  0.24  0.28  0.37  0.57
## 15  UAL         User Agent Alliance -0.80 -0.78 -0.46 -0.37 -0.27 -0.20 -0.08
## 16   AA       Agent's Attentiveness  0.41  0.84  0.98  1.11  1.25  1.49  1.61
## 17   AC           Agent's Coherence  0.74  1.08  1.18  1.27  1.31  1.47  1.57
## 18   AI      Agent's Intentionality -0.47 -0.14  0.56  0.61  0.73  1.00  1.14
## 19   AT                    Attitude -0.26 -0.01  0.36  0.47  0.56  1.00  1.38
## 20   SP             Social Presence -1.29 -1.14 -0.87 -0.72 -0.41 -0.19 -0.13
## 21  IIS Interaction Impact on Self. -0.22 -0.03  0.38  0.49  0.53  0.69  0.90
## 22  AEI  Agent's Emotional Int. Pr. -1.77 -1.52 -1.27 -1.26 -1.11 -0.89 -0.36
## 23  UEP     User's Emotion Presence -0.50 -0.36 -0.07  0.03  0.12  0.55  0.65
## 24  UAI       User Agent Interplay -0.94 -0.81 -0.49 -0.22 -0.07  0.20  0.38
##    q60th q70th q75th q80th q90th q95th
## 1  -0.28  0.91  1.11  1.21  1.71  1.95
## 2   0.65  0.77  0.87  0.91  1.24  1.62
## 3  -0.22  0.31  0.49  0.57  0.77  1.66
## 4   0.43  0.52  0.54  0.77  1.68  2.07
## 5   1.65  1.80  1.87  1.94  2.01  2.09
## 6   1.64  1.79  1.92  1.97  2.19  2.22
## 7   1.54  1.71  1.87  1.93  2.10  2.29
## 8   1.23  1.46  1.62  1.72  2.00  2.31
## 9  -0.25  0.05  0.13  0.43  0.60  0.97
## 10  0.72  0.84  1.03  1.25  1.39  1.43
## 11  1.55  1.61  1.71  1.80  2.03  2.07
## 12  1.05  1.37  1.42  1.56  1.77  1.96
## 13  1.83  2.02  2.08  2.16  2.28  2.34
## 14  0.67  0.83  0.86  1.10  1.34  1.49
## 15 -0.01  0.38  0.41  0.48  0.82  0.93
## 16  1.67  1.75  1.78  1.81  1.95  2.12
## 17  1.68  1.75  1.92  2.00  2.09  2.17
## 18  1.22  1.48  1.57  1.69  1.79  1.86
## 19  1.47  1.58  1.63  2.01  2.22  2.43
## 20 -0.02  0.05  0.20  0.45  0.60  0.75
## 21  1.01  1.14  1.21  1.24  1.31  1.37
## 22 -0.09  0.20  0.42  0.49  0.86  1.32
## 23  0.96  1.14  1.39  1.61  1.87  2.18
## 24  0.62  0.80  1.05  1.21  1.27  1.33
##    Description  q5th q10th q20th q25th q30th q40th q50th q60th q70th q75th
## 1        Mean: -0.51 -0.31  0.00  0.11  0.22  0.45  0.66  0.86  1.09  1.21
## 2          SD:  0.89  0.92  0.89  0.89  0.87  0.84  0.80  0.71  0.62  0.61
## 3      Median: -0.45 -0.26  0.13  0.29  0.34  0.56  0.75  0.98  1.14  1.30
## 4         Min: -2.66 -2.60 -2.20 -2.19 -2.13 -1.74 -1.17 -0.28  0.05  0.13
## 5         Max:  0.92  1.10  1.39  1.44  1.52  1.59  1.74  1.83  2.02  2.08
##   q80th q90th q95th
## 1  1.35  1.58  1.79
## 2  0.58  0.54  0.49
```

```
## 3  1.41  1.74  1.96
## 4  0.43  0.60  0.75
## 5  2.16  2.28  2.43
```

Table D.13: The percentile scores of the difference of the ASAQ construct/dimension scores (based on the representative set 2024 of the long version of the ASAQ, n=1066).

```r
showTable(percentileDiffLongTwoASAQscore_combinedData, constructASAQdesc$CABR,
          constructASAQdesc$CNAME, 0, 1, 1, 1, 1, 1, 1)
```

```
##    CABR                       CNAME q5th q10th q20th q25th q30th q40th q50th
## 1   HLA       Human-Like Appearance 0.12  0.21  0.41  0.58  0.73  1.09  1.56
## 2   HLB         Human-Like Behavior 0.08  0.14  0.28  0.34  0.42  0.57  0.77
## 3    NA         Natural Appearance 0.09  0.16  0.30  0.38  0.47  0.66  0.90
## 4    NB           Natural Behavior 0.05  0.12  0.26  0.32  0.38  0.52  0.72
## 5   AAS    Agent’s Appearance Suit. 0.07  0.12  0.22  0.28  0.31  0.42  0.53
## 6    AU         Agent’s Usability 0.04  0.09  0.21  0.27  0.34  0.43  0.51
## 7    PF               Performance 0.05  0.08  0.16  0.19  0.23  0.35  0.44
## 8    AL        Agent's Likeability 0.09  0.16  0.30  0.37  0.44  0.61  0.74
## 9    AS        Agent's Sociability 0.08  0.16  0.29  0.33  0.41  0.57  0.71
## 10  APP     Agent's Personality Pr. 0.06  0.12  0.28  0.36  0.46  0.60  0.75
## 11  UAA   User Acceptance of the A. 0.05  0.12  0.25  0.31  0.39  0.50  0.62
## 12   AE      Agent's Enjoyability 0.08  0.15  0.28  0.34  0.41  0.55  0.69
## 13   UE         User's Engagement 0.06  0.08  0.15  0.20  0.24  0.32  0.42
## 14   UT              User's Trust 0.05  0.10  0.20  0.25  0.30  0.41  0.53
## 15  UAL        User Agent Alliance 0.04  0.08  0.15  0.20  0.23  0.31  0.41
## 16   AA     Agent's Attentiveness 0.04  0.08  0.16  0.19  0.24  0.32  0.40
## 17   AC         Agent's Coherence 0.04  0.08  0.16  0.19  0.22  0.31  0.40
## 18   AI     Agent's Intentionality 0.07  0.13  0.26  0.32  0.37  0.55  0.68
## 19   AT                  Attitude 0.08  0.16  0.32  0.41  0.54  0.74  0.94
## 20   SP           Social Presence 0.06  0.12  0.21  0.26  0.31  0.43  0.53
## 21  IIS Interaction Impact on Self. 0.05  0.10  0.19  0.27  0.32  0.44  0.57
## 22  AEI   Agent's Emotional Int. Pr. 0.09  0.19  0.35  0.42  0.50  0.71  0.91
## 23  UEP     User's Emotion Presence 0.07  0.17  0.28  0.36  0.46  0.58  0.73
## 24  UAI        User Agent Interplay 0.07  0.11  0.20  0.26  0.31  0.41  0.51
##    q60th q70th q75th q80th q90th q95th
## 1   2.21  2.83  3.01  3.17  3.67  3.97
## 2   0.94  1.14  1.28  1.46  1.87  2.11
## 3   1.09  1.31  1.46  1.60  2.02  2.51
## 4   0.84  1.13  1.42  1.57  2.30  2.76
## 5   0.66  0.80  0.91  1.01  1.25  1.43
## 6   0.66  0.84  0.92  0.97  1.33  1.62
## 7   0.56  0.66  0.74  0.79  1.02  1.21
## 8   0.93  1.17  1.32  1.40  1.77  2.08
## 9   0.87  1.06  1.17  1.28  1.62  1.86
## 10  0.95  1.23  1.34  1.43  1.81  1.99
## 11  0.78  0.92  1.02  1.15  1.47  1.65
## 12  0.85  1.05  1.17  1.28  1.62  1.92
## 13  0.52  0.63  0.69  0.76  1.00  1.26
## 14  0.69  0.80  0.88  0.97  1.19  1.39
## 15  0.49  0.62  0.71  0.77  0.96  1.11
## 16  0.50  0.65  0.74  0.84  1.20  1.50
## 17  0.49  0.61  0.69  0.80  1.04  1.28
## 18  0.84  1.00  1.10  1.23  1.48  1.74
## 19  1.16  1.42  1.55  1.69  2.13  2.35
```

```
## 20  0.70  0.86  0.96  1.03  1.31  1.52
## 21  0.67  0.84  0.91  0.99  1.31  1.54
## 22  1.14  1.44  1.59  1.80  2.24  2.56
## 23  0.89  1.10  1.21  1.36  1.62  1.91
## 24  0.62  0.76  0.86  0.97  1.19  1.44
##    Description q5th q10th q20th q25th q30th q40th q50th q60th q70th q75th q80th
## 1        Mean: 0.07  0.13  0.24  0.31  0.38  0.52  0.67  0.84  1.04  1.15  1.26
## 2          SD: 0.02  0.04  0.07  0.09  0.12  0.18  0.25  0.35  0.46  0.48  0.51
## 3      Median: 0.06  0.12  0.26  0.32  0.38  0.51  0.65  0.81  0.96  1.06  1.19
## 4         Min: 0.04  0.08  0.15  0.19  0.22  0.31  0.40  0.49  0.61  0.69  0.76
## 5         Max: 0.12  0.21  0.41  0.58  0.73  1.09  1.56  2.21  2.83  3.01  3.17
##   q90th q95th
## 1  1.60  1.86
## 2  0.59  0.64
## 3  1.48  1.69
## 4  0.96  1.11
## 5  3.67  3.97
```

Table D.14: The percentile scores of the difference of the ASAQ construct/dimension scores (based on the representative set 2024 of the short version of the ASAQ, n=1066).

```r
showTable(percentileDiffShortTwoASAQscore_combinedData, constructASAQdesc$CABR,
          constructASAQdesc$CNAME, 0, 1, 1, 1, 1, 1, 1)
```

```
##    CABR                       CNAME q5th q10th q20th q25th q30th q40th q50th
## 1   HLA       Human-Like Appearance 0.08  0.22  0.48  0.55  0.78  1.13  1.75
## 2   HLB         Human-Like Behavior 0.10  0.18  0.34  0.43  0.52  0.71  0.92
## 3    NA          Natural Appearance 0.08  0.15  0.33  0.42  0.53  0.71  0.91
## 4    NB            Natural Behavior 0.08  0.17  0.36  0.42  0.54  0.72  0.96
## 5   AAS    Agent’s Appearance Suit. 0.06  0.13  0.23  0.29  0.33  0.46  0.62
## 6    AU           Agent’s Usability 0.04  0.14  0.23  0.29  0.35  0.46  0.58
## 7    PF                 Performance 0.05  0.10  0.22  0.26  0.33  0.44  0.56
## 8    AL        Agent's Likeability 0.10  0.18  0.38  0.46  0.56  0.78  0.97
## 9    AS        Agent's Sociability 0.08  0.15  0.32  0.38  0.45  0.61  0.75
## 10  APP     Agent's Personality Pr. 0.05  0.11  0.21  0.31  0.40  0.53  0.66
## 11  UAA   User Acceptance of the A. 0.05  0.14  0.26  0.33  0.41  0.54  0.73
## 12   AE        Agent's Enjoyability 0.10  0.16  0.33  0.40  0.46  0.63  0.79
## 13   UE           User's Engagement 0.05  0.09  0.17  0.22  0.25  0.35  0.46
## 14   UT                User's Trust 0.05  0.10  0.21  0.26  0.32  0.44  0.54
## 15  UAL        User Agent Alliance 0.05  0.11  0.21  0.28  0.33  0.46  0.57
## 16   AA       Agent's Attentiveness 0.05  0.09  0.17  0.21  0.26  0.37  0.48
## 17   AC           Agent's Coherence 0.04  0.09  0.17  0.22  0.27  0.38  0.44
## 18   AI      Agent's Intentionality 0.06  0.14  0.28  0.34  0.43  0.56  0.68
## 19   AT                    Attitude 0.08  0.16  0.37  0.44  0.53  0.70  0.92
## 20   SP             Social Presence 0.05  0.11  0.23  0.30  0.38  0.56  0.70
## 21  IIS Interaction Impact on Self. 0.05  0.11  0.19  0.24  0.30  0.39  0.53
## 22  AEI  Agent's Emotional Int. Pr. 0.08  0.23  0.38  0.52  0.60  0.83  1.05
## 23  UEP     User's Emotion Presence 0.10  0.18  0.38  0.45  0.55  0.69  0.92
## 24  UAI         User Agent Interplay 0.06  0.16  0.28  0.40  0.46  0.63  0.81
##    q60th q70th q75th q80th q90th q95th
## 1   2.51  3.08  3.31  3.53  4.00  4.30
## 2   1.18  1.40  1.62  1.80  2.30  2.63
## 3   1.20  1.46  1.60  1.72  2.35  3.01
## 4   1.20  1.40  1.55  1.78  2.30  2.74
## 5   0.76  0.96  1.05  1.13  1.40  1.56
```

```
## 6   0.73  0.92  0.98  1.12  1.47  1.77
## 7   0.68  0.82  0.89  0.99  1.25  1.40
## 8   1.16  1.39  1.52  1.69  2.12  2.48
## 9   0.90  1.13  1.24  1.41  1.69  2.06
## 10  0.79  1.04  1.11  1.21  1.41  1.75
## 11  0.89  1.08  1.19  1.31  1.63  1.81
## 12  0.97  1.15  1.28  1.44  1.78  2.00
## 13  0.58  0.67  0.75  0.81  0.99  1.26
## 14  0.68  0.84  0.93  1.03  1.26  1.43
## 15  0.69  0.83  0.94  1.07  1.28  1.54
## 16  0.62  0.75  0.83  0.94  1.31  1.50
## 17  0.55  0.69  0.78  0.87  1.12  1.48
## 18  0.90  1.13  1.21  1.36  1.78  2.16
## 19  1.08  1.37  1.51  1.62  2.04  2.38
## 20  0.86  1.01  1.14  1.25  1.61  1.87
## 21  0.64  0.78  0.88  0.96  1.27  1.54
## 22  1.32  1.54  1.72  1.88  2.37  2.73
## 23  1.10  1.31  1.47  1.64  2.04  2.34
## 24  1.00  1.21  1.36  1.46  1.89  2.11
##    Description q5th q10th q20th q25th q30th q40th q50th q60th q70th q75th q80th
## 1        Mean: 0.07  0.14  0.28  0.35  0.43  0.59  0.76  0.96  1.17  1.29  1.42
## 2          SD: 0.02  0.04  0.08  0.10  0.13  0.18  0.28  0.40  0.48  0.52  0.55
## 3      Median: 0.06  0.14  0.27  0.34  0.42  0.56  0.72  0.90  1.10  1.20  1.33
## 4         Min: 0.04  0.09  0.17  0.21  0.25  0.35  0.44  0.55  0.67  0.75  0.81
## 5         Max: 0.10  0.23  0.48  0.55  0.78  1.13  1.75  2.51  3.08  3.31  3.53
##   q90th q95th
## 1  1.78  2.08
## 2  0.63  0.68
## 3  1.66  1.94
## 4  0.99  1.26
## 5  4.00  4.30
```

Table D.15: The percentile scores of the Cohen's effect sizes (d) (based on the difference of the ASAQ construct/dimension scores of the long version of the ASAQ representative set 2024, n=1066).

```
showTable(percentileEffectSizeLongASAQConstructScore_combinedData,
          constructASAQdesc$CABR, constructASAQdesc$CNAME, 0, 1, 1, 1, 1, 1, 1)
```

```
##    CABR                       CNAME q5th q10th q20th q25th q30th q40th q50th
## 1   HLA       Human-Like Appearance 0.09  0.16  0.33  0.43  0.55  0.76  1.06
## 2   HLB         Human-Like Behavior 0.06  0.10  0.20  0.24  0.29  0.41  0.54
## 3    NA          Natural Appearance 0.08  0.14  0.24  0.31  0.39  0.54  0.72
## 4    NB            Natural Behavior 0.04  0.09  0.20  0.25  0.29  0.40  0.54
## 5   AAS    Agent’s Appearance Suit. 0.06  0.10  0.19  0.24  0.28  0.37  0.47
## 6    AU          Agent’s Usability 0.03  0.08  0.18  0.25  0.29  0.37  0.46
## 7    PF                 Performance 0.05  0.07  0.15  0.19  0.22  0.32  0.42
## 8    AL         Agent's Likeability 0.07  0.13  0.24  0.31  0.37  0.49  0.61
## 9    AS         Agent's Sociability 0.06  0.12  0.22  0.26  0.30  0.44  0.56
## 10  APP     Agent's Personality Pr. 0.05  0.10  0.22  0.28  0.34  0.45  0.57
## 11  UAA    User Acceptance of the A. 0.05  0.11  0.21  0.26  0.33  0.43  0.55
## 12   AE       Agent's Enjoyability 0.07  0.13  0.24  0.31  0.36  0.48  0.62
## 13   UE          User's Engagement 0.06  0.09  0.17  0.20  0.24  0.33  0.43
## 14   UT               User's Trust 0.05  0.09  0.17  0.22  0.27  0.36  0.48
## 15  UAL         User Agent Alliance 0.04  0.08  0.14  0.18  0.23  0.30  0.37
## 16   AA       Agent's Attentiveness 0.05  0.07  0.15  0.19  0.21  0.31  0.38
```

```
## 17   AC           Agent's Coherence 0.04  0.08  0.15  0.19  0.22  0.30  0.39
## 18   AI      Agent's Intentionality 0.06  0.11  0.22  0.26  0.31  0.45  0.58
## 19   AT                   Attitude 0.06  0.14  0.27  0.36  0.45  0.61  0.81
## 20   SP             Social Presence 0.04  0.09  0.15  0.21  0.24  0.32  0.42
## 21  IIS Interaction Impact on Self. 0.05  0.09  0.20  0.25  0.29  0.40  0.52
## 22  AEI  Agent's Emotional Int. Pr. 0.06  0.13  0.25  0.30  0.35  0.49  0.63
## 23  UEP     User's Emotion Presence 0.06  0.14  0.26  0.31  0.40  0.53  0.64
## 24  UAI       User Agent Interplay 0.06  0.11  0.19  0.24  0.29  0.38  0.47
##    q60th q70th q75th q80th q90th q95th
## 1   1.48  2.04  2.17  2.36  2.99  3.32
## 2   0.69  0.84  0.98  1.13  1.46  1.68
## 3   0.92  1.11  1.24  1.36  1.77  2.28
## 4   0.66  0.92  1.10  1.31  2.03  2.44
## 5   0.57  0.70  0.76  0.85  1.02  1.21
## 6   0.60  0.74  0.81  0.91  1.19  1.52
## 7   0.52  0.62  0.68  0.78  1.01  1.20
## 8   0.77  0.94  1.06  1.13  1.54  1.73
## 9   0.67  0.81  0.89  1.02  1.27  1.45
## 10  0.72  0.92  1.02  1.15  1.38  1.62
## 11  0.68  0.79  0.88  1.02  1.25  1.50
## 12  0.74  0.95  1.05  1.13  1.44  1.70
## 13  0.52  0.64  0.68  0.78  0.94  1.07
## 14  0.58  0.70  0.78  0.87  1.07  1.21
## 15  0.46  0.57  0.63  0.69  0.85  0.98
## 16  0.45  0.57  0.65  0.72  1.00  1.20
## 17  0.48  0.60  0.64  0.74  1.03  1.23
## 18  0.70  0.85  0.91  1.02  1.26  1.49
## 19  0.96  1.14  1.30  1.43  1.85  2.09
## 20  0.52  0.64  0.71  0.76  0.98  1.16
## 21  0.65  0.77  0.84  0.92  1.16  1.32
## 22  0.79  0.97  1.12  1.30  1.71  1.98
## 23  0.77  0.95  1.10  1.19  1.56  1.77
## 24  0.58  0.71  0.80  0.87  1.06  1.30
##    Description q5th q10th q20th q25th q30th q40th q50th q60th q70th q75th q80th
## 1        Mean: 0.06  0.11  0.21  0.26  0.31  0.43  0.55  0.69  0.85  0.95  1.06
## 2          SD: 0.01  0.02  0.05  0.06  0.08  0.11  0.15  0.22  0.30  0.32  0.35
## 3      Median: 0.06  0.10  0.20  0.25  0.29  0.41  0.54  0.66  0.80  0.88  1.02
## 4         Min: 0.03  0.07  0.14  0.18  0.21  0.30  0.37  0.45  0.57  0.63  0.69
## 5         Max: 0.09  0.16  0.33  0.43  0.55  0.76  1.06  1.48  2.04  2.17  2.36
##   q90th q95th
## 1  1.37  1.60
## 2  0.47  0.53
## 3  1.25  1.50
## 4  0.85  0.98
## 5  2.99  3.32
```

Table D.16: The percentile scores of the Cohen's effect sizes (d) (based on the difference of the ASAQ construct/dimension scores of the short version of the ASAQ representative set 2024, n=1066).

```r
showTable(percentileEffectSizeShortASAQConstructScore_combinedData,
          constructASAQdesc$CABR, constructASAQdesc$CNAME, 0, 1, 1, 1, 1, 1, 1)
```

```
##    CABR                       CNAME q5th q10th q20th q25th q30th q40th q50th
## 1   HLA       Human-Like Appearance 0.05  0.14  0.32  0.40  0.50  0.69  1.06
## 2   HLB         Human-Like Behavior 0.06  0.11  0.20  0.25  0.29  0.42  0.53
```

```
## 3    NA         Natural Appearance 0.05  0.07  0.17  0.23  0.29  0.39  0.52
## 4    NB           Natural Behavior 0.04  0.09  0.20  0.23  0.30  0.40  0.52
## 5   AAS    Agent’s Appearance Suit. 0.05  0.09  0.16  0.20  0.24  0.32  0.40
## 6    AU          Agent’s Usability 0.04  0.11  0.18  0.22  0.27  0.35  0.46
## 7    PF                Performance 0.03  0.08  0.17  0.20  0.26  0.34  0.42
## 8    AL         Agent's Likeability 0.07  0.11  0.22  0.29  0.35  0.48  0.59
## 9    AS         Agent's Sociability 0.05  0.08  0.18  0.22  0.26  0.36  0.44
## 10  APP     Agent's Personality Pr. 0.03  0.07  0.12  0.19  0.24  0.32  0.38
## 11  UAA  User Acceptance of the A. 0.04  0.10  0.18  0.25  0.29  0.39  0.51
## 12   AE        Agent's Enjoyability 0.06  0.09  0.19  0.24  0.27  0.36  0.48
## 13   UE          User's Engagement 0.05  0.08  0.15  0.18  0.21  0.28  0.36
## 14   UT               User's Trust 0.03  0.07  0.14  0.17  0.20  0.28  0.34
## 15  UAL        User Agent Alliance 0.03  0.06  0.13  0.17  0.21  0.29  0.35
## 16   AA      Agent's Attentiveness 0.04  0.07  0.13  0.16  0.19  0.27  0.36
## 17   AC          Agent's Coherence 0.03  0.07  0.13  0.16  0.20  0.26  0.32
## 18   AI     Agent's Intentionality 0.04  0.09  0.17  0.21  0.24  0.32  0.40
## 19   AT                   Attitude 0.06  0.12  0.27  0.32  0.39  0.49  0.65
## 20   SP            Social Presence 0.03  0.06  0.13  0.17  0.23  0.32  0.40
## 21  IIS Interaction Impact on Self. 0.03  0.07  0.13  0.16  0.19  0.26  0.35
## 22  AEI  Agent's Emotional Int. Pr. 0.05  0.12  0.22  0.26  0.32  0.45  0.57
## 23  UEP     User's Emotion Presence 0.06  0.11  0.23  0.27  0.33  0.44  0.57
## 24  UAI        User Agent Interplay 0.04  0.10  0.18  0.25  0.30  0.41  0.51
##    q60th q70th q75th q80th q90th q95th
## 1   1.46  1.89  2.06  2.28  2.88  3.12
## 2   0.69  0.85  0.94  1.08  1.39  1.64
## 3   0.66  0.83  0.89  0.98  1.41  1.83
## 4   0.67  0.80  0.92  1.07  1.50  1.80
## 5   0.52  0.63  0.70  0.76  0.94  1.02
## 6   0.56  0.68  0.75  0.82  1.05  1.28
## 7   0.53  0.63  0.69  0.75  0.96  1.14
## 8   0.72  0.85  0.93  1.05  1.38  1.60
## 9   0.53  0.67  0.74  0.83  1.03  1.25
## 10  0.45  0.62  0.68  0.74  0.92  1.02
## 11  0.62  0.77  0.86  0.96  1.16  1.38
## 12  0.57  0.70  0.76  0.86  1.06  1.25
## 13  0.45  0.56  0.61  0.66  0.86  1.01
## 14  0.44  0.55  0.59  0.66  0.86  0.99
## 15  0.44  0.52  0.58  0.67  0.82  0.96
## 16  0.46  0.54  0.60  0.66  0.88  0.97
## 17  0.40  0.50  0.55  0.60  0.77  0.98
## 18  0.54  0.65  0.72  0.80  1.06  1.28
## 19  0.79  0.95  1.05  1.19  1.47  1.71
## 20  0.50  0.60  0.65  0.73  0.94  1.10
## 21  0.44  0.53  0.57  0.62  0.82  0.96
## 22  0.69  0.86  0.94  1.04  1.41  1.68
## 23  0.68  0.85  0.93  1.07  1.40  1.64
## 24  0.65  0.79  0.85  0.97  1.20  1.36
##   Description q5th q10th q20th q25th q30th q40th q50th q60th q70th q75th q80th
## 1       Mean: 0.04  0.09  0.18  0.22  0.27  0.37  0.48  0.60  0.74  0.81  0.91
## 2         SD: 0.01  0.02  0.05  0.06  0.07  0.10  0.15  0.21  0.28  0.30  0.34
## 3     Median: 0.04  0.09  0.17  0.22  0.26  0.36  0.45  0.55  0.68  0.74  0.82
## 4        Min: 0.03  0.06  0.12  0.16  0.19  0.26  0.32  0.40  0.50  0.55  0.60
## 5        Max: 0.07  0.14  0.32  0.40  0.50  0.69  1.06  1.46  1.89  2.06  2.28
##   q90th q95th
```

```
## 1  1.17  1.37
## 2  0.43  0.48
## 3  1.06  1.27
## 4  0.77  0.96
## 5  2.88  3.12
```

Tabel D.17: Sample sizes for each ASAQ construct/dimension of the long and short ASAQ versions based on Cohen's effect sizes (d) from Table D.15 and D.16 with .80 power and .05 alpha level (two-tailed t-test).

```r
samplePowerAnalysisASAQConstructScore_combinedData <-
  cbind(samplePowerAnalysisLongASAQConstructScore_combinedData,
        samplePowerAnalysisShortASAQConstructScore_combinedData[, 2:ncol(
          samplePowerAnalysisShortASAQConstructScore_combinedData)])
names(samplePowerAnalysisASAQConstructScore_combinedData) <-
  c("CID", "LONG_Small_q25th", "LONG_Medium_q50th", "LONG_Large_q75th",
    "SHORT_Small_q25th", "SHORT_Medium_q50th", "SHORT_Large_q75th")
showTableSample(samplePowerAnalysisASAQConstructScore_combinedData,
          constructASAQdesc$CABR, constructASAQdesc$CNAME, 0)
```

```
##    CABR                   CNAME LONG_Small_q25th LONG_Medium_q50th
## 1   HLA       Human-Like Appearance               86                15
## 2   HLB         Human-Like Behavior              273                55
## 3    NA          Natural Appearance              164                31
## 4    NB            Natural Behavior              252                55
## 5   AAS     Agent’s Appearance Suit.              273                72
## 6    AU           Agent’s Usability              252                75
## 7    PF                 Performance              436                90
## 8    AL         Agent's Likeability              164                43
## 9    AS         Agent's Sociability              233                51
## 10  APP      Agent's Personality Pr.              201                49
## 11  UAA    User Acceptance of the A.              233                53
## 12   AE        Agent's Enjoyability              164                42
## 13   UE           User's Engagement              393                86
## 14   UT                User's Trust              325                69
## 15  UAL         User Agent Alliance              485               116
## 16   AA       Agent's Attentiveness              436               110
## 17   AC           Agent's Coherence              436               104
## 18   AI      Agent's Intentionality              233                48
## 19   AT                    Attitude              122                25
## 20   SP             Social Presence              357                90
## 21  IIS Interaction Impact on Self.              252                59
## 22  AEI  Agent's Emotional Int. Pr.              175                41
## 23  UEP      User's Emotion Presence              164                39
## 24  UAI         User Agent Interplay              273                72
##    LONG_Large_q75th SHORT_Small_q25th SHORT_Medium_q50th SHORT_Large_q75th
## 1                 5                99                 15                 5
## 2                17               252                 57                19
## 3                11               298                 59                21
## 4                14               298                 59                20
## 5                28               393                 99                33
## 6                25               325                 75                29
## 7                35               393                 90                34
## 8                15               188                 46                19
## 9                21               325                 82                30
## 10               16               436                110                35
```

```
## 11                 21                252                 61                 22
## 12                 15                273                 69                 28
## 13                 35                485                122                 43
## 14                 27                544                137                 46
## 15                 41                544                129                 48
## 16                 38                614                122                 45
## 17                 39                614                154                 53
## 18                 20                357                 99                 31
## 19                 10                154                 38                 15
## 20                 32                544                 99                 38
## 21                 23                614                129                 49
## 22                 14                233                 49                 19
## 23                 14                216                 49                 19
## 24                 26                252                 61                 23
##    Description LONG_Small_q25th LONG_Medium_q50th LONG_Large_q75th
## 1         Max:              485               116               41
##   SHORT_Small_q25th SHORT_Medium_q50th SHORT_Large_q75th
## 1               614                154                53
```

Table D.18: Sample sizes for each ASAQ construct/dimension for the 5th percentile error margin.

```
sampleConfIntervASAQConstructScore_combinedData_p5th <-
  cbind(sampleConfIntervLongASAQConstructScore_combinedData_p5th,
        sampleConfIntervShortASAQConstructScore_combinedData_p5th[, 2:ncol(
          sampleConfIntervShortASAQConstructScore_combinedData_p5th)])
names(sampleConfIntervASAQConstructScore_combinedData_p5th) <-
  c("CID", "LONG_90CI", "LONG_95CI", "LONG_97.5CI", "LONG_99CI",
             "SHORT_90CI","SHORT_95CI", "SHORT_97.5CI", "SHORT_99CI")
showTableSample(sampleConfIntervASAQConstructScore_combinedData_p5th,
  constructASAQdesc$CABR, constructASAQdesc$CNAME, 0)
```

```
##    CABR                      CNAME LONG_90CI LONG_95CI LONG_97.5CI LONG_99CI
## 1   HLA       Human-Like Appearance        92       130         171       225
## 2   HLB         Human-Like Behavior       235       334         436       576
## 3    NA         Natural Appearance       186       264         346       456
## 4    NB           Natural Behavior       168       239         312       412
## 5   AAS    Agent’s Appearance Suit.       454       645         843      1113
## 6    AU          Agent’s Usability       506       718         939      1240
## 7    PF                Performance       511       725         948      1252
## 8    AL        Agent's Likeability       209       296         387       511
## 9    AS        Agent's Sociability       305       433         567       748
## 10  APP     Agent's Personality Pr.       337       478         625       826
## 11  UAA   User Acceptance of the A.       297       422         551       728
## 12   AE       Agent's Enjoyability       211       299         391       517
## 13   UE          User's Engagement       495       703         919      1213
## 14   UT               User's Trust       466       661         865      1142
## 15  UAL        User Agent Alliance       689       979        1280      1691
## 16   AA      Agent's Attentiveness       482       684         894      1181
## 17   AC          Agent's Coherence       543       771        1009      1332
## 18   AI     Agent's Intentionality       345       490         641       846
## 19   AT                   Attitude       173       245         320       423
## 20   SP            Social Presence       551       783        1023      1352
## 21  IIS Interaction Impact on Self.       333       472         618       816
## 22  AEI   Agent's Emotional Int. Pr.       212       300         393       519
## 23  UEP     User's Emotion Presence       250       355         464       613
```

```
## 24  UAI        User Agent Interplay       414       588         769      1015
##    SHORT_90CI SHORT_95CI SHORT_97.5CI SHORT_99CI
## 1         102        145          190        251
## 2         261        370          484        640
## 3         293        416          544        719
## 4         303        430          563        743
## 5         704        999         1307       1726
## 6         476        676          884       1167
## 7         591        839         1097       1449
## 8         284        403          528        697
## 9         452        642          840       1110
## 10        696        988         1292       1706
## 11        432        614          803       1060
## 12        518        736          963       1271
## 13        677        961         1257       1660
## 14        701        996         1302       1720
## 15        767       1089         1424       1881
## 16        575        817         1068       1411
## 17        871       1237         1618       2137
## 18        468        665          869       1148
## 19        243        344          450        595
## 20        634        901         1178       1556
## 21        804       1142         1494       1972
## 22        309        439          574        758
## 23        311        441          577        762
## 24        416        591          772       1020
##    Description LONG_90CI LONG_95CI LONG_97.5CI LONG_99CI SHORT_90CI SHORT_95CI
## 1         Max:       689       979        1280      1691        871       1237
##   SHORT_97.5CI SHORT_99CI
## 1         1618       2137
```

Table D.19:Sample sizes for each ASAQ construct/dimension for the 10th percentile error margin.

```r
sampleConfIntervASAQConstructScore_combinedData_p10th <-
  cbind(sampleConfIntervLongASAQConstructScore_combinedData_p10th,
        sampleConfIntervShortASAQConstructScore_combinedData_p10th[, 2:ncol(
          sampleConfIntervShortASAQConstructScore_combinedData_p10th)])
names(sampleConfIntervASAQConstructScore_combinedData_p10th) <-
  c("CID", "LONG_90CI", "LONG_95CI", "LONG_97.5CI", "LONG_99CI",
               "SHORT_90CI","SHORT_95CI", "SHORT_97.5CI", "SHORT_99CI")
showTableSample(sampleConfIntervASAQConstructScore_combinedData_p10th,
  constructASAQdesc$CABR, constructASAQdesc$CNAME, 0)
```

```
##    CABR                       CNAME LONG_90CI LONG_95CI LONG_97.5CI LONG_99CI
## 1   HLA       Human-Like Appearance        21        30          39        51
## 2   HLB         Human-Like Behavior        90       127         167       220
## 3    NA          Natural Appearance        65        93         121       160
## 4    NB            Natural Behavior        75       107         139       184
## 5   AAS     Agent’s Appearance Suit.       142       202         264       349
## 6    AU            Agent’s Usability       153       217         283       374
## 7    PF                 Performance       148       210         275       363
## 8    AL         Agent's Likeability        68        97         127       167
## 9    AS         Agent's Sociability        94       133         174       230
## 10  APP      Agent's Personality Pr.        77       109         143       189
## 11  UAA   User Acceptance of the A.        95       135         177       234
```

```
## 12   AE        Agent's Enjoyability        77       110         144        190
## 13   UE           User's Engagement       188       267         350        462
## 14   UT                User's Trust       132       188         246        325
## 15  UAL         User Agent Alliance       161       228         298        394
## 16   AA       Agent's Attentiveness       192       273         357        471
## 17   AC           Agent's Coherence       201       286         374        493
## 18   AI      Agent's Intentionality       102       144         189        249
## 19   AT                    Attitude        47        67          88        116
## 20   SP             Social Presence       152       216         282        373
## 21  IIS Interaction Impact on Self.       137       195         255        337
## 22  AEI  Agent's Emotional Int. Pr.        54        77         101        133
## 23  UEP      User's Emotion Presence        61        87         114        150
## 24  UAI          User Agent Interplay       131       186         243        321
##    SHORT_90CI SHORT_95CI SHORT_97.5CI SHORT_99CI
## 1          23         33           43         57
## 2          81        115          150        199
## 3         150        213          279        369
## 4          84        119          155        205
## 5         187        265          347        458
## 6         138        196          257        339
## 7         156        222          290        384
## 8          82        116          152        200
## 9         168        239          313        413
## 10        154        218          286        377
## 11        124        176          230        303
## 12        133        189          247        326
## 13        196        279          364        481
## 14        209        297          389        513
## 15        177        252          329        435
## 16        267        379          496        655
## 17        350        497          650        859
## 18        135        191          250        330
## 19         70         99          129        171
## 20        172        244          319        422
## 21        220        312          408        539
## 22        102        145          189        250
## 23         88        125          163        216
## 24         98        139          182        241
##    Description LONG_90CI LONG_95CI LONG_97.5CI LONG_99CI SHORT_90CI SHORT_95CI
## 1         Max:       201       286         374       493        350        497
##   SHORT_97.5CI SHORT_99CI
## 1          650        859
```

Table D.20: Sample sizes for each ASAQ construct/dimension for the 20th percentile error margin.

```r
sampleConfIntervASAQConstructScore_combinedData_p20th <-
  cbind(sampleConfIntervLongASAQConstructScore_combinedData_p20th,
        sampleConfIntervShortASAQConstructScore_combinedData_p20th[, 2:ncol(
          sampleConfIntervShortASAQConstructScore_combinedData_p20th)])
names(sampleConfIntervASAQConstructScore_combinedData_p20th) <-
  c("CID", "LONG_90CI", "LONG_95CI", "LONG_97.5CI", "LONG_99CI",
              "SHORT_90CI","SHORT_95CI", "SHORT_97.5CI", "SHORT_99CI")
showTableSample(sampleConfIntervASAQConstructScore_combinedData_p20th,
  constructASAQdesc$CABR, constructASAQdesc$CNAME, 0)
```

```
##    CABR                       CNAME LONG_90CI LONG_95CI LONG_97.5CI LONG_99CI
## 1   HLA       Human-Like Appearance         5         6           8        11
## 2   HLB         Human-Like Behavior        43        61          80       105
## 3    NA         Natural Appearance         15        22          28        37
## 4    NB           Natural Behavior         34        48          62        83
## 5   AAS    Agent’s Appearance Suit.        33        47          61        81
## 6    AU           Agent’s Usability        36        52          68        89
## 7    PF                 Performance        69        98         128       169
## 8    AL         Agent's Likeability        24        34          45        59
## 9    AS         Agent's Sociability        35        50          66        87
## 10  APP     Agent's Personality Pr.        19        27          35        46
## 11  UAA   User Acceptance of the A.        34        48          63        83
## 12   AE        Agent's Enjoyability        22        31          41        54
## 13   UE           User's Engagement        54        77         101       133
## 14   UT                User's Trust        31        44          58        77
## 15  UAL         User Agent Alliance        60        85         111       146
## 16   AA       Agent's Attentiveness        70       100         130       172
## 17   AC           Agent's Coherence        52        73          96       126
## 18   AI      Agent's Intentionality        23        33          43        56
## 19   AT                    Attitude        14        20          26        34
## 20   SP             Social Presence        44        62          82       108
## 21  IIS Interaction Impact on Self.        37        53          69        91
## 22  AEI  Agent's Emotional Int. Pr.        19        27          35        46
## 23  UEP     User's Emotion Presence        21        29          38        50
## 24  UAI        User Agent Interplay        38        55          71        94
##    SHORT_90CI SHORT_95CI SHORT_97.5CI SHORT_99CI
## 1           5          7           10         13
## 2          39         55           72         95
## 3          30         43           56         74
## 4          40         57           74         98
## 5          43         60           79        104
## 6          48         68           90        118
## 7          40         57           75         98
## 8          25         36           47         62
## 9          34         48           63         84
## 10         46         65           84        112
## 11         30         43           56         74
## 12         36         52           68         89
## 13         64         91          118        156
## 14         74        105          137        181
## 15         71        101          133        175
## 16         68         97          127        167
## 17         74        105          137        181
## 18         55         79          103        136
## 19         18         25           33         44
## 20         42         60           78        103
## 21         76        108          141        186
## 22         26         37           49         64
## 23         22         31           40         53
## 24         21         29           39         51
##    Description LONG_90CI LONG_95CI LONG_97.5CI LONG_99CI SHORT_90CI SHORT_95CI
## 1         Max:        70       100         130       172         76        108
##   SHORT_97.5CI SHORT_99CI
## 1          141        186
```

Table D.21: Sample sizes for each ASAQ construct/dimension for the 25th percentile error margin.

```r
sampleConfIntervASAQConstructScore_combinedData_p25th <-
  cbind(sampleConfIntervLongASAQConstructScore_combinedData_p25th,
        sampleConfIntervShortASAQConstructScore_combinedData_p25th[, 2:ncol(
          sampleConfIntervShortASAQConstructScore_combinedData_p25th)])
names(sampleConfIntervASAQConstructScore_combinedData_p25th) <-
  c("CID", "LONG_90CI", "LONG_95CI", "LONG_97.5CI", "LONG_99CI",
               "SHORT_90CI","SHORT_95CI", "SHORT_97.5CI", "SHORT_99CI")
showTableSample(sampleConfIntervASAQConstructScore_combinedData_p25th,
  constructASAQdesc$CABR, constructASAQdesc$CNAME, 0)
```

```
##    CABR                      CNAME LONG_90CI LONG_95CI LONG_97.5CI LONG_99CI
## 1   HLA        Human-Like Appearance         2         3           4         6
## 2   HLB          Human-Like Behavior        31        44          57        75
## 3    NA          Natural Appearance        10        14          19        25
## 4    NB            Natural Behavior        44        63          82       108
## 5   AAS     Agent’s Appearance Suit.        23        33          43        57
## 6    AU            Agent’s Usability        19        27          35        47
## 7    PF                  Performance        37        52          68        90
## 8    AL         Agent's Likeability        19        27          35        46
## 9    AS         Agent's Sociability        19        27          35        46
## 10  APP      Agent's Personality Pr.        11        16          21        27
## 11  UAA    User Acceptance of the A.        20        29          37        49
## 12   AE        Agent's Enjoyability        17        24          31        41
## 13   UE           User's Engagement        33        47          61        81
## 14   UT                User's Trust        17        23          31        41
## 15  UAL          User Agent Alliance        40        57          75        99
## 16   AA       Agent's Attentiveness        41        59          77       101
## 17   AC           Agent's Coherence        45        64          84       111
## 18   AI      Agent's Intentionality        12        17          22        29
## 19   AT                    Attitude         8        12          15        20
## 20   SP             Social Presence        46        66          86       114
## 21  IIS Interaction Impact on Self.        25        35          46        61
## 22  AEI  Agent's Emotional Int. Pr.        12        17          22        29
## 23  UEP     User's Emotion Presence        13        19          24        32
## 24  UAI        User Agent Interplay        33        47          61        81
##    SHORT_90CI SHORT_95CI SHORT_97.5CI SHORT_99CI
## 1           2          4            5          6
## 2          21         30           40         52
## 3          17         24           31         41
## 4          34         48           63         83
## 5          24         34           44         59
## 6          25         36           47         62
## 7          21         30           39         52
## 8          20         29           37         49
## 9          31         45           58         77
## 10         38         54           71         94
## 11         17         24           31         42
## 12         27         38           49         65
## 13         41         59           77        101
## 14         68         97          126        167
## 15         46         66           86        114
## 16         46         65           85        113
## 17         52         74           97        128
```

```
## 18          34         48           63          83
## 19          16         23           30          39
## 20          38         54           71          93
## 21          48         68           89         117
## 22          13         18           24          32
## 23          15         21           27          36
## 24          16         23           30          40
##    Description LONG_90CI LONG_95CI LONG_97.5CI LONG_99CI SHORT_90CI SHORT_95CI
## 1         Max:        46        66          86       114         68         97
##   SHORT_97.5CI SHORT_99CI
## 1          126        167
```