

# Package ‘manCULTA’

July 31, 2025

**Title** Common and Unique Latent Transition Analysis (CULTA) as a Way to Examine the Trait-State Dynamics of Alcohol Intoxication

**Version** 1.0.0

**Description** Research compendium for the manuscript  
Pesigan, I. J. A., Russell, M. A., Chow, S.-M. (Under Review).  
Common and Unique Latent Transition Analysis (CULTA) as a Way to Examine the Trait-State Dynamics of Alcohol Intoxication.  
<[doi:10.0000/0000000000](https://doi.org/10.0000/0000000000)>.

**URL** <https://github.com/jeksterslab/manCULTA>,  
<https://jeksterslab.github.io/manCULTA/>, <https://osf.io/gtdmr/>,  
<https://doi.org/10.0000/0000000000>

**BugReports** <https://github.com/jeksterslab/manCULTA/issues>

**License** GPL (>= 3)

**Encoding** UTF-8

**LazyData** true

**Roxygen** list(markdown = TRUE)

**Depends** R (>= 4.0.0)

**LinkingTo** Rcpp, RcppArmadillo

**Imports** Rcpp, ggplot2

**Suggests** knitr, rmarkdown, testthat, lavaan

**RoxygenNote** 7.3.2

**NeedsCompilation** yes

**Author** Ivan Jacob Agaloos Pesigan [aut, cre, cph] (ORCID:  
<<https://orcid.org/0000-0003-4818-8420>>)

**Maintainer** Ivan Jacob Agaloos Pesigan <[r.jeksterslab@gmail.com](mailto:r.jeksterslab@gmail.com)>

## Contents

AIC.fitcult	3
anova.fitcult	5
as.data.frame.simcult	8
as.matrix.simcult	9
BIC.fitcult	10
coef.fitcult	13
Compress	15
confint.fitcult	16
converged	18
entropy	20
FigBiasCULTAEst	23
FigBiasLTAEst	25
FigCoverageCULTAEst	26
FigCoverageLTAEst	28
FigEntropy	29
FigIC	30
FigPowerCULTAEst	31
FigPowerLTAEst	32
FigRMSECULTAEst	34
FigRMSELTAEst	35
FitCULTA1Profile	37
FitCULTA2Profiles	39
FitLTA2Profiles	42
FitRILTA2Profiles	45
GenCULTA2Profiles	48
GenData	55
InputCULTA1Profile	55
InputCULTA2Profiles	58
InputLTA2Profiles	61
InputRILTA2Profiles	63
logLik.fitcult	66
params	69
print.fitcult	70
print.simcult	73
results_culta_est	74
results_entropy	75
results_ic	76
results_lta_est	76
Sim	78
SimFitCULTA1Profile	79
SimFitCULTA2Profiles	80
SimFitLTA2Profiles	81
SimFitRILTA2Profiles	82
SimFN	83
SimGenData	84
SimProj	85

Sum . . . . .	85
SumFitCULTA1Profile . . . . .	86
SumFitCULTA2Profiles . . . . .	87
SumFitLTA2Profiles . . . . .	88
SumFitRILTA2Profiles . . . . .	89
SumLTAParamsCULTA2Profiles . . . . .	90
SumLTAParamsLTA2Profiles . . . . .	91
SumLTAParamsRILTA2Profiles . . . . .	92
summary.fitcultu . . . . .	93
SumParamsCULTA2Profiles . . . . .	95
vcov.fitcultu . . . . .	96
WriteData . . . . .	98

Index	100
-------	-----

AIC.fitcultu	Akaike’s Information Criterion
--------------	--------------------------------

Description

Akaike’s Information Criterion

Usage

```
## S3 method for class 'fitcultu'  
AIC(object, ...)
```

Arguments

object            Object of class fitcultu.  
...               additional arguments.

Value

Returns Akaike’s information criterion (AIC).

Author(s)

Ivan Jacob Agaloos Pesigan

Examples

```
## Not run:  
# complete list of R function arguments -----  
  
# random seed for reproducibility  
set.seed(42)  
  
# dimensions
```

```

n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),

```

```

      c(-0.278, -0.165, -0.199, -0.148)
    )

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
fit <- FitCULTA2Profiles(data = data)
AIC(fit)

## End(Not run)

```

---

anova.fitcult	<i>Compare Two Nested fitcult Models Using Scaled Chi-Square Difference Test</i>
---------------	--

---

## Description

This function compares two fitcult models using the Satorra-Bentler scaled chi-square difference test based on log-likelihoods, number of free parameters, and scaling correction factors. It also returns model fit indices for both models, including AIC, BIC, adjusted BIC, and entropy.

## Usage

```

## S3 method for class 'fitcult'
anova(object, other, ...)

```

**Arguments**

object	Model object of class fitcultla.
other	Another model object of class fitcultla.
...	additional arguments.

**Value**

A list with two elements:

**fit** A matrix summarizing model fit indices for both models, including: logLik, df (number of free parameters), correction (scaling factor), AIC, BIC, aBIC (adjusted BIC), and entropy.

**diff** A named numeric vector with scaled chi-square difference, degrees of freedom difference, and p-value.

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
```

```

    psi_p_3,
    psi_p_4
  )
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

```

```
# model fitting -----
# NOTE: Model fitting takes time
one_profile <- FitCULTA1Profile(data = data)
two_profiles <- FitCULTA2Profiles(data = data)
anova(one_profile, two_profiles)

## End(Not run)
```

---

as.data.frame.simcult

*Coerce an Object of Class simcult to a Data Frame*


---

## Description

Coerce an Object of Class simcult to a Data Frame

## Usage

```
## S3 method for class 'simcult'
as.data.frame(x, ...)
```

## Arguments

x	Object of class simcult.
...	Additional arguments.

## Author(s)

Ivan Jacob Agaloos Pesigan

## Examples

```
x <- GenCULTA2Profiles(
  n = 10,
  m = 6,
  common_trait_loading = matrix(
    data = c(1, 1.25, 1.50, 1.75),
    ncol = 1
  ),
  common_state_loading = matrix(
    data = c(1, 1.5, 1.75, 2.00),
    ncol = 1
  ),
  mu_t = NULL,
  psi_t = NULL,
  mu_p = NULL,
  psi_p = NULL,
```



```

theta = diag(4),
mu_profile = cbind(
  c(-3, -3, -3, -3),
  c(3, 3, 3, 3)
),
mu_x = 0,
sigma_x = 1,
nu_0 = -3.563,
kappa_0 = 0.122,
alpha_0 = -3.586,
beta_00 = 2.250,
gamma_00 = 0.063,
gamma_10 = 0.094,
phi_0 = 0.311,
phi_1 = 0,
psi_s0 = 0.151,
psi_s = 0.290
)
as.data.frame(x)

```

---

as.matrix.simulta	<i>Coerce an Object of Class simulta to a Matrix</i>
-------------------	--

---

## Description

Coerce an Object of Class simulta to a Matrix

## Usage

```
## S3 method for class 'simulta'
as.matrix(x, ...)
```

## Arguments

x	Object of class simulta.
...	Additional arguments.

## Author(s)

Ivan Jacob Agaloos Pesigan

## Examples

```

x <- GenCULTA2Profiles(
  n = 10,
  m = 6,
  common_trait_loading = matrix(
    data = c(1, 1.25, 1.50, 1.75),

```

```

      ncol = 1
    ),
    common_state_loading = matrix(
      data = c(1, 1.5, 1.75, 2.00),
      ncol = 1
    ),
    mu_t = NULL,
    psi_t = NULL,
    mu_p = NULL,
    psi_p = NULL,
    theta = diag(4),
    mu_profile = cbind(
      c(-3, -3, -3, -3),
      c(3, 3, 3, 3)
    ),
    mu_x = 0,
    sigma_x = 1,
    nu_0 = -3.563,
    kappa_0 = 0.122,
    alpha_0 = -3.586,
    beta_00 = 2.250,
    gamma_00 = 0.063,
    gamma_10 = 0.094,
    phi_0 = 0.311,
    phi_1 = 0,
    psi_s0 = 0.151,
    psi_s = 0.290
  )
  as.matrix(x)

```

---

BIC.fitcultla

*Bayesian Information Criterion*


---

## Description

Bayesian Information Criterion

## Usage

```

## S3 method for class 'fitcultla'
BIC(object, adjust = FALSE, ...)

```

## Arguments

object	Object of class fitcultla.
adjust	Logical. If adjust = TRUE, return the sample size adjusted BIC.
...	additional arguments.

**Value**

Returns Bayesian information criterion (BIC).

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
```

```

)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
fit <- FitCULTA2Profiles(data = data)
BIC(fit)
BIC(fit, adjust = TRUE)

## End(Not run)

```

---

coef.fitcultu	<i>Parameter Estimates</i>
---------------	----------------------------

---

**Description**

Parameter Estimates

**Usage**

```
## S3 method for class 'fitcultu'
coef(object, ...)
```

**Arguments**

object	Object of class fitcultu.
...	additional arguments.

**Value**

Returns a vector of parameter estimates.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
```

```

beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,

```

```

    gamma_00 = gamma_00,
    gamma_10 = gamma_10,
    mu_t = mu_t,
    psi_t = psi_t,
    mu_p = mu_p,
    psi_p = psi_p,
    common_trait_loading = common_trait_loading,
    common_state_loading = common_state_loading,
    phi_0 = phi_0,
    phi_1 = phi_1,
    psi_s0 = psi_s0,
    psi_s = psi_s,
    theta = theta,
    mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
fit <- FitCULTA2Profiles(data = data)
coef(fit)

## End(Not run)

```

---

Compress

*Compress Replication*


---

## Description

Compress Replication

## Usage

```
Compress(taskid, repid, output_folder)
```

## Arguments

taskid	Positive integer. Task ID.
repid	Positive integer. Replication ID.
output_folder	Character string. Output folder.

## Value

The output is saved as an external file in output\_folder.

## Author(s)

Ivan Jacob Agaloos Pesigan

---

confint.fitcult	<i>Confidence Intervals for Parameter Estimates</i>
-----------------	---

---

**Description**

Confidence Intervals for Parameter Estimates

**Usage**

```
## S3 method for class 'fitcult'
confint(object, parm = NULL, level = 0.95, ...)
```

**Arguments**

object	Object of class fitcult.
parm	a specification of which parameters are to be given confidence intervals, either a vector of numbers or a vector of names. If missing, all parameters are considered.
level	the confidence level required.
...	additional arguments.

**Value**

Returns a matrix of confidence intervals.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
```



```

nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,

```

```
kappa_0 = kappa_0,
alpha_0 = alpha_0,
beta_00 = beta_00,
gamma_00 = gamma_00,
gamma_10 = gamma_10,
mu_t = mu_t,
psi_t = psi_t,
mu_p = mu_p,
psi_p = psi_p,
common_trait_loading = common_trait_loading,
common_state_loading = common_state_loading,
phi_0 = phi_0,
phi_1 = phi_1,
psi_s0 = psi_s0,
psi_s = psi_s,
theta = theta,
mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
fit <- FitCULTA2Profiles(data = data)
confint(fit, level = 0.95)

## End(Not run)
```

---

converged	<i>Convergence Status of a Model Fit</i>
-----------	--

---

**Description**

Checks whether the model fitting procedure for an object of class `fitculta` has successfully converged.

**Usage**

```
converged(object, ...)
```

**Arguments**

- `object`            Object of class `fitculta`.
- `...`            additional arguments.

**Value**

Logical. TRUE if the model has converged, FALSE otherwise.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
```

```

    data = 1,
    nrow = p,
    ncol = 1
  )
  phi_0 <- 0.000
  phi_1 <- 0.311
  psi_s0 <- 1.00
  psi_s <- 0.25
  theta <- 0.15 * diag(p)

  # profile-specific means
  mu_profile <- cbind(
    c(2.253, 1.493, 1.574, 1.117),
    c(-0.278, -0.165, -0.199, -0.148)
  )

  # data generation -----
  data <- GenCULTA2Profiles(
    n = n,
    m = m,
    mu_x = mu_x,
    sigma_x = sigma_x,
    nu_0 = nu_0,
    kappa_0 = kappa_0,
    alpha_0 = alpha_0,
    beta_00 = beta_00,
    gamma_00 = gamma_00,
    gamma_10 = gamma_10,
    mu_t = mu_t,
    psi_t = psi_t,
    mu_p = mu_p,
    psi_p = psi_p,
    common_trait_loading = common_trait_loading,
    common_state_loading = common_state_loading,
    phi_0 = phi_0,
    phi_1 = phi_1,
    psi_s0 = psi_s0,
    psi_s = psi_s,
    theta = theta,
    mu_profile = mu_profile
  )

  # model fitting -----
  # NOTE: Model fitting takes time
  fit <- FitCULTA2Profiles(data = data)
  converged(fit)

  ## End(Not run)

```

**Description**

Entropy

**Usage**

```
entropy(object, ...)
```

**Arguments**

object	Object of class fitcultu.
...	additional arguments.

**Value**

Returns Akaike's information criterion (AIC).

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
```

```

psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,

```

```

    phi_1 = phi_1,
    psi_s0 = psi_s0,
    psi_s = psi_s,
    theta = theta,
    mu_profile = mu_profile
  )

  # model fitting -----
  # NOTE: Model fitting takes time
  fit <- FitCULTA2Profiles(data = data)
  entropy(fit)

  ## End(Not run)

```

FigBiasCULTAEst

*Plot Relative Bias (CULTA Estimates)***Description**

Plot relative bias for common CULTA estimates.

**Usage**

```
FigBiasCULTAEst(results_culta_est)
```

**Arguments**

`results_culta_est`  
Summary CULTA estimates results data frame.

**Details**

The parameters are indexed as follows:

- 1  $\phi_0$  parameter. Autoregressive coefficient for profile 0.
- 2  $\phi_1$  parameter. Autoregressive coefficient for profile 1.
- 3  $\psi_T$  parameter. Variance in the common trait; reflects stable between-person differences.
- 4  $\lambda_{t2}$  parameter. Factor loading for the common trait and item 2.
- 5  $\lambda_{t3}$  parameter. Factor loading for the common trait and item 3.
- 6  $\lambda_{t4}$  parameter. Factor loading for the common trait and item 4.
- 7  $\psi_{p11}$  parameter. Trait-specific item 1 variance.
- 8  $\psi_{p22}$  parameter. Trait-specific item 2 variance.
- 9  $\psi_{p33}$  parameter. Trait-specific item 3 variance.
- 10  $\psi_{p44}$  parameter. Trait-specific item 4 variance.

- 11  $\psi_{s0}$  parameter. Initial-day variance of the common state; reflects variability in intoxication levels at observation start.
- 12  $\psi_s$  parameter. Residual state variance over days; captures within-person daily fluctuations not explained by trait or AR effects.
- 13  $\lambda_{s2}$  parameter. Factor loading for the common state and item 2.
- 14  $\lambda_{s3}$  parameter. Factor loading for the common state and item 3.
- 15  $\lambda_{s4}$  parameter. Factor loading for the common state and item 4.
- 16  $\theta_{11}$  parameter. Unique state variance for item 1.
- 17  $\theta_{22}$  parameter. Unique state variance for item 2.
- 18  $\theta_{33}$  parameter. Unique state variance for item 3.
- 19  $\theta_{44}$  parameter. Unique state variance for item 4.
- 20  $\nu_0$  parameter. Intercept for initial log-odds of profile 0 (vs. profile 1) when  $X = 0$ .
- 21  $\kappa_0$  parameter. Covariate effect on initial profile membership; higher  $X$  increases odds of profile 0.
- 22  $\alpha_0$  parameter. Baseline log-odds of being in profile 0 across days.
- 23  $\beta_{00}$  parameter. Increased odds of staying in profile 0 if previously in that profile; reflects persistence.
- 24  $\gamma_{00}$  parameter. Covariate effect on staying in profile 0; higher  $X$  increases persistence.
- 25  $\gamma_{10}$  parameter. Covariate effect on switching from state to profile 0; higher  $X$  increases transition odds.
- 26  $\mu_{10}$  parameter. Profile specific mean for profile 0 and item 1.
- 27  $\mu_{20}$  parameter. Profile specific mean for profile 0 and item 2.
- 28  $\mu_{30}$  parameter. Profile specific mean for profile 0 and item 3.
- 29  $\mu_{40}$  parameter. Profile specific mean for profile 0 and item 4.
- 30  $\mu_{11}$  parameter. Profile specific mean for profile 1 and item 1.
- 31  $\mu_{21}$  parameter. Profile specific mean for profile 1 and item 2.
- 32  $\mu_{31}$  parameter. Profile specific mean for profile 1 and item 3.
- 33  $\mu_{41}$  parameter. Profile specific mean for profile 1 and item 4.

### Author(s)

Ivan Jacob Agaloos Pesigan

### See Also

Other Figure Functions: [FigBiasLTAEst\(\)](#), [FigCoverageCULTAEst\(\)](#), [FigCoverageLTAEst\(\)](#), [FigEntropy\(\)](#), [FigIC\(\)](#), [FigPowerCULTAEst\(\)](#), [FigPowerLTAEst\(\)](#), [FigRMSECULTAEst\(\)](#), [FigRMSELTAEst\(\)](#)

### Examples

```
## Not run:
data(results_culta_est, package = "manCULTA")
FigBiasCULTAEst(results_culta_est)

## End(Not run)
```



FigBiasLTAEst

*Plot Relative Bias (LTA Estimates)***Description**

Plot relative bias for common LTA estimates.

**Usage**

```
FigBiasLTAEst(results_lta_est)
```

**Arguments**

results\_lta\_est

Summary LTA estimates results data frame.

**Details**

The parameters are indexed as follows:

- 1  $\theta_{11}$  parameter. Unique state variance for item 1.
- 2  $\theta_{22}$  parameter. Unique state variance for item 2.
- 3  $\theta_{33}$  parameter. Unique state variance for item 3.
- 4  $\theta_{44}$  parameter. Unique state variance for item 4.
- 5  $\nu_0$  parameter. Intercept for initial log-odds of profile 0 (vs. profile 1) when  $X = 0$ .
- 6  $\kappa_0$  parameter. Covariate effect on initial profile membership; higher  $X$  increases odds of profile 0.
- 7  $\alpha_0$  parameter. Baseline log-odds of being in profile 0 across days.
- 8  $\beta_{00}$  parameter. Increased odds of staying in profile 0 if previously in that profile; reflects persistence.
- 9  $\gamma_{00}$  parameter. Covariate effect on staying in profile 0; higher  $X$  increases persistence.
- 10  $\gamma_{10}$  parameter. Covariate effect on switching from state to profile 0; higher  $X$  increases transition odds.
- 11  $\mu_{10}$  parameter. Profile specific mean for profile 0 and item 1.
- 12  $\mu_{20}$  parameter. Profile specific mean for profile 0 and item 2.
- 13  $\mu_{30}$  parameter. Profile specific mean for profile 0 and item 3.
- 14  $\mu_{40}$  parameter. Profile specific mean for profile 0 and item 4.
- 15  $\mu_{11}$  parameter. Profile specific mean for profile 1 and item 1.
- 16  $\mu_{21}$  parameter. Profile specific mean for profile 1 and item 2.
- 17  $\mu_{31}$  parameter. Profile specific mean for profile 1 and item 3.
- 18  $\mu_{41}$  parameter. Profile specific mean for profile 1 and item 4.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Figure Functions: [FigBiasCULTAEst\(\)](#), [FigCoverageCULTAEst\(\)](#), [FigCoverageLTAEst\(\)](#), [FigEntropy\(\)](#), [FigIC\(\)](#), [FigPowerCULTAEst\(\)](#), [FigPowerLTAEst\(\)](#), [FigRMSECULTAEst\(\)](#), [FigRMSELTAEst\(\)](#)

**Examples**

```
## Not run:
data(results_lta_est, package = "manCULTA")
FigBiasLTAEst(results_lta_est)

## End(Not run)
```

---

FigCoverageCULTAEst      *Plot Coverage Probabilities (CULTA Estimates)*

---

**Description**

Plot coverage probabilities for CULTA estimates.

**Usage**

```
FigCoverageCULTAEst(results_culta_est)
```

**Arguments**

results\_culta\_est  
Summary CULTA estimates results data frame.

**Details**

The parameters are indexed as follows:

- 1  $\phi_0$  parameter. Autoregressive coefficient for profile 0.
- 2  $\phi_1$  parameter. Autoregressive coefficient for profile 1.
- 3  $\psi_T$  parameter. Variance in the common trait; reflects stable between-person differences.
- 4  $\lambda_{t2}$  parameter. Factor loading for the common trait and item 2.
- 5  $\lambda_{t3}$  parameter. Factor loading for the common trait and item 3.
- 6  $\lambda_{t4}$  parameter. Factor loading for the common trait and item 4.
- 7  $\psi_{p11}$  parameter. Trait-specific item 1 variance.
- 8  $\psi_{p22}$  parameter. Trait-specific item 2 variance.
- 9  $\psi_{p33}$  parameter. Trait-specific item 3 variance.

- 10  $\psi_{p44}$  parameter. Trait-specific item 4 variance.
- 11  $\psi_{s0}$  parameter. Initial-day variance of the common state; reflects variability in intoxication levels at observation start.
- 12  $\psi_s$  parameter. Residual state variance over days; captures within-person daily fluctuations not explained by trait or AR effects.
- 13  $\lambda_{s2}$  parameter. Factor loading for the common state and item 2.
- 14  $\lambda_{s3}$  parameter. Factor loading for the common state and item 3.
- 15  $\lambda_{s4}$  parameter. Factor loading for the common state and item 4.
- 16  $\theta_{11}$  parameter. Unique state variance for item 1.
- 17  $\theta_{22}$  parameter. Unique state variance for item 2.
- 18  $\theta_{33}$  parameter. Unique state variance for item 3.
- 19  $\theta_{44}$  parameter. Unique state variance for item 4.
- 20  $\nu_0$  parameter. Intercept for initial log-odds of profile 0 (vs. profile 1) when  $X = 0$ .
- 21  $\kappa_0$  parameter. Covariate effect on initial profile membership; higher  $X$  increases odds of profile 0.
- 22  $\alpha_0$  parameter. Baseline log-odds of being in profile 0 across days.
- 23  $\beta_{00}$  parameter. Increased odds of staying in profile 0 if previously in that profile; reflects persistence.
- 24  $\gamma_{00}$  parameter. Covariate effect on staying in profile 0; higher  $X$  increases persistence.
- 25  $\gamma_{10}$  parameter. Covariate effect on switching from state to profile 0; higher  $X$  increases transition odds.
- 26  $\mu_{10}$  parameter. Profile specific mean for profile 0 and item 1.
- 27  $\mu_{20}$  parameter. Profile specific mean for profile 0 and item 2.
- 28  $\mu_{30}$  parameter. Profile specific mean for profile 0 and item 3.
- 29  $\mu_{40}$  parameter. Profile specific mean for profile 0 and item 4.
- 30  $\mu_{11}$  parameter. Profile specific mean for profile 1 and item 1.
- 31  $\mu_{21}$  parameter. Profile specific mean for profile 1 and item 2.
- 32  $\mu_{31}$  parameter. Profile specific mean for profile 1 and item 3.
- 33  $\mu_{41}$  parameter. Profile specific mean for profile 1 and item 4.

#### Author(s)

Ivan Jacob Agaloos Pesigan

#### See Also

Other Figure Functions: [FigBiasCULTAEst\(\)](#), [FigBiasLTAEst\(\)](#), [FigCoverageLTAEst\(\)](#), [FigEntropy\(\)](#), [FigIC\(\)](#), [FigPowerCULTAEst\(\)](#), [FigPowerLTAEst\(\)](#), [FigRMSECULTAEst\(\)](#), [FigRMSELTAEst\(\)](#)

**Examples**

```
## Not run:
data(results_culta_est, package = "manCULTA")
FigCoverageCULTAEst(results_culta_est)

## End(Not run)
```

---

FigCoverageLTAEst      *Plot Coverage Probabilities (LTA Estimates)*

---

**Description**

Plot coverage probabilities for common LTA estimates.

**Usage**

```
FigCoverageLTAEst(results_lta_est)
```

**Arguments**

results\_lta\_est  
Summary LTA estimates results data frame.

**Details**

The parameters are indexed as follows:

- 1  $\theta_{11}$  parameter. Unique state variance for item 1.
- 2  $\theta_{22}$  parameter. Unique state variance for item 2.
- 3  $\theta_{33}$  parameter. Unique state variance for item 3.
- 4  $\theta_{44}$  parameter. Unique state variance for item 4.
- 5  $\nu_0$  parameter. Intercept for initial log-odds of profile 0 (vs. profile 1) when  $X = 0$ .
- 6  $\kappa_0$  parameter. Covariate effect on initial profile membership; higher  $X$  increases odds of profile 0.
- 7  $\alpha_0$  parameter. Baseline log-odds of being in profile 0 across days.
- 8  $\beta_{00}$  parameter. Increased odds of staying in profile 0 if previously in that profile; reflects persistence.
- 9  $\gamma_{00}$  parameter. Covariate effect on staying in profile 0; higher  $X$  increases persistence.
- 10  $\gamma_{10}$  parameter. Covariate effect on switching from state to profile 0; higher  $X$  increases transition odds.
- 11  $\mu_{10}$  parameter. Profile specific mean for profile 0 and item 1.
- 12  $\mu_{20}$  parameter. Profile specific mean for profile 0 and item 2.
- 13  $\mu_{30}$  parameter. Profile specific mean for profile 0 and item 3.

- 14**  $\mu_{40}$  parameter. Profile specific mean for profile 0 and item 4.
- 15**  $\mu_{11}$  parameter. Profile specific mean for profile 1 and item 1.
- 16**  $\mu_{21}$  parameter. Profile specific mean for profile 1 and item 2.
- 17**  $\mu_{31}$  parameter. Profile specific mean for profile 1 and item 3.
- 18**  $\mu_{41}$  parameter. Profile specific mean for profile 1 and item 4.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Figure Functions: [FigBiasCULTAEst\(\)](#), [FigBiasLTAEst\(\)](#), [FigCoverageCULTAEst\(\)](#), [FigEntropy\(\)](#), [FigIC\(\)](#), [FigPowerCULTAEst\(\)](#), [FigPowerLTAEst\(\)](#), [FigRMSECULTAEst\(\)](#), [FigRMSELTAEst\(\)](#)

**Examples**

```
## Not run:
data(results_lta_est, package = "manCULTA")
FigCoverageLTAEst(results_lta_est)

## End(Not run)
```

---

FigEntropy

*Plot Entropy*


---

**Description**

Plot average entropy.

**Usage**

```
FigEntropy(results_entropy)
```

**Arguments**

results\_entropy  
Summary entropy results data frame.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Figure Functions: [FigBiasCULTAEst\(\)](#), [FigBiasLTAEst\(\)](#), [FigCoverageCULTAEst\(\)](#), [FigCoverageLTAEst\(\)](#), [FigIC\(\)](#), [FigPowerCULTAEst\(\)](#), [FigPowerLTAEst\(\)](#), [FigRMSECULTAEst\(\)](#), [FigRMSELTAEst\(\)](#)

**Examples**

```
## Not run:
data(results_entropy, package = "manCULTA")
FigEntropy(results_entropy)

## End(Not run)
```

---

FigIC

---

*Plot Information Criteria*


---

**Description**

Plot average information criteria.

**Usage**

```
FigIC(results_ic)
```

**Arguments**

`results_ic`      Summary information criteria results data frame.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Figure Functions: [FigBiasCULTAEst\(\)](#), [FigBiasLTAEst\(\)](#), [FigCoverageCULTAEst\(\)](#), [FigCoverageLTAEst\(\)](#), [FigEntropy\(\)](#), [FigPowerCULTAEst\(\)](#), [FigPowerLTAEst\(\)](#), [FigRMSECULTAEst\(\)](#), [FigRMSELTAEst\(\)](#)

**Examples**

```
## Not run:
data(results_ic, package = "manCULTA")
FigIC(results_ic)

## End(Not run)
```

---

FigPowerCULTAEst	<i>Plot Statistical Power (CULTA Estimates)</i>
------------------	---

---

**Description**

Plot statistical power for CULTA estimates.

**Usage**

```
FigPowerCULTAEst(results_culta_est)
```

**Arguments**

`results_culta_est`  
Summary CULTA estimates results data frame.

**Details**

The parameters are indexed as follows:

- 1  $\phi_0$  parameter. Autoregressive coefficient for profile 0.
- 2  $\phi_1$  parameter. Autoregressive coefficient for profile 1.
- 3  $\psi_T$  parameter. Variance in the common trait; reflects stable between-person differences.
- 4  $\lambda_{t2}$  parameter. Factor loading for the common trait and item 2.
- 5  $\lambda_{t3}$  parameter. Factor loading for the common trait and item 3.
- 6  $\lambda_{t4}$  parameter. Factor loading for the common trait and item 4.
- 7  $\psi_{p11}$  parameter. Trait-specific item 1 variance.
- 8  $\psi_{p22}$  parameter. Trait-specific item 2 variance.
- 9  $\psi_{p33}$  parameter. Trait-specific item 3 variance.
- 10  $\psi_{p44}$  parameter. Trait-specific item 4 variance.
- 11  $\psi_{s0}$  parameter. Initial-day variance of the common state; reflects variability in intoxication levels at observation start.
- 12  $\psi_s$  parameter. Residual state variance over days; captures within-person daily fluctuations not explained by trait or AR effects.
- 13  $\lambda_{s2}$  parameter. Factor loading for the common state and item 2.
- 14  $\lambda_{s3}$  parameter. Factor loading for the common state and item 3.
- 15  $\lambda_{s4}$  parameter. Factor loading for the common state and item 4.
- 16  $\theta_{11}$  parameter. Unique state variance for item 1.
- 17  $\theta_{22}$  parameter. Unique state variance for item 2.
- 18  $\theta_{33}$  parameter. Unique state variance for item 3.
- 19  $\theta_{44}$  parameter. Unique state variance for item 4.
- 20  $\nu_0$  parameter. Intercept for initial log-odds of profile 0 (vs. profile 1) when  $X = 0$ .

- 21**  $\kappa_0$  parameter. Covariate effect on initial profile membership; higher  $X$  increases odds of profile 0.
- 22**  $\alpha_0$  parameter. Baseline log-odds of being in profile 0 across days.
- 23**  $\beta_{00}$  parameter. Increased odds of staying in profile 0 if previously in that profile; reflects persistence.
- 24**  $\gamma_{00}$  parameter. Covariate effect on staying in profile 0; higher  $X$  increases persistence.
- 25**  $\gamma_{10}$  parameter. Covariate effect on switching from state to profile 0; higher  $X$  increases transition odds.
- 26**  $\mu_{10}$  parameter. Profile specific mean for profile 0 and item 1.
- 27**  $\mu_{20}$  parameter. Profile specific mean for profile 0 and item 2.
- 28**  $\mu_{30}$  parameter. Profile specific mean for profile 0 and item 3.
- 29**  $\mu_{40}$  parameter. Profile specific mean for profile 0 and item 4.
- 30**  $\mu_{11}$  parameter. Profile specific mean for profile 1 and item 1.
- 31**  $\mu_{21}$  parameter. Profile specific mean for profile 1 and item 2.
- 32**  $\mu_{31}$  parameter. Profile specific mean for profile 1 and item 3.
- 33**  $\mu_{41}$  parameter. Profile specific mean for profile 1 and item 4.

#### Author(s)

Ivan Jacob Agaloos Pesigan

#### See Also

Other Figure Functions: [FigBiasCULTAEst\(\)](#), [FigBiasLTAEst\(\)](#), [FigCoverageCULTAEst\(\)](#), [FigCoverageLTAEst\(\)](#), [FigEntropy\(\)](#), [FigIC\(\)](#), [FigPowerLTAEst\(\)](#), [FigRMSECULTAEst\(\)](#), [FigRMSELTAEst\(\)](#)

#### Examples

```
## Not run:
data(results_culta_est, package = "manCULTA")
FigPowerCULTAEst(results_culta_est)

## End(Not run)
```

---

FigPowerLTAEst

*Plot Statistical Power (LTA Estimates)*

---

#### Description

Plot statistical power for common LTA estimates.

#### Usage

```
FigPowerLTAEst(results_lta_est)
```



**Arguments**`results_lta_est`

Summary LTA estimates results data frame.

**Details**

The parameters are indexed as follows:

- 1  $\theta_{11}$  parameter. Unique state variance for item 1.
- 2  $\theta_{22}$  parameter. Unique state variance for item 2.
- 3  $\theta_{33}$  parameter. Unique state variance for item 3.
- 4  $\theta_{44}$  parameter. Unique state variance for item 4.
- 5  $\nu_0$  parameter. Intercept for initial log-odds of profile 0 (vs. profile 1) when  $X = 0$ .
- 6  $\kappa_0$  parameter. Covariate effect on initial profile membership; higher  $X$  increases odds of profile 0.
- 7  $\alpha_0$  parameter. Baseline log-odds of being in profile 0 across days.
- 8  $\beta_{00}$  parameter. Increased odds of staying in profile 0 if previously in that profile; reflects persistence.
- 9  $\gamma_{00}$  parameter. Covariate effect on staying in profile 0; higher  $X$  increases persistence.
- 10  $\gamma_{10}$  parameter. Covariate effect on switching from state to profile 0; higher  $X$  increases transition odds.
- 11  $\mu_{10}$  parameter. Profile specific mean for profile 0 and item 1.
- 12  $\mu_{20}$  parameter. Profile specific mean for profile 0 and item 2.
- 13  $\mu_{30}$  parameter. Profile specific mean for profile 0 and item 3.
- 14  $\mu_{40}$  parameter. Profile specific mean for profile 0 and item 4.
- 15  $\mu_{11}$  parameter. Profile specific mean for profile 1 and item 1.
- 16  $\mu_{21}$  parameter. Profile specific mean for profile 1 and item 2.
- 17  $\mu_{31}$  parameter. Profile specific mean for profile 1 and item 3.
- 18  $\mu_{41}$  parameter. Profile specific mean for profile 1 and item 4.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Figure Functions: [FigBiasCULTAEst\(\)](#), [FigBiasLTAEst\(\)](#), [FigCoverageCULTAEst\(\)](#), [FigCoverageLTAEst\(\)](#), [FigEntropy\(\)](#), [FigIC\(\)](#), [FigPowerCULTAEst\(\)](#), [FigRMSECULTAEst\(\)](#), [FigRMSELTAEst\(\)](#)

**Examples**

```
## Not run:
data(results_lta_est, package = "manCULTA")
FigPowerLTAEst(results_lta_est)

## End(Not run)
```

FigRMSECULTAEst

*Plot Root Mean Square Error (CULTA Estimates)***Description**

Plot root mean square error for CULTA estimates.

**Usage**

```
FigRMSECULTAEst(results_culta_est)
```

**Arguments**

results\_culta\_est

Summary CULTA estimates results data frame.

**Details**

The parameters are indexed as follows:

- 1  $\phi_0$  parameter. Autoregressive coefficient for profile 0.
- 2  $\phi_1$  parameter. Autoregressive coefficient for profile 1.
- 3  $\psi_T$  parameter. Variance in the common trait; reflects stable between-person differences.
- 4  $\lambda_{t2}$  parameter. Factor loading for the common trait and item 2.
- 5  $\lambda_{t3}$  parameter. Factor loading for the common trait and item 3.
- 6  $\lambda_{t4}$  parameter. Factor loading for the common trait and item 4.
- 7  $\psi_{p11}$  parameter. Trait-specific item 1 variance.
- 8  $\psi_{p22}$  parameter. Trait-specific item 2 variance.
- 9  $\psi_{p33}$  parameter. Trait-specific item 3 variance.
- 10  $\psi_{p44}$  parameter. Trait-specific item 4 variance.
- 11  $\psi_{s0}$  parameter. Initial-day variance of the common state; reflects variability in intoxication levels at observation start.
- 12  $\psi_s$  parameter. Residual state variance over days; captures within-person daily fluctuations not explained by trait or AR effects.
- 13  $\lambda_{s2}$  parameter. Factor loading for the common state and item 2.
- 14  $\lambda_{s3}$  parameter. Factor loading for the common state and item 3.
- 15  $\lambda_{s4}$  parameter. Factor loading for the common state and item 4.
- 16  $\theta_{11}$  parameter. Unique state variance for item 1.
- 17  $\theta_{22}$  parameter. Unique state variance for item 2.
- 18  $\theta_{33}$  parameter. Unique state variance for item 3.
- 19  $\theta_{44}$  parameter. Unique state variance for item 4.
- 20  $\nu_0$  parameter. Intercept for initial log-odds of profile 0 (vs. profile 1) when  $X = 0$ .

- 21**  $\kappa_0$  parameter. Covariate effect on initial profile membership; higher  $X$  increases odds of profile 0.
- 22**  $\alpha_0$  parameter. Baseline log-odds of being in profile 0 across days.
- 23**  $\beta_{00}$  parameter. Increased odds of staying in profile 0 if previously in that profile; reflects persistence.
- 24**  $\gamma_{00}$  parameter. Covariate effect on staying in profile 0; higher  $X$  increases persistence.
- 25**  $\gamma_{10}$  parameter. Covariate effect on switching from state to profile 0; higher  $X$  increases transition odds.
- 26**  $\mu_{10}$  parameter. Profile specific mean for profile 0 and item 1.
- 27**  $\mu_{20}$  parameter. Profile specific mean for profile 0 and item 2.
- 28**  $\mu_{30}$  parameter. Profile specific mean for profile 0 and item 3.
- 29**  $\mu_{40}$  parameter. Profile specific mean for profile 0 and item 4.
- 30**  $\mu_{11}$  parameter. Profile specific mean for profile 1 and item 1.
- 31**  $\mu_{21}$  parameter. Profile specific mean for profile 1 and item 2.
- 32**  $\mu_{31}$  parameter. Profile specific mean for profile 1 and item 3.
- 33**  $\mu_{41}$  parameter. Profile specific mean for profile 1 and item 4.

#### Author(s)

Ivan Jacob Agaloos Pesigan

#### See Also

Other Figure Functions: [FigBiasCULTAEst\(\)](#), [FigBiasLTAEst\(\)](#), [FigCoverageCULTAEst\(\)](#), [FigCoverageLTAEst\(\)](#), [FigEntropy\(\)](#), [FigIC\(\)](#), [FigPowerCULTAEst\(\)](#), [FigPowerLTAEst\(\)](#), [FigRMSELTAEst\(\)](#)

#### Examples

```
## Not run:
data(results_culta_est, package = "manCULTA")
FigRMSECULTAEst(results_culta_est)

## End(Not run)
```

---

FigRMSELTAEst

*Plot Root Mean Square Error (LTA Estimates)*

---

#### Description

Plot root mean square error for common LTA estimates.

#### Usage

```
FigRMSELTAEst(results_lta_est)
```

**Arguments**

`results_lta_est`

Summary LTA estimates results data frame.

**Details**

The parameters are indexed as follows:

- 1  $\theta_{11}$  parameter. Unique state variance for item 1.
- 2  $\theta_{22}$  parameter. Unique state variance for item 2.
- 3  $\theta_{33}$  parameter. Unique state variance for item 3.
- 4  $\theta_{44}$  parameter. Unique state variance for item 4.
- 5  $\nu_0$  parameter. Intercept for initial log-odds of profile 0 (vs. profile 1) when  $X = 0$ .
- 6  $\kappa_0$  parameter. Covariate effect on initial profile membership; higher  $X$  increases odds of profile 0.
- 7  $\alpha_0$  parameter. Baseline log-odds of being in profile 0 across days.
- 8  $\beta_{00}$  parameter. Increased odds of staying in profile 0 if previously in that profile; reflects persistence.
- 9  $\gamma_{00}$  parameter. Covariate effect on staying in profile 0; higher  $X$  increases persistence.
- 10  $\gamma_{10}$  parameter. Covariate effect on switching from state to profile 0; higher  $X$  increases transition odds.
- 11  $\mu_{10}$  parameter. Profile specific mean for profile 0 and item 1.
- 12  $\mu_{20}$  parameter. Profile specific mean for profile 0 and item 2.
- 13  $\mu_{30}$  parameter. Profile specific mean for profile 0 and item 3.
- 14  $\mu_{40}$  parameter. Profile specific mean for profile 0 and item 4.
- 15  $\mu_{11}$  parameter. Profile specific mean for profile 1 and item 1.
- 16  $\mu_{21}$  parameter. Profile specific mean for profile 1 and item 2.
- 17  $\mu_{31}$  parameter. Profile specific mean for profile 1 and item 3.
- 18  $\mu_{41}$  parameter. Profile specific mean for profile 1 and item 4.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Figure Functions: [FigBiasCULTAEst\(\)](#), [FigBiasLTAEst\(\)](#), [FigCoverageCULTAEst\(\)](#), [FigCoverageLTAEst\(\)](#), [FigEntropy\(\)](#), [FigIC\(\)](#), [FigPowerCULTAEst\(\)](#), [FigPowerLTAEst\(\)](#), [FigRMSECULTAEst\(\)](#)

**Examples**

```
## Not run:
data(results_lta_est, package = "manCULTA")
FigRMSELTAEst(results_lta_est)

## End(Not run)
```

FitCULTA1Profile

*Fit the One-Profile CULTA Model (CUTS Model with AR)***Description**

Fits the one-profile CULTA model using Mplus.

**Usage**

```
FitCULTA1Profile(
  data,
  wd = ".",
  mplus_bin = NULL,
  starts = 10,
  starting_values = NULL
)
```

**Arguments**

<code>data</code>	R object. Object of class <code>simculta</code> .
<code>wd</code>	Character string. Working directory.
<code>mplus_bin</code>	Character string. Path to Mplus binary. If <code>mplus_bin = NULL</code> , the function will try to find the appropriate binary.
<code>starts</code>	Positive integer. Number of initial stage starting values.
<code>starting_values</code>	Optional list of starting values.

**Value**

Returns an object of class `fitculta`. which is a list with the following elements:

- `call`: Function call.
- `fun`: Function used ("FitCULTA1Profile").
- `args`: Function arguments.
- `output`: Mplus output files.
- `elapsed`: Elapsed time.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Model Fitting Functions: [FitCULTA2Profiles\(\)](#), [FitLTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputCULTA2Profiles\(\)](#), [InputLTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)

**Examples**

```

## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)

```

```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
FitCULTA1Profile(data = data)

## End(Not run)

```

---

FitCULTA2Profiles

*Fit the Two-Profile CULTA Model*


---

## Description

Fits the two-profile CULTA model using Mplus.

**Usage**

```
FitCULTA2Profiles(
  data,
  wd = ".",
  ncores = 1L,
  mplus_bin = NULL,
  starts = c(20, 4),
  stiterations = 10,
  stscale = 5,
  starting_values = NULL
)
```

**Arguments**

<code>data</code>	R object. Object of class <code>simcultu</code> .
<code>wd</code>	Character string. Working directory.
<code>ncores</code>	Positive integer. Number of cores to use.
<code>mplus_bin</code>	Character string. Path to Mplus binary. If <code>mplus_bin = NULL</code> , the function will try to find the appropriate binary.
<code>starts</code>	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
<code>stiterations</code>	Positive integer. Number of initial stage iterations.
<code>stscale</code>	Positive integer. Random start scale.
<code>starting_values</code>	Optional list of starting values.

**Value**

Returns an object of class `fitcultu`. which is a list with the following elements:

- `call`: Function call.
- `fun`: Function used ("FitCULTA2Profiles").
- `args`: Function arguments.
- `output`: Mplus output files.
- `elapsed`: Elapsed time.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitLTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputCULTA2Profiles\(\)](#), [InputLTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)



**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
```

```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
FitCULTA2Profiles(data = data)

## End(Not run)

```

---

FitLTA2Profiles

*Fit the Two-Profile LTA Model*


---

## Description

Fits the two-profile LTA model using Mplus.

**Usage**

```
FitLTA2Profiles(
  data,
  wd = ".",
  ncores = 1L,
  mplus_bin = NULL,
  starts = c(20, 4),
  stiterations = 10,
  stscale = 5,
  starting_values = NULL
)
```

**Arguments**

<code>data</code>	R object. Object of class <code>simcult.a</code> .
<code>wd</code>	Character string. Working directory.
<code>ncores</code>	Positive integer. Number of cores to use.
<code>mplus_bin</code>	Character string. Path to Mplus binary. If <code>mplus_bin = NULL</code> , the function will try to find the appropriate binary.
<code>starts</code>	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
<code>stiterations</code>	Positive integer. Number of initial stage iterations.
<code>stscale</code>	Positive integer. Random start scale.
<code>starting_values</code>	Optional list of starting values.

**Value**

Returns an object of class `fitcult.a`. which is a list with the following elements:

- `call`: Function call.
- `fun`: Function used ("FitLTA2Profiles").
- `args`: Function arguments.
- `output`: Mplus output files.
- `elapsed`: Elapsed time.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitCULTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputCULTA2Profiles\(\)](#), [InputLTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
```

```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
FitLTA2Profiles(data = data)

## End(Not run)

```

---

FitRILTA2Profiles

*Fit the Two-Profile RILTA Model*


---

## Description

Fits the two-profile RILTA model using Mplus.

**Usage**

```
FitRILTA2Profiles(
  data,
  wd = ".",
  ncores = 1L,
  mplus_bin = NULL,
  starts = c(20, 4),
  stiterations = 10,
  stscale = 5,
  starting_values = NULL
)
```

**Arguments**

<code>data</code>	R object. Object of class <code>simcultu</code> .
<code>wd</code>	Character string. Working directory.
<code>ncores</code>	Positive integer. Number of cores to use.
<code>mplus_bin</code>	Character string. Path to Mplus binary. If <code>mplus_bin = NULL</code> , the function will try to find the appropriate binary.
<code>starts</code>	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
<code>stiterations</code>	Positive integer. Number of initial stage iterations.
<code>stscale</code>	Positive integer. Random start scale.
<code>starting_values</code>	Optional list of starting values.

**Value**

Returns an object of class `fitcultu`. which is a list with the following elements:

- `call`: Function call.
- `fun`: Function used ("FitRILTA2Profiles").
- `args`: Function arguments.
- `output`: Mplus output files.
- `elapsed`: Elapsed time.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitCULTA2Profiles\(\)](#), [FitLTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputCULTA2Profiles\(\)](#), [InputLTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
```

```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
FitRILTA2Profiles(data = data)

## End(Not run)

```



**Description**

Generates data from a two-profile longitudinal CULTA model where profile membership, trait components, and state dynamics are influenced by an observed covariate. The function produces simulated responses incorporating covariate effects, individual differences, and time-varying fluctuations.

**Usage**

```
GenCULTA2Profiles(
  n,
  m,
  mu_x,
  sigma_x,
  nu_0,
  kappa_0,
  alpha_0,
  beta_00,
  gamma_00,
  gamma_10,
  mu_t,
  psi_t,
  mu_p,
  psi_p,
  common_trait_loading,
  common_state_loading,
  phi_0,
  phi_1,
  psi_s0,
  psi_s,
  theta,
  mu_profile
)
```

**Arguments**

n	Positive integer. Number of individuals.
m	Positive integer. Number of measurement occasions.
mu_x	Numeric. Mean of the covariate $\mu_X$ .
sigma_x	Numeric. Variance of the covariate $\sigma_X$ .
nu_0	Numeric. Intercept $\nu_0$ for the logistic model of initial profile membership.
kappa_0	Numeric. Covariate effect $\kappa_0$ on initial profile membership.
alpha_0	Numeric. Intercept $\alpha_0$ for the logistic model of profile transitions across time.
beta_00	Numeric. Effect $\beta_{00}$ for self-persistence in profile 0 transitions.
gamma_00	Numeric. Covariate effect $\gamma_{00}$ on remaining in profile 0.
gamma_10	Numeric. Covariate effect $\gamma_{10}$ on transitioning from profile 1 to profile 0.

mu_t	Numeric or vector of length $q$ . Mean $\mu_T$ of the common trait factor. If mu_t = NULL, defaults to zero.
psi_t	Numeric matrix of size $q \times q$ . Positive definite covariance matrix $\psi_T$ for the common trait factor.
mu_p	Numeric vector of length $p$ . Mean vector $\mu_p$ for unique trait components. If mu_p = NULL, defaults to zero.
psi_p	Numeric matrix of size $p \times p$ . Positive definite covariance matrix $\Psi_p$ for unique trait components.
common_trait_loading	Numeric matrix of size $p \times q$ . Factor loading matrix specifying the influence of the common trait on each observed item.
common_state_loading	Numeric matrix of size $p \times 1$ . Factor loading matrix specifying the influence of the common state on each observed item.
phi_0	Numeric. Autoregressive coefficient $\phi_0$ for the common state process in profile 0.
phi_1	Numeric. Autoregressive coefficient $\phi_1$ for the common state process in profile 1.
psi_s0	Numeric. Variance $\psi_{s0}$ of the initial common state.
psi_s	Numeric. Innovation variance $\psi_s$ for the common state process.
theta	Numeric matrix of size $p \times p$ . Positive definite covariance matrix $\Theta$ for unique state components.
mu_profile	Numeric matrix of size $p \times 2$ . Profile-specific means for each observed item across two latent profiles.

## Details

The [GenCULTA2Profiles\(\)](#) function generates data for a two-profile CULTA model with a covariate. The CULTA model incorporates a covariate, latent categorical variables, trait components, state components, and profile-specific means to simulate longitudinal data with latent profile transitions.

Let  $i \in \{1, \dots, n\}$  denote the index for individuals, let  $t \in \{0, \dots, m-1\}$  denote the index measurement occasions, let  $k \in \{1, \dots, p\}$  denote the index items, and let  $c \in \{0, 1\}$  be the index of the two latent profiles (profile 0 and profile 1). Let  $q$  be the trait dimension,  $q = 1$  in this context.

### Covariate

The covariate is generated from a normal distribution with mean  $\mu_X$  and variance  $\sigma_X$ .

### Latent Categorical Variables

Latent categorical variables represent profile membership for each individual at each measurement occasion. In a two-profile model, profile membership is influenced by a covariate and previous profile status, following a logistic formulation. We distinguish between:

- Initial profile membership (baseline time point)
- Profile transitions across subsequent time points

We describe both components below.

### Initial Profile Membership

For the first measurement occasion ( $t = 0$ ), profile membership is determined by the following log-odds for belonging to profile 0 (with profile 1 as the reference category):

$$\left( \begin{array}{cc} \nu_0 + \kappa_0 \times \text{Covariate} & 0 \end{array} \right).$$

The corresponding probability of belonging to each profile is given by:

$$\left( \begin{array}{cc} \frac{\exp(\nu_0 + \kappa_0 \times \text{Covariate})}{\exp(\nu_0 + \kappa_0 \times \text{Covariate}) + 1} & \frac{1}{\exp(\nu_0 + \kappa_0 \times \text{Covariate}) + 1} \end{array} \right).$$

Profile membership at the first occasion is sampled based on these probabilities.

### Profile Transitions

For subsequent occasions ( $t = 1, \dots, m-1$ ), profile transitions depend on the profile at the previous occasion and the covariate. The log-odds for transitioning to profile 0 at time  $t$  are given by:

$$\left( \begin{array}{cc} \alpha_0 + \beta_{00} + \gamma_{00} \times \text{Covariate} & 0 \\ \alpha_0 + \gamma_{10} \times \text{Covariate} & 0 \end{array} \right).$$

The probability of transitioning to each profile is computed as:

$$\left( \begin{array}{cc} \frac{\exp(\alpha_0 + \beta_{00} + \gamma_{00} \times \text{Covariate})}{\exp(\alpha_0 + \beta_{00} + \gamma_{00} \times \text{Covariate}) + 1} & \frac{1}{\exp(\alpha_0 + \beta_{00} + \gamma_{00} \times \text{Covariate}) + 1} \\ \frac{\exp(\alpha_0 + \gamma_{10} \times \text{Covariate})}{\exp(\alpha_0 + \gamma_{10} \times \text{Covariate}) + 1} & \frac{1}{\exp(\alpha_0 + \gamma_{10} \times \text{Covariate}) + 1} \end{array} \right).$$

Profile membership for each subsequent time point is sampled using these transition probabilities, based on the individual's covariate value and previous profile.

### Trait Components

The trait variate captures between-person differences and is composed of a shared (common) component and item-specific (unique) components. The full decomposition is given by:

$$\text{Trait}_i = \text{Common Trait Loading} \times \text{Common Trait}_i + \text{Unique Trait}_i.$$

We describe each component below.

### Common Trait

The common trait  $\text{Common Trait}_i$  represents shared individual differences that influence all items uniformly. It is drawn from a normal distribution with mean  $\mu_T$  and variance  $\psi_T$ :

$$\text{Common Trait}_i \sim \mathcal{N}(\mu_T, \psi_T)$$

The influence of the common trait on each item is determined by the  $p \times q$  common trait loading,

### Unique Traits

The unique trait component  $\text{Unique Trait}_{k,i}$  captures item-specific stable differences and is drawn from a multivariate normal distribution:

$$\text{Unique Trait}_i \sim \mathcal{N}(\boldsymbol{\mu}_p, \boldsymbol{\Psi}_{p \times p})$$

### Combined Trait Variate

The trait variate for item  $k$  and individual  $i$  is obtained by combining the common and unique trait components:

$$\text{Trait}_{k,i} = \text{Common Trait Loading}_k \times \text{Common Trait}_i + \text{Unique Trait}_{k,i}.$$

The common trait component introduces shared variance across items, while the unique trait component allows for item-specific differences not explained by the common trait.

### State Components

The state variate is composed of two parts: a common state shared across items, and unique states specific to each item. The full decomposition is given by:

$$\text{State}_{k,i,t} = \text{Common State Loading}_k \times \text{Common State}_{i,t} + \text{Unique State}_{k,i,t}.$$

We describe each component below.

### Common State

The common state  $\text{Common State}_{i,t}$  evolves over time following a first-order autoregressive process:

$$\text{Common State}_{i,t} = \phi_c \times \text{Common State}_{i,t-1} + \zeta_{i,t}.$$

The initial common state is drawn from a normal distribution:

$$\text{Common State}_{i,0} \sim \mathcal{N}(0, \psi_{s_0}).$$

The innovation term  $\zeta_{i,t}$  is normally distributed:

$$\zeta_{i,t} \sim \mathcal{N}(0, \psi_s).$$

The autoregressive parameter  $\phi_c$  depends on latent profile membership  $c$ :

$$\phi_c = \phi_0 + (\phi_1 - \phi_0) c.$$

Here,  $\phi_0$  and  $\phi_1$  represent the autoregressive coefficients for profiles coded as 0 and 1, respectively.

### Unique State

The unique state  $\text{Unique State}_{k,i,t}$  captures item-specific deviations and is drawn from a multivariate normal distribution:

$$\text{Unique State}_{i,t} \sim \mathcal{N}(0, \boldsymbol{\theta})$$

where  $\boldsymbol{\theta}$  is the item-level covariance matrix for the unique state component.

### Combined State Variate

The state variate for item  $k$ , individual  $i$ , and time  $t$  combines the common and unique state components:

$$\text{State}_{k,i,t} = \text{Common State Loading}_k \times \text{Common State}_{i,t} + \text{Unique State}_{k,i,t}$$

The common state loading parameter  $\text{Common State Loading}_k$  controls the influence of the shared state on each item.

### Observed Variables

The observed variable is given by

$$Y_{k,i,t} = \mu_{k,c} + \text{Trait}_{k,i} + \text{State}_{k,i,t}$$

where  $\mu_{k,c}$  is the profile specific mean, while  $\text{Trait}_{k,i}$  and  $\text{State}_{k,i,t}$  correspond to the trait and state components of the model.

**Value**

Returns an object of class `simcult`, which is a list with the following elements:

- `call`: Function call.
- `fun`: Function used ("GenCULTA2Profiles").
- `args`: Function arguments.
- `id`: Vector of ID numbers.
- `covariate`: Vector of covariate values.
- `categorical`: Latent profiles.
- `common_trait`: Common trait.
- `unique_trait`: Unique trait.
- `common_state`: Common state.
- `trait`: Common trait + unique trait.
- `state`: Common state + unique state.
- `data`: Generated data which is a matrix of observed variables generated from the CULTA model with two-profiles.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Data Generation Functions: [GenData\(\)](#)

**Examples**

```
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 10 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
```

```

gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- diag(1)
mu_t <- 0
psi_p <- diag(p)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 0.151
psi_s <- 0.290
theta <- diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,

```

```
psi_s = psi_s,
theta = theta,
mu_profile = mu_profile
)
```

---

GenData	<i>Simulate Data</i>
---------	----------------------

---

**Description**

The function simulates data using the [GenCULTA2Profiles\(\)](#) function.

**Usage**

```
GenData(taskid)
```

**Arguments**

taskid                      Positive integer. Task ID.

**See Also**

Other Data Generation Functions: [GenCULTA2Profiles\(\)](#)

**Examples**

```
## Not run:
set.seed(42)
sim <- GenData(taskid = 1)
as.matrix(sim)

## End(Not run)
```

---

InputCULTA1Profile	<i>Generate Mplus Inout file for the One-Profile CULTA Model (CUTS Model with AR)</i>
--------------------	---

---

**Description**

Generates Mplus input file for the one-profile CULTA model.

**Usage**

```
InputCULTA1Profile(data, wd = ".", starts = 10, starting_values = NULL)
```

**Arguments**

data	R object. Object of class simcult.
wd	Character string. Working directory.
starts	Positive integer. Number of initial stage starting values.
starting_values	Optional list of starting values.

**Value**

Writes data and input files in wd.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitCULTA2Profiles\(\)](#), [FitLTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA2Profiles\(\)](#), [InputLTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
```



```

psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,

```

```

    phi_0 = phi_0,
    phi_1 = phi_1,
    psi_s0 = psi_s0,
    psi_s = psi_s,
    theta = theta,
    mu_profile = mu_profile
  )

  # generate data and Mplus input files fitting -----
  InputCULTA1Profile(data = data)

  ## End(Not run)

```

---

InputCULTA2Profiles     *Generate Mplus Input file for the Two-Profile CULTA Model*

---

## Description

Generates Mplus input file for the two-profile CULTA model.

## Usage

```

InputCULTA2Profiles(
  data,
  wd = ".",
  ncores = 1L,
  starts = c(20, 4),
  stiterations = 10,
  stscale = 5,
  starting_values = NULL
)

```

## Arguments

data	R object. Object of class <code>simcultA</code> .
wd	Character string. Working directory.
ncores	Positive integer. Number of cores to use.
starts	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
stiterations	Positive integer. Number of initial stage iterations.
stscale	Positive integer. Random start scale.
starting_values	Optional list of starting values.

## Value

Writes data and input files in `wd`.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitCULTA2Profiles\(\)](#), [FitLTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputLTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
```

```

    ncol = q
  )

  # state parameters
  common_state_loading <- matrix(
    data = 1,
    nrow = p,
    ncol = 1
  )
  phi_0 <- 0.000
  phi_1 <- 0.311
  psi_s0 <- 1.00
  psi_s <- 0.25
  theta <- 0.15 * diag(p)

  # profile-specific means
  mu_profile <- cbind(
    c(2.253, 1.493, 1.574, 1.117),
    c(-0.278, -0.165, -0.199, -0.148)
  )

  # data generation -----
  data <- GenCULTA2Profiles(
    n = n,
    m = m,
    mu_x = mu_x,
    sigma_x = sigma_x,
    nu_0 = nu_0,
    kappa_0 = kappa_0,
    alpha_0 = alpha_0,
    beta_00 = beta_00,
    gamma_00 = gamma_00,
    gamma_10 = gamma_10,
    mu_t = mu_t,
    psi_t = psi_t,
    mu_p = mu_p,
    psi_p = psi_p,
    common_trait_loading = common_trait_loading,
    common_state_loading = common_state_loading,
    phi_0 = phi_0,
    phi_1 = phi_1,
    psi_s0 = psi_s0,
    psi_s = psi_s,
    theta = theta,
    mu_profile = mu_profile
  )

  # generate data and Mplus input files fitting -----
  InputCULTA2Profiles(data = data)

  ## End(Not run)

```

---

InputLTA2Profiles	<i>Generate Mplus Input file for the Two-Profile LTA Model</i>
-------------------	--

---

**Description**

Generates Mplus input file for the two-profile LTA model.

**Usage**

```
InputLTA2Profiles(  
  data,  
  wd = ".",  
  ncores = 1L,  
  starts = c(20, 4),  
  stiterations = 10,  
  stscale = 5,  
  starting_values = NULL  
)
```

**Arguments**

data	R object. Object of class <code>simcult.a</code> .
wd	Character string. Working directory.
ncores	Positive integer. Number of cores to use.
starts	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
stiterations	Positive integer. Number of initial stage iterations.
stscale	Positive integer. Random start scale.
starting_values	Optional list of starting values.

**Value**

Writes data and input files in `wd`.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitCULTA2Profiles\(\)](#), [FitLTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputCULTA2Profiles\(\)](#), [InputRILTA2Profiles\(\)](#)

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
```

```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# generate data and Mplus input files fitting -----
InputLTA2Profiles(data = data)

## End(Not run)

```

---

InputRILTA2Profiles      *Generate Mplus Input file for the Two-Profile RILTA Model*

---

## Description

Generates Mplus input file for the two-profile RILTA model.

**Usage**

```
InputRILTA2Profiles(
  data,
  wd = ".",
  ncores = 1L,
  starts = c(20, 4),
  stiterations = 10,
  stscale = 5,
  starting_values = NULL
)
```

**Arguments**

<code>data</code>	R object. Object of class <code>simcult</code> .
<code>wd</code>	Character string. Working directory.
<code>ncores</code>	Positive integer. Number of cores to use.
<code>starts</code>	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
<code>stiterations</code>	Positive integer. Number of initial stage iterations.
<code>stscale</code>	Positive integer. Random start scale.
<code>starting_values</code>	Optional list of starting values.

**Value**

Writes data and input files in `wd`.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**See Also**

Other Model Fitting Functions: [FitCULTA1Profile\(\)](#), [FitCULTA2Profiles\(\)](#), [FitLTA2Profiles\(\)](#), [FitRILTA2Profiles\(\)](#), [InputCULTA1Profile\(\)](#), [InputCULTA2Profiles\(\)](#), [InputLTA2Profiles\(\)](#)

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
```



```

q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

```

```

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# generate data and Mplus input files fitting -----
InputRILTA2Profiles(data = data)

## End(Not run)

```

---

logLik.fitcultla

---

*Extract Log-Likelihood*


---

## Description

Extract Log-Likelihood

## Usage

```

## S3 method for class 'fitcultla'
logLik(object, ...)

```

## Arguments

object	Object of class fitcultla.
...	additional arguments.

**Value**

Returns an object of class logLik. This is a number with at the attribute, "df" (degrees of freedom), giving the number of (estimated) parameters in the model, and "correction" which is the scaling correction factor for MLR.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
```

```

    nrow = p,
    ncol = q
  )

  # state parameters
  common_state_loading <- matrix(
    data = 1,
    nrow = p,
    ncol = 1
  )
  phi_0 <- 0.000
  phi_1 <- 0.311
  psi_s0 <- 1.00
  psi_s <- 0.25
  theta <- 0.15 * diag(p)

  # profile-specific means
  mu_profile <- cbind(
    c(2.253, 1.493, 1.574, 1.117),
    c(-0.278, -0.165, -0.199, -0.148)
  )

  # data generation -----
  data <- GenCULTA2Profiles(
    n = n,
    m = m,
    mu_x = mu_x,
    sigma_x = sigma_x,
    nu_0 = nu_0,
    kappa_0 = kappa_0,
    alpha_0 = alpha_0,
    beta_00 = beta_00,
    gamma_00 = gamma_00,
    gamma_10 = gamma_10,
    mu_t = mu_t,
    psi_t = psi_t,
    mu_p = mu_p,
    psi_p = psi_p,
    common_trait_loading = common_trait_loading,
    common_state_loading = common_state_loading,
    phi_0 = phi_0,
    phi_1 = phi_1,
    psi_s0 = psi_s0,
    psi_s = psi_s,
    theta = theta,
    mu_profile = mu_profile
  )

  # model fitting -----
  # NOTE: Model fitting takes time
  fit <- FitCULTA2Profiles(data = data)
  logLik(fit, level = 0.95)

```

```
## End(Not run)
```

---

 params

*Simulation Parameters*


---

## Description

Simulation Parameters

## Usage

```
data(params)
```

## Format

A dataframe with 5 rows and 38 columns:

**taskid** Simulation Task ID.

**n** Sample size.

**m** Measurement occasions.

**mu\_x**  $\mu_x$  parameter. Mean of the covariate.

**sigma\_x**  $\sigma_x$  parameter. Variance of the covariate.

**mu\_10**  $\mu_{10}$  parameter. Profile specific mean for profile 0 and item 1.

**mu\_20**  $\mu_{20}$  parameter. Profile specific mean for profile 0 and item 2.

**mu\_30**  $\mu_{30}$  parameter. Profile specific mean for profile 0 and item 3.

**mu\_40**  $\mu_{40}$  parameter. Profile specific mean for profile 0 and item 4.

**lambda\_t2**  $\lambda_{t2}$  parameter. Factor loading for the common trait and item 2.

**lambda\_s2**  $\lambda_{s2}$  parameter. Factor loading for the common state and item 2.

**lambda\_t3**  $\lambda_{t3}$  parameter. Factor loading for the common trait and item 3.

**lambda\_s3**  $\lambda_{s3}$  parameter. Factor loading for the common state and item 3.

**lambda\_t4**  $\lambda_{t4}$  parameter. Factor loading for the common trait and item 4.

**lambda\_s4**  $\lambda_{s4}$  parameter. Factor loading for the common state and item 4.

**theta\_11**  $\theta_{11}$  parameter. Unique state variance for item 1.

**theta\_22**  $\theta_{22}$  parameter. Unique state variance for item 2.

**theta\_33**  $\theta_{33}$  parameter. Unique state variance for item 3.

**theta\_44**  $\theta_{44}$  parameter. Unique state variance for item 4.

**phi\_0**  $\phi_0$  parameter. Autoregressive coefficient for profile 0.

**psi\_t**  $\psi_T$  parameter. Variance in the common trait; reflects stable between-person differences.

**psi\_p\_11**  $\psi_{p11}$  parameter. Trait-specific item 1 variance.

**psi\_p\_22**  $\psi_{p22}$  parameter. Trait-specific item 2 variance.

- psi\_p\_33**  $\psi_{p33}$  parameter. Trait-specific item 3 variance.
- psi\_p\_44**  $\psi_{p44}$  parameter. Trait-specific item 4 variance.
- psi\_s0**  $\psi_{s0}$  parameter. Initial-day variance of the common state; reflects variability in intoxication levels at observation start.
- psi\_s**  $\psi_s$  parameter. Residual state variance over days; captures within-person daily fluctuations not explained by trait or AR effects.
- mu\_11**  $\mu_{11}$  parameter. Profile specific mean for profile 1 and item 1.
- mu\_21**  $\mu_{21}$  parameter. Profile specific mean for profile 1 and item 2.
- mu\_31**  $\mu_{31}$  parameter. Profile specific mean for profile 1 and item 3.
- mu\_41**  $\mu_{41}$  parameter. Profile specific mean for profile 1 and item 4.
- phi\_1**  $\phi_1$  parameter. Autoregressive coefficient for profile 1.
- nu\_0**  $\nu_0$  parameter. Intercept for initial log-odds of profile 0 (vs. profile 1) when  $X = 0$ .
- alpha\_0**  $\alpha_0$  parameter. Baseline log-odds of being in profile 0 across days.
- kappa\_0**  $\kappa_0$  parameter. Covariate effect on initial profile membership; higher  $X$  increases odds of profile 0.
- beta\_00**  $\beta_{00}$  parameter. Increased odds of staying in profile 0 if previously in that profile; reflects persistence.
- gamma\_00**  $\gamma_{00}$  parameter. Covariate effect on staying in profile 0; higher  $X$  increases persistence.
- gamma\_10**  $\gamma_{10}$  parameter. Covariate effect on switching from state to profile 0; higher  $X$  increases transition odds.

### Author(s)

Ivan Jacob Agaloos Pesigan

---

print.fitcult

*Print Method for an Object of Class fitcult*

---

### Description

Print Method for an Object of Class fitcult

### Usage

```
## S3 method for class 'fitcult'
print(x, alpha = NULL, digits = 4, ...)
```

### Arguments

x	Object of class fitcult.
alpha	Numeric vector. Significance level $\alpha$ . If alpha = NULL, use alpha = 0.05.
digits	Digits to print.
...	additional arguments.

**Value**

Prints a matrix of standardized regression slopes, standard errors, test statistics, p-values, and confidence intervals.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
```

```

    ncol = q
  )

  # state parameters
  common_state_loading <- matrix(
    data = 1,
    nrow = p,
    ncol = 1
  )
  phi_0 <- 0.000
  phi_1 <- 0.311
  psi_s0 <- 1.00
  psi_s <- 0.25
  theta <- 0.15 * diag(p)

  # profile-specific means
  mu_profile <- cbind(
    c(2.253, 1.493, 1.574, 1.117),
    c(-0.278, -0.165, -0.199, -0.148)
  )

  # data generation -----
  data <- GenCULTA2Profiles(
    n = n,
    m = m,
    mu_x = mu_x,
    sigma_x = sigma_x,
    nu_0 = nu_0,
    kappa_0 = kappa_0,
    alpha_0 = alpha_0,
    beta_00 = beta_00,
    gamma_00 = gamma_00,
    gamma_10 = gamma_10,
    mu_t = mu_t,
    psi_t = psi_t,
    mu_p = mu_p,
    psi_p = psi_p,
    common_trait_loading = common_trait_loading,
    common_state_loading = common_state_loading,
    phi_0 = phi_0,
    phi_1 = phi_1,
    psi_s0 = psi_s0,
    psi_s = psi_s,
    theta = theta,
    mu_profile = mu_profile
  )

  # model fitting -----
  # NOTE: Model fitting takes time
  fit <- FitCULTA2Profiles(data = data)
  print(fit)

  ## End(Not run)

```



---

print.simculta	<i>Print Method for an Object of Class simculta</i>
----------------	---

---

**Description**

Print Method for an Object of Class simculta

**Usage**

```
## S3 method for class 'simculta'  
print(x, ...)
```

**Arguments**

x	Object of class simculta.
...	Additional arguments.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
x <- GenCULTA2Profiles(  
  n = 10,  
  m = 6,  
  common_trait_loading = matrix(  
    data = c(1, 1.25, 1.50, 1.75),  
    ncol = 1  
  ),  
  common_state_loading = matrix(  
    data = c(1, 1.5, 1.75, 2.00),  
    ncol = 1  
  ),  
  mu_t = NULL,  
  psi_t = NULL,  
  mu_p = NULL,  
  psi_p = NULL,  
  theta = diag(4),  
  mu_profile = cbind(  
    c(-3, -3, -3, -3),  
    c(3, 3, 3, 3)  
  ),  
  mu_x = 0,  
  sigma_x = 1,  
  nu_0 = -3.563,  
  kappa_0 = 0.122,
```

```

alpha_0 = -3.586,
beta_00 = 2.250,
gamma_00 = 0.063,
gamma_10 = 0.094,
phi_0 = 0.311,
phi_1 = 0,
psi_s0 = 0.151,
psi_s = 0.290
)
print(x)

```

---

results_culta_est	<i>Simulation Results (CULTA Estimates)</i>
-------------------	---

---

## Description

Simulation Results (CULTA Estimates)

## Usage

```
data(results_culta_est)
```

## Format

A dataframe with 165 rows and 22 columns:

**taskid** Task ID.

**replications** Number of replications.

**parnames** Parameter names

**parameter** Population parameter value.

**model** Fitted model.

**n** Sample size.

**est** Mean parameter estimate.

**se** Mean standard error.

**z** Mean  $z$  statistic.

**p** Mean  $p$ -value.

**ll** Mean lower limit of the 95% confidence interval.

**ul** Mean upper limit of the 95% confidence interval.

**sig** Proportion of statistically significant results.

**theta\_hit** Proportion of replications where the confidence intervals contained the population parameter.

**sq\_error** Mean squared error.

**bias** Bias.

**rel\_bias** Relative bias.

**se\_bias** Bias in standard error estimate.

**rel\_se\_bias** Relative bias in standard error estimate.

**rmse** Root mean square error.

**coverage** Coverage probability.

**power** Statistical power.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

results_entropy	<i>Simulation Results (Entropy)</i>
-----------------	-------------------------------------

---

**Description**

Simulation Results (Entropy)

**Usage**

```
data(results_entropy)
```

**Format**

A dataframe with 14 rows and 4 columns:

**TaskID** Simulation Task ID.

**N** Sample size.

**Model** Fitted model.

**Entropy** Mean entropy.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

results_ic	<i>Simulation Results (Information Criteria)</i>
------------	--

---

**Description**

Simulation Results (Information Criteria)

**Usage**

```
data(results_ic)
```

**Format**

A dataframe with 60 rows and 5 columns:

**TaskID** Simulation Task ID.

**N** Sample size.

**Model** Fitted model.

**IC** Information criteria type.

**Value** Mean information criteria.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

results_lta_est	<i>Simulation Results (LTA Estimates)</i>
-----------------	---

---

**Description**

Simulation Results (LTA Estimates)

**Usage**

```
data(results_lta_est)
```

**Format**

A dataframe with 270 rows and 22 columns:

**taskid** Task ID.

**replications** Number of replications.

**parnames** Parameter names

**parameter** Population parameter value.

**model** Fitted model.

**n** Sample size.

**est** Mean parameter estimate.

**se** Mean standard error.

**z** Mean  $z$  statistic.

**p** Mean  $p$ -value.

**ll** Mean lower limit of the 95% confidence interval.

**ul** Mean upper limit of the 95% confidence interval.

**sig** Proportion of statistically significant results.

**theta\_hit** Proportion of replications where the confidence intervals contained the population parameter.

**sq\_error** Mean squared error.

**bias** Bias.

**rel\_bias** Relative bias.

**se\_bias** Bias in standard error estimate.

**rel\_se\_bias** Relative bias in standard error estimate.

**rmse** Root mean square error.

**coverage** Coverage probability.

**power** Statistical power.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

Sim	<i>Simulation Replication</i>
-----	-------------------------------

---

**Description**

Simulation Replication

**Usage**

```
Sim(  
  taskid,  
  repid,  
  output_folder,  
  overwrite,  
  integrity,  
  seed,  
  mplus_bin,  
  starts,  
  stiterations,  
  stscales,  
  max_iter  
)
```

**Arguments**

taskid	Positive integer. Task ID.
repid	Positive integer. Replication ID.
output_folder	Character string. Output folder.
overwrite	Logical. Overwrite existing output in output_folder.
integrity	Logical. If integrity = TRUE, check for the output file integrity when overwrite = FALSE.
seed	Integer. Random seed.
mplus_bin	Character string. Path to Mplus binary. If mplus_bin = NULL, the function will try to find the appropriate binary.
starts	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
stiterations	Positive integer. Number of initial stage iterations.
stscales	Positive integer. Random start scale.
max_iter	Positive integer. Maximum number of reruns.

**Value**

The output is saved as an external file in output\_folder.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

 SimFitCULTA1Profile     *Simulation Replication - FitCULTA1Profile*


---

**Description**

Simulation Replication - FitCULTA1Profile

**Usage**

```

SimFitCULTA1Profile(
  taskid,
  repid,
  output_folder,
  seed,
  suffix,
  overwrite,
  integrity,
  mplus_bin,
  starts,
  max_iter
)

```

**Arguments**

taskid	Positive integer. Task ID.
repid	Positive integer. Replication ID.
output_folder	Character string. Output folder.
seed	Integer. Random seed.
suffix	Character string. Output of <code>manCULTA:::SimSuffix()</code> .
overwrite	Logical. Overwrite existing output in <code>output_folder</code> .
integrity	Logical. If <code>integrity = TRUE</code> , check for the output file integrity when <code>overwrite = FALSE</code> .
mplus_bin	Character string. Path to Mplus binary. If <code>mplus_bin = NULL</code> , the function will try to find the appropriate binary.
starts	Positive integer. Number of initial stage starting values.
max_iter	Positive integer. Maximum number of reruns.

**Details**This function is executed via the `Sim` function.

**Value**

The output is saved as an external file in output\_folder.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

SimFitCULTA2Profiles    *Simulation Replication - FitCULTA2Profiles*

---

**Description**

Simulation Replication - FitCULTA2Profiles

**Usage**

```
SimFitCULTA2Profiles(
  taskid,
  repid,
  output_folder,
  seed,
  suffix,
  overwrite,
  integrity,
  mplus_bin,
  starts,
  stiterations,
  stscale,
  max_iter
)
```

**Arguments**

taskid	Positive integer. Task ID.
repid	Positive integer. Replication ID.
output_folder	Character string. Output folder.
seed	Integer. Random seed.
suffix	Character string. Output of manCULTA:::SimSuffix().
overwrite	Logical. Overwrite existing output in output_folder.
integrity	Logical. If integrity = TRUE, check for the output file integrity when overwrite = FALSE.
mplus_bin	Character string. Path to Mplus binary. If mplus_bin = NULL, the function will try to find the appropriate binary.
starts	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.



stiterations	Positive integer. Number of initial stage iterations.
stscale	Positive integer. Random start scale.
max_iter	Positive integer. Maximum number of reruns.

**Details**

This function is executed via the Sim function.

**Value**

The output is saved as an external file in output\_folder.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

SimFitLTA2Profiles	<i>Simulation Replication - FitLTA2Profiles</i>
--------------------	---

---

**Description**

Simulation Replication - FitLTA2Profiles

**Usage**

```
SimFitLTA2Profiles(  
  taskid,  
  repid,  
  output_folder,  
  seed,  
  suffix,  
  overwrite,  
  integrity,  
  mplus_bin,  
  starts,  
  stiterations,  
  stscale,  
  max_iter  
)
```

**Arguments**

taskid	Positive integer. Task ID.
repid	Positive integer. Replication ID.
output_folder	Character string. Output folder.
seed	Integer. Random seed.

suffix	Character string. Output of <code>manCULTA:::SimSuffix()</code> .
overwrite	Logical. Overwrite existing output in <code>output_folder</code> .
integrity	Logical. If <code>integrity = TRUE</code> , check for the output file integrity when <code>overwrite = FALSE</code> .
mplus_bin	Character string. Path to Mplus binary. If <code>mplus_bin = NULL</code> , the function will try to find the appropriate binary.
starts	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
stiterations	Positive integer. Number of initial stage iterations.
stscale	Positive integer. Random start scale.
max_iter	Positive integer. Maximum number of reruns.

### Details

This function is executed via the `Sim` function.

### Value

The output is saved as an external file in `output_folder`.

### Author(s)

Ivan Jacob Agaloos Pesigan

---

SimFitRILTA2Profiles    *Simulation Replication - FitRILTA2Profiles*

---

### Description

Simulation Replication - FitRILTA2Profiles

### Usage

```
SimFitRILTA2Profiles(
  taskid,
  repid,
  output_folder,
  seed,
  suffix,
  overwrite,
  integrity,
  mplus_bin,
  starts,
  stiterations,
  stscale,
  max_iter
)
```

**Arguments**

taskid	Positive integer. Task ID.
repid	Positive integer. Replication ID.
output_folder	Character string. Output folder.
seed	Integer. Random seed.
suffix	Character string. Output of <code>manCULTA:::SimSuffix()</code> .
overwrite	Logical. Overwrite existing output in <code>output_folder</code> .
integrity	Logical. If <code>integrity = TRUE</code> , check for the output file integrity when <code>overwrite = FALSE</code> .
mplus_bin	Character string. Path to Mplus binary. If <code>mplus_bin = NULL</code> , the function will try to find the appropriate binary.
starts	Vector of positive integer of length two. Number of initial stage starts and number of final stage optimizations.
stiterations	Positive integer. Number of initial stage iterations.
stscale	Positive integer. Random start scale.
max_iter	Positive integer. Maximum number of reruns.

**Details**

This function is executed via the `Sim` function.

**Value**

The output is saved as an external file in `output_folder`.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

SimFN

*Simulation File Name*

---

**Description**

Simulation File Name

**Usage**

```
SimFN(output_type, output_folder, suffix)
```

**Arguments**

output_type	Character string. Output type.
output_folder	Character string. Output folder.
suffix	Character string. Output of <code>manCULTA:::SimSuffix()</code> .

**Value**

Returns a character string file name with the output\_folder in the OS-specific format.

---

SimGenData	<i>Simulation Replication - GenData</i>
------------	---

---

**Description**

Simulation Replication - GenData

**Usage**

SimGenData(taskid, repid, output\_folder, seed, suffix, overwrite, integrity)

**Arguments**

taskid	Positive integer. Task ID.
repid	Positive integer. Replication ID.
output_folder	Character string. Output folder.
seed	Integer. Random seed.
suffix	Character string. Output of manCULTA:::SimSuffix().
overwrite	Logical. Overwrite existing output in output_folder.
integrity	Logical. If integrity = TRUE, check for the output file integrity when overwrite = FALSE.

**Details**

This function is executed via the Sim function.

**Value**

The output is saved as an external file in output\_folder.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

SimProj	<i>Simulation Project Name</i>
---------	--------------------------------

---

**Description**

Simulation Project Name

**Usage**

SimProj()

**Value**

Returns the project name as a character string.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

Sum	<i>Summary</i>
-----	----------------

---

**Description**

Summary

**Usage**

Sum(taskid, reps, output\_folder, overwrite, integrity, ncores = 1L)

**Arguments**

- |               |   |
|---------------|---|
| taskid        | Positive integer. Task ID.  |
| reps          | Positive integer. Number of replications.   |
| output_folder | Character string. Output folder.  |
| overwrite     | Logical. Overwrite existing output in output_folder.                                      |
| integrity     | Logical. If integrity = TRUE, check for the output file integrity when overwrite = FALSE. |
| ncores        | Positive integer. Number of cores to use.   |

**Value**

The output is saved as an external file in output\_folder.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

SumFitCULTA1Profile      *Summary (FitCULTA1Profile)*

---

**Description**

Summary (FitCULTA1Profile)

**Usage**

```
SumFitCULTA1Profile(  
  taskid,  
  reps,  
  output_folder,  
  overwrite,  
  integrity,  
  ncores = 1L  
)
```

**Arguments**

taskid	Positive integer. Task ID.
reps	Positive integer. Number of replications.
output_folder	Character string. Output folder.
overwrite	Logical. Overwrite existing output in output_folder.
integrity	Logical. If integrity = TRUE, check for the output file integrity when overwrite = FALSE.
ncores	Positive integer. Number of cores to use.

**Details**

This function is executed via the Sum function.

**Value**

The output is saved as an external file in output\_folder.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

**SumFitCULTA2Profiles    *Summary (FitCULTA2Profiles)***

---

**Description**

Summary (FitCULTA2Profiles)

**Usage**

```
SumFitCULTA2Profiles(  
  taskid,  
  reps,  
  output_folder,  
  overwrite,  
  integrity,  
  ncores = 1L  
)
```

**Arguments**

taskid	Positive integer. Task ID.
reps	Positive integer. Number of replications.
output_folder	Character string. Output folder.
overwrite	Logical. Overwrite existing output in output_folder.
integrity	Logical. If integrity = TRUE, check for the output file integrity when overwrite = FALSE.
ncores	Positive integer. Number of cores to use.

**Details**

This function is executed via the Sum function.

**Value**

The output is saved as an external file in output\_folder.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

SumFitLTA2Profiles      *Summary (FitLTA2Profiles)*

---

**Description**

Summary (FitLTA2Profiles)

**Usage**

```
SumFitLTA2Profiles(  
  taskid,  
  reps,  
  output_folder,  
  overwrite,  
  integrity,  
  ncores = 1L  
)
```

**Arguments**

taskid	Positive integer. Task ID.
reps	Positive integer. Number of replications.
output_folder	Character string. Output folder.
overwrite	Logical. Overwrite existing output in output_folder.
integrity	Logical. If integrity = TRUE, check for the output file integrity when overwrite = FALSE.
ncores	Positive integer. Number of cores to use.

**Details**

This function is executed via the Sum function.

**Value**

The output is saved as an external file in output\_folder.

**Author(s)**

Ivan Jacob Agaloos Pesigan



---

**SumFitRILTA2Profiles    *Summary (FitRILTA2Profiles)***

---

**Description**

Summary (FitRILTA2Profiles)

**Usage**

```
SumFitRILTA2Profiles(  
  taskid,  
  reps,  
  output_folder,  
  overwrite,  
  integrity,  
  ncores = 1L  
)
```

**Arguments**

taskid	Positive integer. Task ID.
reps	Positive integer. Number of replications.
output_folder	Character string. Output folder.
overwrite	Logical. Overwrite existing output in output_folder.
integrity	Logical. If integrity = TRUE, check for the output file integrity when overwrite = FALSE.
ncores	Positive integer. Number of cores to use.

**Details**

This function is executed via the Sum function.

**Value**

The output is saved as an external file in output\_folder.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

SumLTAParamsCULTA2Profiles

*Summary (LTAParamsCULTA2Profiles)*

---

## Description

Summary (LTAParamsCULTA2Profiles)

## Usage

```
SumLTAParamsCULTA2Profiles(  
  taskid,  
  reps,  
  output_folder,  
  overwrite,  
  integrity,  
  ncores = 1L  
)
```

## Arguments

taskid	Positive integer. Task ID.
reps	Positive integer. Number of replications.
output_folder	Character string. Output folder.
overwrite	Logical. Overwrite existing output in output_folder.
integrity	Logical. If integrity = TRUE, check for the output file integrity when overwrite = FALSE.
ncores	Positive integer. Number of cores to use.

## Details

This function is executed via the Sum function.

## Value

The output is saved as an external file in output\_folder.

## Author(s)

Ivan Jacob Agaloos Pesigan

---

`SumLTAParamsLTA2Profiles`*Summary (LTAParamsLTA2Profiles)*

---

**Description**

Summary (LTAParamsLTA2Profiles)

**Usage**

```
SumLTAParamsLTA2Profiles(  
  taskid,  
  reps,  
  output_folder,  
  overwrite,  
  integrity,  
  ncores = 1L  
)
```

**Arguments**

<code>taskid</code>	Positive integer. Task ID.
<code>reps</code>	Positive integer. Number of replications.
<code>output_folder</code>	Character string. Output folder.
<code>overwrite</code>	Logical. Overwrite existing output in <code>output_folder</code> .
<code>integrity</code>	Logical. If <code>integrity = TRUE</code> , check for the output file integrity when <code>overwrite = FALSE</code> .
<code>ncores</code>	Positive integer. Number of cores to use.

**Details**

This function is executed via the `Sum` function.

**Value**

The output is saved as an external file in `output_folder`.

**Author(s)**

Ivan Jacob Agaloos Pesigan

---

`SumLTAParamsRILTA2Profiles`*Summary (LTAParamsRILTA2Profiles)*

---

**Description**

Summary (LTAParamsRILTA2Profiles)

**Usage**

```
SumLTAParamsRILTA2Profiles(  
  taskid,  
  reps,  
  output_folder,  
  overwrite,  
  integrity,  
  ncores = 1L  
)
```

**Arguments**

<code>taskid</code>	Positive integer. Task ID.
<code>reps</code>	Positive integer. Number of replications.
<code>output_folder</code>	Character string. Output folder.
<code>overwrite</code>	Logical. Overwrite existing output in <code>output_folder</code> .
<code>integrity</code>	Logical. If <code>integrity = TRUE</code> , check for the output file integrity when <code>overwrite = FALSE</code> .
<code>ncores</code>	Positive integer. Number of cores to use.

**Details**

This function is executed via the `Sum` function.

**Value**

The output is saved as an external file in `output_folder`.

**Author(s)**

Ivan Jacob Agaloos Pesigan

summary.fitcultu

*Summary Method for an Object of Class fitcultu***Description**

Summary Method for an Object of Class fitcultu

**Usage**

```
## S3 method for class 'fitcultu'
summary(object, alpha = NULL, digits = 4, ...)
```

**Arguments**

object	Object of class fitcultu.
alpha	Numeric vector. Significance level $\alpha$ . If alpha = NULL, use alpha = 0.05.
digits	Digits to print.
...	additional arguments.

**Value**

Returns a matrix of standardized regression slopes, standard errors, test statistics, p-values, and confidence intervals.

**Author(s)**

Ivan Jacob Agaloos Pesigan

**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
```

```

kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,

```

```

    alpha_0 = alpha_0,
    beta_00 = beta_00,
    gamma_00 = gamma_00,
    gamma_10 = gamma_10,
    mu_t = mu_t,
    psi_t = psi_t,
    mu_p = mu_p,
    psi_p = psi_p,
    common_trait_loading = common_trait_loading,
    common_state_loading = common_state_loading,
    phi_0 = phi_0,
    phi_1 = phi_1,
    psi_s0 = psi_s0,
    psi_s = psi_s,
    theta = theta,
    mu_profile = mu_profile
  )

  # model fitting -----
  # NOTE: Model fitting takes time
  fit <- FitCULTA2Profiles(data = data)
  summary(fit)

  ## End(Not run)

```

---

SumParamsCULTA2Profiles

*Summary (ParamsCULTA2Profiles)*


---

## Description

Summary (ParamsCULTA2Profiles)

## Usage

```

SumParamsCULTA2Profiles(
  taskid,
  reps,
  output_folder,
  overwrite,
  integrity,
  ncores = 1L
)

```

## Arguments

taskid	Positive integer. Task ID.
reps	Positive integer. Number of replications.

output_folder	Character string. Output folder.
overwrite	Logical. Overwrite existing output in output_folder.
integrity	Logical. If integrity = TRUE, check for the output file integrity when overwrite = FALSE.
ncores	Positive integer. Number of cores to use.

### Details

This function is executed via the Sum function.

### Value

The output is saved as an external file in output\_folder.

### Author(s)

Ivan Jacob Agaloos Pesigan

---

vcov.fitcultu	<i>Sampling Covariance Matrix</i>
---------------	-----------------------------------

---

### Description

Sampling Covariance Matrix

### Usage

```
## S3 method for class 'fitcultu'
vcov(object, ...)
```

### Arguments

object	Object of class fitcultu.
...	additional arguments.

### Value

Returns a matrix of the variance-covariance matrix of parameter estimates.

### Author(s)

Ivan Jacob Agaloos Pesigan



**Examples**

```
## Not run:
# complete list of R function arguments -----

# random seed for reproducibility
set.seed(42)

# dimensions
n <- 1000 # number of individuals
m <- 6 # measurement occasions
p <- 4 # number of items
q <- 1 # common trait dimension

# covariate parameters
mu_x <- 11.4009
sigma_x <- 24.67566

# profile membership and transition parameters
nu_0 <- -3.563
kappa_0 <- 0.122
alpha_0 <- -3.586
beta_00 <- 2.250
gamma_00 <- 0.063
gamma_10 <- 0.094

# trait parameters
psi_t <- 0.10 * diag(1)
mu_t <- 0
psi_p <- diag(p)
psi_p_1 <- 0.10
psi_p_2 <- 0.10
psi_p_3 <- 0.50
psi_p_4 <- 0.50
diag(psi_p) <- c(
  psi_p_1,
  psi_p_2,
  psi_p_3,
  psi_p_4
)
mu_p <- rep(x = 0, times = p)
common_trait_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = q
)

# state parameters
common_state_loading <- matrix(
  data = 1,
  nrow = p,
  ncol = 1
)
```

```

phi_0 <- 0.000
phi_1 <- 0.311
psi_s0 <- 1.00
psi_s <- 0.25
theta <- 0.15 * diag(p)

# profile-specific means
mu_profile <- cbind(
  c(2.253, 1.493, 1.574, 1.117),
  c(-0.278, -0.165, -0.199, -0.148)
)

# data generation -----
data <- GenCULTA2Profiles(
  n = n,
  m = m,
  mu_x = mu_x,
  sigma_x = sigma_x,
  nu_0 = nu_0,
  kappa_0 = kappa_0,
  alpha_0 = alpha_0,
  beta_00 = beta_00,
  gamma_00 = gamma_00,
  gamma_10 = gamma_10,
  mu_t = mu_t,
  psi_t = psi_t,
  mu_p = mu_p,
  psi_p = psi_p,
  common_trait_loading = common_trait_loading,
  common_state_loading = common_state_loading,
  phi_0 = phi_0,
  phi_1 = phi_1,
  psi_s0 = psi_s0,
  psi_s = psi_s,
  theta = theta,
  mu_profile = mu_profile
)

# model fitting -----
# NOTE: Model fitting takes time
fit <- FitCULTA2Profiles(data = data)
vcov(fit)

## End(Not run)

```

---

WriteData

---

Write Data to File

---

### Description

Generic function to write data to file.

**Usage**

```
WriteData(x, file, ...)

## S3 method for class 'simcultu'
WriteData(x, file, ...)
```

**Arguments**

x	Object of class <code>simcultu</code> .
file	Character string. File name.
...	Additional arguments.

**Value**

Invisibly returns `NULL`. Writes data to file as a side effect.

**Methods (by class)**

- `WriteData(simcultu)`: Method for objects of class `simcultu`.

**Author(s)**

Ivan Jacob Agaloos Pesigan

# Index

- \* **Compression Functions**
  - Compress, [15](#)
- \* **Data Generation Functions**
  - GenCULTA2Profiles, [48](#)
  - GenData, [55](#)
- \* **Figure Functions**
  - FigBiasCULTAEst, [23](#)
  - FigBiasLTAEst, [25](#)
  - FigCoverageCULTAEst, [26](#)
  - FigCoverageLTAEst, [28](#)
  - FigEntropy, [29](#)
  - FigIC, [30](#)
  - FigPowerCULTAEst, [31](#)
  - FigPowerLTAEst, [32](#)
  - FigRMSECULTAEst, [34](#)
  - FigRMSELTAEst, [35](#)
- \* **Model Fitting Functions**
  - FitCULTA1Profile, [37](#)
  - FitCULTA2Profiles, [39](#)
  - FitLTA2Profiles, [42](#)
  - FitRILTA2Profiles, [45](#)
  - InputCULTA1Profile, [55](#)
  - InputCULTA2Profiles, [58](#)
  - InputLTA2Profiles, [61](#)
  - InputRILTA2Profiles, [63](#)
- \* **compress**
  - Compress, [15](#)
- \* **culta**
  - FitCULTA1Profile, [37](#)
  - FitCULTA2Profiles, [39](#)
  - FitLTA2Profiles, [42](#)
  - FitRILTA2Profiles, [45](#)
  - GenCULTA2Profiles, [48](#)
  - InputCULTA1Profile, [55](#)
  - InputCULTA2Profiles, [58](#)
  - InputLTA2Profiles, [61](#)
  - InputRILTA2Profiles, [63](#)
- \* **data**
  - params, [69](#)
  - results\_culta\_est, [74](#)
  - results\_entropy, [75](#)
  - results\_ic, [76](#)
  - results\_lta\_est, [76](#)
- \* **figure**
  - FigBiasCULTAEst, [23](#)
  - FigBiasLTAEst, [25](#)
  - FigCoverageCULTAEst, [26](#)
  - FigCoverageLTAEst, [28](#)
  - FigEntropy, [29](#)
  - FigIC, [30](#)
  - FigPowerCULTAEst, [31](#)
  - FigPowerLTAEst, [32](#)
  - FigRMSECULTAEst, [34](#)
  - FigRMSELTAEst, [35](#)
- \* **fit**
  - FitCULTA1Profile, [37](#)
  - FitCULTA2Profiles, [39](#)
  - FitLTA2Profiles, [42](#)
  - FitRILTA2Profiles, [45](#)
  - SimFitCULTA1Profile, [79](#)
  - SimFitCULTA2Profiles, [80](#)
  - SimFitLTA2Profiles, [81](#)
  - SimFitRILTA2Profiles, [82](#)
- \* **gendata**
  - GenData, [55](#)
  - SimGenData, [84](#)
- \* **input**
  - InputCULTA1Profile, [55](#)
  - InputCULTA2Profiles, [58](#)
  - InputLTA2Profiles, [61](#)
  - InputRILTA2Profiles, [63](#)
- \* **manCULTA**
  - Compress, [15](#)
  - FigBiasCULTAEst, [23](#)
  - FigBiasLTAEst, [25](#)
  - FigCoverageCULTAEst, [26](#)
  - FigCoverageLTAEst, [28](#)
  - FigEntropy, [29](#)

- FigIC, 30
- FigPowerCULTAEst, 31
- FigPowerLTAEst, 32
- FigRMSECULTAEst, 34
- FigRMSELTAEst, 35
- FitCULTA1Profile, 37
- FitCULTA2Profiles, 39
- FitLTA2Profiles, 42
- FitRILTA2Profiles, 45
- GenCULTA2Profiles, 48
- GenData, 55
- InputCULTA1Profile, 55
- InputCULTA2Profiles, 58
- InputLTA2Profiles, 61
- InputRILTA2Profiles, 63
- Sim, 78
- SimFitCULTA1Profile, 79
- SimFitCULTA2Profiles, 80
- SimFitLTA2Profiles, 81
- SimFitRILTA2Profiles, 82
- SimFN, 83
- SimGenData, 84
- SimProj, 85
- Sum, 85
- SumFitCULTA1Profile, 86
- SumFitCULTA2Profiles, 87
- SumFitLTA2Profiles, 88
- SumFitRILTA2Profiles, 89
- SumLTAParamsCULTA2Profiles, 90
- SumLTAParamsLTA2Profiles, 91
- SumLTAParamsRILTA2Profiles, 92
- SumParamsCULTA2Profiles, 95
- \* methods**
  - AIC.fitcultla, 3
  - anova.fitcultla, 5
  - as.data.frame.simcultla, 8
  - as.matrix.simcultla, 9
  - BIC.fitcultla, 10
  - coef.fitcultla, 13
  - confint.fitcultla, 16
  - converged, 18
  - entropy, 21
  - logLik.fitcultla, 66
  - print.fitcultla, 70
  - print.simcultla, 73
  - summary.fitcultla, 93
  - vcov.fitcultla, 96
  - WriteData, 98
- \* mixture**
  - FitCULTA1Profile, 37
  - FitCULTA2Profiles, 39
  - FitLTA2Profiles, 42
  - FitRILTA2Profiles, 45
  - GenCULTA2Profiles, 48
  - InputCULTA1Profile, 55
  - InputCULTA2Profiles, 58
  - InputLTA2Profiles, 61
  - InputRILTA2Profiles, 63
- \* parameters**
  - params, 69
  - results\_culta\_est, 74
  - results\_entropy, 75
  - results\_ic, 76
  - results\_lta\_est, 76
- \* simulation**
  - Sim, 78
  - SimFitCULTA1Profile, 79
  - SimFitCULTA2Profiles, 80
  - SimFitLTA2Profiles, 81
  - SimFitRILTA2Profiles, 82
  - SimFN, 83
  - SimGenData, 84
  - SimProj, 85
  - Sum, 85
  - SumFitCULTA1Profile, 86
  - SumFitCULTA2Profiles, 87
  - SumFitLTA2Profiles, 88
  - SumFitRILTA2Profiles, 89
  - SumLTAParamsCULTA2Profiles, 90
  - SumLTAParamsLTA2Profiles, 91
  - SumLTAParamsRILTA2Profiles, 92
  - SumParamsCULTA2Profiles, 95
- \* sim**
  - GenCULTA2Profiles, 48
- \* state**
  - FitCULTA1Profile, 37
  - FitCULTA2Profiles, 39
  - FitLTA2Profiles, 42
  - FitRILTA2Profiles, 45
  - GenCULTA2Profiles, 48
  - InputCULTA1Profile, 55
  - InputCULTA2Profiles, 58
  - InputLTA2Profiles, 61
  - InputRILTA2Profiles, 63
- \* summary**
  - Sum, 85

- SumFitCULTA1Profile, 86
- SumFitCULTA2Profiles, 87
- SumFitLTA2Profiles, 88
- SumFitRILTA2Profiles, 89
- SumLTAParamsCULTA2Profiles, 90
- SumLTAParamsLTA2Profiles, 91
- SumLTAParamsRILTA2Profiles, 92
- SumParamsCULTA2Profiles, 95
- \* trait**
  - FitCULTA1Profile, 37
  - FitCULTA2Profiles, 39
  - FitLTA2Profiles, 42
  - FitRILTA2Profiles, 45
  - GenCULTA2Profiles, 48
  - InputCULTA1Profile, 55
  - InputCULTA2Profiles, 58
  - InputLTA2Profiles, 61
  - InputRILTA2Profiles, 63
- AIC.fitcultla, 3
- anova.fitcultla, 5
- as.data.frame.simcultla, 8
- as.matrix.simcultla, 9
- BIC.fitcultla, 10
- coef.fitcultla, 13
- Compress, 15
- confint.fitcultla, 16
- converged, 18
- entropy, 20
- FigBiasCULTAEst, 23, 26, 27, 29, 30, 32, 33, 35, 36
- FigBiasLTAEst, 24, 25, 27, 29, 30, 32, 33, 35, 36
- FigCoverageCULTAEst, 24, 26, 26, 29, 30, 32, 33, 35, 36
- FigCoverageLTAEst, 24, 26, 27, 28, 29, 30, 32, 33, 35, 36
- FigEntropy, 24, 26, 27, 29, 29, 30, 32, 33, 35, 36
- FigIC, 24, 26, 27, 29, 30, 32, 33, 35, 36
- FigPowerCULTAEst, 24, 26, 27, 29, 30, 31, 33, 35, 36
- FigPowerLTAEst, 24, 26, 27, 29, 30, 32, 32, 35, 36
- FigRMSECULTAEst, 24, 26, 27, 29, 30, 32, 33, 34, 36
- FigRMSELTAEst, 24, 26, 27, 29, 30, 32, 33, 35, 35
- FitCULTA1Profile, 37, 40, 43, 46, 56, 59, 61, 64
- FitCULTA2Profiles, 37, 39, 43, 46, 56, 59, 61, 64
- FitLTA2Profiles, 37, 40, 42, 46, 56, 59, 61, 64
- FitRILTA2Profiles, 37, 40, 43, 45, 56, 59, 61, 64
- GenCULTA2Profiles, 48, 55
- GenCULTA2Profiles(), 50, 55
- GenData, 53, 55
- InputCULTA1Profile, 37, 40, 43, 46, 55, 59, 61, 64
- InputCULTA2Profiles, 37, 40, 43, 46, 56, 58, 61, 64
- InputLTA2Profiles, 37, 40, 43, 46, 56, 59, 61, 64
- InputRILTA2Profiles, 37, 40, 43, 46, 56, 59, 61, 63
- logLik.fitcultla, 66
- params, 69
- print.fitcultla, 70
- print.simcultla, 73
- results\_culta\_est, 74
- results\_entropy, 75
- results\_ic, 76
- results\_lta\_est, 76
- Sim, 78
- SimFitCULTA1Profile, 79
- SimFitCULTA2Profiles, 80
- SimFitLTA2Profiles, 81
- SimFitRILTA2Profiles, 82
- SimFN, 83
- SimGenData, 84
- SimProj, 85
- Sum, 85
- SumFitCULTA1Profile, 86
- SumFitCULTA2Profiles, 87
- SumFitLTA2Profiles, 88
- SumFitRILTA2Profiles, 89
- SumLTAParamsCULTA2Profiles, 90
- SumLTAParamsLTA2Profiles, 91

SumLTAParamsRILTA2Profiles, [92](#)

summary.fitcultla, [93](#)

SumParamsCULTA2Profiles, [95](#)

vcov.fitcultla, [96](#)

WriteData, [98](#)