Domain Modelling -

Understanding the things we talk about

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LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST

Background

Background - From theory

Background - From theory to practice

Background - From theory to practice, and back

Research is team work

Marija Bjeković

Bas van Gils

Giancarlo Guizzardi

Stijn Hoppenbrouwers

Agenda

Role

Foundations

Challenges

Agenda

Role

Foundations

Challenges

Domain modelling - Goes by different names

Information modelling

Ontology modelling

Business process modelling

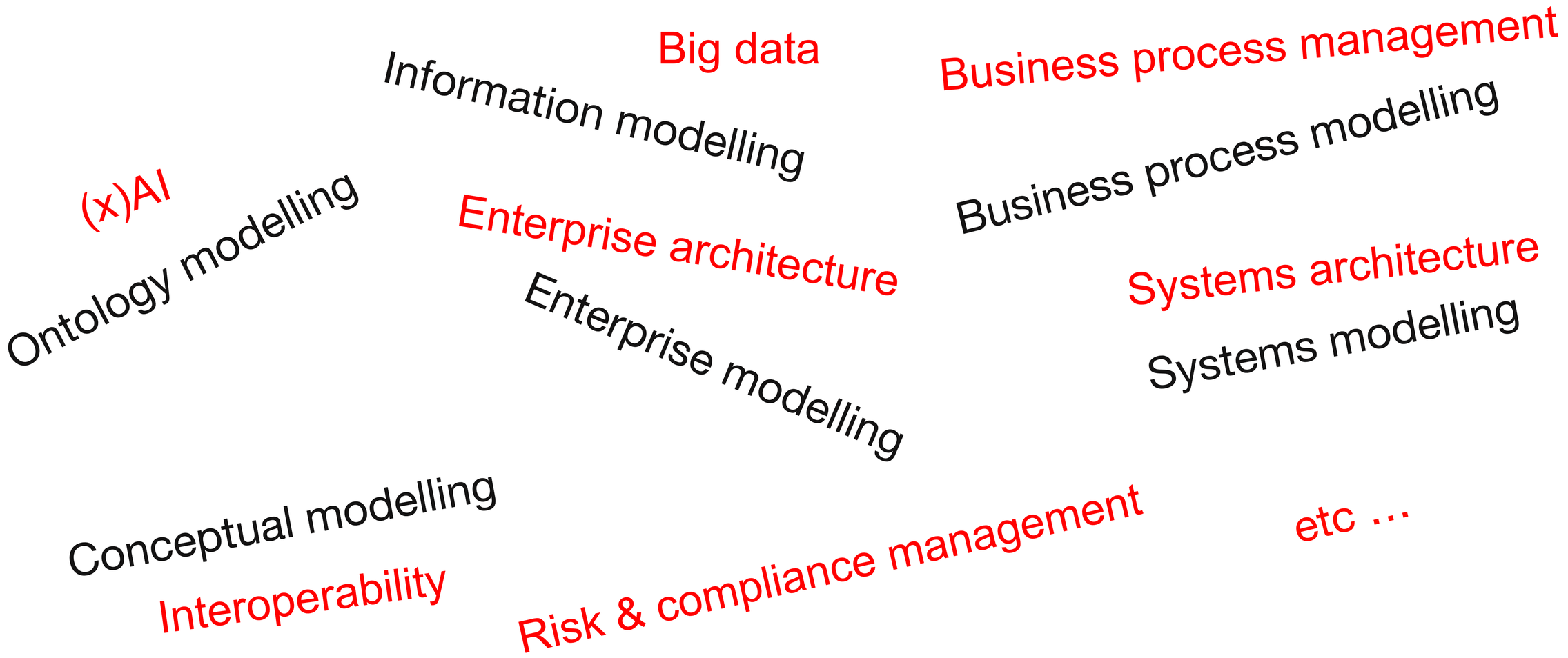
Enterprise modelling

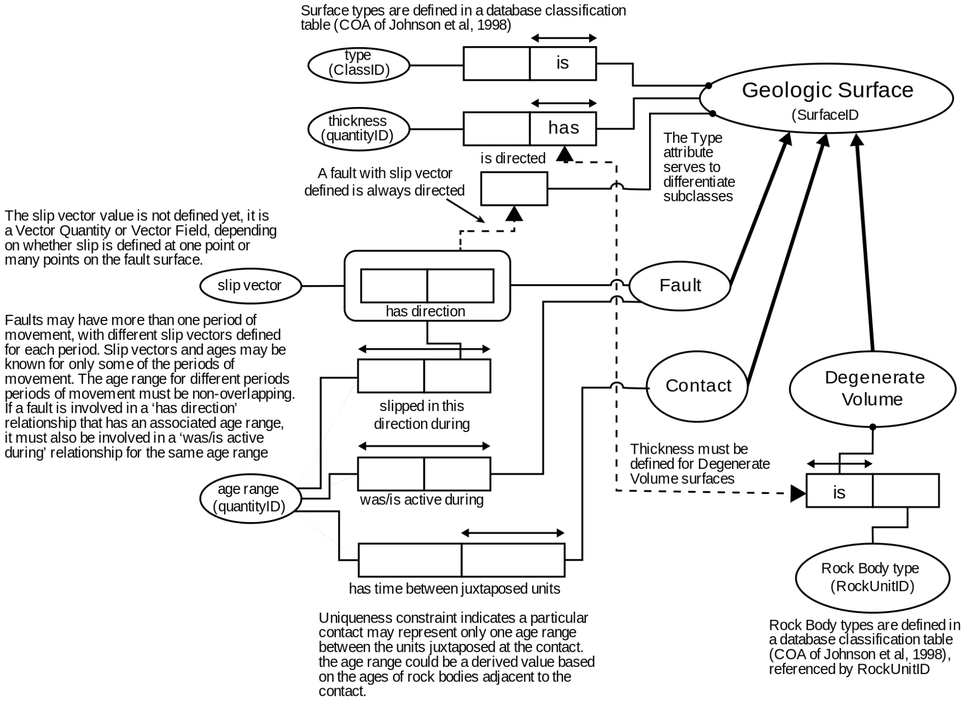
Systems modelling

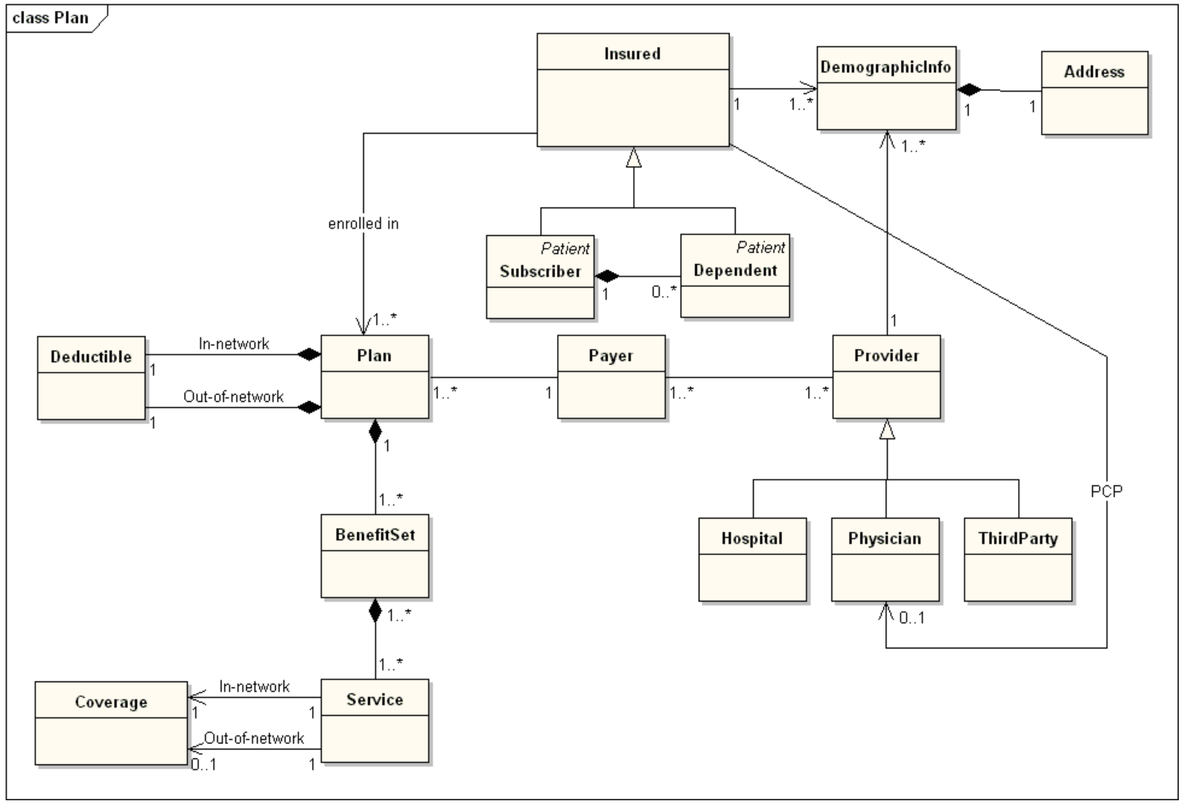
Conceptual modelling

etc …

Domain modelling - Used in different application contexts







A.40 IT systems are sustainable

Type of information: technology

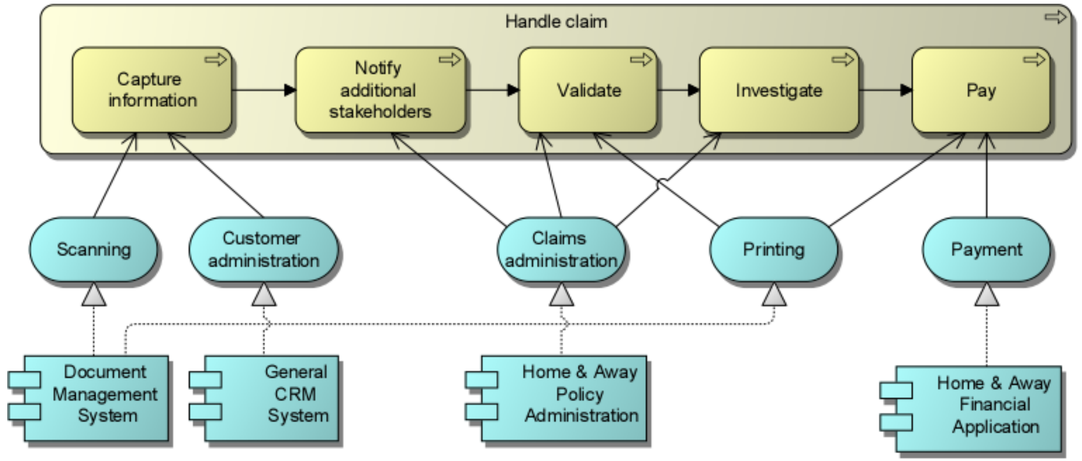
Quality attributes: efficiency

Rationale:

- IT contributes significantly to to the polution of the Earth due to energy consumption and the generation of waste.
- There is a general awareness that measures need to be taken to protect our natural resources and prevent global warming as much as we can.

Implications:

- Energy consumption and the usage of environment-friendly materials are criteria in the acquisition of new IT systems.
- Energy consumption is explicitly taken into account in the design of IT environments such as data centers.



Typical role of domain models in EE / EA

Understand

Assess

Diagnose

Design

Realise

Operate

Regulate

Domain models come in a rich variety

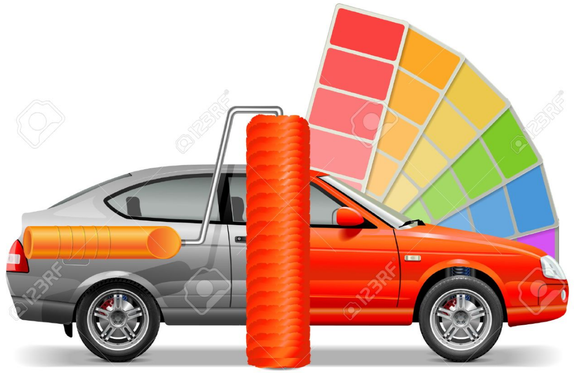
Not always in terms of boxes and lines

Not always in terms of an explicit modelling language

Sometimes we don't even realise we're using domain models

Some examples …

What's the colour of a car?



MARIN

What's a ship propellor?

Your home insurance policy

SECTION 1. DEFINITIONS

The following definitions will have the meaning stated below wherever they appear in bold and capitalised throughout this **Policy** unless otherwise shown for any **Policy** section.

Accidental Damage
Damage caused suddenly and unexpectedly from an outside force.

Buildings
The private dwelling used for domestic purposes only located at the **Risk Address** and all domestic offices, stables, garages and outbuildings used solely in connection therewith and on the same premises, the fixtures and fittings therein and the patios, terraces, footpaths, walls, gates and fences around and pertaining there to.

SWI swissinfo.ch

Swiss Re wins World Trade Center case

Swiss Re said on Wednesday that a New York appeals court had ruled in its favour in a compensation dispute with the leaseholder of the World Trade Center (WTC).

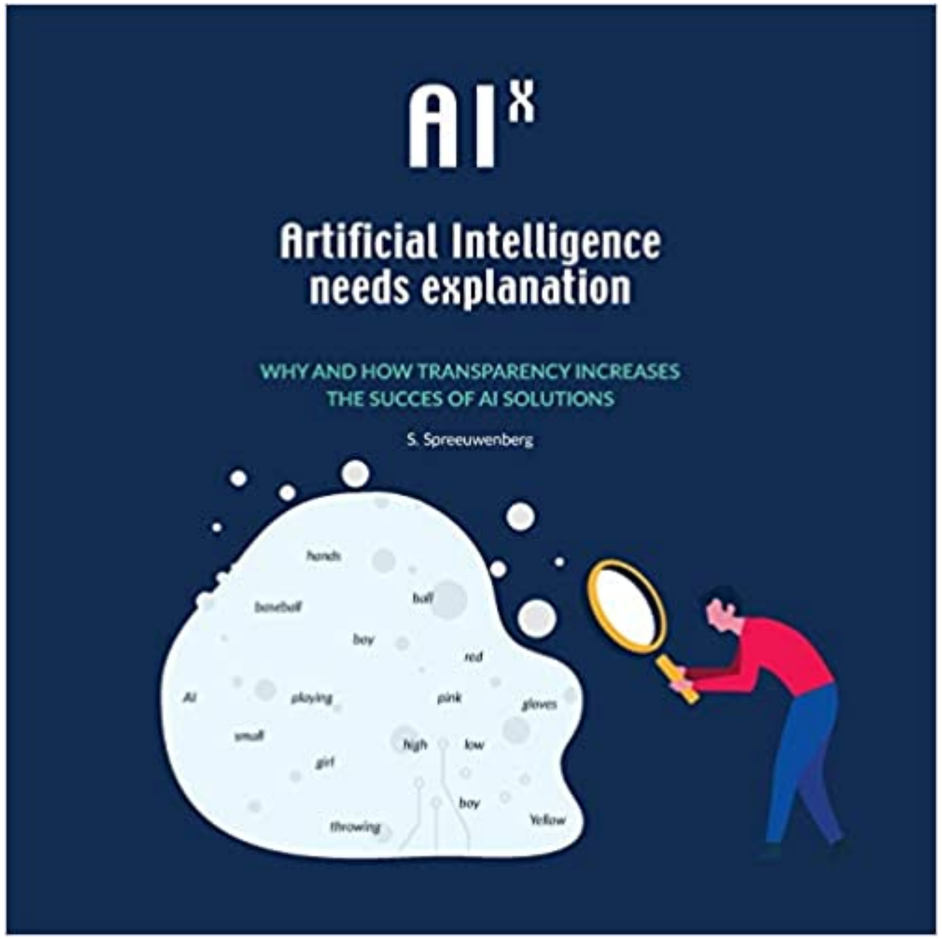
October 19, 2006 - 00:05

It said the court had confirmed that the destruction of the WTC in the September 11, 2001 terrorist attacks was a single event and not a double one as the leaseholder claimed. The ruling ends a long legal battle.

Putting the X on statistical AI

Silvie Spreeuwenberg:

1. Get a shared understanding of the domain
2. Understand the task and select the right scope
3. Collect the right data and improve its quality
4. Select AI techniques that deliver results
5. Generate good explanations
6. Evolve the system over time



Springer Link

Original Article | Published: 23 May 2018

Big Data Semantics

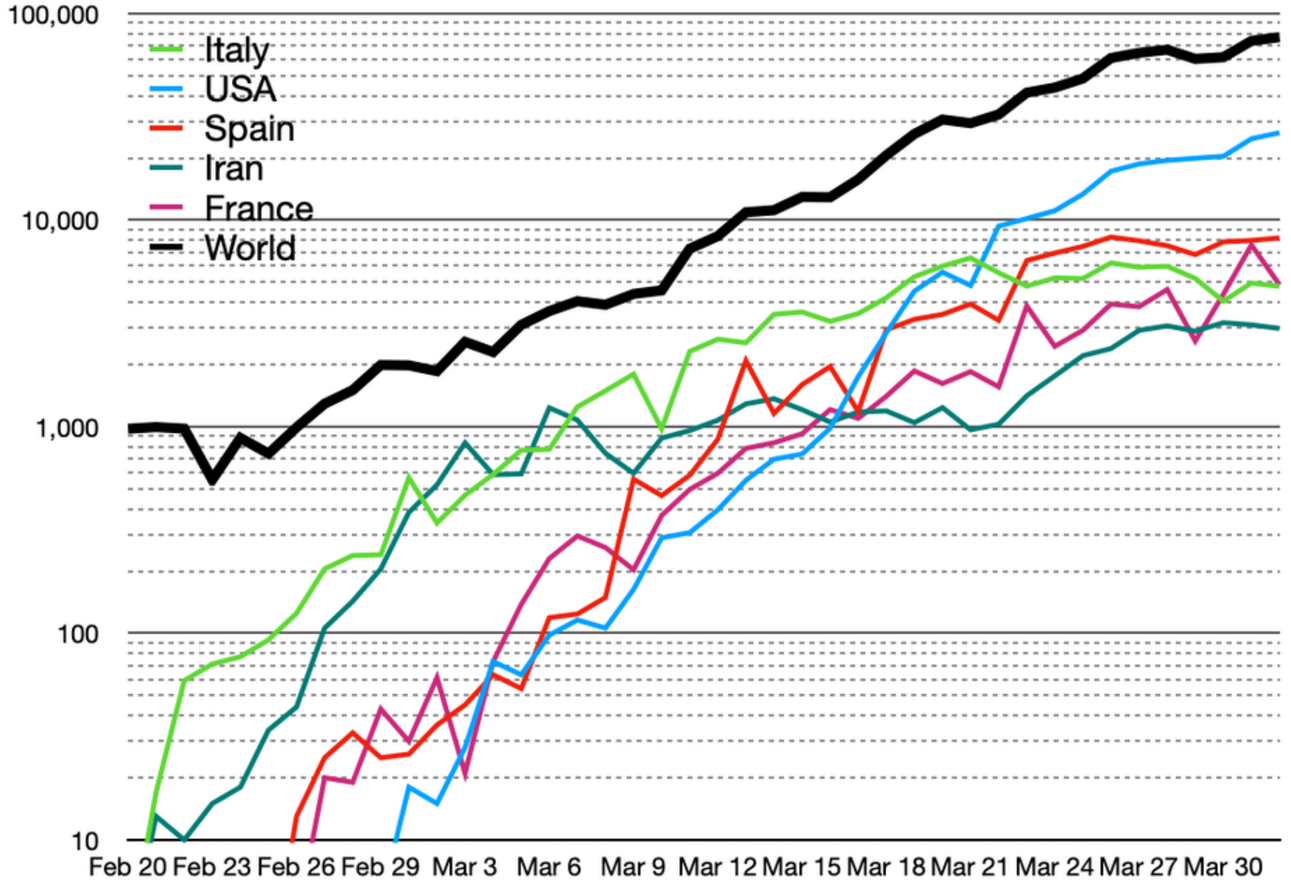
Paolo Ceravolo ✉, Antonia Azzini, Marco Angelini, Tiziana Catarci, Philippe Cudré-Mauroux, Ernesto Damiani, Alexandra Mazak, Maurice Van Keulen, Mustafa Jarrar, Giuseppe Santucci, Kai-Uwe Sattler, Monica Scannapieco, Manuel Wimmer, Robert Wrembel & Fadi Zaraket

Journal on Data Semantics **7**, 65–85(2018) | Cite this article

1118 Accesses | **13** Citations | **1** Altmetric | Metrics

Abstract

Big Data technology has discarded traditional data modeling approaches as no longer applicable to distributed data processing. It is, however, largely recognized that Big Data impose novel challenges in data and infrastructure management. Indeed, multiple components and procedures must be coordinated to ensure a high level of data quality and accessibility for the application layers, e.g., data analytics and reporting. In this paper, the third of its kind co-authored by members of IFIP WG 2.6 on Data Semantics, we propose a review of the literature addressing these topics and discuss relevant challenges for future research. Based on our literature review, we argue that methods, principles, and perspectives developed by the Data Semantics community can significantly contribute to address Big Data challenges.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10,000
1,000
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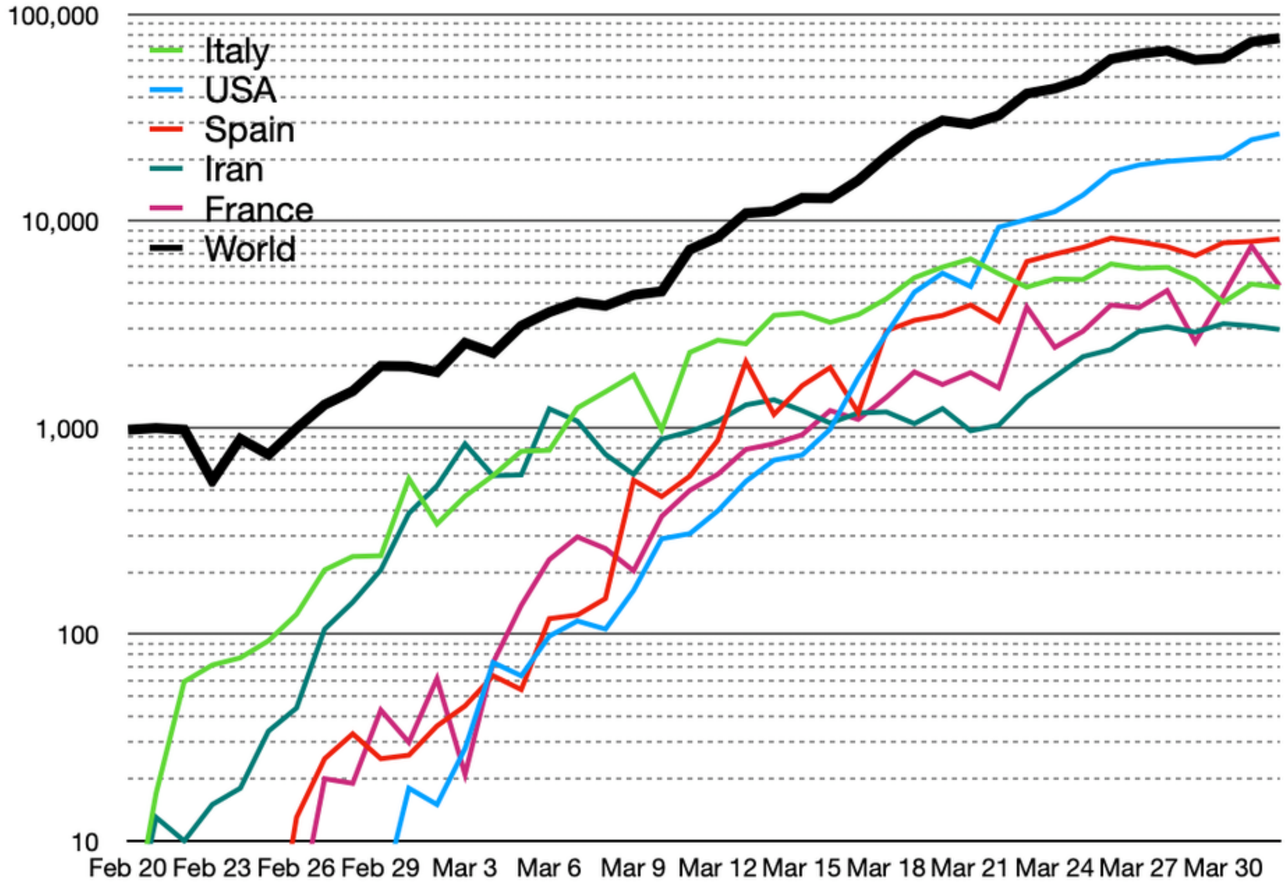
10
Italy
USA
Spain
Iran
France
World
Feb 20 Feb 23 Feb 26 Feb 29 Mar 3 Mar 6 Mar 9 Mar 12 Mar 15 Mar 18 Mar 21 Mar 24 Mar 27 Mar 30

Coronavirus: country comparisons are pointless unless ....



Source: https://theconversation.com/coronavirus-country-comparisons-are-pointless-unless-we-account-for-these-biases-in-testing-135464

Domain models

Define the elements of a domain and their relations; i.e. the domain concepts

Capture knowledge about the domain

Key in creating shared understanding

Domain models

Define the elements of a domain and their relations; i.e. the domain concepts

What are we talking about?

Capture knowledge about the domain (with a modality: is / planned / ought / …)

What do we know about the domain?

Key in creating shared understanding

Are we on the same page?

Domain models

Depending on the purpose, different forms and languages can be used

From highly specific and mathematically formalised, to more global and indicative

Domain modelling happens naturally

Can we do it better? Especially in an EE / EA context …

Agenda

Role

Foundations

Challenges

Do we understand domain modelling?

Ample research on (some of the) applied fields of modelling:

- Information modelling
- Business process modelling
- …

Less so into the foundational aspects of modelling

Generic challenges; generic solutions

Foundations of domain modelling

1. the essence of what a model is
2. the act of modelling (creation, use, …)
3. the role of (modelling) languages

Domain model

an artefact that is:

acknowledged by an observer

as representing

an abstraction

of some domain

for a particular purpose

Based on Apostel, Stachowiak, FRISCO, …

And our own work 😇

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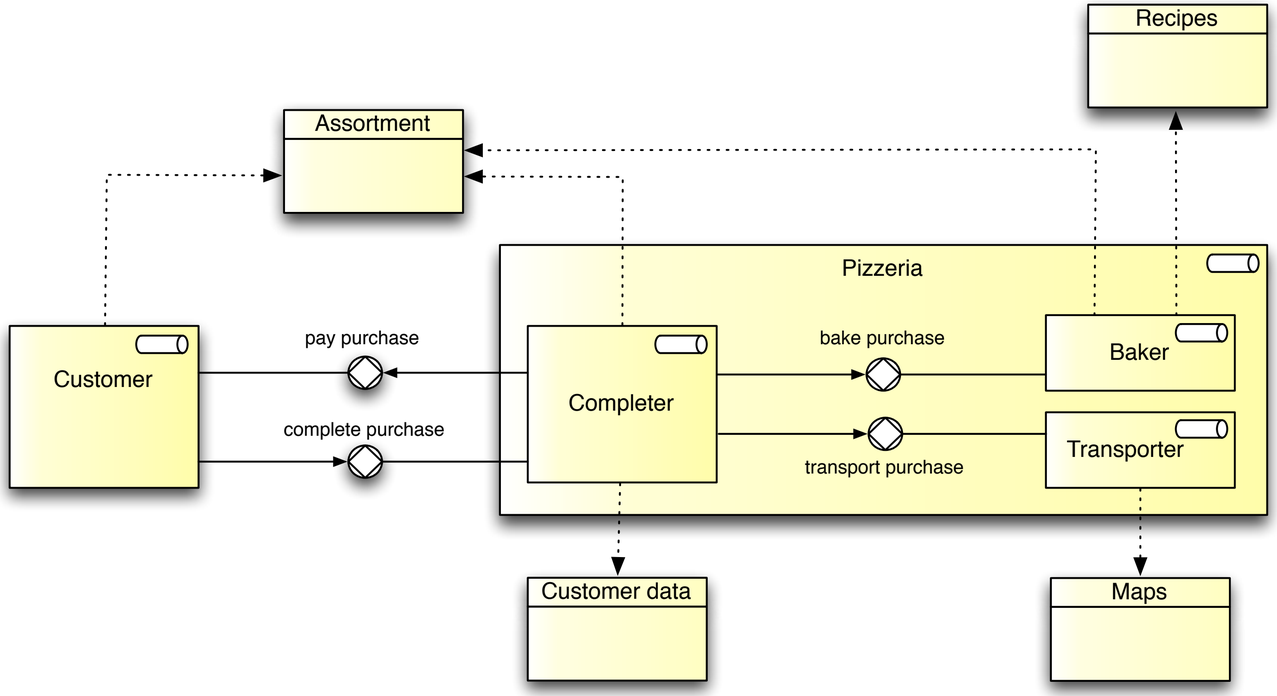
Examples


Recipes
Assortment
Pizzeria
Customer
pay purchase
Completer
bake purchase
Baker
complete purchase
transport purchase
Transporter
Customer data
Maps


playmobil
City Life
PIZZA
PROMO-PACK
70336 | 4+ | 167 pc

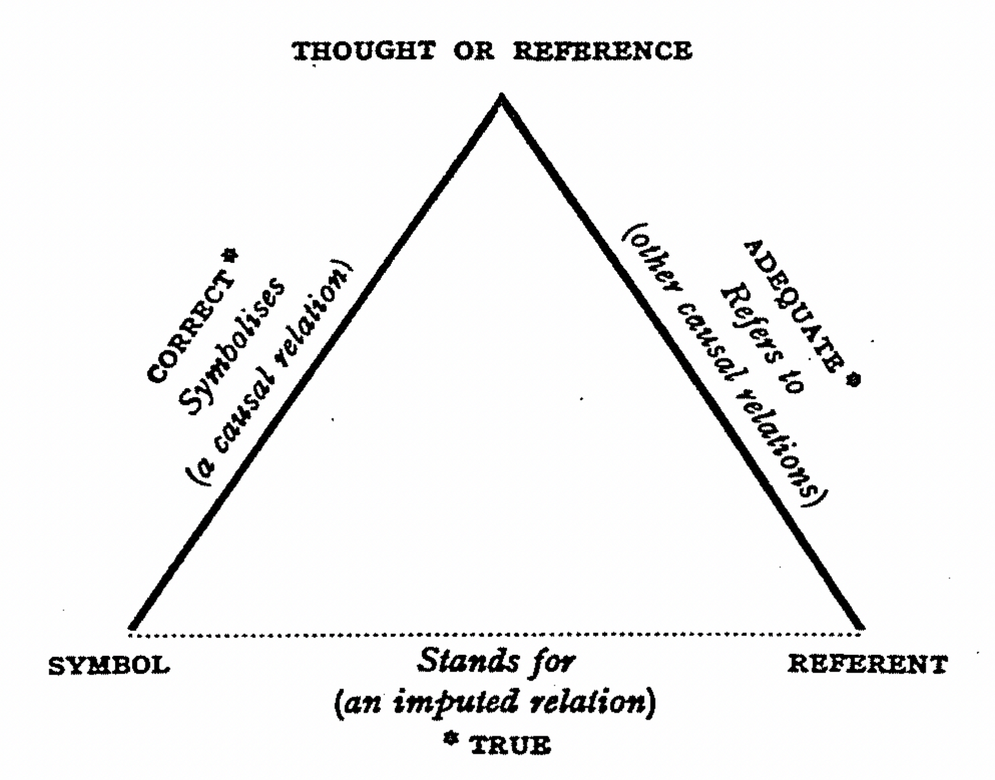

6660
5:00
TIME
RUN THE HOTTEST NEW PIZZA SHOP!

Conceptual domain model

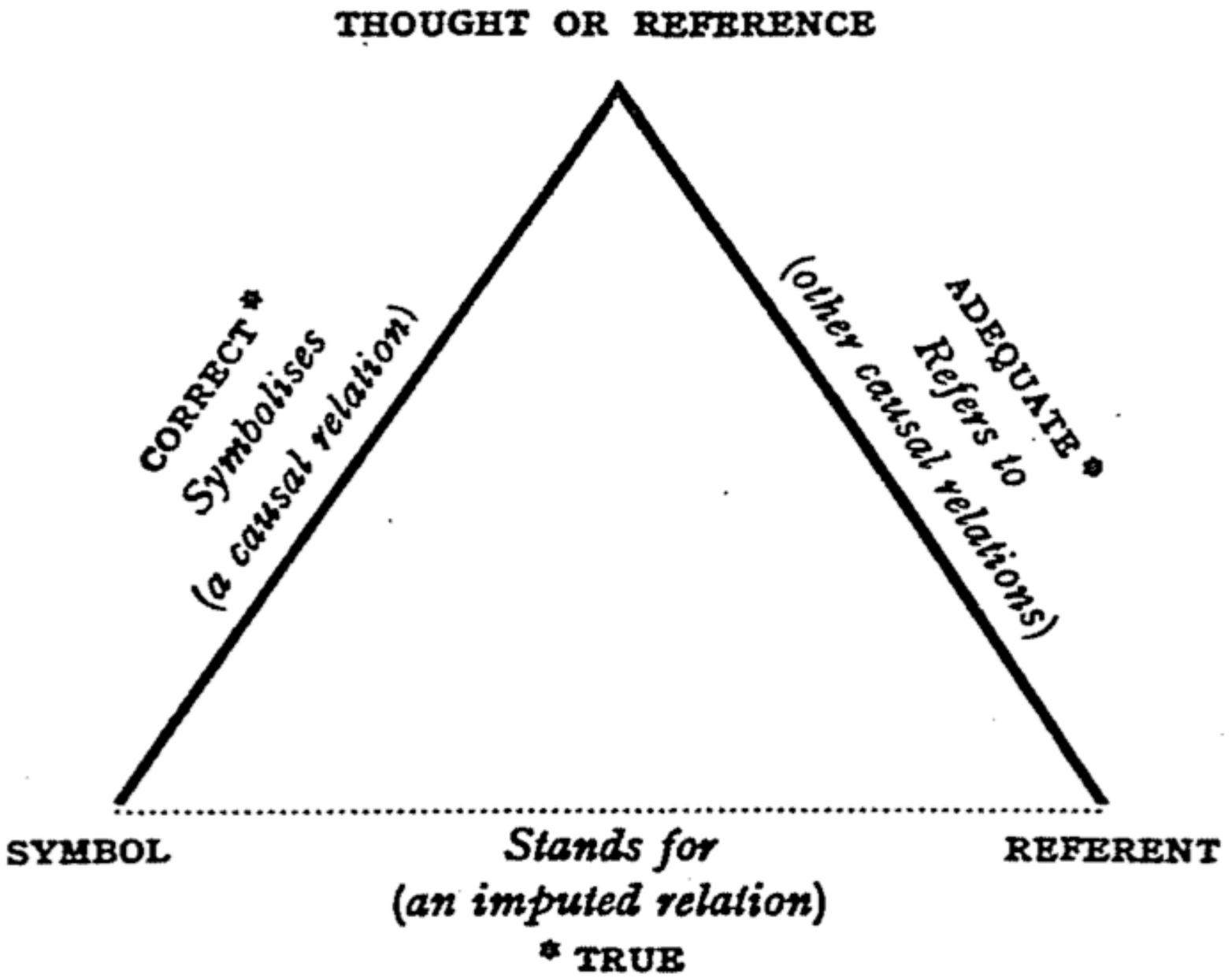
A model where its purpose is dominated by the ambition to remain as-true-as-possible to representing the concepts of (the abstraction of) the domain

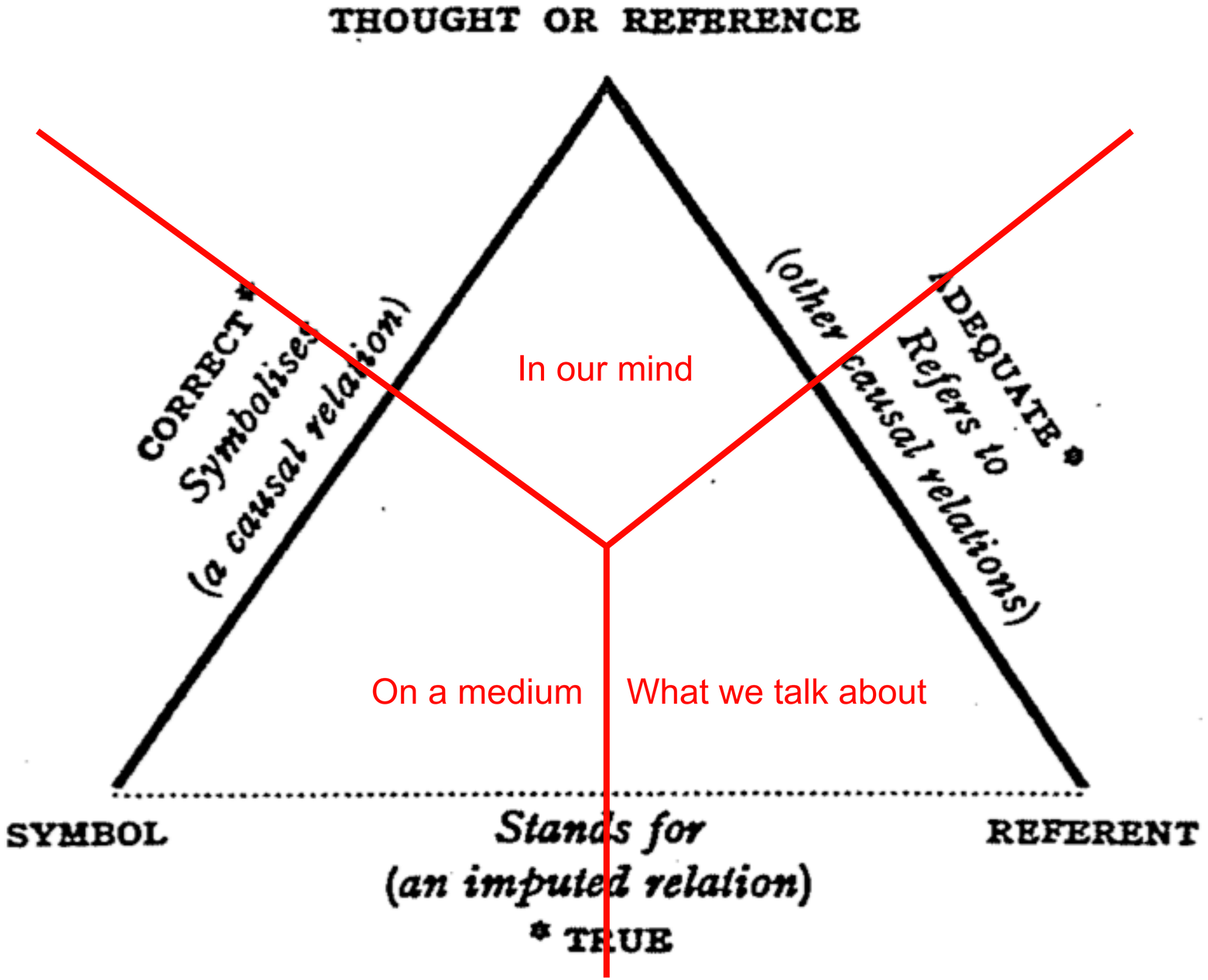
For simulation / execution / computational purposes, the conceptual quality of a model might be “compromised”, in exchange for other qualities

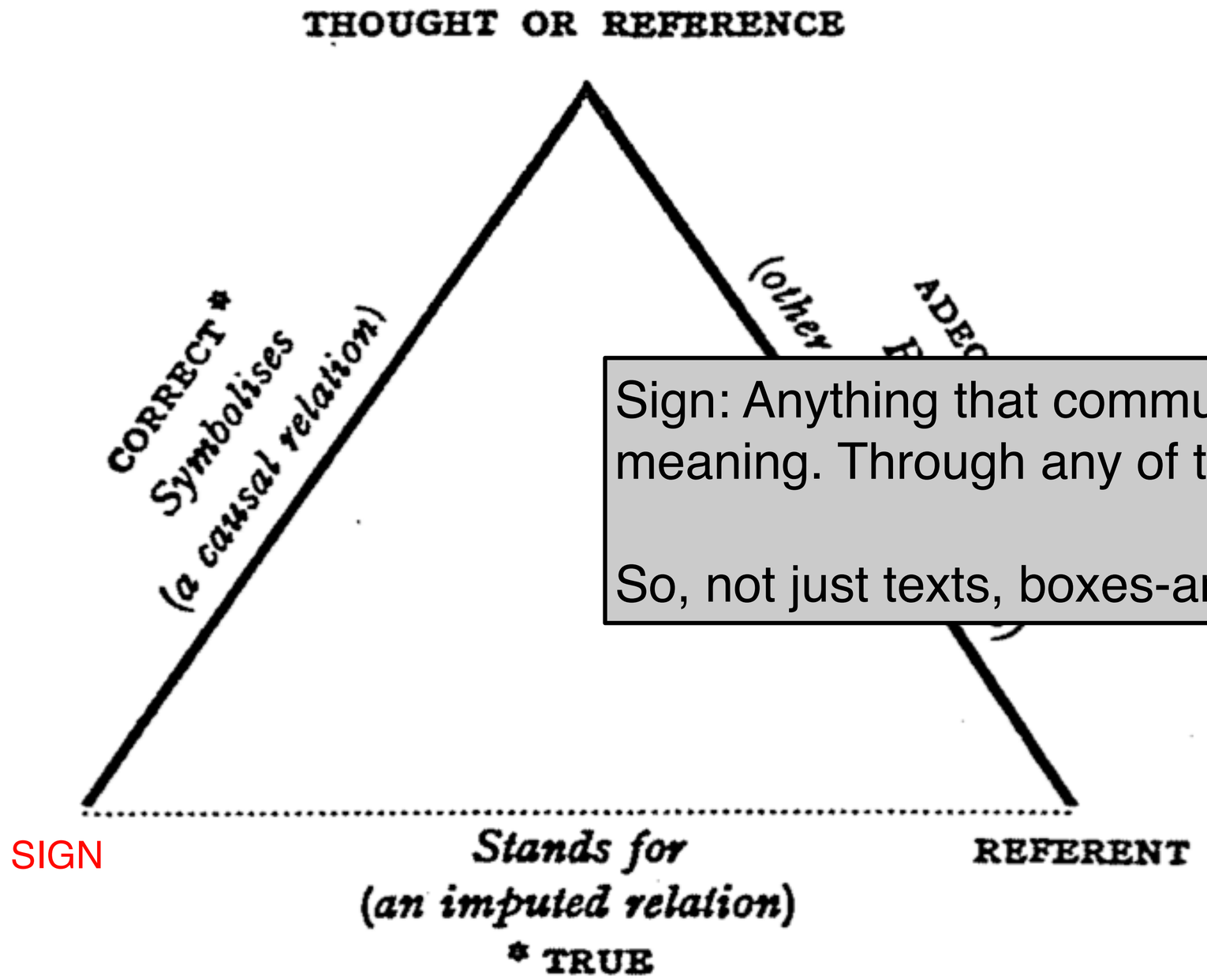
Semiotic triangle



C. K. Ogden and I. A. Richards. The Meaning of Meaning - A Study of the Influence of Language upon Thought and of the Science of Symbolism. Magdalene College, University of Cambridge, Oxford, United Kingdom, 1923.

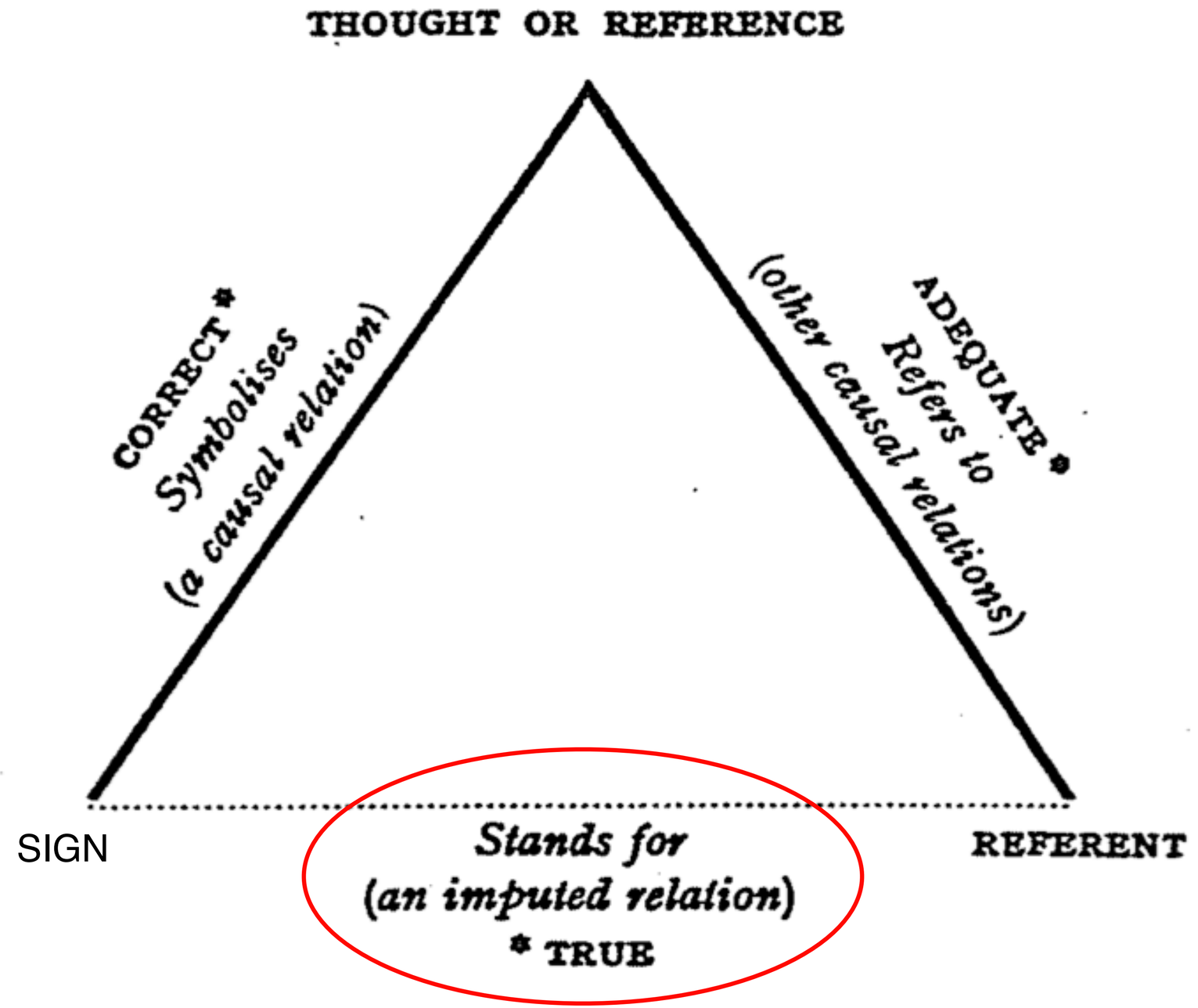

THOUGHT OR REFERENCE
CORRECT *
Symbolises
(a causal relation)
ADEQUATE *
Refers to
(other causal relations)
SYMBOL
Stands for
(an imputed relation)
REFERENT
* TRUE


THOUGHT OR REFERENCE
CORRECT *
Symbolises
(a causal relation)
In our mind
(other causal relations)
ADEQUATE *
Refers to
On a medium
What we talk about
SYMBOL
Stands for
(an imputed relation)
REFERENT
* TRUE

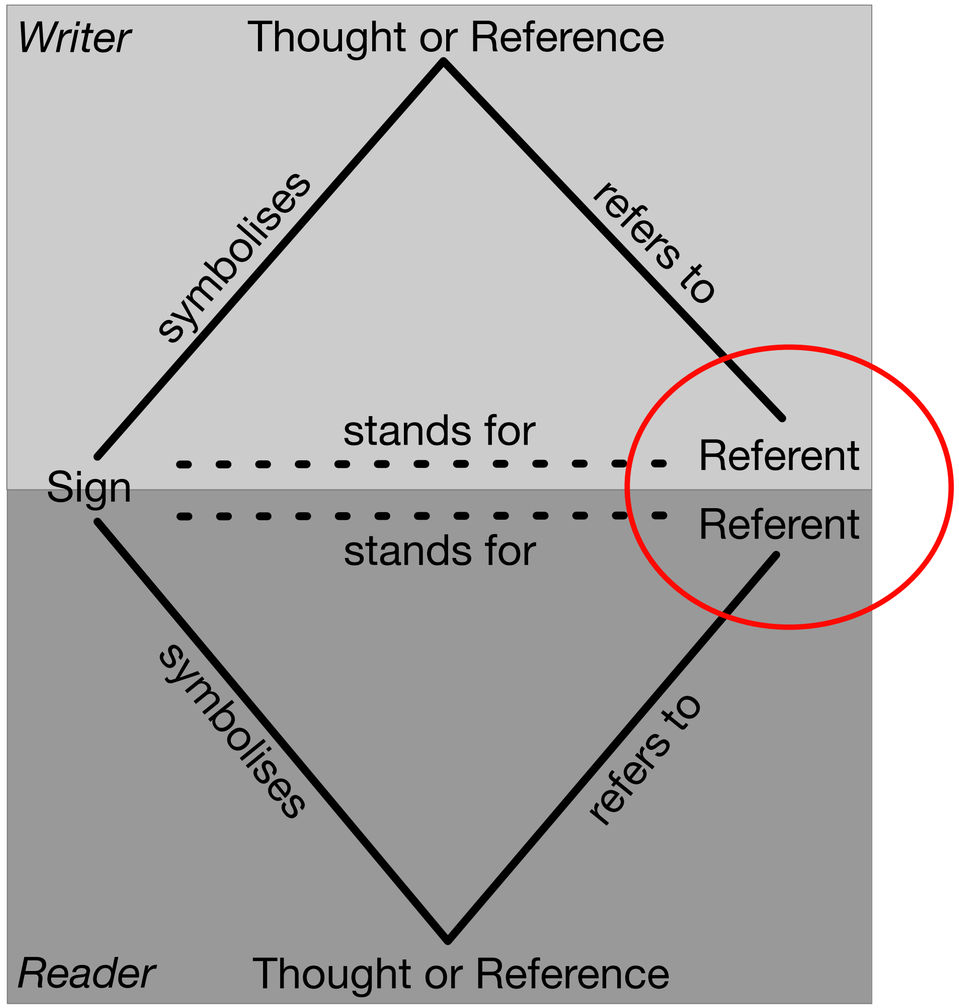


Sign: Anything that communicates a meaning. Through any of the senses

So, not just texts, boxes-and-lines, …


THOUGHT OR REFERENCE
CORRECT *
Symbolises
(a causal relation)
ADEQUATE *
Refers to
(other causal relations)
SIGN
Stands for
(an imputed relation)
* TRUE
REFERENT

It takes two to communicate



When looking at a domain …

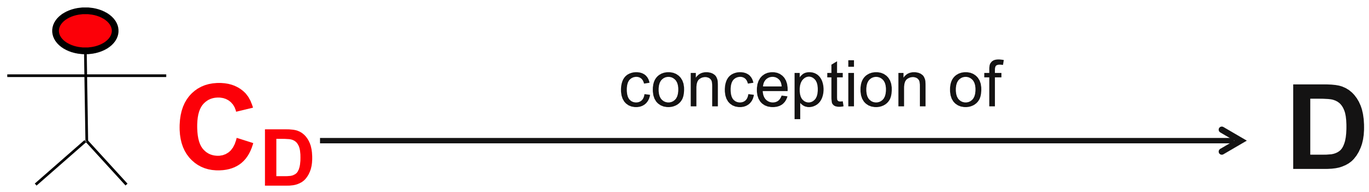
In our mind:

- *Perception*
- *Conception*

Influenced by:

- *Purpose*
- *Assumptions, biases, …*
- *Ontological commitment(s)*

When creating a model …



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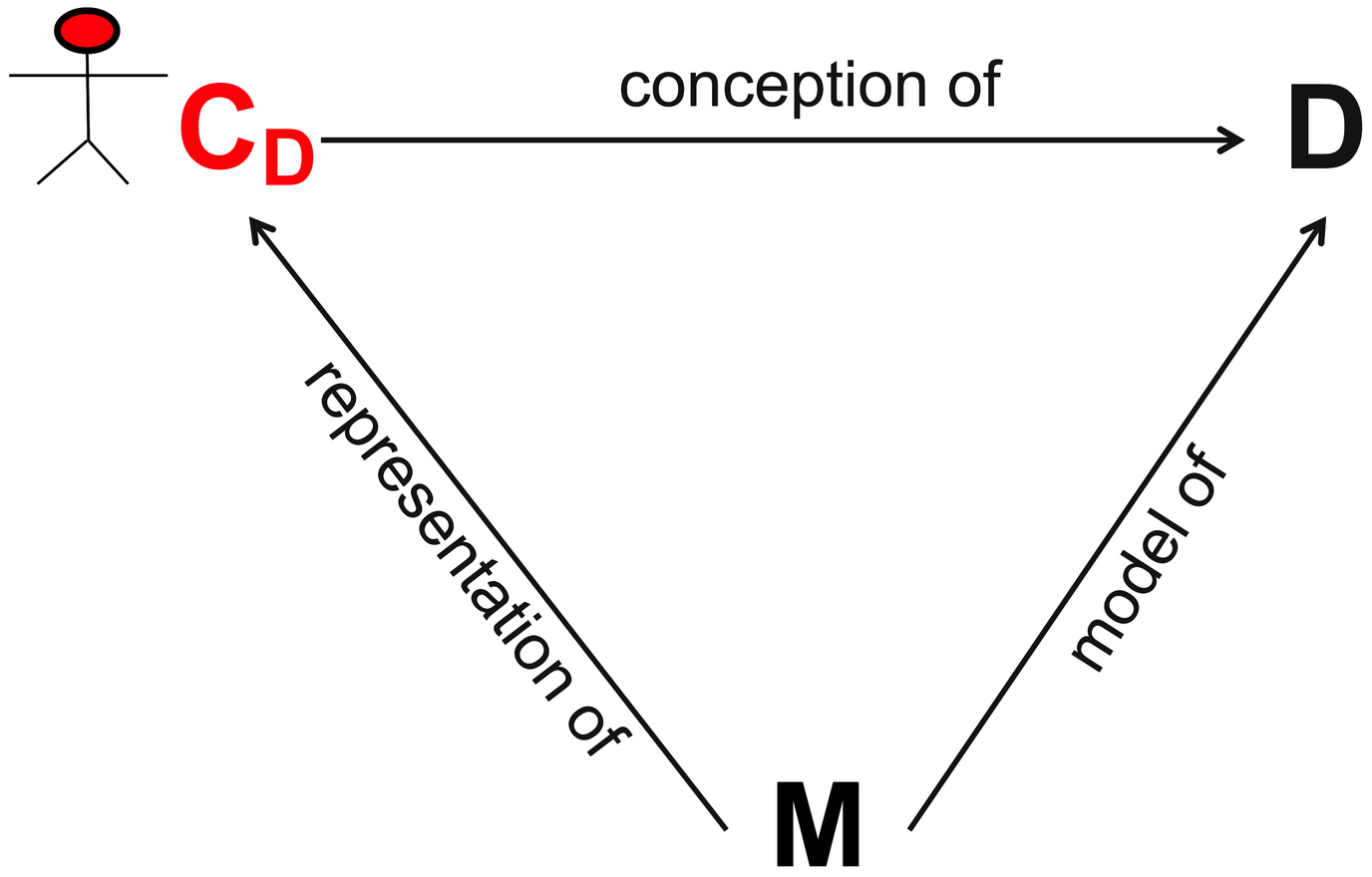

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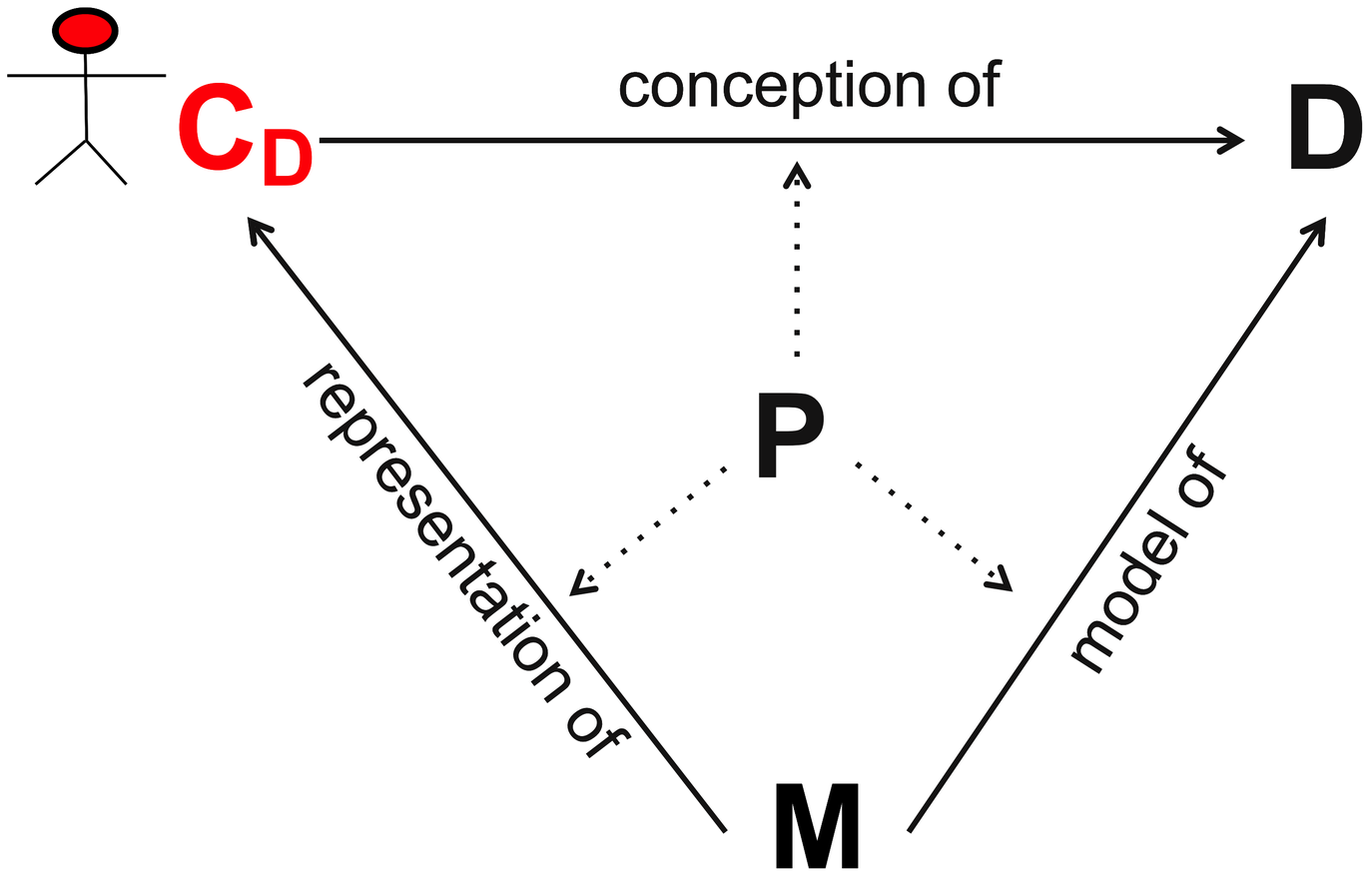

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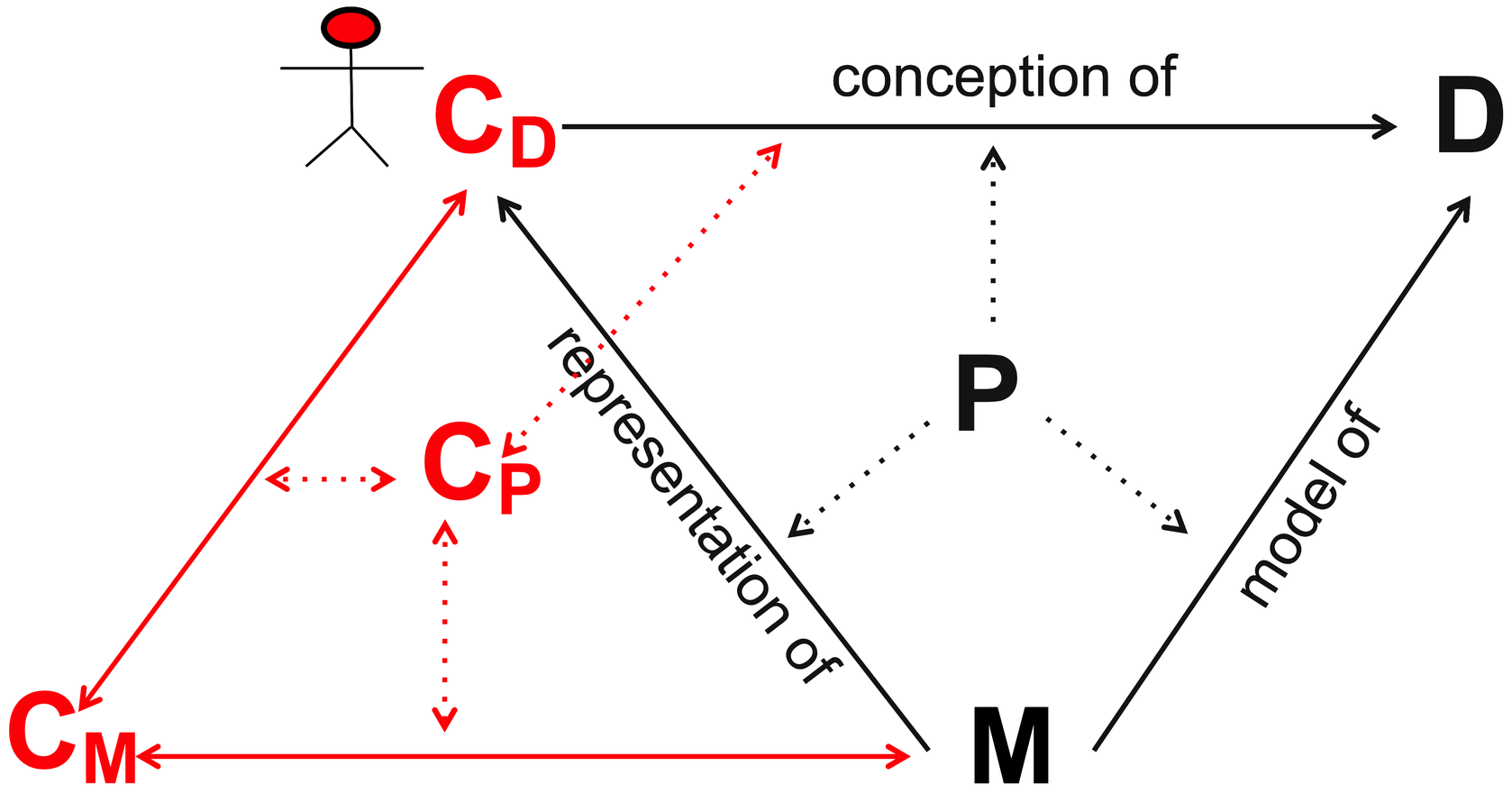
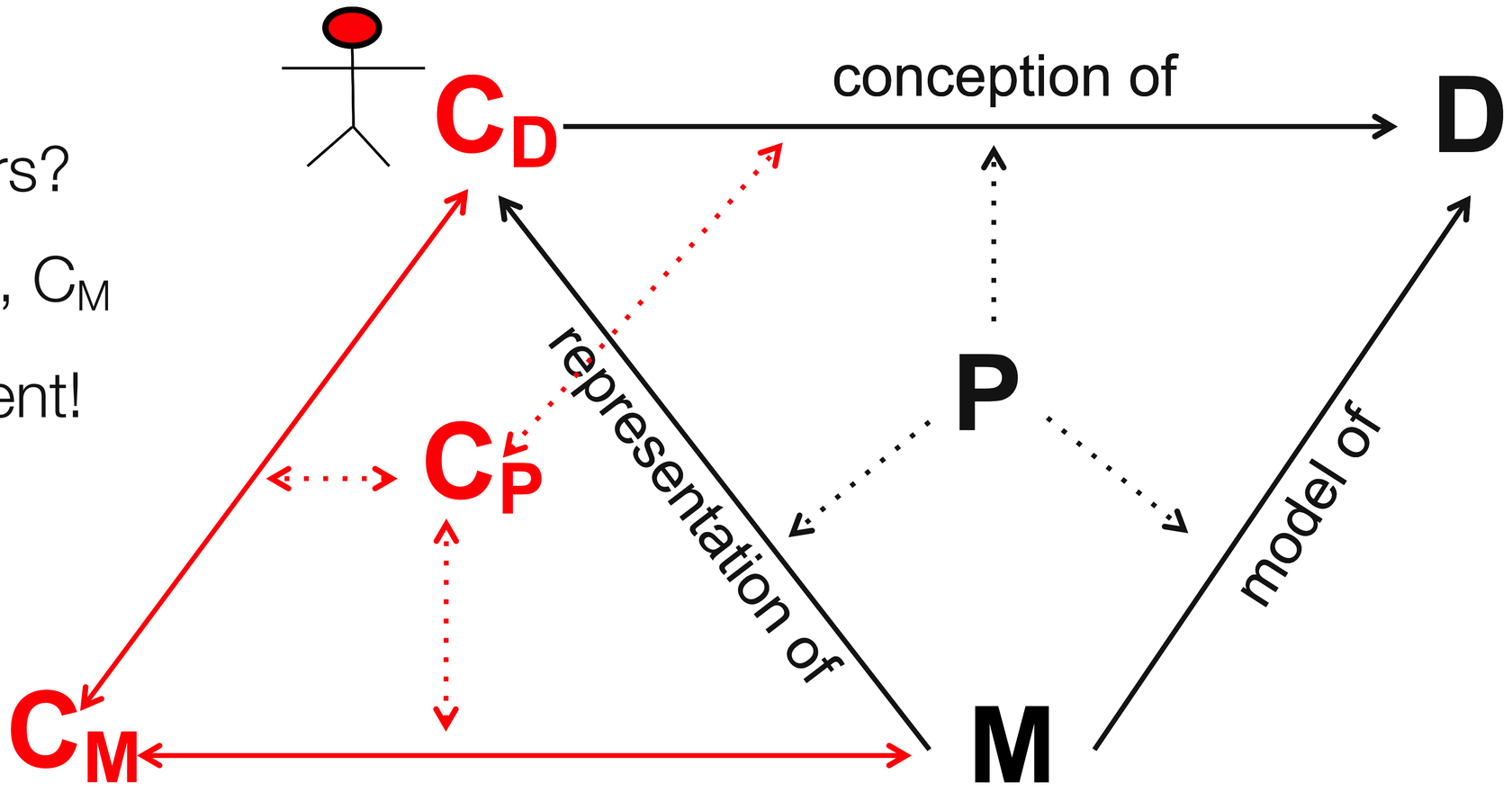


When creating a model …

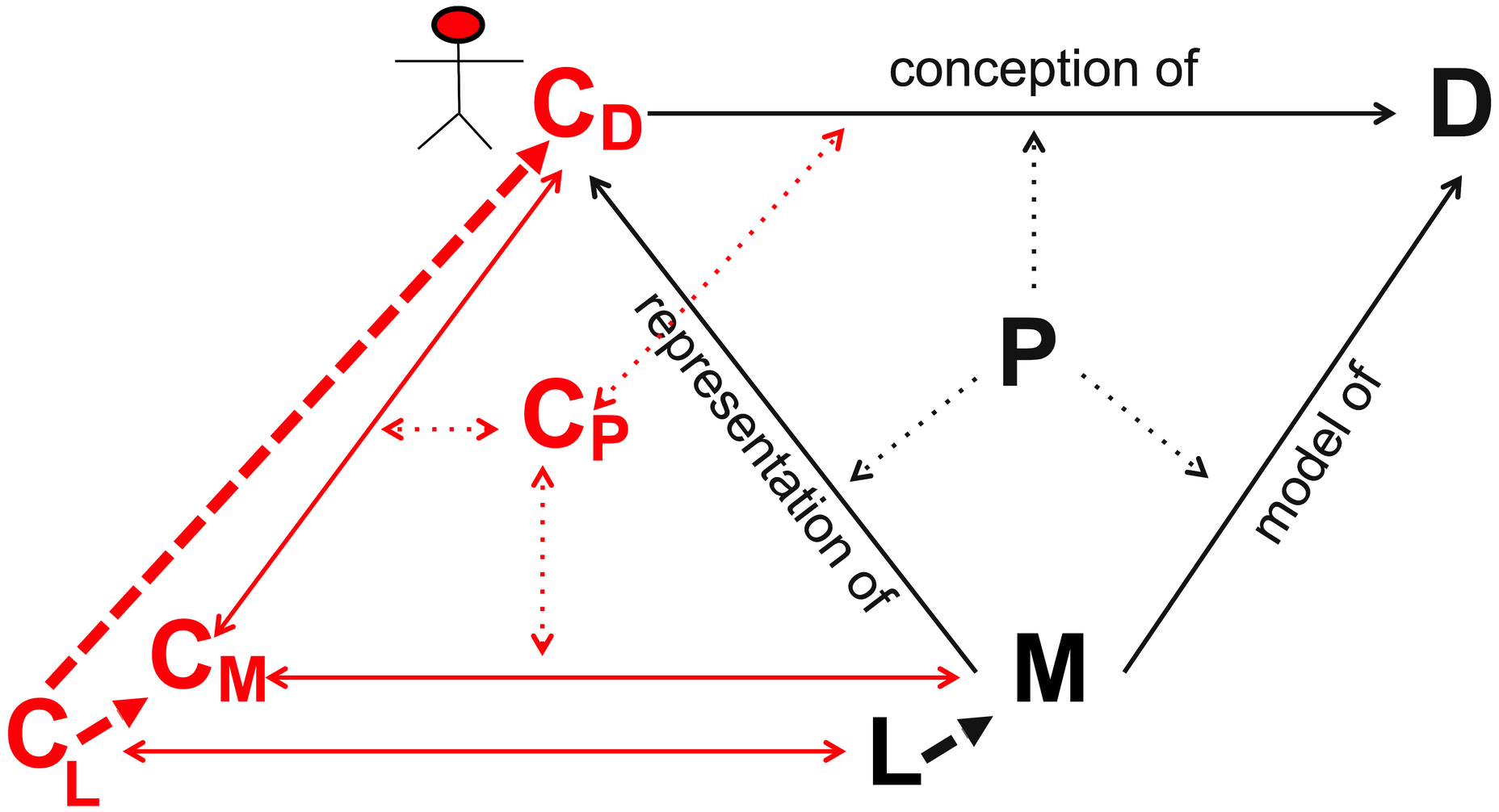
Multiple modellers?

Each has C_D, C_P, C_M

Requires alignment!



The role of modelling languages



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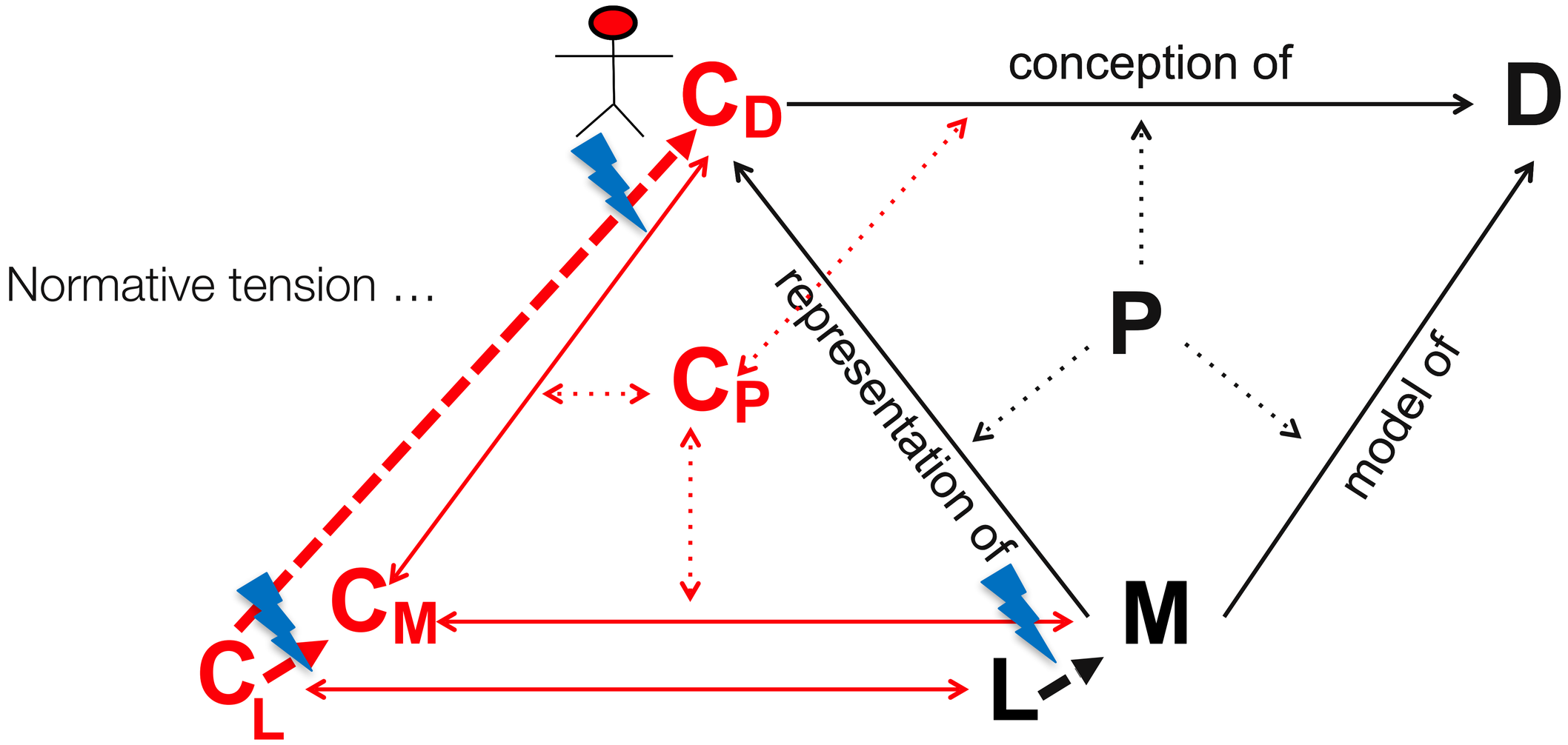


Normative frames (in modelling)

That what, consciously or subconsciously, restricts us when creating a model

Could be beneficial: focus, scoping, guidance, interoperability, …

Could be harmful: framing, black swans, tunnel vision, …

Examples of normative frames

Modelling languages: UML, ArchiMate, BPMN, …

Design frameworks: Zachman, TOGAF, ArchiMate, DEMO, UML, …

Reference models

Foundational ontologies: BWW, UFO, …

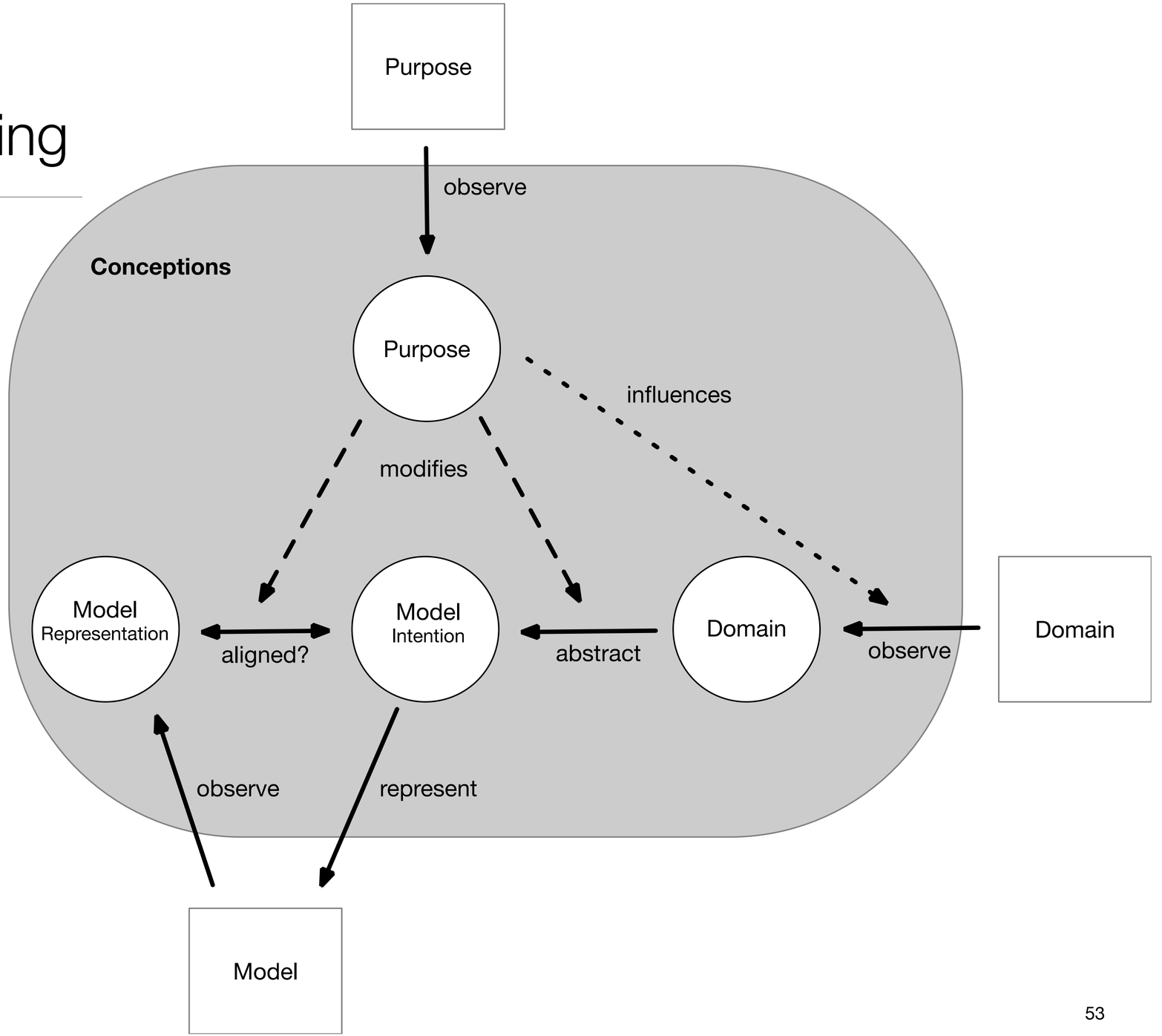
Self interests, due to goals, stakes, …

Cognitive biases, due to upbringing, training, ...

Philosophical stance: objectivist, subjectivist, …

Conceptions when modelling

normative frames
& ontological commitments



Agenda

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Foundations

Challenges

Challenges – Modelling is natural …

How to make it better?

Improving the RoME (Return on Modelling Effort)

- *Reduce the effort*
- *Increase the return, in relation to the model's purpose*

Challenges – Shared focus

How to ensure that different creators / readers of a model relate it to the same domain?

How to ensure that different creators / readers of a model have the same understanding (thought) of the model, assuming they relate it to the same domain?

Challenges – Shared purpose

How to make the (intended) purpose of a model explicit?

How to tune a model's representation and abstraction features to its (intended) purpose?

How to ensure that all actors involved in the creation and / or use of a model have the same understanding about, and agree to, its purpose?

Challenges – Guidance in abstraction

How to make the right, in relation to the purpose, abstractions from a domain?

Guidelines / methods?

Usage of foundational ontologies and reference models to ensure consistency and completeness?

Challenges – Normative frames

Which normative frames exist?

What are their positive / negative effects (in relation to a model's purpose)?

How to manage (mitigate / optimise) these impacts?

Foundational ontologies as a neutral frame of expression?

Challenges – Just enough, just in time, language

RoME and modelling languages?

How to make modelling languages more flexible?

How to support the emergence of modelling concepts?

How to make modelling language landscapes more flexible?

Guidance from foundational ontologies?

Challenges – IT for modelling

Model management

Model mining & validation

Collaboration support & human-model interaction

Modelling language emergence & management

Agenda

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QUESTION
ANSWER
QUESTION
QUESTION
QUESTION
ANSWER
ANSWER