

On views, diagrams, programs, animations, and other models

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How do these relate?











Background

My general interest:

- Foundations and applications of domain modelling
- Model-driven systems

Key application field to *enable* with model-driven systems:

- Modelling in an enterprise context
- Enterprise design management







Background

- M. Bjekovic, H. A. Proper, and J.-S. Sottet. Embracing pragmatics. In E. S. K. Yu, G. Dobbie, M. Jarke, and S. Purao, editors, Conceptual Modeling - 33rd International Conference, ER 2014, Atlanta, GA, USA, October 27-29, 2014. Proceedings, volume 8824 of Lecture Notes in Computer Science, pages 431-444. Springer, Heidelberg, Germany, 2014. ISBN: 978-3-319-12205-2
- H. A. Proper and G. Guizzardi. On Domain Conceptualization. In D. Aveiro, G. Guizzardi, R. Pergl, and H. A. Proper, editors, Advances in Enterprise Engineering XIV 10th Enterprise Engineering Working Conference, EEWC 2020, Bozen-Bolzano, Italy, September 28, October 19, and November 9-10, 2020, Revised Selected Papers, volume 411 of Lecture Notes in Business Information Processing, pages 49-69. Springer, Heidelberg, Germany, 2021. ISBN: 978-3-030-74195-2
- G. Guizzardi and H. A. Proper. On Understanding the Value of Domain Modeling. In G. Guizzardi, T. P. Sales, C. Griffo, and M. Furnagalli, editors, Proceedings of 15th International Workshop on Value Modelling and Business Ontologies (VMBO 2021), Bolzano, Italy, 2021, volume 2835 of CEUR Workshop Proceedings. CEUR-WS.org, 2021.
- 4. H. A. Proper and G. Guizzardi. Modeling for Enterprises; Let's go to RoME ViA RiME. In *PoEM 2022 Forum Proceedings*. CEUR-WS.org, 2022







Domain modelling

Views, diagrams, ...

Conceptual fidelity of models

Modelling languages







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A social artefact that is understood, and acknowledged, by a (collective) human actor to represent Based on Peirce, Ogden & Richards, Based on Stachowiak, FRISCO, ... Apostel, an abstraction of some domain for a particular cognitive purper

And our own work 😇



A social artefact that is understood, and acknowledged, by a (collective) human actor to represent an abstraction of some domain

for a particular cognitive purpose





Domain model

A social artefact that is understood, and acknowledged, by a (collective) human actor to represent an abstraction of some domain for a particular cognitive purpose

Examples:

enterprise models, business process models, ontology models, software models, information models, value models,





Domain model

A social artefact that is understood, and acknowledged, by a (collective) human actor to represent an abstraction of some domain for a particular cognitive purpose





A social artefact that is understood, and acknowledged, by a (collective) human actor to represent an abstraction of some domain for a particular cognitive purpose

Models are represented on some kind of medium

This could be an interactive, or a non-interactive medium

It could also be an "experiential" medium





Domain model

A social artefact that is understood, and acknowledged, by a (collective) human actor to represent an abstraction of some domain for a particular cognitive purpose





{ dynamic, static } x { models, domains }

The modelled domain may be static or dynamic

The model (qua artefact) may be static or dynamic

Examples (domain : model)

- Dynamic : dynamic
- Dynamic : static
- Static : dynamic
- Static : static

An animation of a business processA business process in BPMNA navigable application architectureA diagram with an application architecture





{ dynamic, static } x { models, domains }

The modelled domain may be static or dynamic

The model (qua artefact) may be static or dynamic

Dynamic models can be interactive or non-interactive

E.g. a "My Pizzeria" game to illustrate the workings of a planned pizzeria





A model does not have to be "minimal"

In general, we *do* allow for models where parts of the model can be derived from other parts of the model

An example from ArchiMate:







Return on Modelling Effort (RoME)

How to make trade-offs between a modelling effort and its (potential) return in relation to specific contexts and purposes?



Modelling capability?

Modelling is natural





Modelling practices emerge naturally

Z. Zarwin, M. Bjekovic, J.-M. Favre, J.-S. Sottet, and H. A. Proper. Natural modelling. Journal Of Object Technology, 13(3):4: 1-36, July 2014





Modelling capability?

Modelling is natural





Modelling practices emerge naturally

When modeling becomes critical, we should start talking about modeling capabilities ...

Including modelling related concepts and tooling ...







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Views





Products













An all encompassing, and too large to show, XXX model with lots of crossing lines ...





27

A view is a model that is derived from another model

It may:

- have a stricter focus
- further abstract from the original domain
- use other symbols & language for its representation
- use another medium for its representation

We'll come back to these later





A view is a model that is derived from another model

Interesting case:

• A "screenshot" of a dynamic model can be a view as well, based on a "temporal state abstraction"





A view is a model that is derived from another model

Views can be edited as well ...

Does lead to the traditional "view update" problem when the view involves e.g. a further abstraction or a temporal selection





Tables



Value Interfac	Value Trans	Occurrence	Valuatio	Value	Total
{MONEY,GOOD}		10		100	
	MONEY	10	10	100	
	(all transfers)	10	0	- 0	
INVESTMENT				- 0	
EXPENSES				- 0	
total for actor					100





A model/view with a static (in principle) two-dimensional grid representation of a (possibly derived) ternary relation (type) concerning the modelled domain

Dynamic-ifying a table:

 We could "allow" ourselves to blend in/out specific rows/columns, thus changing the "informational payload" that the model provides to us at that moment





A spreadsheet can be used to represent/render a table

A spreadsheet with actual formulas, but no "open" cells would be an example of a table (qua model) with derived parts

A spreadsheet "what if analy Warning: A lot of spreadsheets allows one to Contain "hidden" domain models ... A spreadsheet with "intentionally left open" cells to enable male of an *interactive model* as it



Diagram (qua model)

A model that is represented in a two dimensional (static) graphical form

Dynamic-ifying diagrams:

- We could allow ourselves to blend in/out specific (types of) elements [think: layers in Google Maps]
- Or ... enable navigation through the model based on (different kinds of) part-whole relations
 [think: zooming in on Google Earth]





Specifications

G10 Design Specification				
Aesthetics	What shape will it be? What colour(s) will it be? Will it have different textures? Will it have a particular style? Will it have any particular aroma? Will it have any particular flavour or flavours?			
Target Audience	Who is it for exactly? What are the customer's requirements/user needs?	My target audience consists of members of the wider IGBIS school community.		
Function	What must it do? What is its purpose?			
Manufacture	How will it be manufactured? How will it be cooked?	It will manufactured as a one of prototype of the product.		
Materials	What will the key ingredients be?			
Size	What size will it be?			
Quantity	How many portions will you produce and present?	We will produce two portions of the product.		





Machine	CNC Vertical Machining Centre		
Make	Makino Max 65S		
Table Travel	650 x 400 x 400mm		
Load Capacity	400 Kg		
Power Supply	200/220V, 3 Phase, 50/ 60Hz, 20 KVA		
Machine Weight	4500 Kg		
Rapid Traverse Rate [X,Y axis]	30000 [mm/min]		
Rapid Traverse Rate [Z axis]	24000 [mm/min]		
Feed rate	1-8000 [mm/min]		
Spindle speed	12000 [rpm]		
No of tools	20		
Maximum tool weight	7 [Kg]		
Positioning accuracy	±0.0015[mm]		
Repeatability	±0.001 [mm]		





Specification

A model that normatively prescribes the properties of a (to be designed, to be elaborated, to happen, ...) phenomenon





Program (qua representation)

A specification which captures the required behaviour of a computer in an actionable way, such that a computer can directly exhibit this required behaviour (via interpretation or compilation)



Simulation (qua model)

A model that provides a simulation of the dynamic behaviour of the modelled domain

If simulation-runs can be generated "on the fly" based on different scenario's, the simulation (qua model) becomes an interactive model Homework ... the specification of the simulation versus the simulation ...





A model that is represented as a "movie" that illustrates the dynamic behaviour in the modelled domain in terms of the involved agents, subjects, etc

If animation-runs can be generated "on the fly" based on different scenario's, the animation (qua model) becomes an interactive model







Nature of the modelled domain: *static, dynamic, ...*

Intention of the models: *describe*, *simulate*, *specify*, ...

Derivation of models from models: views

Form:

- *dynamic*, *static*, *interactive*, ...
- diagrams, table, animation, ...







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Traditional view from *information systems engineering*:

- conceptual models express the concepts, and their (allowed) relations, of the *universe of discourse*,
- while avoiding the inclusion of implementation/storage details

ISO/IEC JTC 1/SC 32 Technical Committee on Data management and interchange. Information processing systems - Concepts and Terminology for the Conceptual Schema and the Information Base. Technical Report ISO/TR 9007:1987, ISO, 1987.





Older roots:

M. R. Quillian. Semantic memory, Semantic Information Processing. PhD thesis, MIT, Massachusetts, 1968.

as discussed in:

N. Guarino, G. Guizzardi, and J. Mylopoulos. On the philosophical foundations of conceptual models. Information Modelling and Knowledge Bases XXXI, 321:1, 2020.





A domain model, where

- the purpose of the model is dominated by the ambition to remain as-true-as-possible to the conceptualization (i.e. our ontological commitment) of the domain by the (collective) human actor,
- while there is an explicit mapping from the elements in the model to the latter domain conceptualization.
 Conceptual models have a much broader role to play in society than conceptual database design ... they allow us to understand the concepts, and their relations, in any domain



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Conceptual fidelity





Non/not-so conceptual (domain) models?





Utilisation-design (domain) model

A domain model that has a representation, that is suitable for some computational or experiential purpose, which compromises the conceptual truefulness

It typically involves elements that do not pertain to the domain as such, but rather to its (designed) utilization

Could e.g. be implementation or experiental related utilization













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Each utilisation-design model should have an underlying conceptual model







Each utilisation-design model should have an underlying conceptual model

Different utilisation-design models can have the same underlying conceptual model







Each utilisation-design model should have an underlying conceptual model

Different utilisation-design models can have the same underlying conceptual model

Utilisation-design is also connected to the medium used to represent the model, and ultimately the purpose of the model







View	
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use another medium for its representation	52
We'll come back to these later	52
BIG 23	



View

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Define the conventions which should be met by models

Conventions such as:

- Ontological commitment
- Abstract syntax and semantics
- Concrete syntax
- Medium

ROME!

required at least basic conventions optional optional





A modelling language is more than just the "defined language"

It also originates/evolves out of use, as a social construction (with personal interpretations) between the participants

As designed vs as-used ...

Frozen language!?





A modelling language is more than just the "defined language"

It further evolves based on the things one "needs to talk about":

 cyber risks, GDPR compliance, human-AI alignment, sustainability, ..., .., .

As a consequence a modelling language must be generic; or it must evolve ...

It's the law; the Law of Requisite Variety





Law of Requisite Variety (W. Ross Ashby)

When a system C aims to control / regulate parts of the behavior of a system R, then the variety of C should (at least) match the variety of that part of R's behavior it aims to control

Controlling system: A frozen modelling language (system)

Controlled system: Designing complex systems in a changing world

Designing a generic or a specific language (system): How much do you want to control?





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