

Mathematical formulas in a graphical context: From dual calculator to app to specific market

ABSTRACT

The present mathematical formulas paradigm do not take fully advantage from XXI century possibilities: so, new proposals have to come. Graphical context, defined as a set of graphical elements that surrounds and explains concepts, is a powerful didactic tool. New technologies offer a wide range of possibilities to cope with current needs, and graphic software is leading to a new paradigm. Didactics follow historical tradition so change comes with difficulty even if the advantages of a new graphical proposal can be demonstrated. So, here is a daring proposal FORMUGRAM: from the analytical side used in industry applications (energy efficiency...) to an arithmetic calculator that you do not need to type any number and you see the quantitative inputs and the results.

Framework

Motivation

"Computing is more about graphics than ever", this quotation from *Fortune Magazine* (30 Aug 10, page 14) is the core subject from an interdisciplinary team of professionals, scientists and university professors. The project has its roots with *Ciència Recreativa Estalella* (2008), an enjoying science project (20 university professors from UdG, UPC, UMU...) with different science books, exhibitions, multimedia products... Following Josep Tarrés research about mathematical formulas in a graphical context, by 2012 Sergio Escalera and Oriol Pujol, university professors from Barcelona University, joined the project.

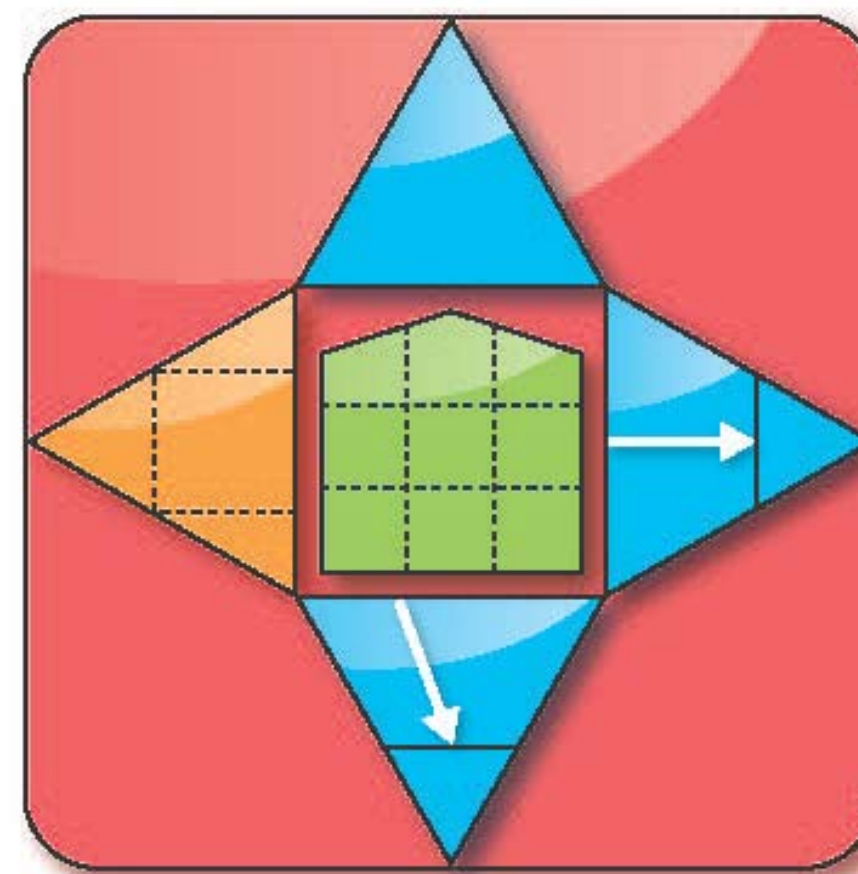
FORMUGRAM

Basics

The graphical context

A graphical context has to have three features. First, it has to be broader than the subject it covers: similar graphic symbols in different subjects. Second, a graphical context has to be intuitive: there are global symbols (for example, an arrow indicates direction, the degree of thickness shows importance...) but other symbols have to be understood easily (for example, time runs from left to right); also, symbolic physical properties with graphical power can be added. Third, all graphical elements have to be coherent so there are no misunderstandings: established symbols as traffic lights (red, yellow and green) and standard graphs are well accepted.

New R+D directions



FORMUGRAM is part of a project with graphical context as ecosystem: colors, geometrical shapes, symbols, symmetries... as well as "management features" (directional menus...)

Horizontal apps:

- Arithmetic and scientific dual calculators
- Spreadsheet in graphical context

Vertical apps:

- Financial analysis
- Car consumption efficiency
- Entertainment (Formudoku...)

The dual calculator

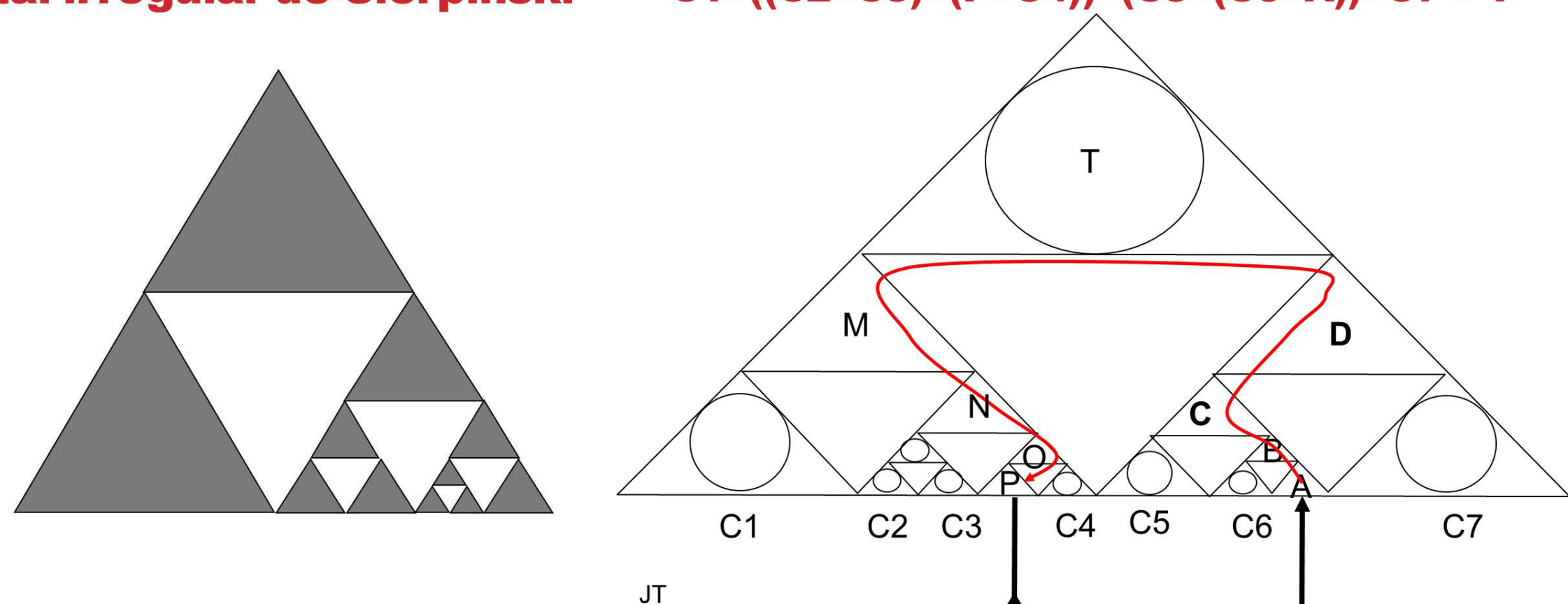
Description

An arithmetic calculator that you do not need to type any number and you see the quantitative inputs and the results. Using geometric shapes and an intuitive way to deal with them, the calculator in a graphical context matches the current trends of tablets and smartphones. Expressions including standard operations can be represented graphically in an intuitive way. Also, it can be used as a standard calculator. This software and its methodology represents a first to market innovative product with high potential applicability

Sierpinski fractal

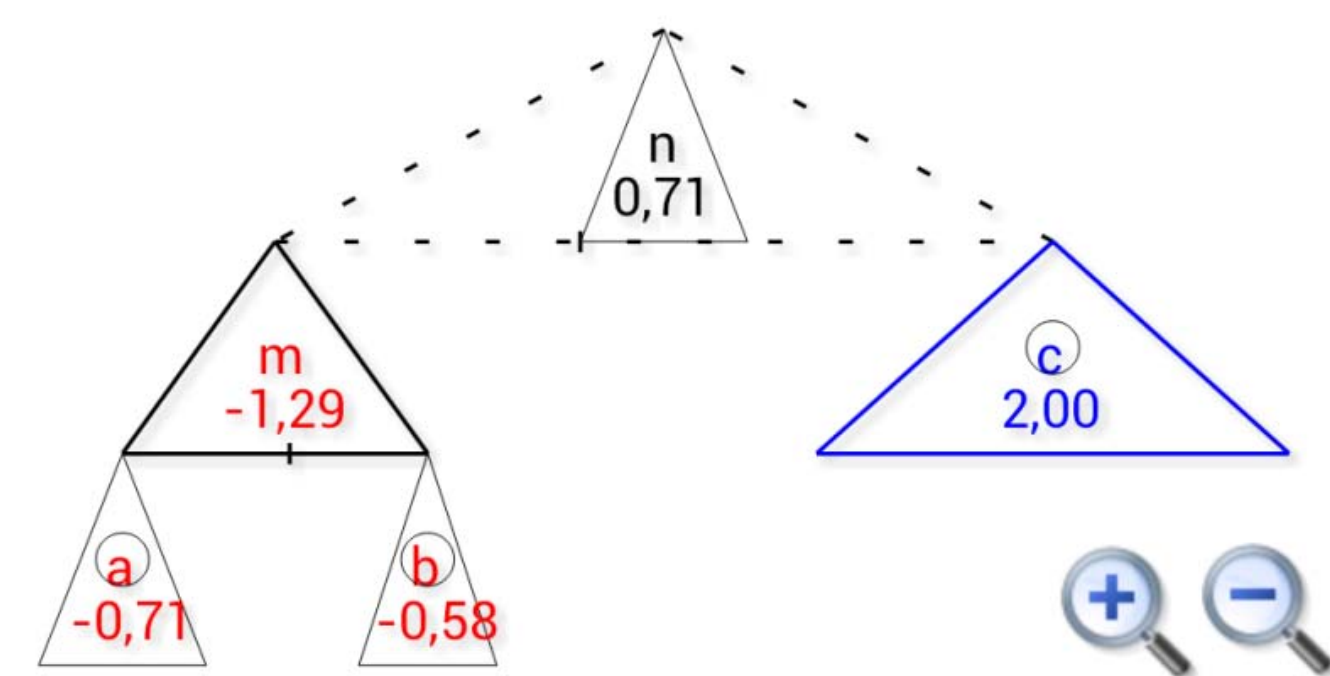
- Using the Sierpinsky fractal, sums are easier to understand. The "what if" is very intuitive.

Fractal irregular de Sierpinski **Exemple** $C1 + ((C2 + C3) + (P + C4)) + (C5 + (C6 + A)) + C7 = T$

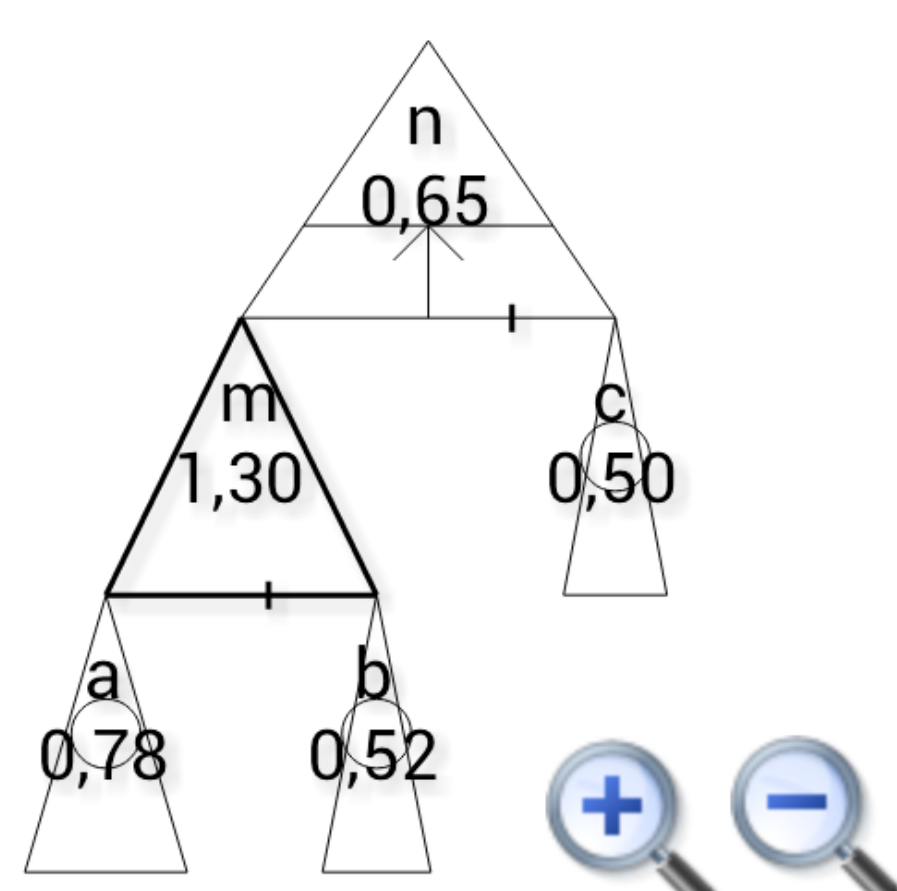


Examples

There is no subtraction: it is an addition of positive and negative numbers.



There is no division: it is a multiplication of numbers and inverses.

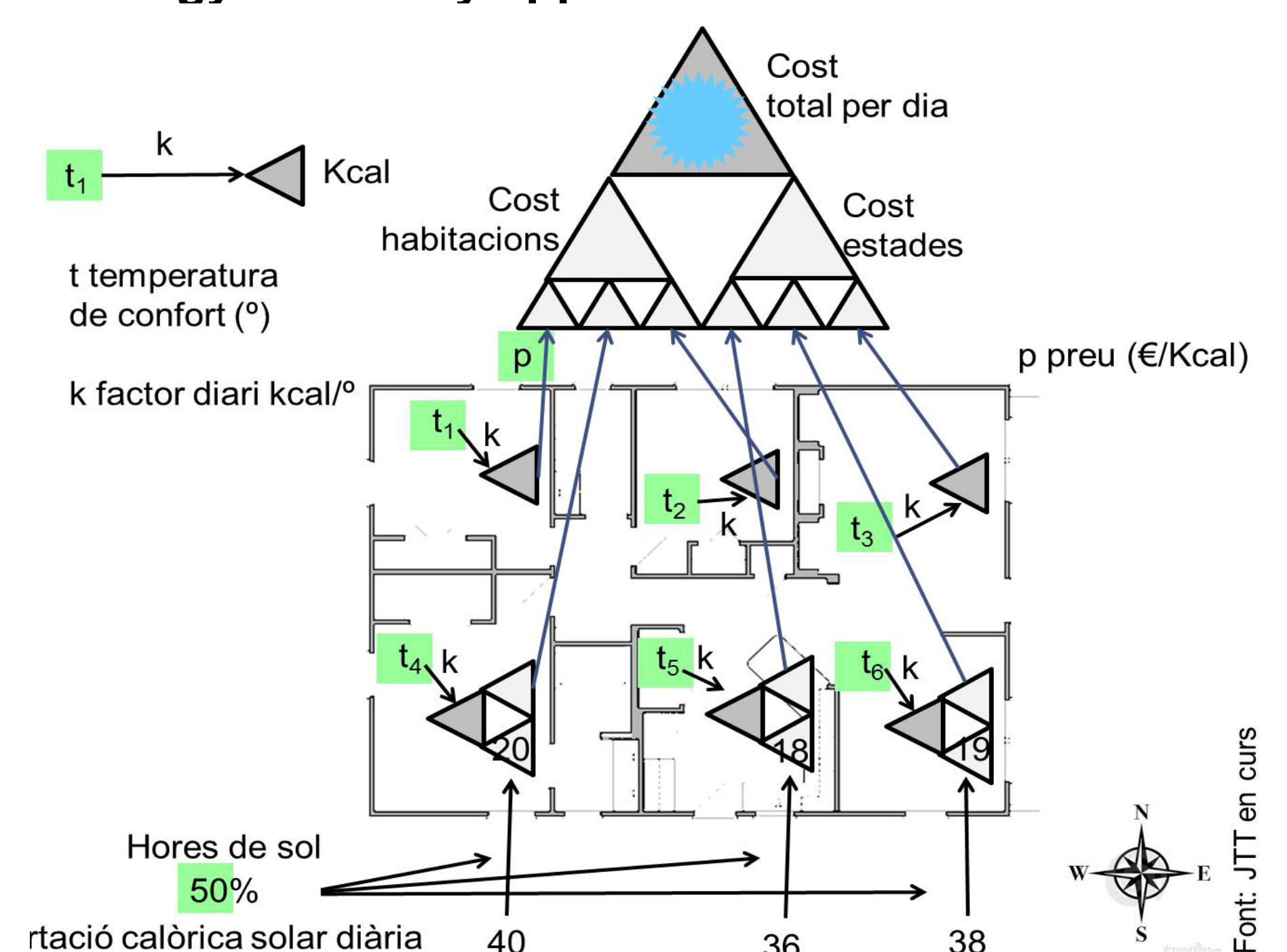


Market applications

EFIGRAM. Energy efficiency applications

Energy efficiency has a high potential using mathematical formulas in a graphical context:
-Energy performance
-Energy monitoring system

Overall, FORMUGRAM gives a clear understanding of the different energy, inputs, interdependencies, etc.

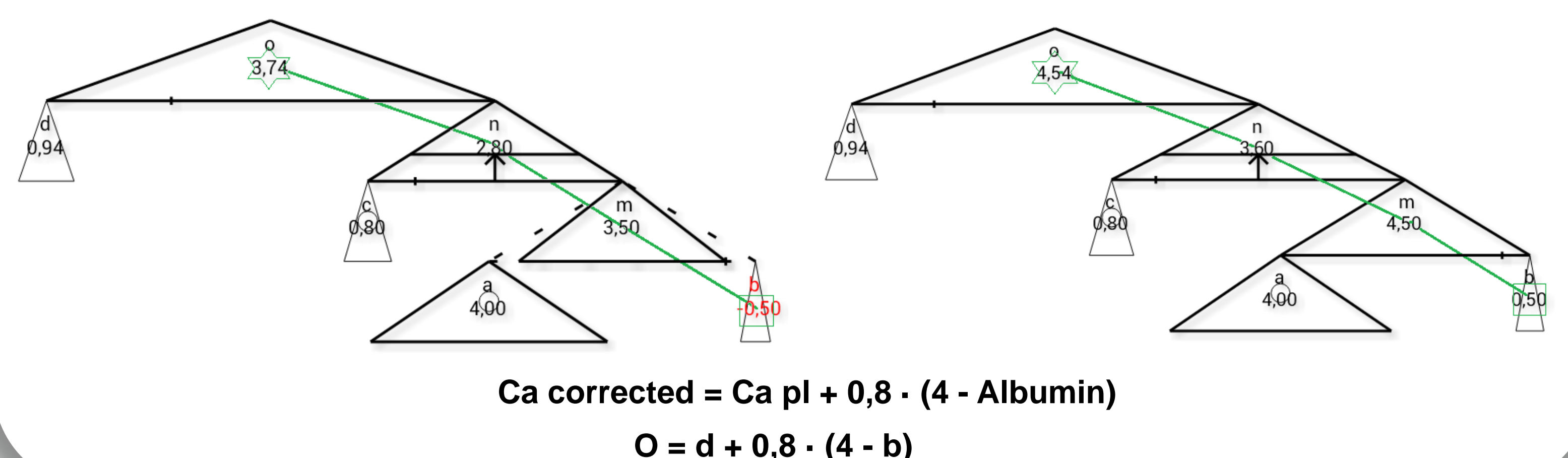


Health information technology (HIT)

FORMUGRAM is ready for apps tailored to health. From medical to pharmaceutical, tablets and iPads can have a great deal of new possibilities. For instance:

- Basic medical statistics in a graphical context.
- Models in medicine and pharmacy. The health information technology needs mathematical models.

Example: Calcium Correction



References