

**A Philosophy of Domain Science & Engineering**  
**An Interpretation of Kai Sørlander's Philosophy**

The **Victor Ivannikov** Memorial Event, May 3–4, 2018, Yerevan, Armenia

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**Dedicated to his well-being**  
**Prof., Dr. Hrant Marandjian**

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Vitya, we miss you

# 1. Pre-Sørlander: Domain Science & Engineering: Recent Papers

- A Domain Analysis & Description Method – Principles, Techniques and Modeling Languages. Research Note, May 3, 2018. <http://www.imm.dtu.dk/~dibj/2018/adam/2018daad.pdf>. Complete **revision of:** Manifest Domains: Analysis & Description. *Formal Aspects of Computing*, 29(2):175–225, Online: July 2016, Journal: March 2017.
- Domain Facets: Analysis & Description. November 2016. <http://www.imm.dtu.dk/~dibj/2016/facets/faoc-facets.pdf>. Extensive revision of Domain Engineering. In Paul Boca and Jonathan Bowen, editors, *Formal Methods: State of the Art and New Directions*, Eds. Paul Boca and Jonathan Bowen, pages 1–42, London, UK, 2010. Springer.
- Domain Analysis and Description – Formal Models of Processes and Prompts. 2016. Extensive **revision of:** Domain Analysis: Endurants – An Analysis & Description Process Model. In Shusaku Iida, José Meseguer, and Kazuhiro Ogata, editors, *Specification, Algebra, and Software: A Festschrift Symposium in Honor of Kokichi Futatsugi*. Springer, May 2014. <http://www.imm.dtu.dk/~dibj/2016/process/process-p.pdf>.
- To Every Manifest Domain a CSP Expression — A Rôle for Mereology in Computer Science. *Journal of Logical and Algebraic Methods in Programming*, (94):91–108, January 2018. Extensive **revision of:** *A Rôle for Mereology in Domain Science and Engineering*. Synthese Library (eds. Claudio Calosi and Pierluigi Graziani). Springer, Amsterdam, The Netherlands, October 2014.

## 2. Post-Sørlander: Domain Science & Engineering: Reports

- The computing science  $\oplus$  philosophy report:  
[www.imm.dtu.dk/~dibj/2018/philosophy/filo.pdf](http://www.imm.dtu.dk/~dibj/2018/philosophy/filo.pdf)
- The “full talk”:  
[www.imm.dtu.dk/~dibj/2018/Yerevan/Marandjian.pdf](http://www.imm.dtu.dk/~dibj/2018/Yerevan/Marandjian.pdf)
- The paper version of the “full talk”:  
[www.imm.dtu.dk/~dibj/2018/Yerevan/bjorner-yerevan.pdf](http://www.imm.dtu.dk/~dibj/2018/Yerevan/bjorner-yerevan.pdf)
- This talk:  
[www.imm.dtu.dk/~dibj/2018/Yerevan/mini.pdf](http://www.imm.dtu.dk/~dibj/2018/Yerevan/mini.pdf)

### 3. What is a Domain ?

#### Characterisation:

- By a **domain** we shall understand
  - ⊗ a **rationaly describable** segment of
  - ⊗ a **human assisted** reality, i.e., of the world,
    - ⊗ its **physical parts**,
    - ⊗ and **living species**. **– from Kai Sørlander's Philosophy !**
  - ⊗ These are
    - ⊗ **endurants** (“still”), existing in space,
    - ⊗ as well as **perdurants** (“alive”), existing also in time.

## Characterisation [of Domain] continued:

- ❖ Emphasis is placed on “**human-assistedness**”,
  - ⊗ that is, that there is *at least one (man-made)* **artifact**  
[distinction to natural parts]  
[not made in my pre-Kai Sørlander papers]
  - ⊗ and that **humans** are a primary cause for
    - \* change of **endurant states**
    - \* as well as **perdurant behaviours**
  - ⊗ Among the *entities*
    - \* we may, in any one specific domain description,
    - \* include **humans**
    - \* in so far as their **properties**  
can be objectively analysed & described ■

## 4. What is the Problem ?

- The problem *is not that we do not* know how to describe a domain!
- The problem is that we do not know **whether our description could be otherwise.**
- Formulated differently:
  - ❖ *Which are the elements that any description of the world, i.e., a domain must necessarily evolve around ?*
  - ❖ *Or: which are the absolutely necessary conditions for describing any domain ?*
  - ❖ Science cannot address that problem.
  - ❖ Philosophy has!

## 5. The Kai Sørlander Philosophy

- Sørlander addresses exactly that problem:
  - ❖ [1] **Kai Sørlander:** *Det Uomgængelige – Filosofiske Deduktioner* [**The Inevitable – Philosophical Deductions**], with a foreword by Georg Henrik von Wright, Munksgaard · Rosinante, 1994. 168 pages.
  - ❖ [2] **Kai Sørlander:** *Indføring i Filosofien* [**Introduction to The Philosophy**], Informations Forlag, 2016. 233 pages.



- In [2] Sørlander carefully reasons that
  - ⊗ the philosophies of
    - ⊗ Descartes,      ⊗ Locke,      ⊗ Hume,      ⊗ Hegel,
    - ⊗ Spinoza,      ⊗ Berkeley,      ⊗ Kant,      ⊗ Russell
  - and others are **fraught with contradictions**,
  - ⊗ that, for example,
    - ⊗ Kant's *Dass Ding an Sich* and *Das Ding für Uns* fail, that
    - ⊗ Hegels "historicism" fails, and that
    - ⊗ Russell's nominalism fails.

- Instead of *Immanuel Kant*'s building on **the possibility of conscience**

*Kai Sørlander* builds on **the possibility of truth** –

- ❖ from which he then, through careful *logical and meta-logical reasoning*,
- ❖ involving the use of **transcendental deductions**,
- ❖ builds the foundation for describing any world.

- *Without going into details we shall summarise our findings.*

## 6. The Technical Talk

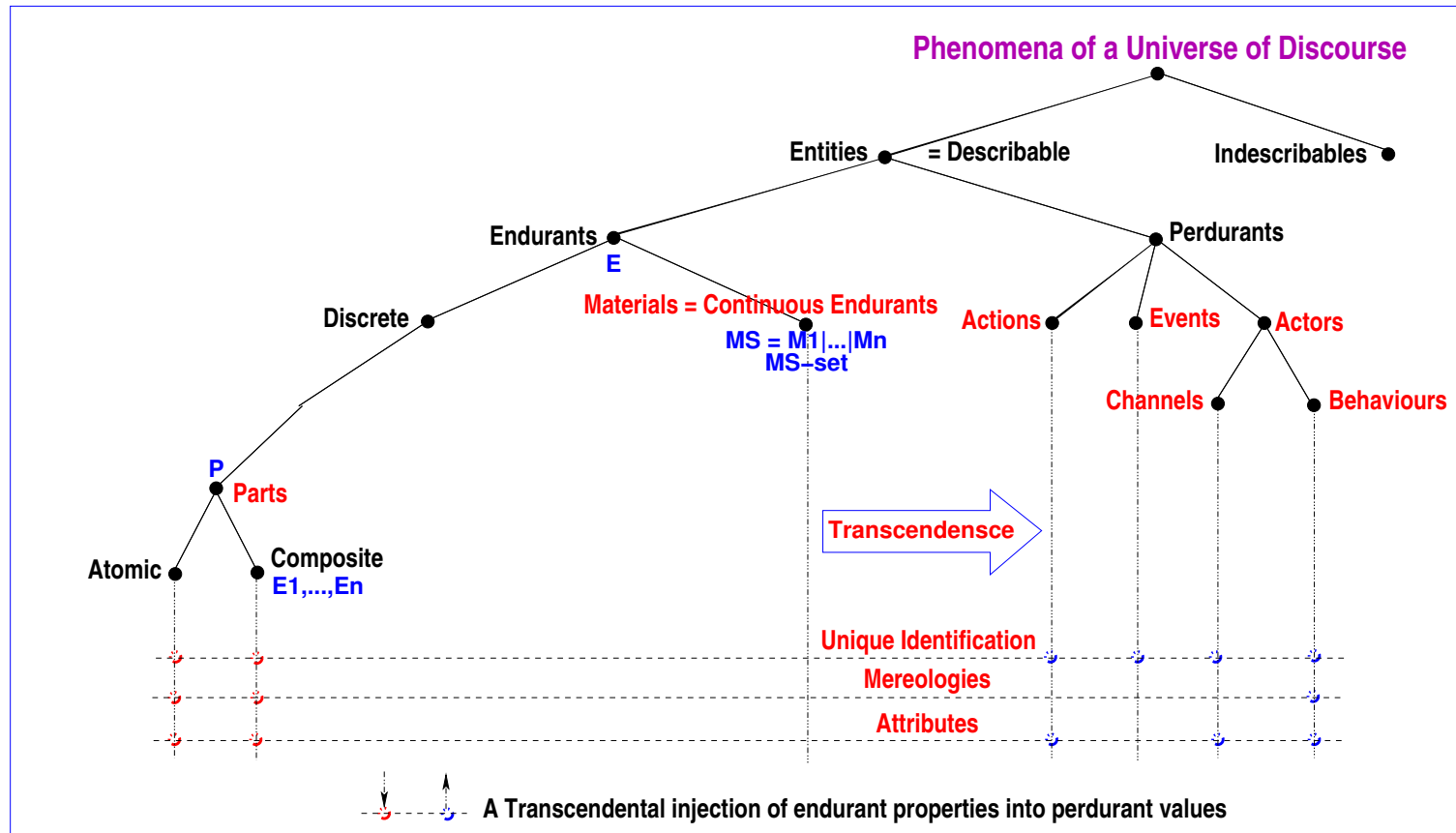


Figure 1: A pre-Sørlander Parts and Materials Upper Ontology

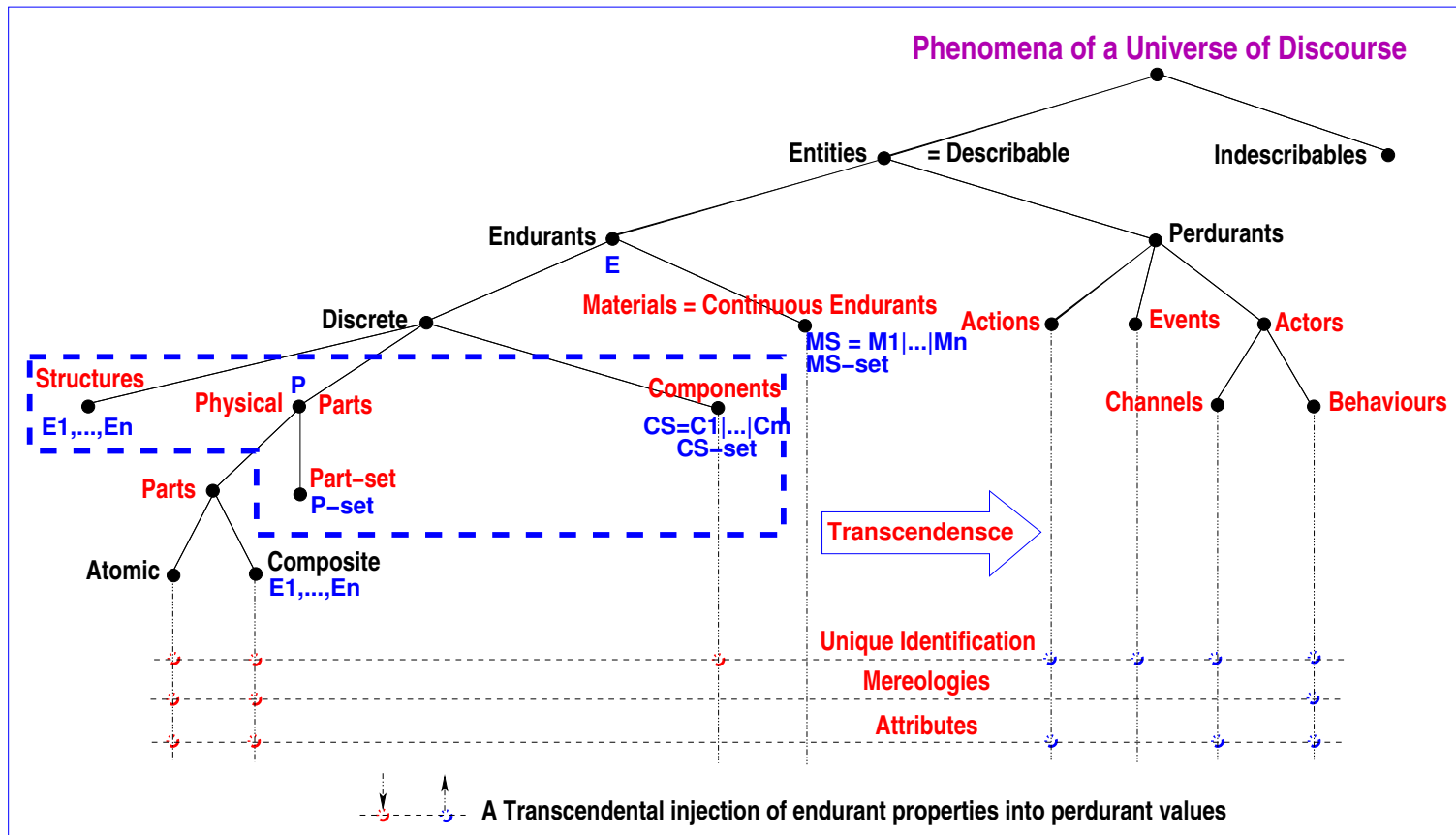


Figure 2: Still pre-Sørlander: Adding Structures, Part-sets and Components

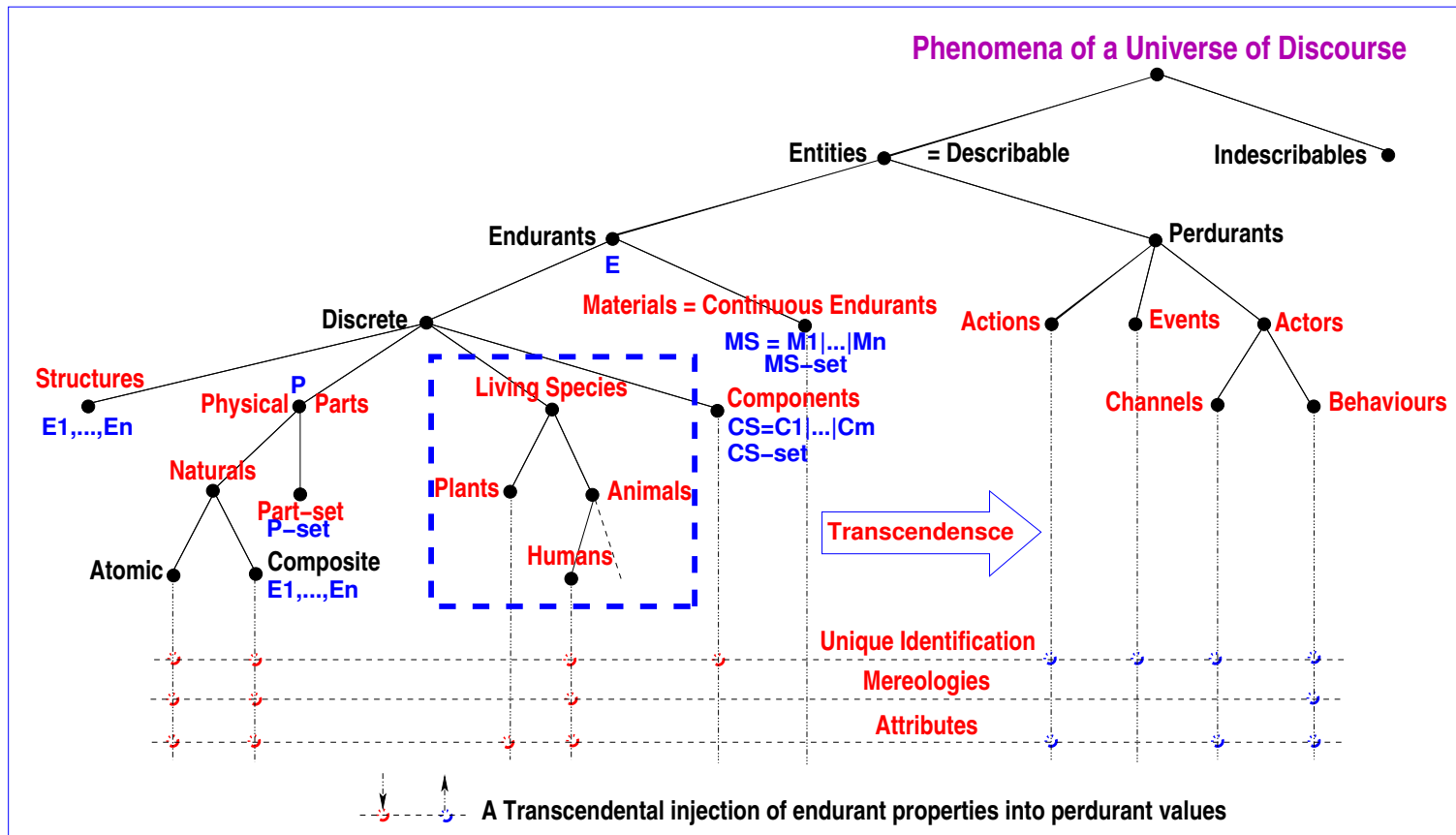


Figure 3: Post-Sørlander: Adding Living Species

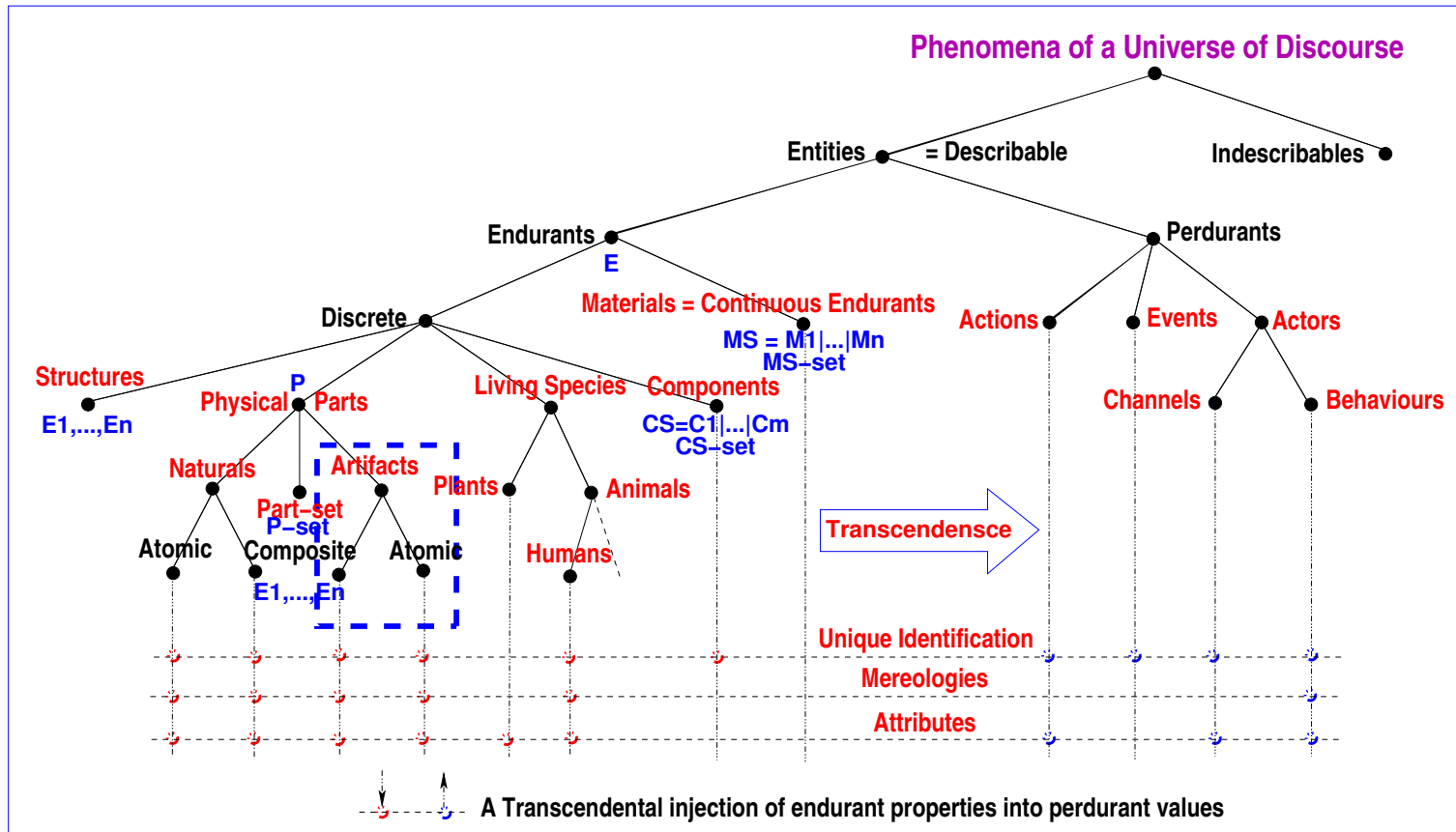


Figure 4: Final-Sørlander: Adding Artifacts

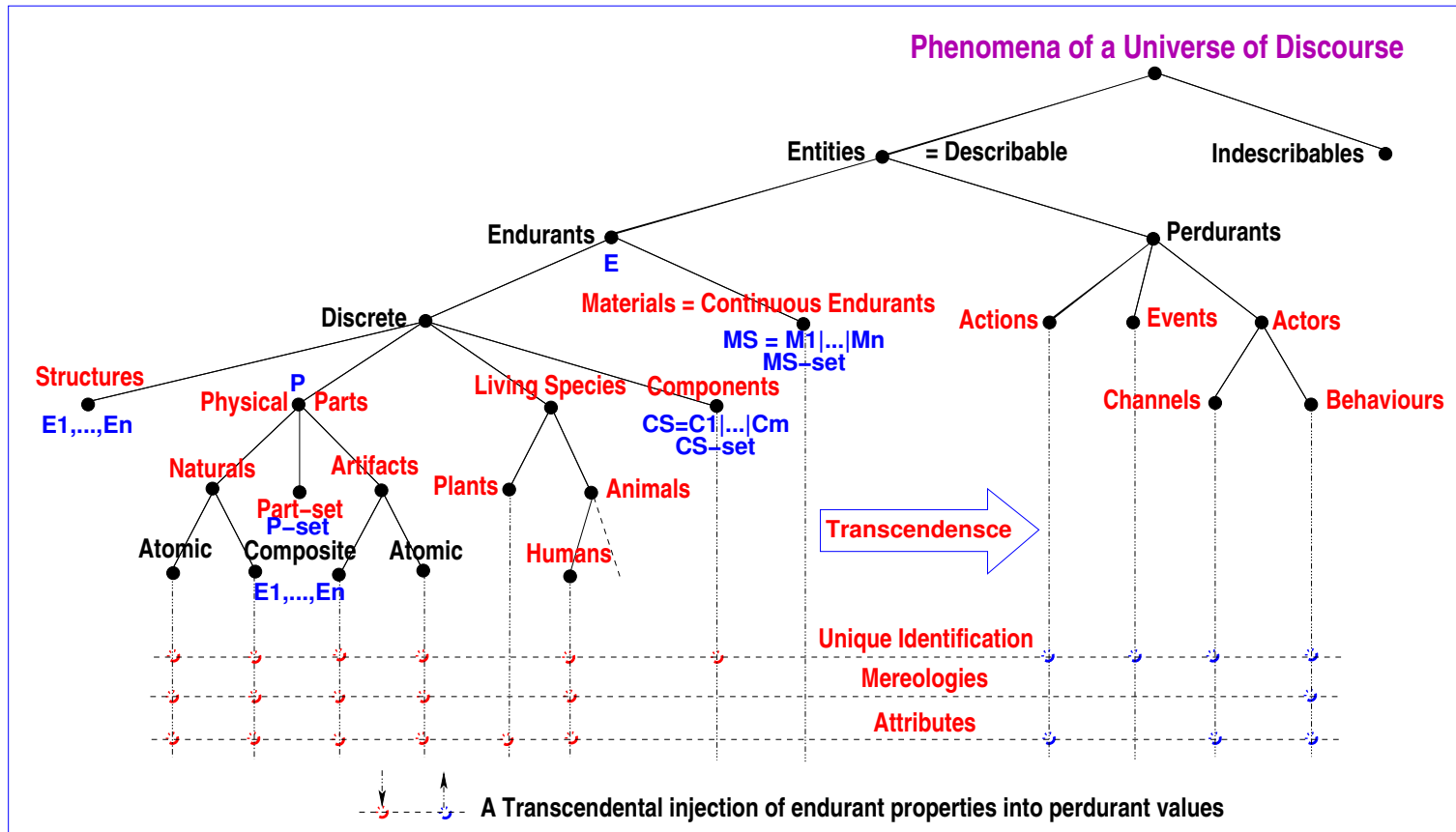


Figure 5: A Final Upper Ontology for Domains

## 7. The Calculi

### 7.1. The Domain Analysis Calculus

- a. is\_entity
- b. is\_endurant
- c. is\_perdurant
- d. is\_discrete
- e. is\_continuous
- f. is\_structure
- g. is\_part
- h. is\_component
- i. is\_material
- j. is\_atomic
- k. is\_composite
- l. observe\_endurants
- m. has\_concrete\_type
- n. has\_components
- o. has\_materials
- p. is\_living\_species
- q. is\_plant
- r. is\_animal
- s. is\_human
- t. is\_artifact
- u. has\_mereology
- v. attribute\_types



## 7.2. The Domain Description Calculus

- [1] observe\_endurant\_sorts
- [2] observe\_part\_type
- [3] observe\_component\_sorts
- [4] observe\_material\_sorts
- [5] observe\_unique\_identifier
- [6] observe\_mereology
- [7] observe\_attributes

## 8. Examples of Domains

- **railways,**
- **road transport,**
- **container shipping,**
- **health care,**
- **document systems,**
- **oil pipelines,**
- **e-market,**
- **weather information,**
- **credit card systems,**
- **urban planning,**
- **swarms of drones,**
- et cetera, et cetera!

The paper:

- **<http://www.imm.dtu.dk/~dibj/2018/philosophy/filo.pdf>**

gives references.

## 9. Closing

- We have introduced two major and **new**, concepts:
  - ❖ (i) **domain analysis & description**  
*as a precursor to software development*; and
  - ❖ (ii) **philosophy**  
*as a basis for determining major elements on a domain analysis & description method.*
- We claim these, (i) and (ii), as **new** elements of computer science.

THANK YOU FOR YOUR ATTENTION

## 10. Acknowledgements

- I gratefully acknowledge:
    - ❖ Prof. Dr **Arutyun Avetisyan**, Moscow
    - ❖ Prof. Dr **Yury Haykovich Shoukourian**, Yerevan
    - ❖ Prof. Dr **Vladimir Sahakyan**, Yerevan
- for their invitation and support.

**We are living in interesting times**  
**I wish all the very best for Armenia**



**Lunch with Viktor Petrovich**  
**Friday, April 24, 2015, Dom Literatow, Povarskaya 50**