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WLINKIT – SOME HINTS TO USE THE SYSTEM[1]

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WLinkIt is representative of a category of computer based modelling systems called *semi-quantitative* systems (Sampaio,96). The system can be used to represent causal relationships between objects and/or events of a certain domain. The vocabulary used in its environment tries to correspond well to intuitive or common-sense ways of talking about systems.

The construction of a model with WLinkIt is made through the use of a direct-manipulation interface using a graph metaphor to define the objects and relationship of a certain model. In most cases these objects can be used by the modeller to represent some aspects of the world to be modelled such as the level of pollution of a city, its main causes and its consequence on the health of the population of that city.

To create a model with WLinkIt, the user has to define the variables and relationships and attach to them some characteristics that reflect the functional aspects of the objects and events being modelled. The system, in its turn, is responsible for running the model. In order to do so, it executes two steps: First it has to choose a set of mathematical equations (always hidden from the user) - based on the characteristics of the variables and relationships already created - that will control the behaviour of the model. Second, it makes the model evolve over time through the calculation and iteration of these equations. During this process of running the model, the user receives visual feedback from the system, seeing changes in some physical aspects of the objects on the screen.

LinkIt Elements

LinkIt has two main system-objects: variable and link.

Variables

Object-variables are presented to the user as a box (called variable-box) containing one or two level bars inside it. This type of object can be of two forms:

Smooth variables can be used to represent any factor about a problem someone wants to model. They are shown on the screen as a rectangular box with a horizontal amount level indicator in the middle.They can be of two different range: [0, +1] (Only Positive Values) and [-1, +1] (Any value). These two ranges combined with the visualization of the amount level on the screen, permit the representation of positive and negative values or more qualitative ideas such as above or below the "normal" level.

On/Off variables can be seen as a special case of Smooth variables. They serve to represent conditional factors that can control the behaviour of dependent variables. Their box is divided into two parts. The left part contains a threshold level indicator (a small triangle) used to define when the

variable will trigger and the other part of the box contains the amount level indicator. Both of them can be moved by the user independently.

When a variable is created its default range is set to 'positive only' values. If the user changes it to 'any value' (through the Information box of the variable), the height of the variable box doubles and all links that arrive or depart from it are redrawn to fit the new size of the box.

The resting level (internal value = 0) of an 'any value' variable is indicated by two small dots located on the left and right side of the box .

- **Delete a variable from the screen -** Click on the variable and press the keyboard <del>.
- **Changing the level of a variable -** Just click on the level bar and drag it up or down
- **Changing the parameters of variables (boxes) –** Double click on the variable you want to change the parameters. A parameter box (see Figure 1) will be shown.

  The parameter <Faixa de Variação> means Range of variation of a variable. It can be:
    - Only positive values - <Valores Positivos>
    - Any Value - <Qualquer valor>

  The parameter <Cor> means the colour of the level of a certain variable (default is black). To change it just click on the new colour you want.

  The parameter <Gráfico> means Graph and define whether the system will draw (<desenhar>) a graph of the variable during simulation.
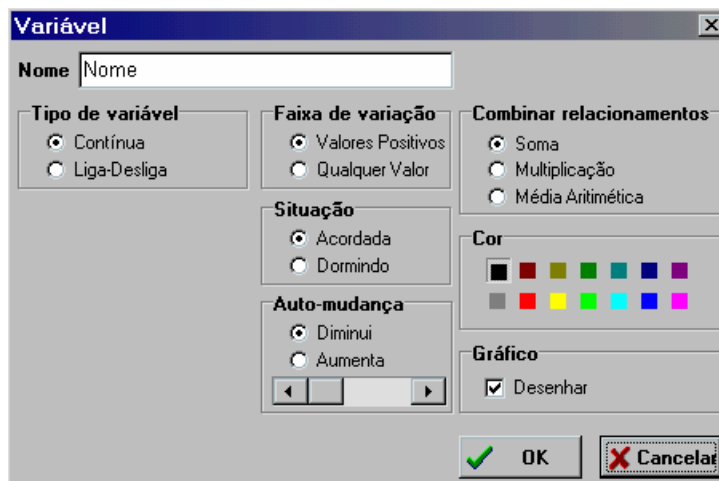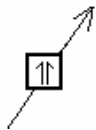

Figure 1: Parameters of a Variable

Links

       Links are used to connect variables and define a causal relationship between them. Basically the system provides two different types of links:

Go together links are used to define relationships where the value of the affected factor is immediately calculated based on the value of the causal factor. Mathematically it serves to represent relationships of the kind $y = a * x$ where a is a constant that can be modified by the user. The value of a is visually represented in the model by the sign showed inside the square box in the middle of a link .

Gradual (or *cumulative*) links are used to define relationships where the value of the causal factor can be seen as a rate of change of the dependent factor. Mathematically it serves to represent relationships of the kind $y(t+1) = y(t) + a * x$, which is a discrete time step approximation of the linear differential equation $dy / dt = a * x$, where a is a constant that can be modified by the user. The value of a is visually represented in the model by the sign showed inside the circle box in the middle of a link .

       Also the links that arrive at a certain variable (called input combination) can be combined in one of three different forms: they can be summed up (or subtracted if an opposite link is used), multiplied (or divided if an opposite link is used) and averaged.

       The parameters of a certain link can be changed by double-clicking on the hot area (its center) of the link.

- **Delete a link from the screen -** Click on the hot area of the link and press the keyboard <del>.
- **Changing the parameters of a link –** Double click on the hot area of the link you want to change the parameters. A box titled <Relacionamento> will be shown as below in Figure 2.

    The parameter <Tipo de Realcionamento> means <u>Type of the Link</u>. It can be:

- Gradual or Cumulative - <X determina quanto Y vai mudar>
- Go together - <X determina o valor de Y>

  The parameter <Direção> means the <u>Direction</u> of influence of the causal variable on the dependent variable. It can be:

- Same direction - (<Mesma>)
- Opposite direction - <Oposta>
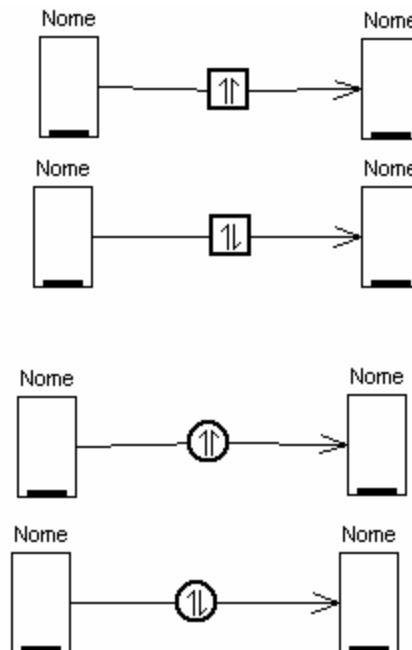
Figure 2: Parameters of a link

Figure 3: Different types and Direction of links (from above: Go together, Same direction; Go togrther opposite direction; Cumulative, Same direction; Cumulative Opposite direction)

SIMULATING A MODEL

The following buttons presented on the menu bar are related to the simulation of a model created or loaded by the user. To invoke one of them, just single click on it.

- **Playing a model**

- **Stop playing a model**

- **Making the clock equal to zero and cleaning the Graph area**