Multirelational Semantics for Extended Entity–Relationship Schemata With Applications

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Motivation

ERW

- A tool bridging conceptual modelling with web applications

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- Starting from any schema, generate a web-based content manager

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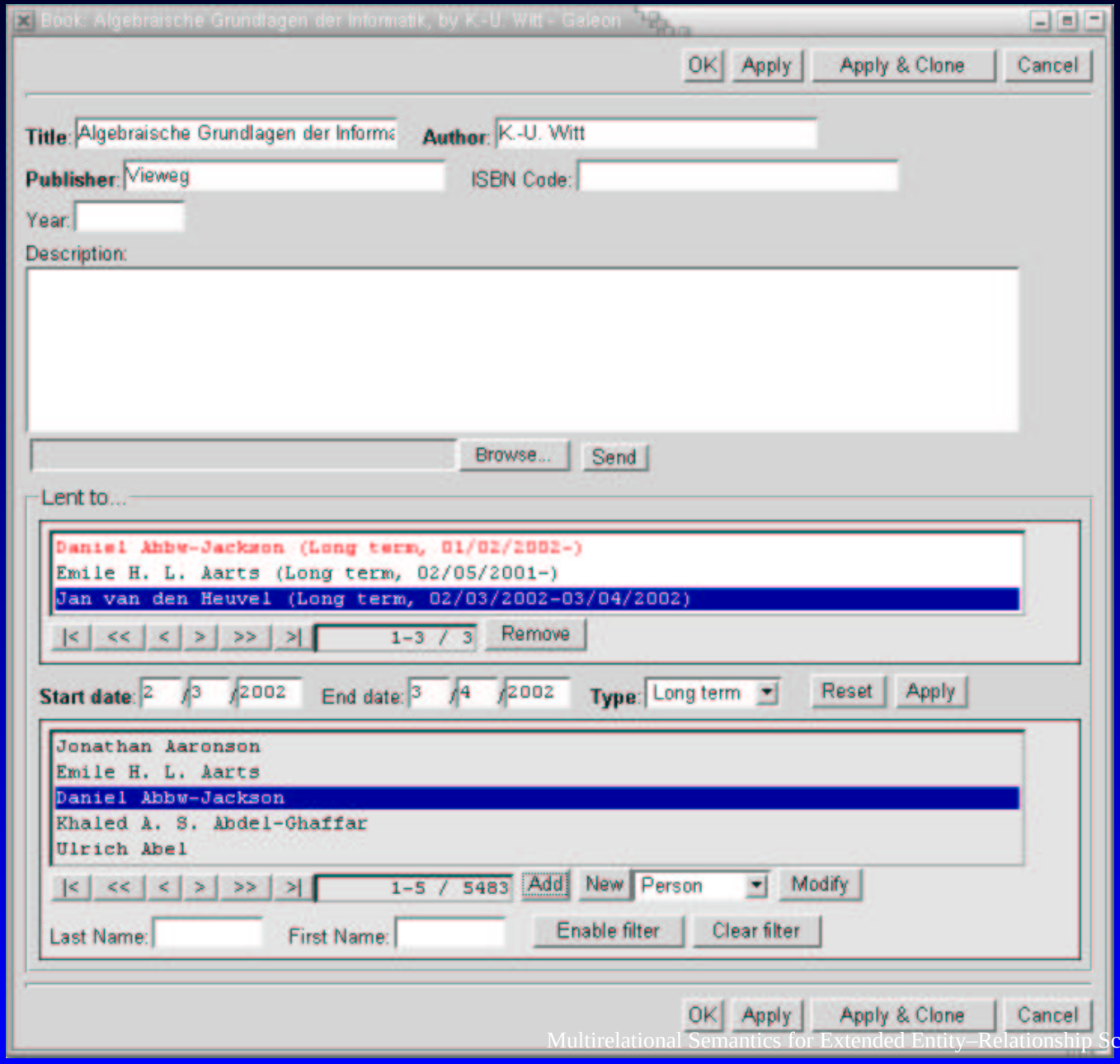
- Concept similar to WebML (Ceri, Fraternali & Bongio WWW 2000) but different scope and features

ERW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Author: K.-U. Witt
Publisher: Vieweg
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Daniel Abbw-Jackson (Long term, 01/02/2002-)
Emile H. L. Aarts (Long term, 02/05/2001-)
Jan van den Heuvel (Long term, 02/03/2002-03/04/2002)
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Validation

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- We concentrate on the third condition (the "application" in the title)

Double Ownership

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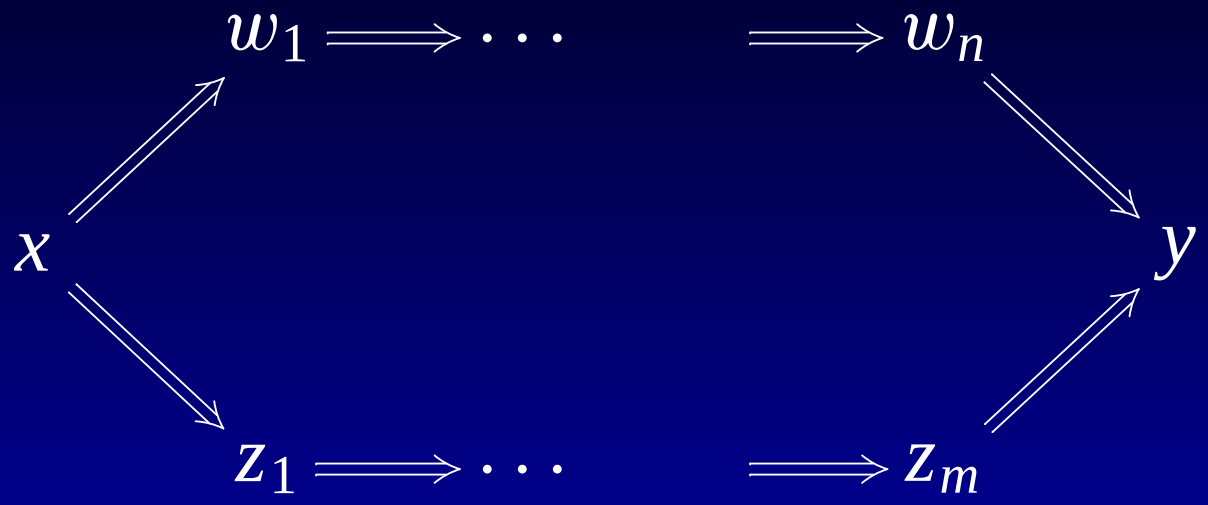

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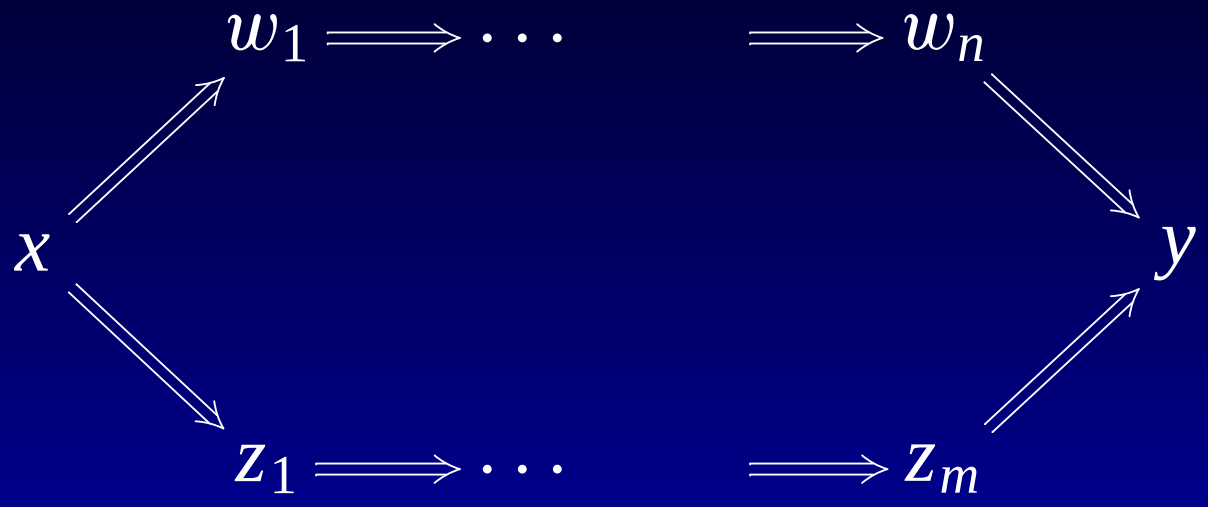
- 

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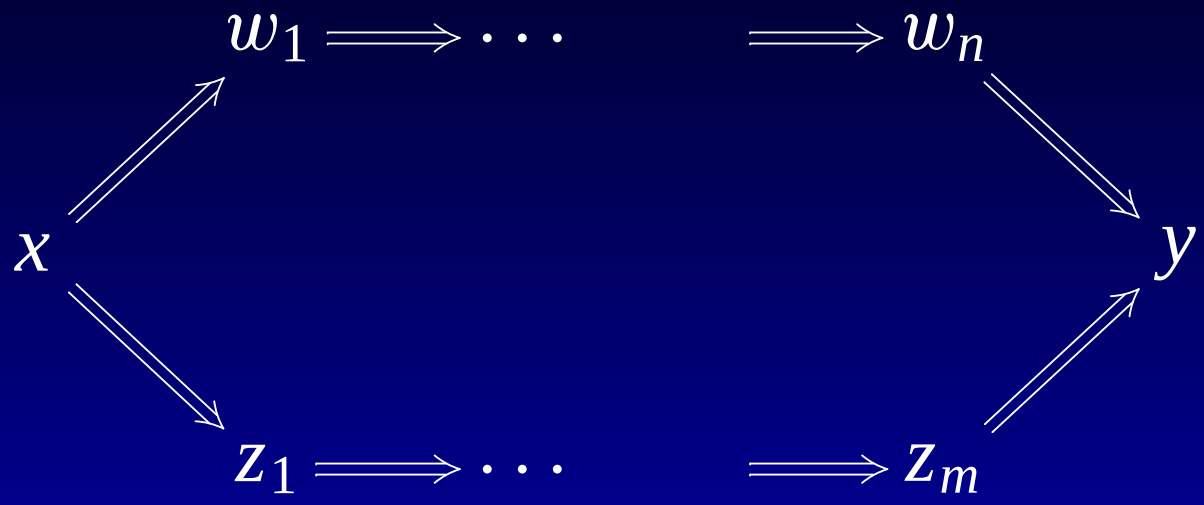

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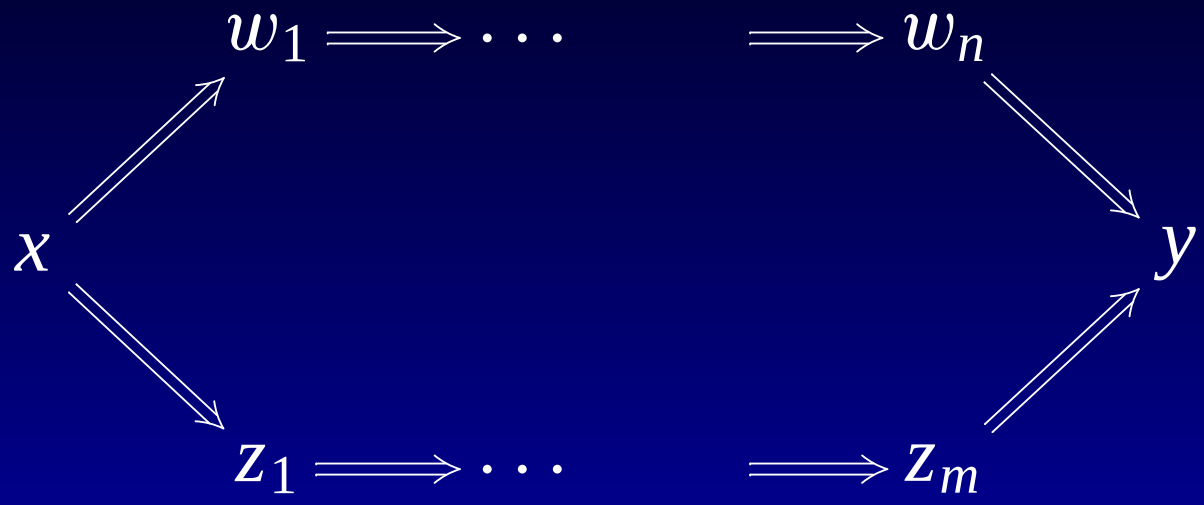

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- You need a formal semantics, or things mess up (e.g., Balaban & Shoval ER 1999)

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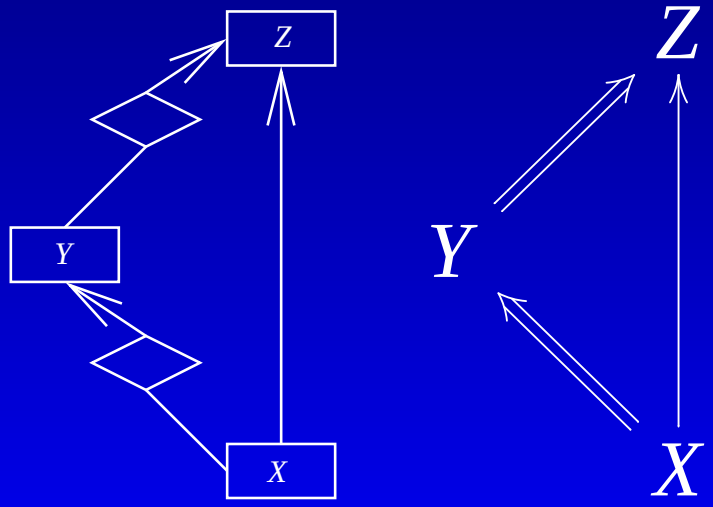
- 

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- Use only minimal types
- . . . but none of the above works
- To prove a soundness and completeness result we need a formal, mathematical semantics (e.g., see Gogolla & Hohenstein 1991, Thalheim 2000,. . .)

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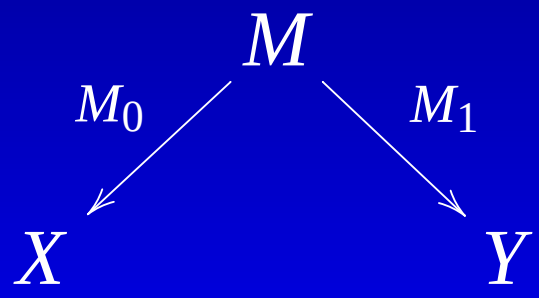

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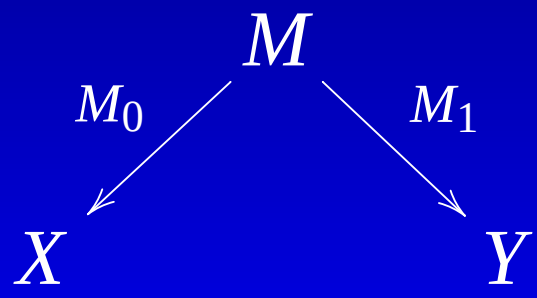

- Provides ready-made composition etc.

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- Not in general!

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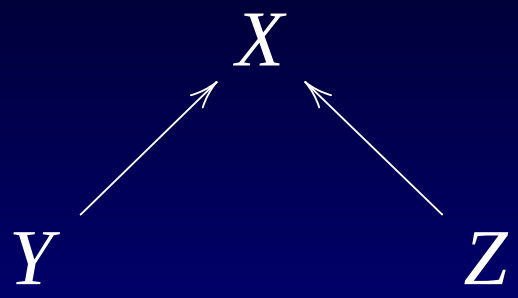

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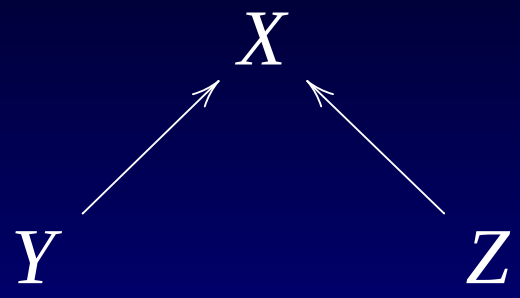

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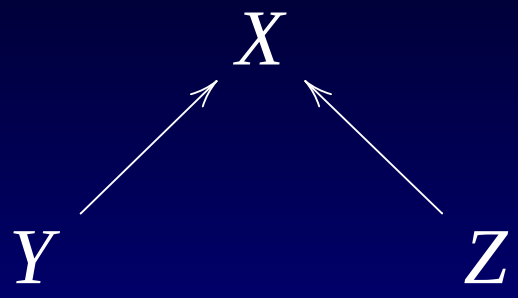

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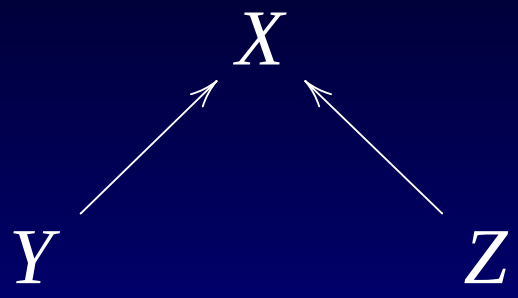

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- Conjunctive vs. disjunctive subtyping

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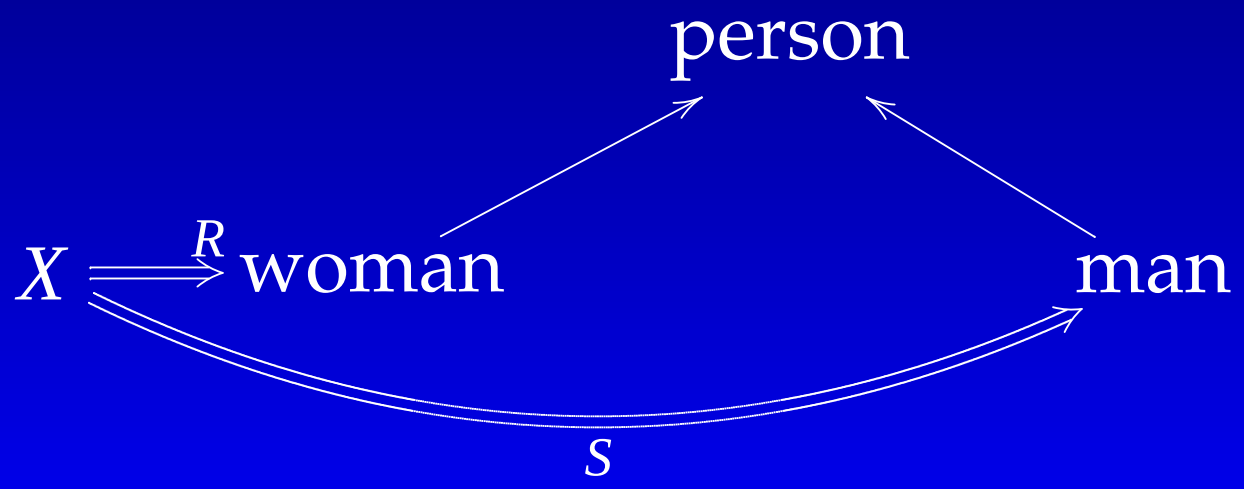

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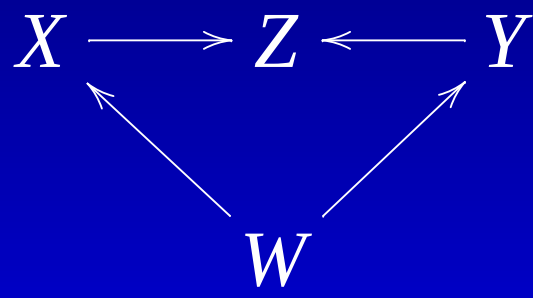

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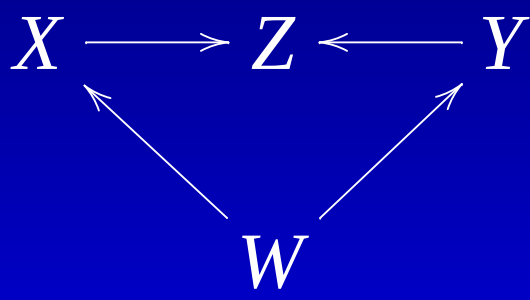

- Mathematically, you need a *stability* condition on the semantic map (Berry 1978, see the paper)

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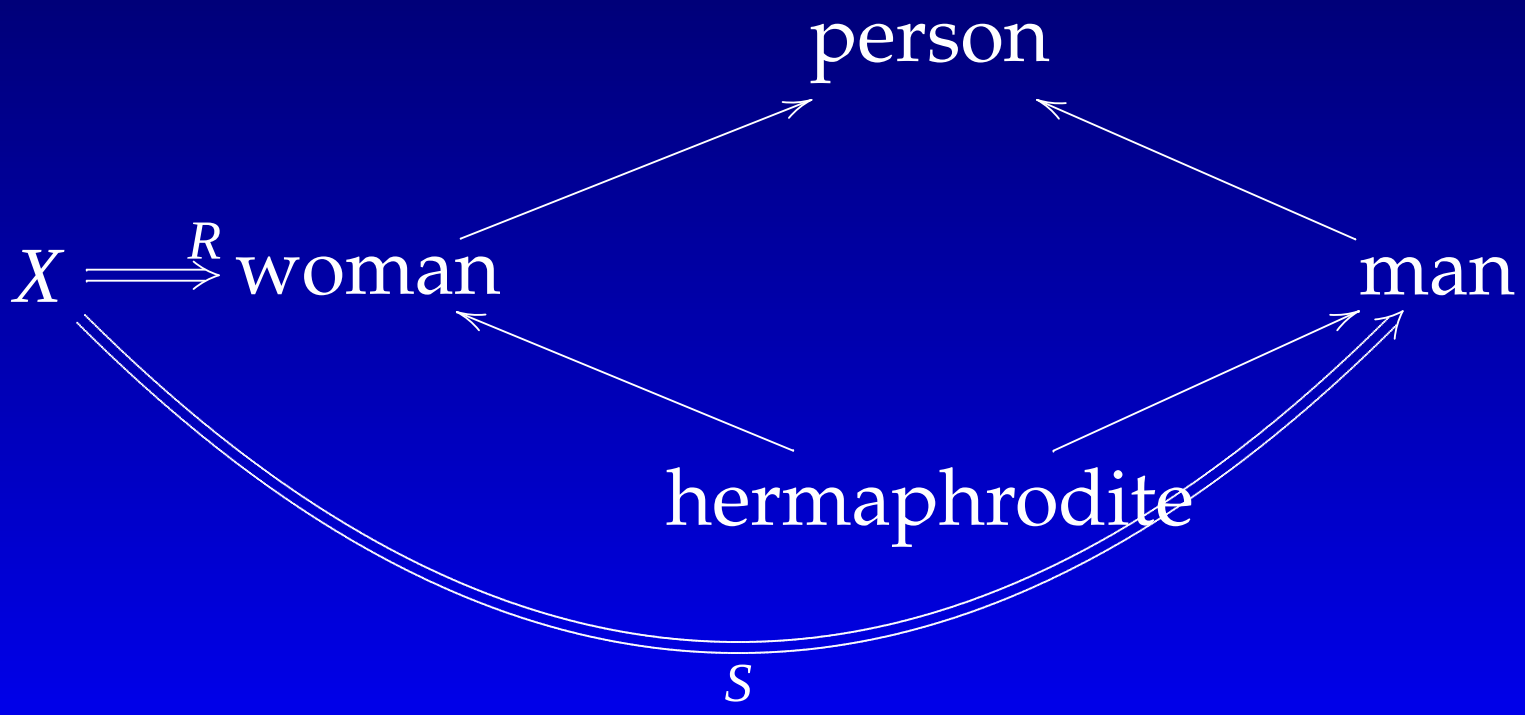

Validating Ownership

Syntax vs. Semantics

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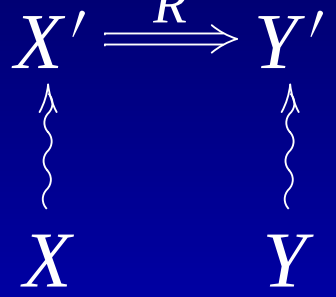

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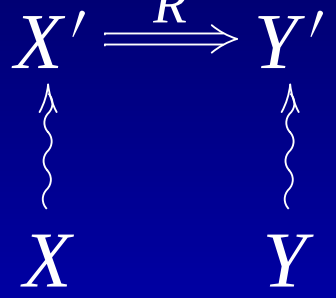
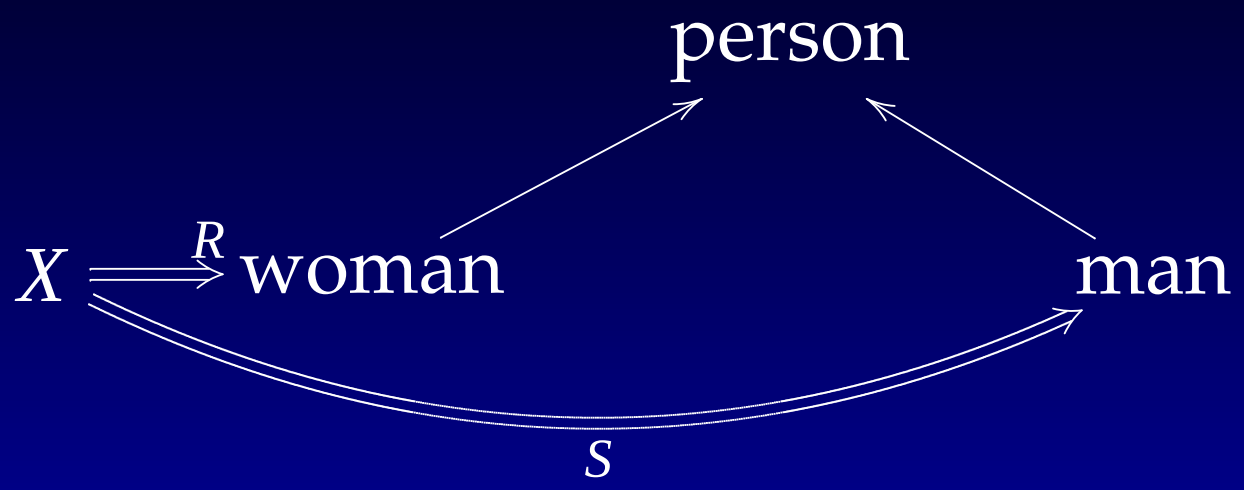


- Can we just build a new graph with extended identification functions, and check that no pair of parallel paths exists?

It May Work!



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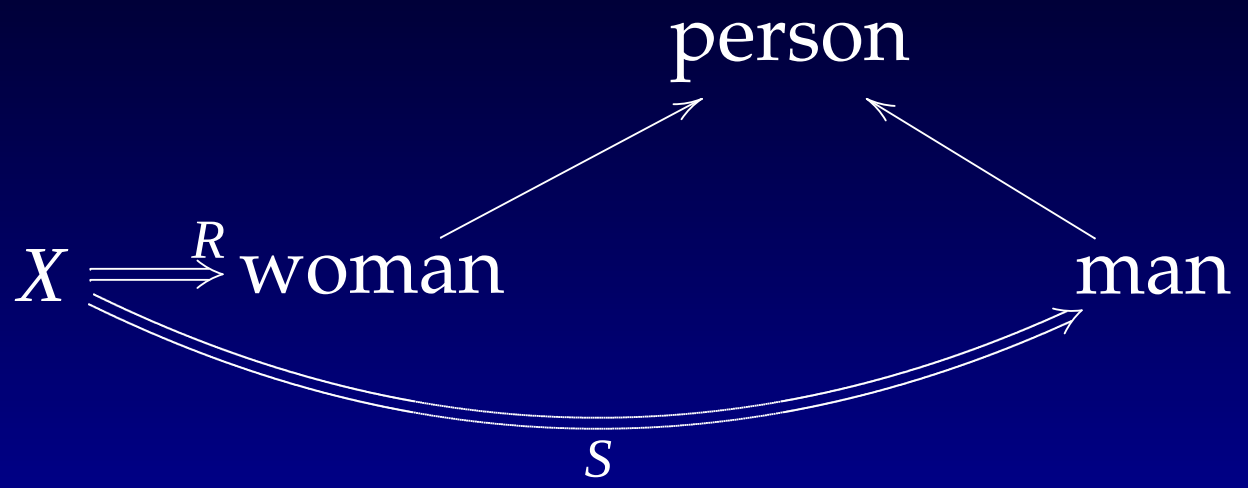
- 

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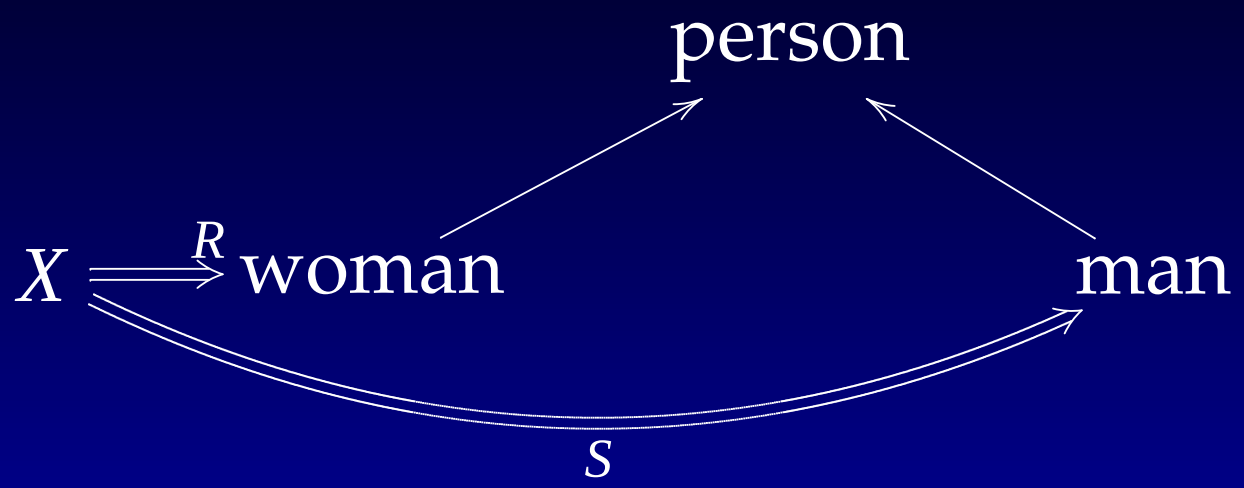

- No additional arcs
- The schema is valid

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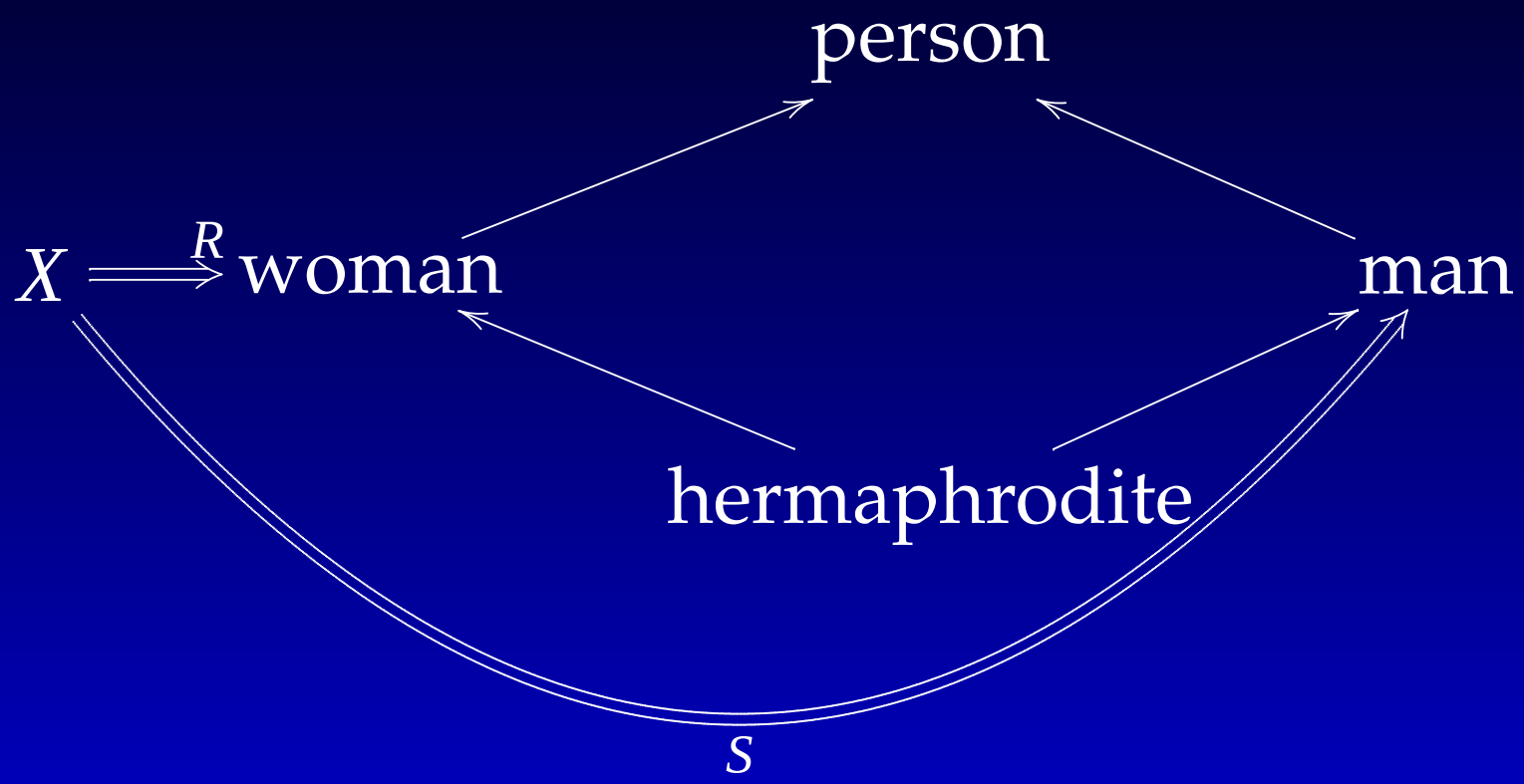

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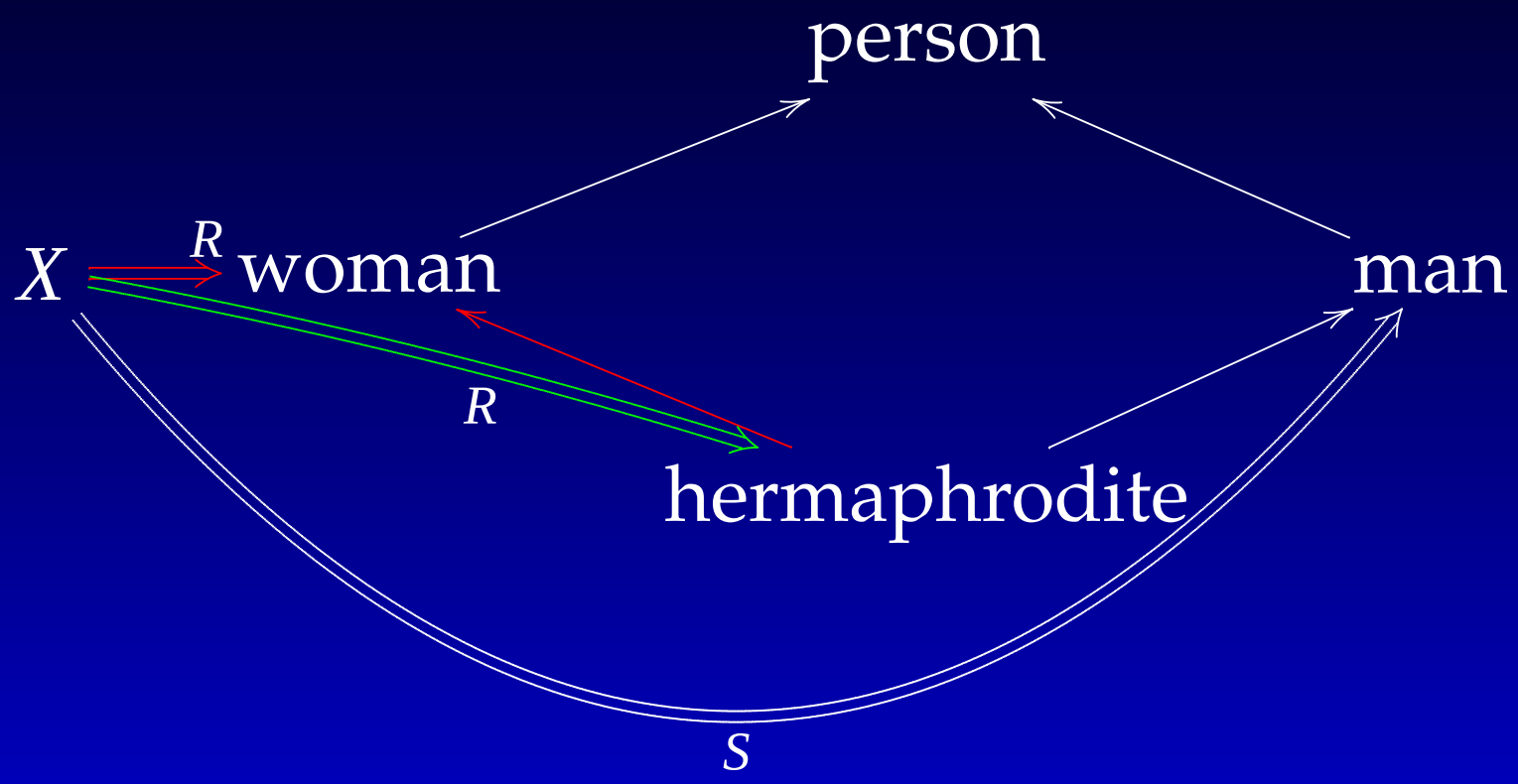

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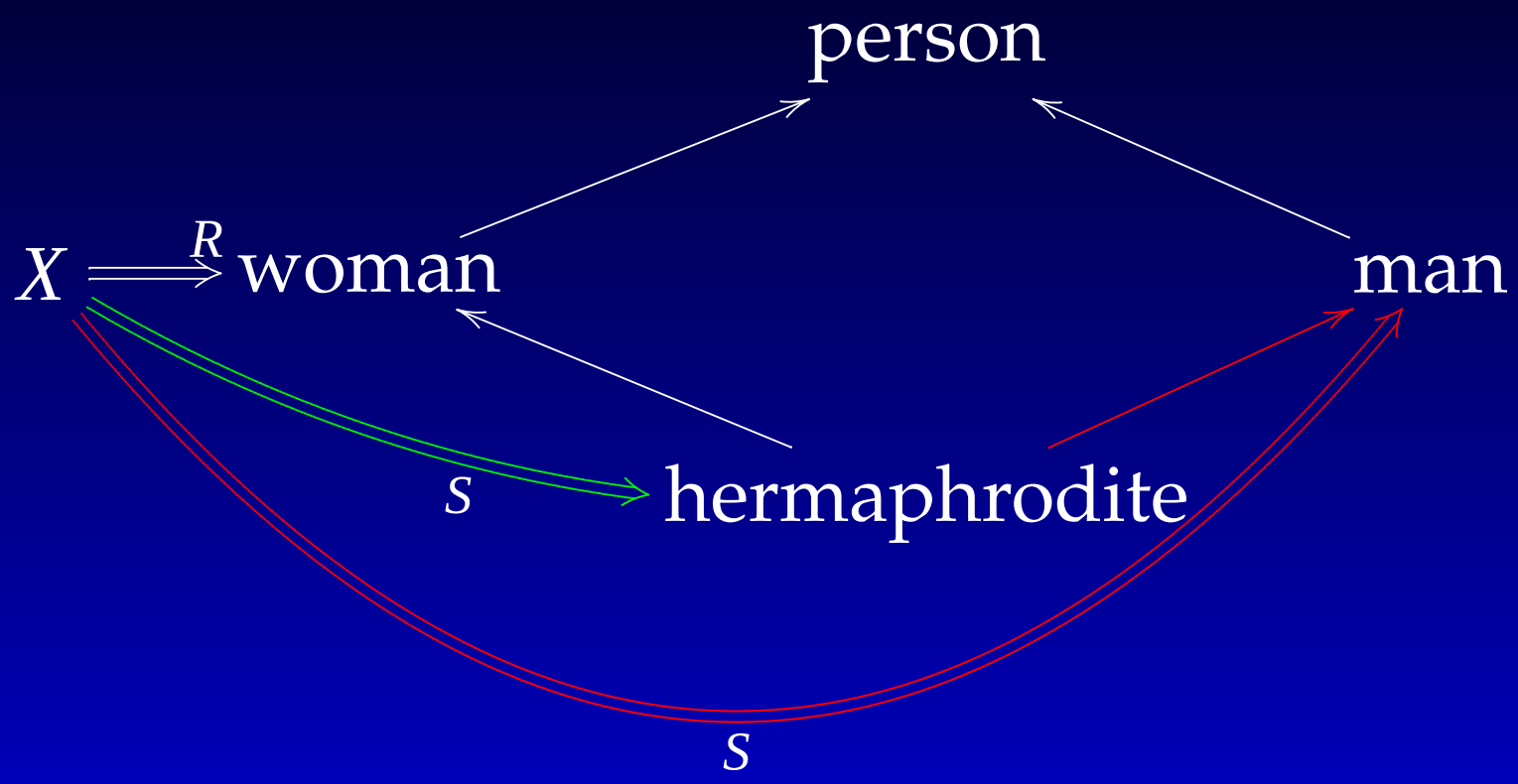

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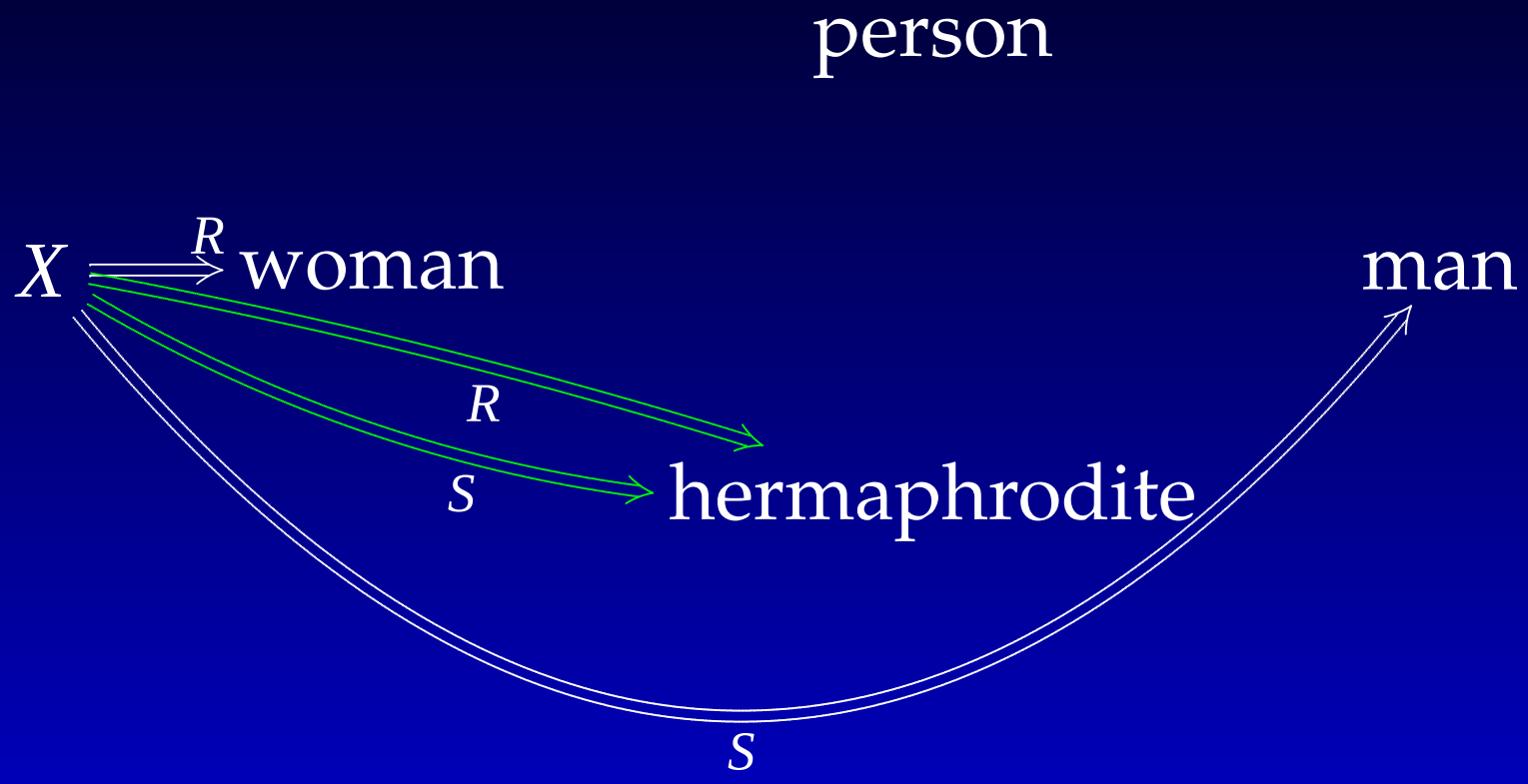
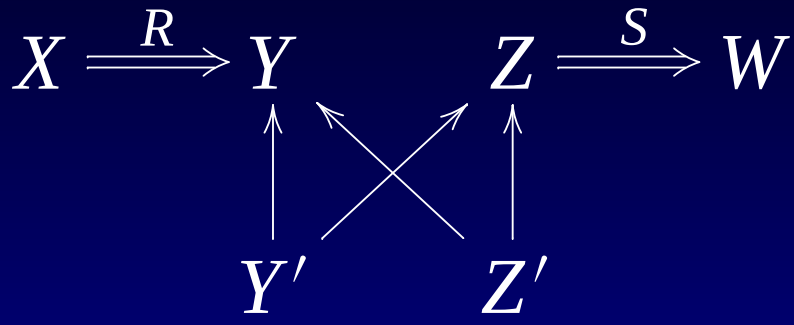


But it really doesn't...



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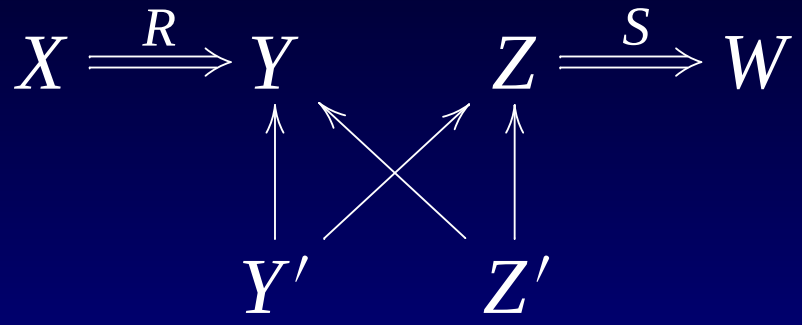
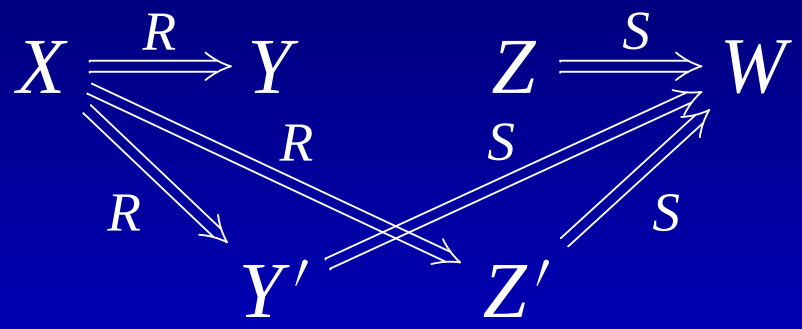
- 

- 

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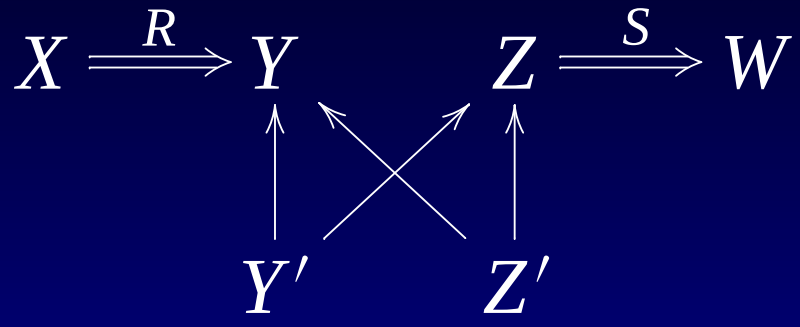
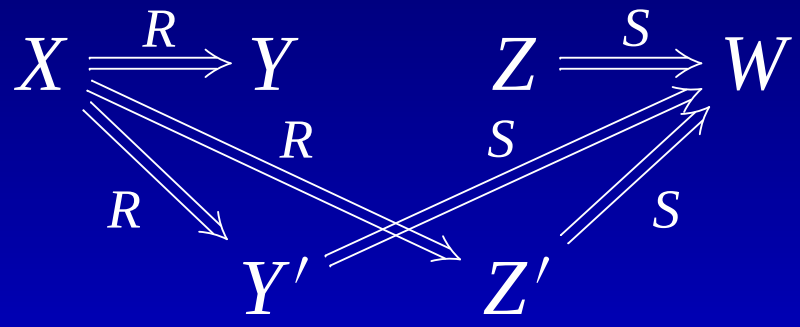
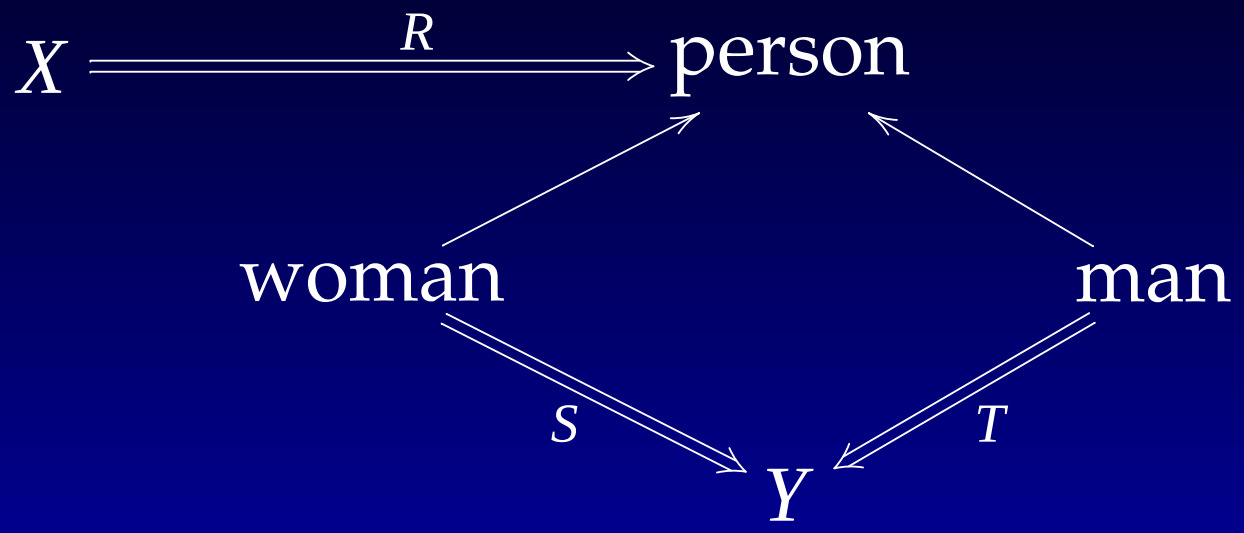
- 

- 

- Thus, not all pairs of parallel paths are bad. Maybe we should check that the sequence of labels (identification functions) is different...

. . . and Maybe Not



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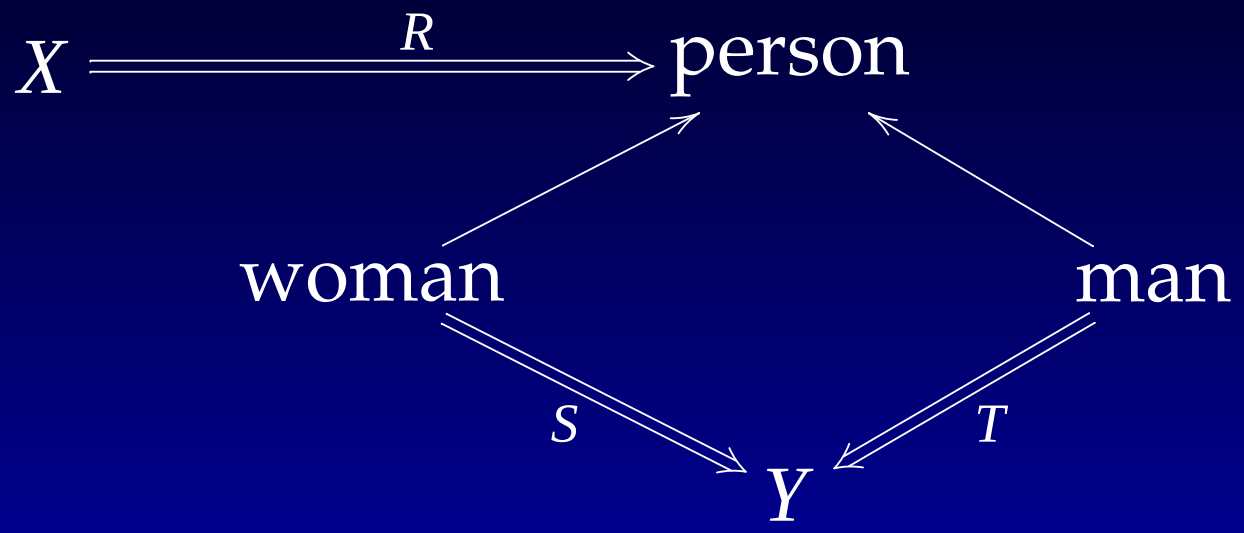

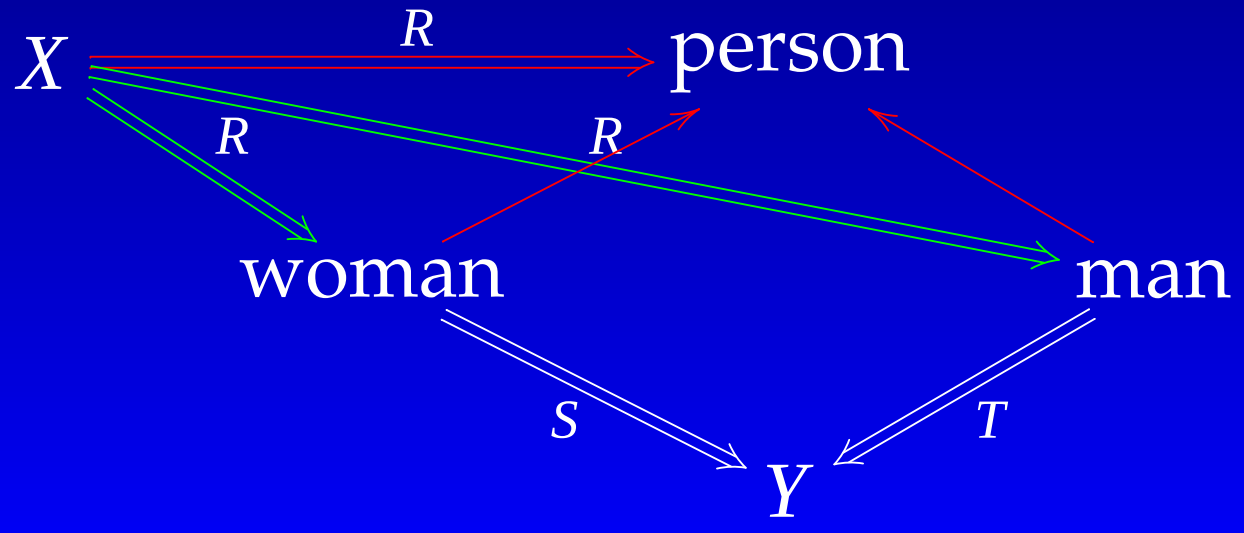

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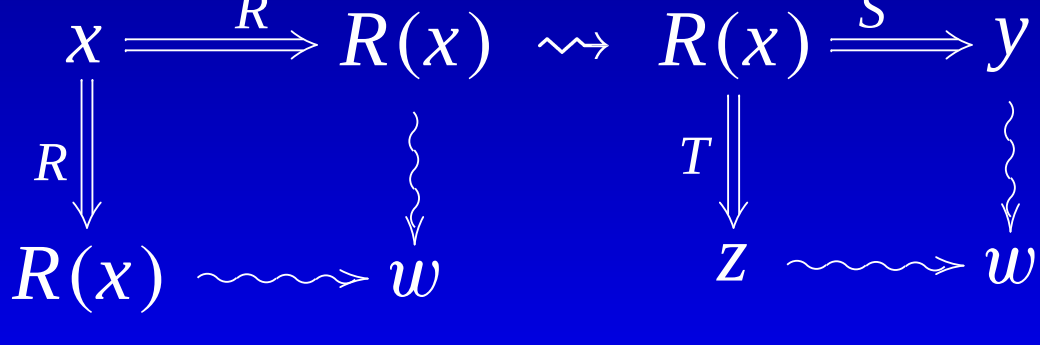
- Indeed, if double ownership is possible, then it must happen in such a way that *the first identification function is different*:



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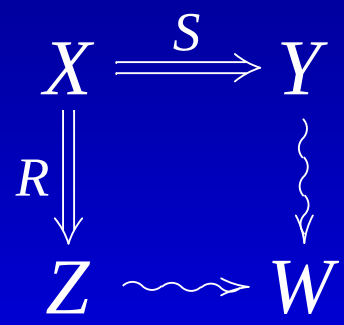

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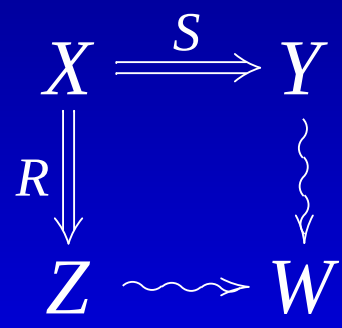

- Everything here is polynomial (albeit of rather high degree)

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- With some care, this leads to an algorithm that is cubic in the entity types and quadratic in the identification functions, provided that there is an upper bound on the size of type hierarchies
- Essentially, it's cubic (works for thousands of entity types)

Highlights

- The type semantics above allows the same element x to belong to different type hierarchies, with a clearly defined meaning

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- By making slightly stronger the stability condition, one can force all elements representing different entities to be distinct ("theoretician's semantics")
- The bicategorical composition of multirelation (pullback) is simply the join operation from relational algebra