Acceptance of the Virtual Coach

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Introduction

The purpose of this file is to allow for the reproduction of our results on the acceptance of the virtual coach reported in the "Materials"-section of the paper.

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Setup

First, we load the packages that we need.

```
library(BayesianFirstAid)  # For Bayesian t-test
library(ltm)  # For computing Cronbach's alpha
library(readxl)  # For reading excel-file
```

Data

We load the pre-processed post-questionnaire data from the acceptance dataset (Albers, Neerincx, and Brinkman (2022)).

```
exceldata = read_excel("Data/Post_Questionnaire_Acceptance_Anonym_Preprocessed.xlsx")
df = data.frame(exceldata)
```

Compute Acceptance Index Measure

Next, we want to use the mean of the six acceptance items as an index measure. The six items were based on the ones used by (Provoost et al. (2020)), which in turn were based on the ones used by (Bickmore et al.

(2010)). Each of the six items was measured on a scale from -5 to 5. To assess the reliability, we compute Cronbach's alpha.

```
res = cronbach.alpha(df[c("A1R_1","A2R_1","A3R_1", "A4R_1", "A5R_1", "A6R_1")])

print(paste0("Cronbach's alpha: ", round(res$alpha, 2)))
```

```
## [1] "Cronbach's alpha: 0.86"
```

```
df$acc = (df$A1R_1 + df$A2R_1 + df$A3R_1 + df$A4R_1 + df$A5R_1 + df$A6R_1)/6
```

Bayesian Analysis of Acceptance

We will now conduct a Bayesian one-sample t-test comparing the acceptance score to a value of 0. Since the acceptance items were measured on scales from -5 to 5, a value greater than 0 indicates a positive attitude toward the virtual coach Sam and a value less than 0 a negative attitude.

For this t-test we make use of the Bayesian First Aid package (Bååth (2014)).

```
set.seed(18)  # for reproducibility
bayes.t.test(df$acc, mu = 0, paired = FALSE, cred.mass = 0.95)
```

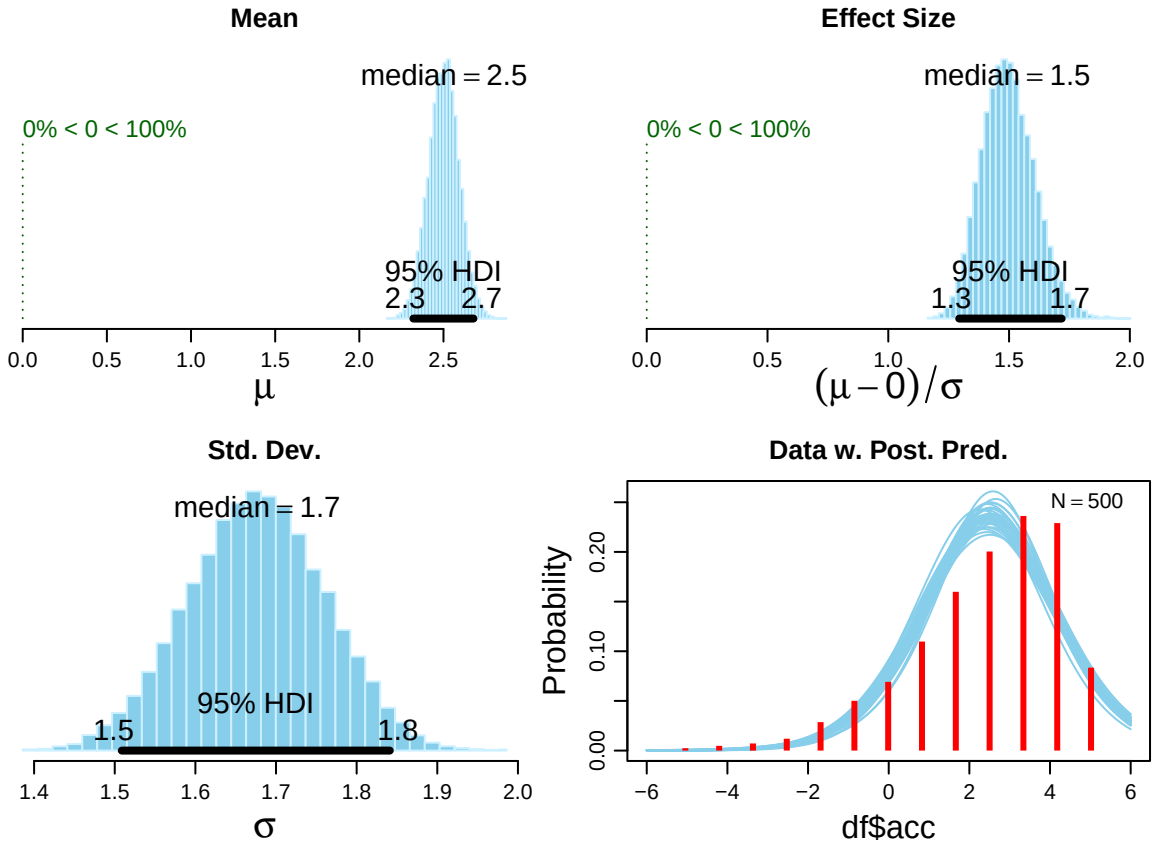
```
##
##  Bayesian estimation supersedes the t test (BEST) - one sample
##
## data: df$acc, n = 500
##
##   Estimates [95% credible interval]
## mean of df$acc: 2.5 [2.3, 2.7]
## sd of df$acc: 1.7 [1.5, 1.8]
##
## The mean is more than 0 by a probability of >0.999
## and less than 0 by a probability of <0.001
```

```
set.seed(18)  # for reproducibility
# Save return value to inspect result further
fit <- bayes.t.test(df$acc, mu = 0, paired = FALSE, cred.mass = 0.95)
summary(fit)
```

```
##   Data
## df$acc, n = 500
##
##   Model parameters and generated quantities
## mu: the mean of df$acc
## sigma: the scale of df$acc , a consistent
##   estimate of SD when nu is large.
## nu: the degrees-of-freedom for the t distribution fitted to df$acc
## eff_size: the effect size calculated as (mu - 0) / sigma
## x_pred: predicted distribution for a new datapoint generated as df$acc
##
##   Measures
##            mean     sd  HDIlo  HDIup %<comp %>comp
## mu        2.502  0.091  2.321  2.678  0.000  1.000
## sigma     1.676  0.085  1.509  1.841  0.000  1.000
## nu       17.641 15.360  4.640 43.794  0.000  1.000
## eff_size  1.498  0.110  1.294  1.718  0.000  1.000
```

```
## x_pred    2.510  1.824 -1.033  6.164  0.078  0.922
##
## 'HDIlo' and 'HDIup' are the limits of a 95% HDI credible interval.
## '%<comp' and '%>comp' are the probabilities of the respective parameter being
## smaller or larger than 0.
##
##   Quantiles
##           q2.5%  q25% median   q75% q97.5%
## mu        2.323 2.442  2.503  2.563  2.680
## sigma     1.508 1.618  1.677  1.734  1.841
## nu        6.123 9.658 13.220 19.820 56.297
## eff_size  1.300 1.421  1.492  1.569  1.728
## x_pred   -1.064 1.345  2.499  3.663  6.140
```

```
plot(fit)
```



References

Albers, Nele, Mark A. Neerincx, and Willem-Paul Brinkman. 2022. "Acceptance of a Virtual Coach for Quitting Smoking and Becoming Physically Active: Dataset." https://data.4tu.nl/articles/dataset/Acceptance_of_a_Virtual_Coach_for_Quitting_Smoking_and_Becoming_Physically_Active_Dataset/19934783. https://doi.org/10.4121/19934783.v1.

Bååth, Rasmus. 2014. "Bayesian First Aid: A Package That Implements Bayesian Alternatives to the Classical *.test Functions in r." In *UseR! 2014 - the International r User Conference*.

Bickmore, Timothy W, Suzanne E Mitchell, Brian W Jack, Michael K Paasche-Orlow, Laura M Pfeifer, and Julie O'Donnell. 2010. "Response to a Relational Agent by Hospital Patients with Depressive Symptoms." *Interacting with Computers* 22 (4): 289–98.

Provoost, Simon, Annet Kleiboer, José Ornelas, Tibor Bosse, Jeroen Ruwaard, Artur Rocha, Pim Cuijpers, and Heleen Riper. 2020. "Improving Adherence to an Online Intervention for Low Mood with a Virtual Coach: Study Protocol of a Pilot Randomized Controlled Trial." *Trials* 21 (1): 1–12.