Package: masc (via r-universe)

October 27, 2026

Title Simulate the Multi-Attribute Search and Choice (MASC) Model

Version 0.1.0

Description Simulates the Multi-Attribute Search and Choice (MASC) model of Gluth, Deakin and Rieskamp (2026) <doi:10.1037/rev0000614> for multi-attribute decision-making, including sequential information search, Bayesian belief updating, and choice. Beliefs may be treated as univariate (independent attributes), or multivariate over correlated attributes ('MASC-C'), in which observing one attribute updates beliefs about correlated attributes via a Kalman filter.

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Imports Rcpp, stats

Suggests knitr, rmarkdown, testthat (>= 3.0.0), broom, patchwork, ggplot2, dplyr, tibble, purrr

Config/testthat/edition 3

Encoding UTF-8

RoxygenNote 7.3.3

URL https://github.com/kiante-fernandez/masc

BugReports https://github.com/kiante-fernandez/masc/issues

LinkingTo Rcpp, RcppArmadillo

VignetteBuilder knitr

Depends R (>= 2.10)

LazyData true

NeedsCompilation yes

Author Kiante Fernandez [aut, cre, cph] (ORCID: <https://orcid.org/0000-0002-8493-880X>)

Maintainer Kiante Fernandez <kiantefernan@gmail.com>

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`hotelgluth2024` *Hotel Choice Experiment Dataset from Gluth et al. (2026)*

Description

A dataset from a multi-attribute decision-making experiment examining how people search for and evaluate information when choosing between hotel options.

Usage

```
hotelgluth2024
```

Format

`hotelgluth2024`**:**
A data frame with multiple rows per subject, each representing a single trial in a hotel choice experiment with three attributes:

dataset Identifier for the dataset type, set to "hotel"
subject Unique identifier for each participant in the experiment
trial Trial number within each subject's experimental session
opt1_att1 Value of the first attribute for the first hotel option (distance to beach)
opt1_att2 Value of the second attribute for the first hotel option (room size)
opt1_att3 Value of the third attribute for the first hotel option (number of stars)
opt2_att1 Value of the first attribute for the second hotel option (distance to beach)
opt2_att2 Value of the second attribute for the second hotel option (room size)
opt2_att3 Value of the third attribute for the second hotel option (number of stars)
difficulty Difficulty level of the choice trial, based on the difference in option ratings
choice Chosen hotel option (1 or 2)
rt Reaction time for the choice
att_w1 Weight of the first attribute (distance to beach)
att_w2 Weight of the second attribute (room size)
att_w3 Weight of the third attribute (number of stars)
sigma Model parameter related to sampling noise
alpha Model parameter related to search rule sensitivity
delta Model parameter related to choice threshold

Details

This dataset captures individual decision-making processes in a hotel choice experiment. Participants were asked to choose between two hotel options described by three attributes: distance to beach, room size, and number of stars. The dataset includes both the raw choice data and estimated model parameters from the Multi-Attribute Search and Choice (MASC) model.

Source

Gluth, S., Deakin, J., & Rieskamp, J. (2026). A theory of multiattribute search and choice. *Psychological Review*. doi:10.1037/rev0000614

References

Gluth, S., Deakin, J., & Rieskamp, J. (2026). A theory of multiattribute search and choice. *Psychological Review*. doi:10.1037/rev0000614

`rMASC` *Multi-Attribute Search and Choice (MASC) Model*

Description

Implements the MASC model of multi-attribute decision making. This model simulates how people make decisions when comparing options with multiple attributes by sequentially sampling information about different attributes until reaching a decision.

Usage

```
rMASC(
  data = NULL,
  n = 1,
  n_options = 2,
  n_attributes = 3,
  w = NULL,
  sigma = 1,
  alpha = 3,
  delta = 0.01,
  theta = 0.01,
  lambda = 1,
  max_steps = 100,
  Sigma_true = NULL,
  Sigma_belief = NULL
)
```

Arguments

data	Optional data frame containing trial-wise attribute values. Each row represents one trial, and columns should be named following the pattern opt<i>_att<j> where i is the option number and j is the attribute number. For example, with 2 options and 3 attributes, columns should be: opt1_att1, opt1_att2, opt1_att3, opt2_att1, opt2_att2, opt2_att3. If NULL, generates random values for n trials.
n	Integer. Number of trials to generate when data is NULL (default: 1). Ignored when data is provided.
n_options	Integer. Number of choice options (default: 2).
n_attributes	Integer. Number of attributes per option (default: 3).
w	Numeric vector. Attribute weights summing to 1. If NULL, weights are randomly generated from beta(3/4, 3/4) distribution (default: NULL).
sigma	Numeric. Standard deviation of sampling noise (default: 1).
alpha	Numeric. Controls how strongly fixations follow the myopic search rule. Higher values (>10) make search more deterministic, lower values (near 0) make it more random (default: 3).
delta	Numeric. Amount by which decision threshold increases per fixation (default: 0.01).
theta	Numeric. Initial decision threshold (default: 0.01).
lambda	Numeric. Precision of prior beliefs about attributes (default: 1).
max_steps	Integer. Maximum number of fixations allowed (default: 100).
Sigma_true	Correlation/covariance structure of the generated stimuli (an n_attributes x n_attributes matrix, or a single number giving a uniform off-diagonal correlation). When NULL (default), attributes are independent (identity), reproducing the original MASC behaviour. Ignored when data is supplied (the data are the stimuli).
Sigma_belief	The decision maker's assumed correlation structure between attributes (matrix or single number). This is what enables the multivariate ("MASC-C") belief update: observing one attribute spreads information to correlated attributes via a Kalman update. NULL (default) matches Sigma_true; 0 forces independent (univariate) beliefs. When the resulting matrix is diagonal the model reduces exactly to the original univariate MASC update.

Value

A list containing:

- results: Data frame with trial-by-trial results including:
  - trial: Trial number
  - response: Option chosen by model (1 to n_options)
  - best_option: Option with highest weighted value
  - correct: Whether response matches best_option
  - rt: Number of fixations taken
  - prop_fix_opt1, prop_fix_opt2: Proportion of fixations to each option

- weights: Vector of attribute weights used
- parameters: List of model parameters used (sigma, alpha, delta, theta)
- raw: List containing detailed raw data for each trial. Each element corresponds to a trial and includes:
  - trial: Trial number
  - response: The option chosen by the model (1 to n_options)
  - best_option: The option with the highest weighted value
  - correct: Boolean indicating if response matches best_option
  - rt: Number of fixations taken to reach a decision
  - x: Matrix of true attribute values for all options
  - opt_values: Vector of computed option values (weighted sums)
  - weights: Vector of attribute weights used in this trial
  - sigma: Sampling noise parameter used
  - alpha: Search sensitivity parameter used
  - delta: Threshold increment parameter used
  - theta: Initial threshold parameter used
  - fix_sequence: Vector showing the sequence of fixations made
  - prop_fix_opt: Vector of proportions of fixations to each option
  - prop_fix_att: Vector of proportions of fixations to each attribute

References

Gluth, S., Deakin, J., & Rieskamp, J. (2026). A theory of multiattribute search and choice. *Psychological Review*. doi:10.1037/rev0000614

Examples

```
# Example 1: Generate 5 random trials
results <- rMASC(n = 5, w = c(0.5, 0.3, 0.2))

# Example 2: Custom attribute values for multiple trials
trial_data <- data.frame(
    # Option 1's attributes across 3 trials
    opt1_att1 = c(4.5, 4.2, 4.8),  # Attribute 1 values
    opt1_att2 = c(3.2, 3.5, 3.1),  # Attribute 2 values
    opt1_att3 = c(2.8, 2.9, 2.7),  # Attribute 3 values
    # Option 2's attributes across 3 trials
    opt2_att1 = c(3.8, 3.9, 3.7),  # Attribute 1 values
    opt2_att2 = c(4.1, 4.0, 4.2),  # Attribute 2 values
    opt2_att3 = c(3.1, 3.3, 3.0)   # Attribute 3 values
)

# Run model with custom weights
results <- rMASC(
    data = trial_data,
    w = c(0.5, 0.3, 0.2)  # weights for attributes
)
```

```
# Example 3: Correlated attributes (MASC-C). The decision maker exploits a
# positive correlation structure, so observing one attribute informs beliefs
# about the others ("belief spread").
results <- rMASC(
    n = 20,
    w = c(0.5, 0.3, 0.2),
    Sigma_true = 0.6,    # stimuli are positively correlated
    Sigma_belief = 0.6   # matched beliefs (use 0 for the original MASC model)
)
```

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