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What is abstraction in conceptual modelling?

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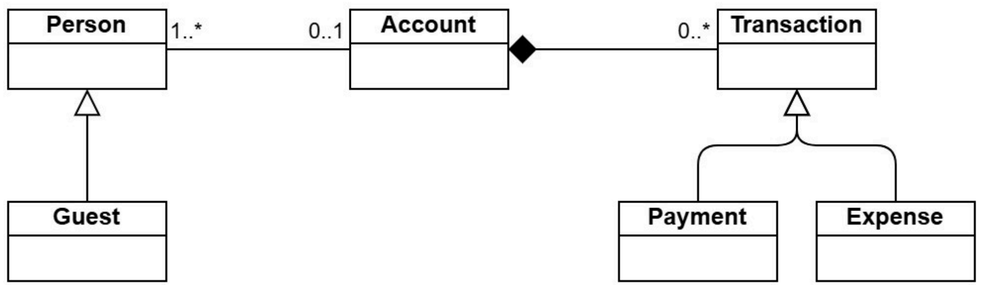
Agenda

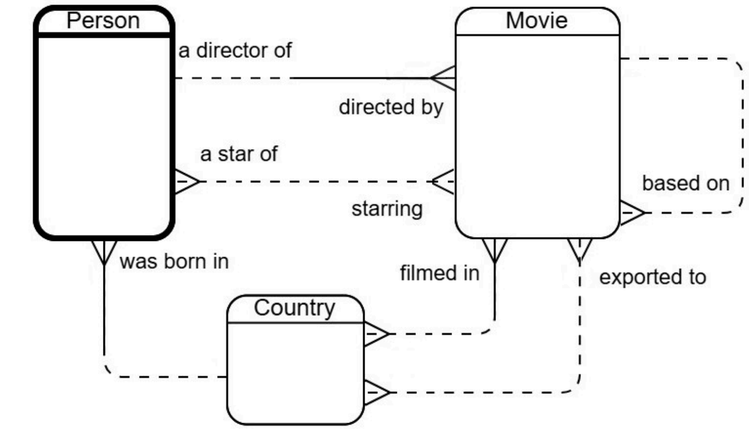
1. What types of conceptual models abstractions exist?
2. How abstraction influence model value?

What types of conceptual models abstractions exist?

Conceptual model is a language artefact representing a conceptualization of a particular domain relevant to the engineering of software artefacts.

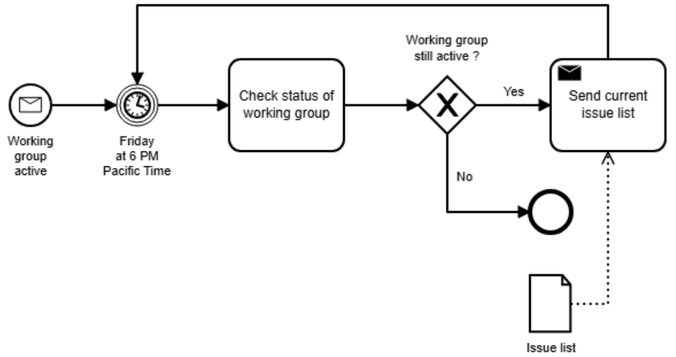


UML



ER

(Barker's notation)



BPMN

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Computer science is the mechanization of abstraction

—AHO AND ULLMAN (2000) “FOUNDATIONS OF COMPUTER SCIENCE”

“

Abstracting in modeling is a process that transforms lower-level elements into higher-level elements containing fewer details on a larger granularity.

—**EGYED (2002)** “AUTOMATED ABSTRACTION OF CLASS DIAGRAMS”

“

Abstraction is a way to reduce complexity

— GUTTAG (1977) “ABSTRACT DATA TYPES AND THE DEVELOPMENT OF DATA STRUCTURES”

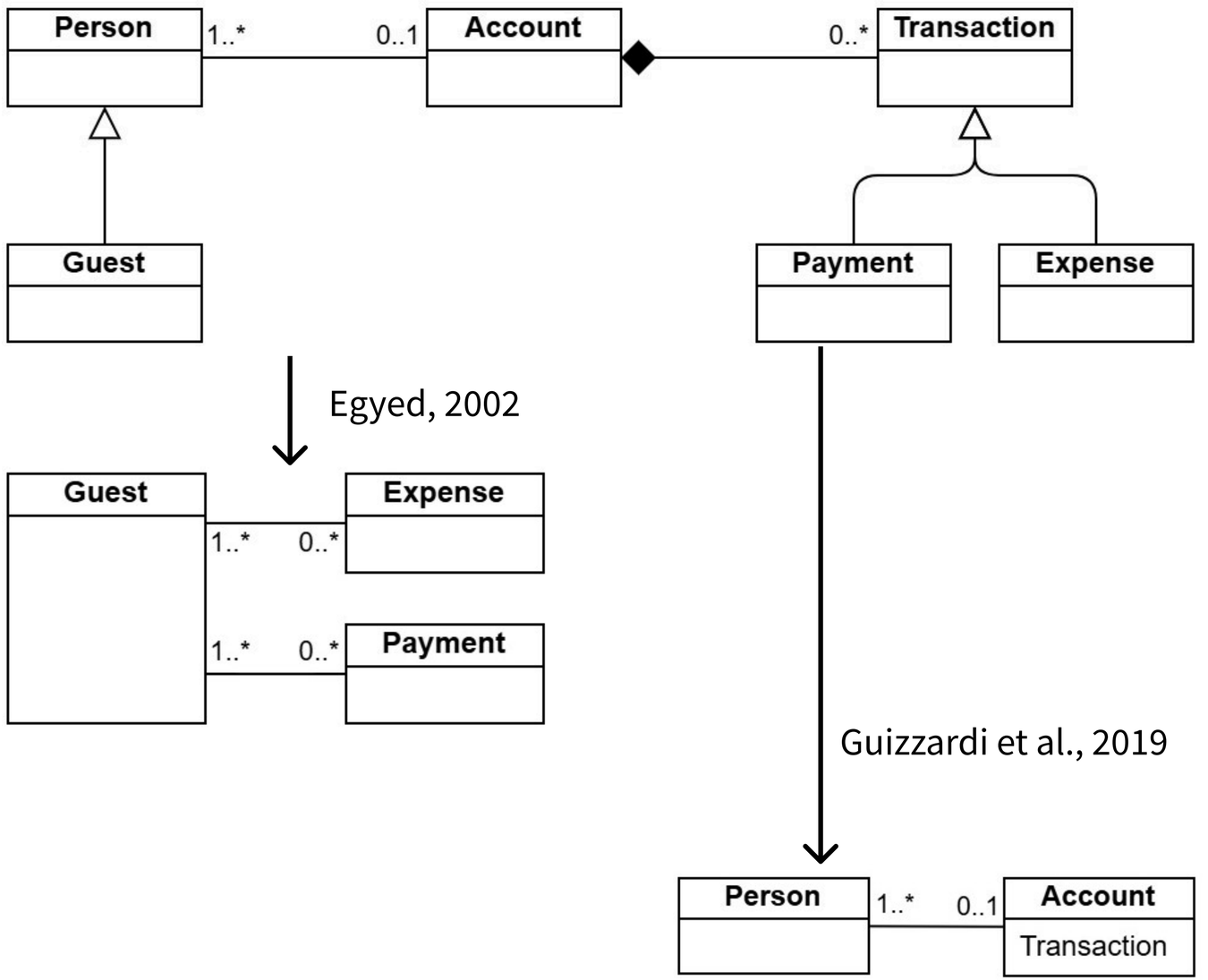
“

Abstraction is a mapping from a ground (original) to an abstracted (intended) space.

— SAITTA AND ZUCKER (2013) “ABSTRACTION IN ARTIFICIAL INTELLIGENCE AND COMPLEX SYSTEMS”

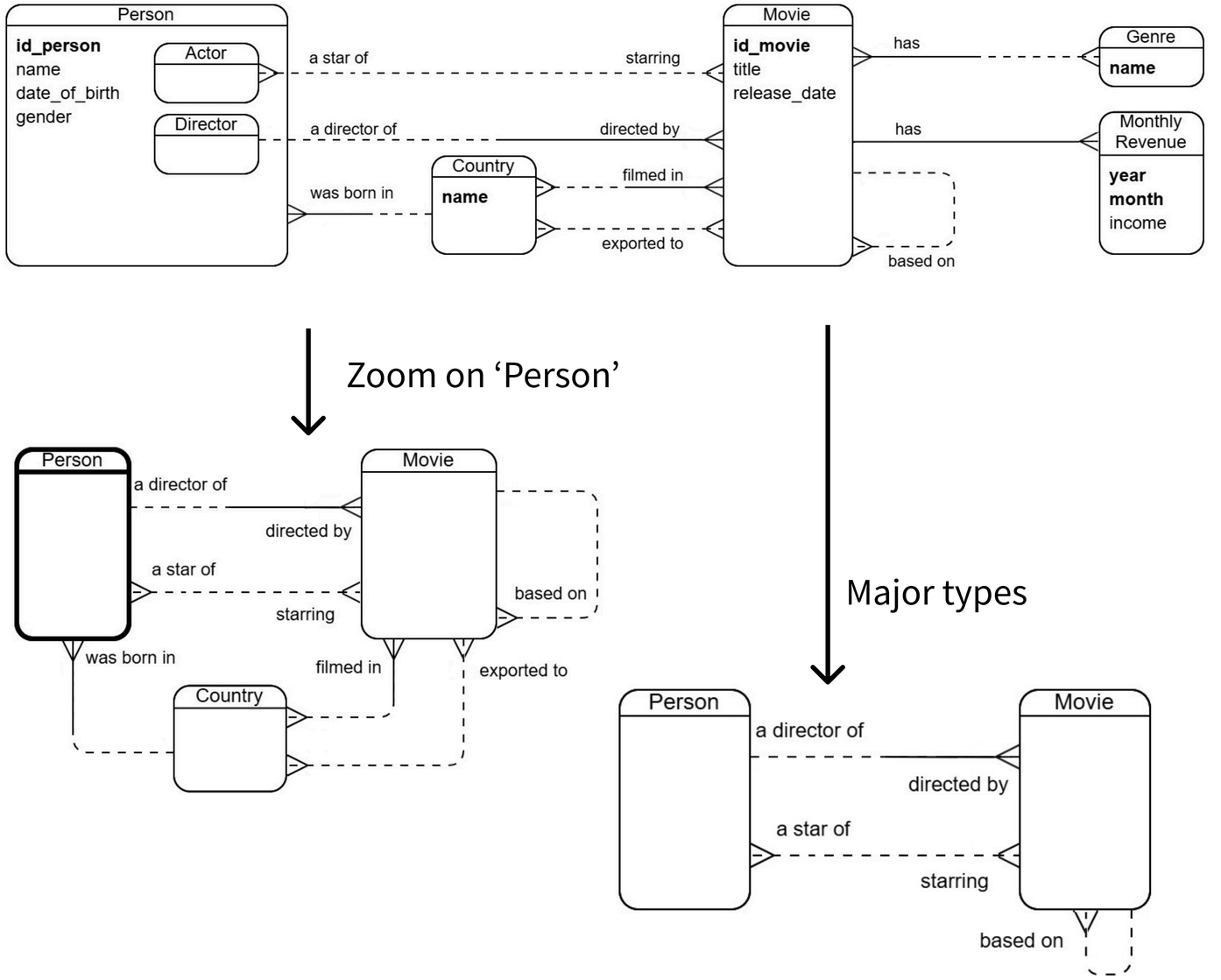
Abstraction of UML Class Diagrams

- with structural modifications
  - ML-approaches for identifying key concepts
  - pattern-based approaches
- with reducing visual complexity (e.g., colouring schema changes)



Abstraction in ER-diagrams

- modularization (clustering)
  - with user input
  - automated
- layering (filtration, display toggles, black-box and glass-box views)
- object-type zoom (perspective or viewpoint extraction)
- creation of refinement levels



How abstraction influence model value?

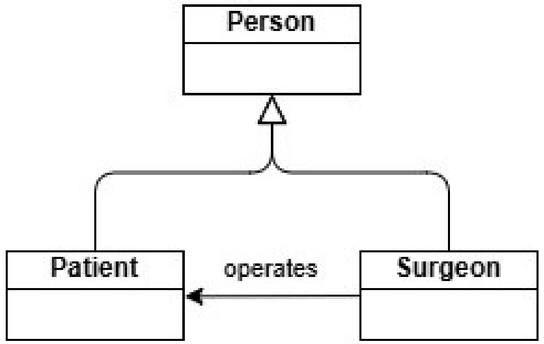
“

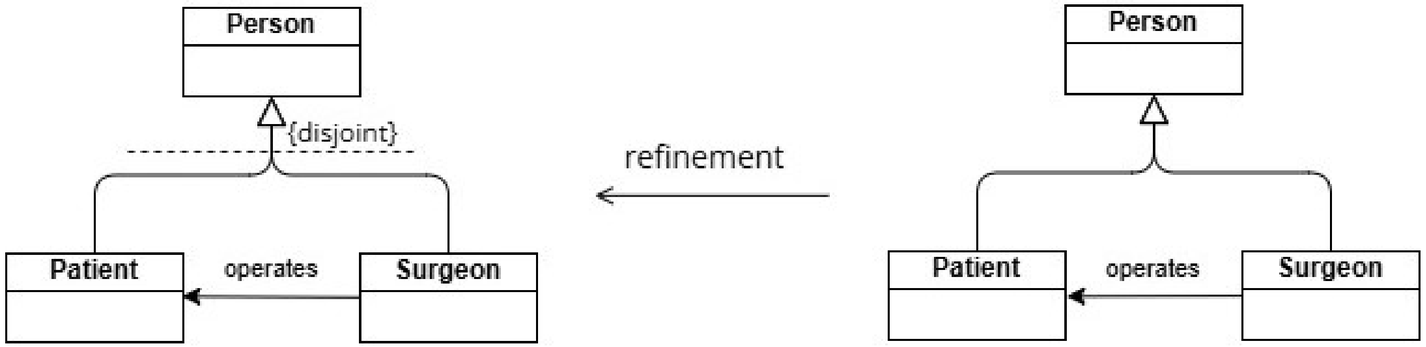
Use value is the value of an artefact arises from **how well** its **aspects** (features, characteristics) such as qualities, dispositions (capacities, vulnerabilities, affordances) **align with the goals** or needs of a given agent in a specific context.

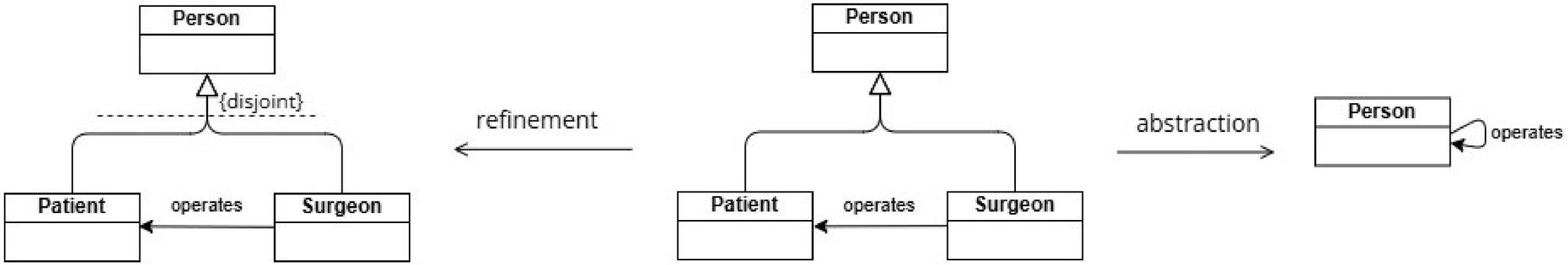
— SALES, T.P. ET AL.:
THE COMMON ONTOLOGY OF VALUE AND RISK.
IN: CONCEPTUAL MODELING, 2018, PP. 121–135.

Characteristics of the value:

1. Goal dependency
2. Ascription to experience
3. Intrinsic properties

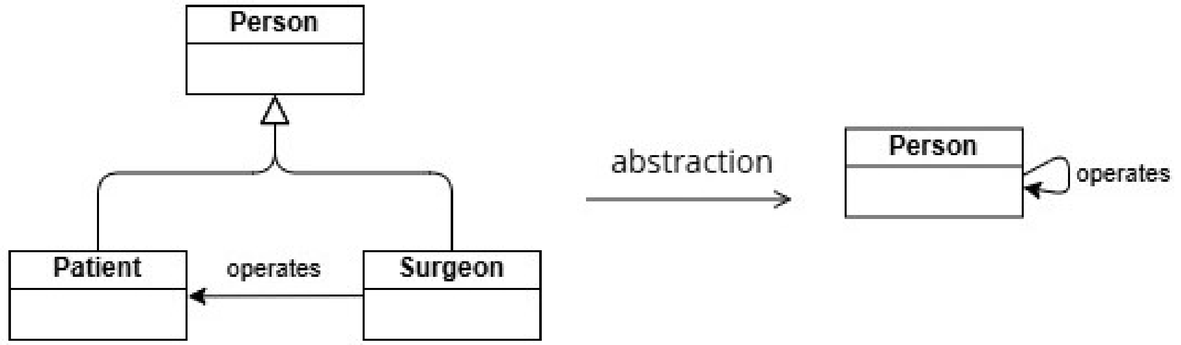

Person
Patient
operates
Surgeon


Person
{disjoint}
Patient
operates
Surgeon
refinement
Person
Patient
operates
Surgeon


Person
{disjoint}
Patient
operates
Surgeon
refinement
Person
Patient
operates
Surgeon
abstraction
Person
operates

Abstraction is value-increasing lossy transformation over a model's information content and capabilities

...while refinement serves to increase both information content and capabilities.



- removed content is one that does not add value to particular agent
- this 'extra' content actually ends up grounding vulnerabilities (information occlusion, high cost of visual inspection, increased computational complexity) that are value decreasing

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Thank You for Your Attention

If you have any questions, please do not hesitate to contact us:

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