FRAMalyse

Process of the Task

Goal: Beta-Test of the FRAMalyse: Cognitive Walkthrough with Specific Tasks.

1) **<u>Basic FRAM Model (used in the test)</u>**
   - 26 functions with 43 couplings, divided into agents and stages.
2) **<u>Tasks for the Cognitive Walkthrough:</u>**

   The test is intended for the exploration of the software; it is not about speed or the correctness of solving the tasks listed below. Only essential functions are tested in the tasks, not all functions in detail. Afterward, the app can be freely explored.

   The FRAM model has already been created in FMV, and the required CSV files have been exported and saved in the directory “2 - Start File\Upload Model Data (Upload Both Files)”.

I. Parameterization and Calculation

1. Run FRAMalyse and Upload Model Data

- **Run FRAMalyse.**
- **Upload the required CSV files** from *Start File\Upload Model Data (Upload Both Files)*:
  - "FMV_new-couplings"
  - "FMV_new-functions"

2. Parameterization

2.1 Modify Function Parameters

- Go to **Menu > Parameterization and Calculation > Agents, stages, and variability manifestation frequencies**
- Click the **question mark** in the top left to view the introduction.
- Modify parameters for **Function A**:
    - Function Type
    - Color of Function Type
    - Agent
    - Stage
    - Variability Frequencies: P_TE, P_OT, P_TL, P_NAA, P_I, P_A, P_PR
    - Order of Agent and Order of Stage
- Click **"Test Data"** to generate random values for testing.

2.2 Modify Variability Manifestation & Propagation Parameters

- Go to **Menu > Parameterization and Calculation > Variability manifestation impact and propagation of variability**
- Click the **question mark** in the top left to view the introduction.
- Modify:
    - Table: Assignment of numerical values to the propagation of variability
    - Table: Assignment of numerical values to the variability manifestation of timing and precision
    - Table: Allocation of numerical values of the weighting factors for WaU and WaD

3. Calculate Metrics

- Go to **Menu > Parameterization and Calculation > Calculating metrics**
- Click the **question mark** to view the introduction.
- **Perform calculation**
- **Review key metrics**:
    - **OFCV and Katz-Centrality** values for **Function K**
- **Download results** as **Excel or CSV**

II. Data Visualization

1. Upload Scenario Data

- Click **the second upload button ("Upload Scenarios")** in the toolbar.
- Upload pre-generated metrics for:
    - **Scenario_1.xlsx**
    - **Scenario_2.xlsx**
- Files are located in *2 - Start File\Upload Scenario*

2. Model Overview & Descriptive Analysis

2.1 Network Analysis

- Go to **Menu > Data Visualization > Basics (Descriptive) > Network of Model**
- Click **the question mark** to view the introduction.
- Answer key questions:
    - Which function has the **highest OFCV**?
    - Which coupling has the **highest CV**?
    - What is the **stage** and **agent** of **Function K**?
        - Click "**Function A"** in the function list
    - Where does this variability **propagate** of **Function K**?
    - Reset network view: Click **"All"** in the function list.

2.2 Model Characteristics & Relationships

- Go to **Menu > Data Visualization > Basics (Descriptive) > Characteristics, frequencies, and interrelationships**
- Click **the question mark** to view the introduction.
- Answer key questions:
    - **Overall number** of functions and couplings
    - How many functions belong to **Agent1**? (See **Treemap**)
    - How many functions belong to **Stage1**?

        - Click **DropDown** above Treemap → Select **"Function-Stage"**

2.3 Variability Analysis (Sankey Diagram & Chord Diagram)

- **Sankey Diagram:**
    - Select **Function K** in the function list:
        - How many functions **receive variability**?
        - How many functions **transfer variability**?
        - Which function transfers the **most variability** and through which aspect?
        - What is the **average CV**?
            - Click the **DropDown** in the **top left corner** of the tab → Select **"Average of coupling variability"**
- **Chord Diagram:**
    - Go to **Menu > Data Visualization > Basics (Descriptive) > Interdependencies – Chord diagram**
    - Click **the question mark** to view the introduction.
    - Click **"Function K"** node to view related information in the table.
    - Click **any chord** of Function K to view details.
    - Use the **filter** to exclude "**Agent4"** nodes.

III. Function & Coupling Evaluation

1. Function Evaluation

- Go to **Menu > Data Visualization > Advanced (Evaluation) > Risk Functions**
- Click **the question mark** to view the introduction.
- Select **risk functions** for both scenarios and start the analysis.
- Go to **Global System Variability and Risk Distribution**
    - Compare **Global System Variability** between both scenarios.
- Go to **Functional Variability System Resonance Matrix**
    - Change **upper boundary** from **30% to 35%**

    - Identify functions with **Functional Variability & System Resonance > 35%**
- Go to **Interaction and Variability**
    - Compare **interaction and variability** between scenarios
    - Find:
        - Function with **highest DLFCV** in **Scenario_1**
        - Function with **highest WaU** in **Scenario_2**

2. Coupling Evaluation (Monte Carlo Simulation)

- Go to **Menu > Parameterization and Calculation > Monte Carlo Simulation**
- Click **the question mark** to view the introduction.
- Set parameters:
    - **Threshold Criticality of CV** = 12
    - **Number of Runs** = 100
    - **Error Probability** = 5%
    - **Longest Paths** = 11
- **Perform Monte Carlo Simulation**:
    - Click **"All Paths"** for both scenarios.
    - Identify:
        - **Two related critical upstream-downstream couplings**.
        - **Critical longest paths of couplings**.
    - **Visualize** critical paths in the **network diagram**.
    - **Download simulation results**.