

## Instructions for use of the FRAM Model Visualiser (FMV)

*These instructions refer to FMV version 0.4.0 - January 2016*

*Please read the **Conditions of Use** at the end of this document.*

### Installation

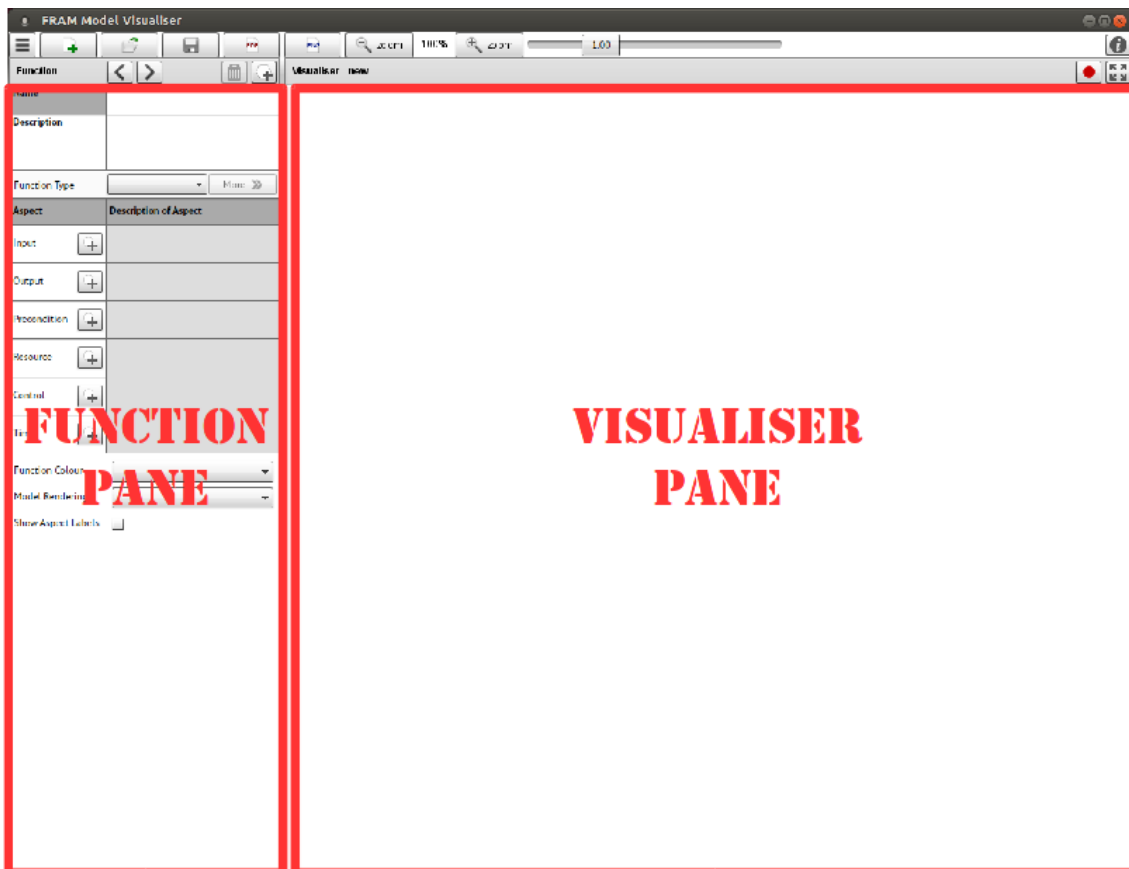
The FMV, as well as these Instructions, can be downloaded from the FRAM website: <http://functionalresonance.com/tools-visualisation/fram-visualisation.html>.

Before installing the FMV, you must download and install Adobe Air. You can get Adobe Air from the Adobe website: <http://get.adobe.com/air>. This will detect your operating system and select the appropriate version for download. Once you have installed Adobe Air, you just right-click on the FMV file and select 'Open With Adobe AIR Application Installer'

The FMV has been tested on Windows 7, Windows 8, Linux (Ubuntu) and Apple Mac.

### Layout

When the FMV starts, the following window appears:

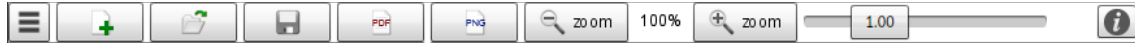


The whole window can be resized in the usual way.

## Using the FMV

### Project Control

The top row contains the following items:



The purpose of the buttons - from left to right - is as follows:

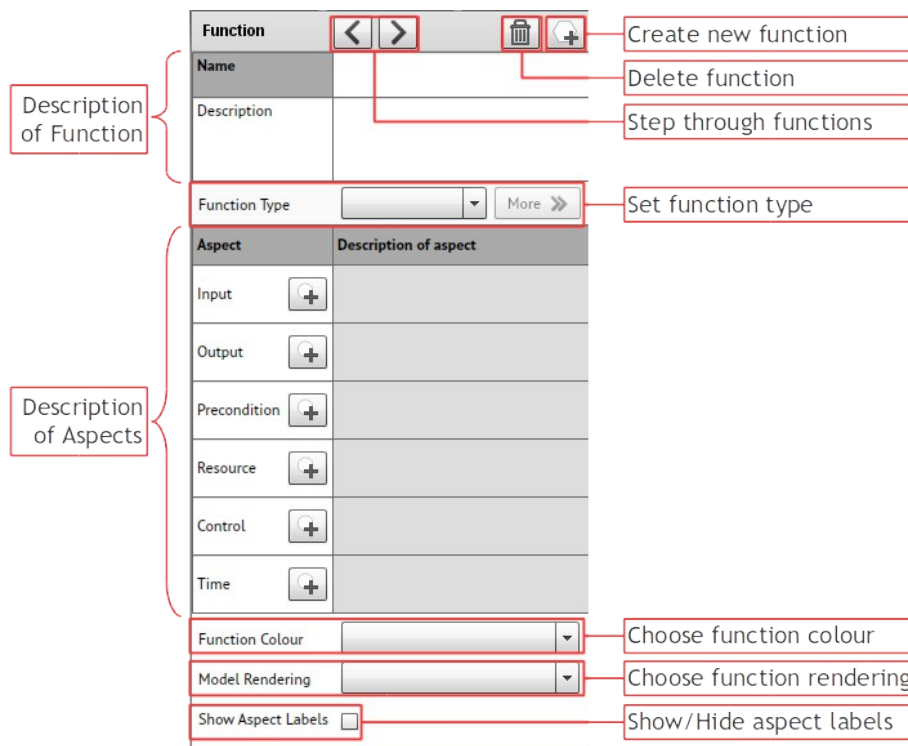
- **Menu button.** This shows a drop-down menu with the following possible selections: [New, Open, Save, Export PDF Report, Save Image, Recent, Language, Exit]. The first five selections can also be made by the buttons to the right of the Menu button.  
The *Recent* button can be used to retrieve recently used models, rather than doing this through the standard *Open* file dialogue.
- **New.** Clicking on this button starts a new project (FRAM model). If an existing project already is active, the user will be given the choice to 'Save' it, 'Don't Save' it, or 'Cancel'.
- **Open.** This button is used to open a project file previously produced by the FRAM Model Visualiser (.xfmv).
- **Save.** This button is used to save the current project. This will open the usual Save File dialogue pane. The user can choose where to save the file and how to name it. The file extension will be .xfmv.  
A file save option dialogue will also appear on closing the FMV, if unsaved changes were made.
- **Export PDF Report.** The button generates a report for the current model. The report is in a standard PDF format and opens in the user's native PDF viewer. It contains a set of tables, one for each of the model functions that have been created. The information will be the contents of the Function Page for each function. The report will also include a visualiser image on the last page. The image resolution can be changed using the zoom level in the *Visualiser Pane*, similar to the *Save* function, but a larger image resolution will increase the file size. A zoom level of 100% is economical on file size, while 200% gives better image quality but still a reasonable file size. Orphan aspects are highlighted in red, consistent with the highlighting in the *Visualiser Pane*.
- **Image.** This will save the current image as a .png file. The whole image is saved even if some of it is off-screen. The size and quality of the image is proportional to the zoom level. For example, at 200% zoom the saved image is twice the size (and hence better quality) than an image saved at 100% zoom. A 100% zoom is a relatively small file size. 200% zoom would be better for inserting into a document, while 400% is 'best'. The saved image is exactly what you see on screen and includes any highlighting if a function is selected. If you do not want to include the selected function highlighting in the saved image, then first click on the blank background to deselect the function. If you save the image while in the Playback record mode (described later) then the image includes the selected Playback highlighting.
- **Zoom control.** The size of the image can be controlled in two ways. One is by the two zoom buttons. The other is by the slider. The maximum zoom size is 400%.
- **Information.** This provides information about the software (version number) and the developers.

It also allows the user to change the language of the interface. The current possibilities are:

- English (United States) - Status: verified
- English (United Kingdom) - Status: verified
- Dansk (Denmark) - Status: verified
- Deutsch (Germany) - Status: verified
- Español (Spain) - Status: verification pending
- Français (France) - Status: verification pending
- Português (Portugal, Brazil) - Status: verified
- 中国 (China) - Status: verified
- 日本人 (Japan) - Status: verified
- 한국어 (Korea) - Status: verified

(The same selection can be made using the *Menu* button.) The user can input all data in their respective language. In order to display the Chinese, Japanese or Korean language interfaces correctly, the user must first install the corresponding language support packages.

**The Function Pane**

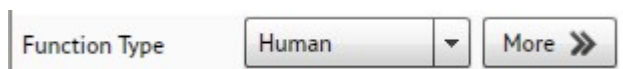


The top line of the *Function Pane* contains four buttons.

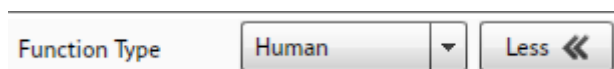
- **Create New Function.** When you click on this button, an empty hexagon appears in the Visualiser window. When you fill in the name of the function in the Name field (see below), the name will also appear inside the newly created hexagon.
- **Delete function.** When you click on this button, the currently selected function will be deleted. Before this happens, a 'delete function' dialogue box will appear to ask for confirmation.
- **Step through functions.** The two buttons here are used to step through the functions in the order in which they were defined (chronologically). They only work if a model has been loaded. Clicking on the right button [>] will highlight the first function that was defined and also show the related information in the *Function Pane*. (If you start by clicking on the left [<] button, the function that was added last will be highlighted.) Clicking on the button again will highlight the next function (in the chronological order), and so on. Clicking on the left button [<] will move the highlight a step back in the sequence.  
This is followed by two fields that are used to describe the function.
- **Name:** This contains the name of the function. The name should be short but distinct. Function names should begin with a verb in the infinitive form (but without the 'to'), because a function describes an activity.
- **Description:** The description is a free text characterisation of the function, which may include who usually carries it out. It is generally useful to provide as much information as possible here, and to use the Description field for general notes that are relevant for characterising what the functions does.  
In addition to describing the function, it is also possible to select the Function Type.
- **Set Function Type.** Here the function type can be specified. The possible options are:

undefined
Technological
Human
Organisational

When the function type has been specified, it is possible to describe the potential variability of the function. This is done by clicking on the button to the right, marked [More >>].



When you click on the [More >>] button, it opens the *Function Variability Pane* within the *Visualiser Pane*. At the same time it changes to a [Less <<] button, as shown below.



Clicking on the [Less <<] button will close the *Function Variability Pane* and change the button to [More >>].

The next item in the *Function Pane* is a sub-pane to describe the Aspects of a Function. This sub-pane initially contains six lines corresponding to the six aspect types: **Input**, **Output**,

**Precondition, Resource, Control, and Time.** Each aspect type is followed by a New Aspect button (a small hexagon with a '+' sign), which is used to create a new Aspect of that type. **You must create a new (empty) Aspect before you can type anything into the aspect pane.**

When you click to describe a new Aspect, for instance a new Input, an empty pane opens to the right of the aspect type, followed by a *Delete* button (garbage can).



You can write the name of the Aspect directly in the pane. Remember that Aspects describe states (noun phrases) rather than actions. You complete the entry of the name by moving the mouse to a different field (e.g., by clicking on the corresponding hexagon in the *Visualiser Pane*, or another aspect name), or by pressing the 'Tab' key.

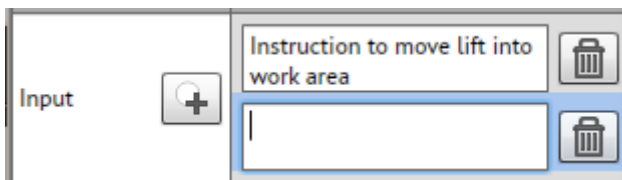
**Caution:** (If you press 'Enter' this will just create a new line in the aspect name. The key code for 'Enter' will become part of the Aspect name string, even though it is not visible. This may lead to problems during the automatic model check.)

It is also possible to use keyboard shortcuts. Use 'Shift Tab' to go back to the New Aspect button and then press 'Enter' to add another Aspect. Pressing Tab twice will take you forward to the Add Aspect button of the next Aspect category.

As soon as you have completed the entry of the aspect name, it will be marked correspondingly in the *Visualiser Pane*. If the aspect name already exists for an Aspect of a different function, a thin blue connector will be drawn. If the aspect name does not yet exist for another function, the Aspect will be marked by a red ring in the *Visualiser Pane*.

The same procedure can be applied to any of the six Aspects.

If you click on the New Aspect button for an Aspect for the second time, a new line will be added for that Aspect. This contains (as before) an entry pane and a *Delete* button. In this way it is possible to add new Aspects as required, and also to delete already defined Aspects.



The names given to the Aspects can be edited/corrected directly in the name field of the Aspects. Any changes will immediately be shown in the *Visualiser Pane*, which thus represents the current status of the model.

**Caution:** If you add a new Aspect to a function, but do not fill in the Aspect name, it will be interpreted as the null string, even though this is not visible. This may lead to problems during the automatic model check.

Finally, after describing the Function and its Aspects, it is possible to specify details of the rendering in the *Visualiser Pane*.

- **Choose Function colour:** It is possible to choose the colour of a hexagon's edge. This may be useful to mark functions that somehow differ, for instance, because they are carried out by different parts of an organisation. The default colour is *white*, meaning no colouring of the edge. The choices are the following:

white
blue
green
grey
red
yellow
purple
custom

The last choice ('custom') opens a palette from which the user freely can choose a colour or directly enter any standard 'RGB' value.

- **Choose Model Rendering.** This provides two options. The default is 'Traditional', which means that both foreground and background functions are shown as hexagons with a white edge. The alternative is 'Modern'. Here foreground functions have a larger hexagon that extends to the Aspect connection points and has a very light grey background. Here foreground functions are shown as hexagons with a black edge, while background functions are shown as grey boxes. The 'Modern' rendering can be useful to simplify the rendering of a model with many functions.
- **Show/Hide Aspect labels.** If this option is checked, the Aspect names will be shown on the connecting lines.

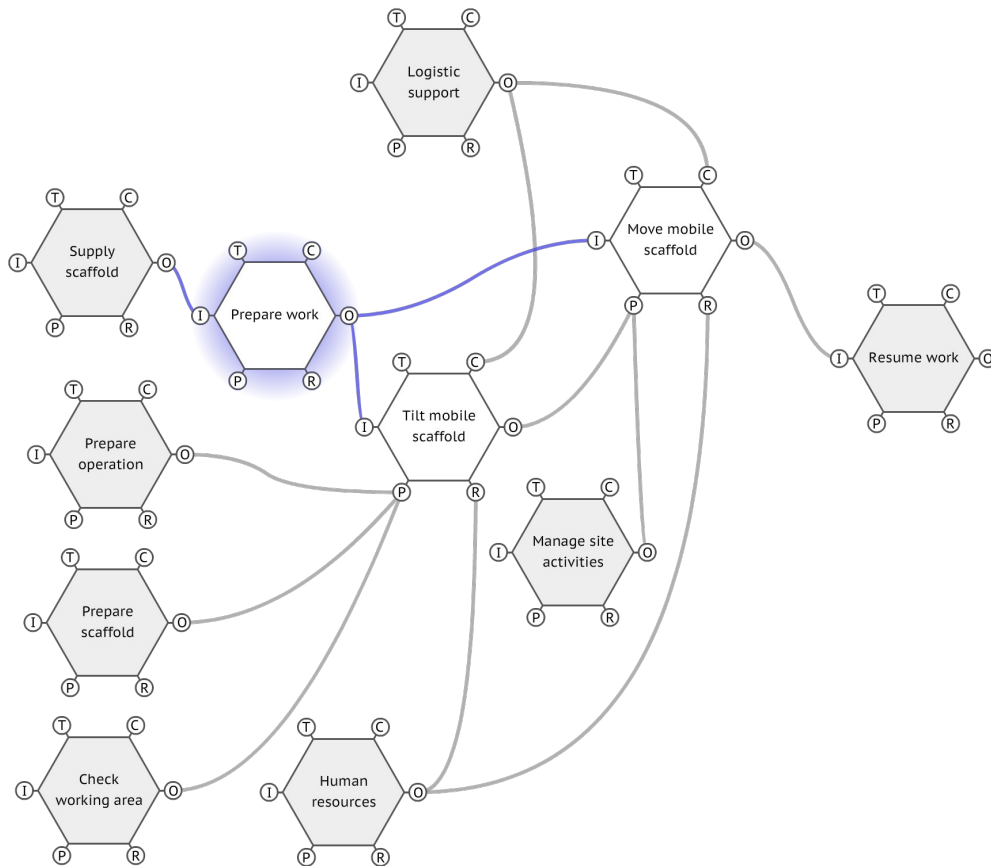
### The Visualiser Pane

To the right is the *Visualiser Pane*. This either contains the image for the model that is being built, or the image of the project that has been opened. The image shows the functions (hexagons) as well as lines connecting the hexagons.

- For some functions the Aspects may be marked with a thick red line. This means that the Aspects are 'orphans', or in other words that the model is incomplete. The designation of an Aspect as an orphan aspect is made automatically by the FMV according to the FRAM syntax.

**Caution:** An Aspect is marked as an orphan if the Aspect name is unique, i.e., does not match the name of any other Aspect. This will happen when a name is entered for the first time, since it obviously will be unique, but also if the name has been misspelled. In addition to actual misspellings this may happen because the name includes a non-printing character, such as a carriage return, a tab, or a space. Conversely, two Aspects may become connected if they contain the same incorrect string, for instance the null string.

- Background functions are shown with a grey interior. A function is recognised as a background function if it only has one or more Outputs or one or more Inputs. (The latter is also called a *drain*.) The FMV will automatically detect whether a function is a background function.
- Foreground functions are shown with a white interior. A background function becomes a foreground function if one or more of the other four aspects (P, R, C, T) are defined. The FMV will automatically detect whether a function is a foreground function.



A function (hexagon) can be selected by clicking on it. It will be deselected if you click on another function or on the background.

When a function is selected, it is marked by a circular shading behind the hexagon. The *Function Pane* will also show the data for the selected function, as described above. All connecting lines associated with the selected function will be coloured blue. These represent the function's Aspects that are connected with the Aspects of other functions.

A function that is selected can be moved around in the *Visualiser Pane* by clicking and dragging with the mouse; the connectors to other functions will automatically follow the movement. If the image of the model extends beyond the visible window then scroll bars will appear so you can scroll to any part of the model. You can also click and drag anywhere on the background to scroll the model.

The edge colour of a selected function can be changed via the *Choose Function Colour* button (cf., above). The colour will remain even when the function has been deselected.

### Describing the variability of a function

The FMV enables the user to describe the potential variability of functions. In order to do this, the user must first set the *Function Type*, as described above. When the *Function Type* has been selected, the *Functional Variability Pane* can then be opened by clicking on the [More >>] button.

If the *Function Type* is *Technological*, the *Function Variability Pane* will look as follows:

Possible source of variability		Likelihood
Internal	Few, well known	Low
External	Maintenance, (mis)use	Low

**Potential Output variability with regard to time**

<input type="radio"/> Too early	Unlikely
<input type="radio"/> On time	Normal, expected
<input type="radio"/> Too late	Unlikely, but possible if software is involved
<input type="radio"/> Not at all	Very unlikely (only in case of complete breakdown)

**Potential Output variability with regard to precision**

<input type="radio"/> Precise	Normal, expected
<input type="radio"/> Acceptable	Unlikely
<input type="radio"/> Imprecise	Unlikely

If the *Function Type* is *Human*, the *Function Variability Pane* will look as follows:

Possible source of variability		Likelihood
Internal	Very many, physiological and psychological	High frequency, large amplitude
External	Very many, social and organisational	High frequency, large amplitude

**Potential Output variability with regard to time**

<input type="radio"/> Too early	Possible (snap answer, serendipity)
<input type="radio"/> On time	Possible, should be typical
<input type="radio"/> Too late	Possible, more likely than too early
<input type="radio"/> Not at all	Possible, to a lesser degree

**Potential Output variability with regard to precision**

<input type="radio"/> Precise	Possible, but unlikely
<input type="radio"/> Acceptable	Typical
<input type="radio"/> Imprecise	Possible, likely

And if the *Function Type* is *Organisational*, the *Function Variability Pane* will look as follows:



Possible source of variability		Likelihood
Internal	Many, function specific and/or relating to 'culture'	Low frequency, large amplitude
External	Many, instrumental or 'culture'	Low frequency, large amplitude

**Potential Output variability with regard to time**

<input type="radio"/> Too early	Unlikely
<input type="radio"/> On time	Likely
<input type="radio"/> Too late	Possible
<input type="radio"/> Not at all	Possible

**Potential Output variability with regard to precision**

<input type="radio"/> Precise	Unlikely
<input type="radio"/> Acceptable	Possible
<input type="radio"/> Imprecise	Likely

In all three cases, the upper part summarises the characterisation of the internal (endogenic) and external (exogenic) variability as described in the FRAM book (and the FRAM handbook). This is purely a memory aid for the user.

The middle and the lower parts allows the user to describe the potential Output variability with regard to *time* and *precision*, respectively. This is done by marking one of the given alternatives using the radio buttons. The brief text describing each option will correspond to the *Function Type*.

- If the Output is described as variable (by marking *time* as one of [Too early, Too late, Not at all] or marking *precision* as one of [Acceptable, Imprecise]), then the function will be marked by a wave symbol in the *Visualiser Pane*. This is to remind the user that the function is described as being potentially variable.
- The selection can be changed whenever needed by clicking on another radio button or the text associated with the radio button (for instance, 'Precise'). If the new selections are 'on time' and 'precise', the wave symbol will disappear.
- The selection can be cancelled by clicking the selected radio button or text again. The selection can also be cancelled by setting the Function Type to *undefined*. In both cases the wave symbol will disappear.

The *Function Variability Pane* will disappear when the [Less <<] button is clicked, but the selections will of course be remembered.

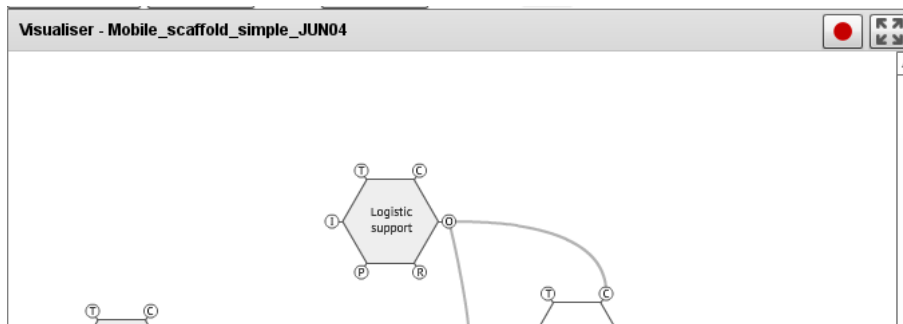
## Playback

The FRAM is a method to build a model or representation of a system or a set of activities - of how something is done. The model can then be the basis for an analysis, either an investigation of something that has happened (accidents, incidents, etc.), an assessment of something that may possibly happen (risk assessment), or an evaluation of a design.

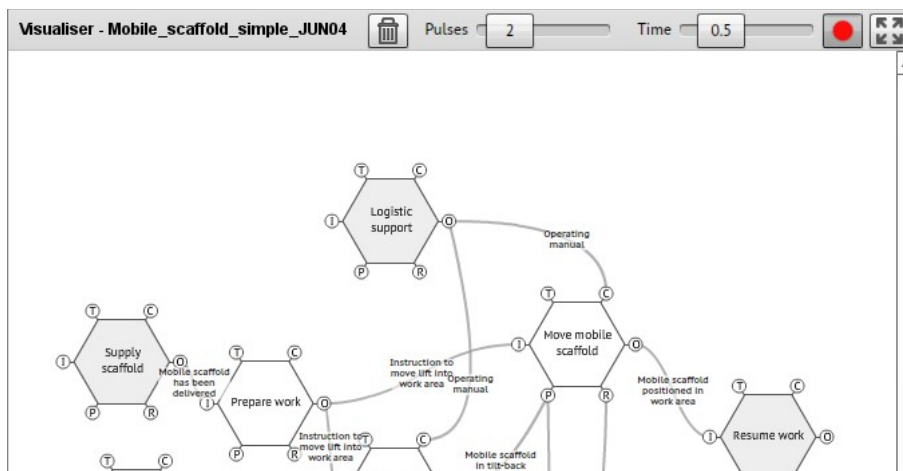
An analysis will usually be based on an instantiation of the model. One way of doing that is to describe or specify a specific set of circumstances (a scenario) and then use that to go through the functions in order to develop a common understanding of how the variability of functions may interact - or how it did interact in the case of a retrospective analysis.

The current version of the FMV supports this kind of ‘walk-through, talk-through’ of an instantiation. It is possible to record the sequence in which functions are selected (and discussed), and afterwards to play back that sequence. This provides a way to capture how an analysis took place, and to replay that to illustrate how the upstream-downstream couplings were instantiated.

The Playback is controlled by two buttons on the top right part of the *Visualiser Pane*. The *Record* button to the left changes the *Visualiser Pane* to be in *Record* mode. The *Full Screen* button to the right changes the *Visualiser Pane* to be in *Playback* mode.



When you press the *Record* button, a number of controls are added to the top of the *Visualiser Pane* as shown below. Aspect labels will also appear on the connecting lines.



### Recording a sequence

When the *Visualiser Pane* is in the *Record* mode, clicking on a Function will add it to the *Playback Animation List*. Clicking on an Aspect label, normally (one of) the Output(s) from the function, will add the connecting line (downstream coupling) to the *Playback Animation List*.

Functions and lines will be added to the *Playback Animation List* in the order that they are selected. Functions and lines are highlighted red as they are selected. Red numbers will also appear to indicate the order of the selections.

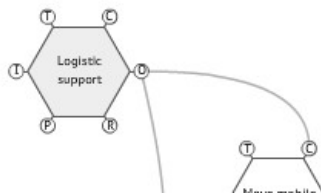
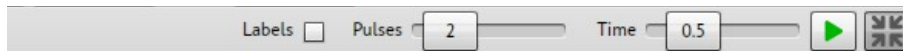
Pressing the *Delete* button (‘trash can’) will delete and reset the entire selection.

The *Pulses* and *Time* settings can be used to adjust the appearance of the animation during *Playback*.

When the sequence (instantiation) has been completed, press the Record button again to exit the record mode. The display of the Aspect labels will now be determined by the status of the *Show/Hide Aspect Labels* checkbox.

### Playback of a sequence

To begin Playback, first enter the Full Screen mode by pressing the *Full Screen* button. The display will zoom to fit the whole model within the screen size. The controls of the *Visualiser Pane* will now look like this.



Prior to *Playback* the following settings can be adjusted: Display of Aspect labels, Number of Pulses per animation, Time of each Pulse in seconds.

To begin the Playback animation, press the Play button. Pressing the Play button again during Playback will pause the animation. Press it again to resume. Pressing the Space Bar will have the same effect of toggling the Playback between pause and resume.

The Playback animation can be cancelled at any time by clicking anywhere on the screen.

Functions can be moved and repositioned in the Full Screen mode in the same way as the normal editing mode.

When the use of the playback has been completed, press the Full Screen button again to exit the Full Screen mode and return to the normal editing mode.

### Change log

There is now a change log which shows a record of the changes and improvements that have been made to the FMV. The change log also provides a channel for reporting feedback and suggesting improvements and changes. The Change log can be found at <http://www.zerprize.com/fram/>

### Comments

The new FMV provides a valuable tool for the FRAM model development. Please feel free to use it, and let us have your feedback. If you produce any good models, we will be happy to post them on the website.

The FRAMily invites and welcomes suggestions for contributions to a continued development, not least suggestions for projects that can be used as a means to fund such developments.

### Background

The FRAM Model Visualiser (FMV) is the work of Rees Hill. You can find him at <http://www.zerprize.com>.

The FMV provides a powerful editor, visualiser, and model checker in a single package. Earlier software tools incorporating the principles of the method were the FRAM Visualizer (<https://code.google.com/p/framvisualizer/>) and the FRAM Model Builder (FMB). Both projects have provided inspiration for the FMV, but both have by now been discontinued.

### **Conditions of use**

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