Categorization

PA116 – L5
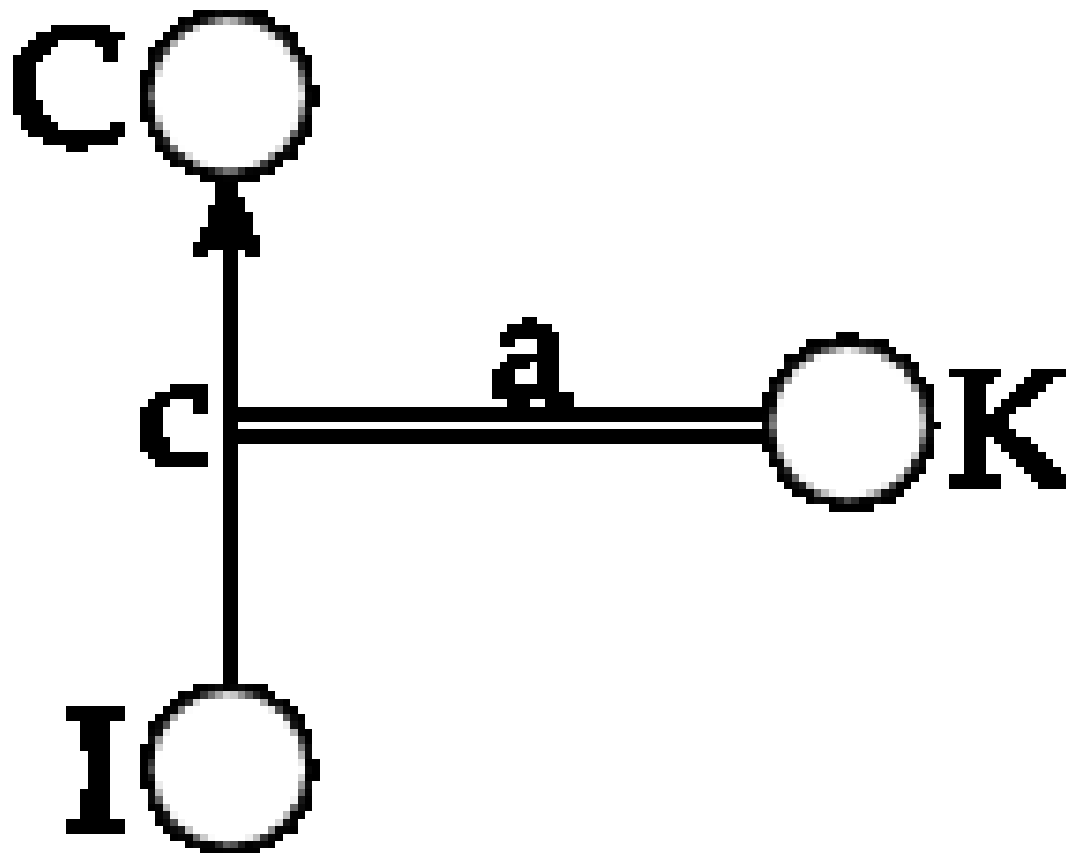
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Fig. 1: T (elementary belief)

Categorization by G. Lakoff - category as container

- Term **category** is not a synonym for type!
- Categories are **containers**, into/from which we insert/remove objects
- Inserting objects into categories is called **categorization**
- Level-of-detail and way-of-categorizing rely on a subject, which is doing the categorization and upon what basis it is done
- **Hierarchical taxonomy of categories**: the order from the most general ones to the most specialized ones

Example: Item of Technical Maintenance
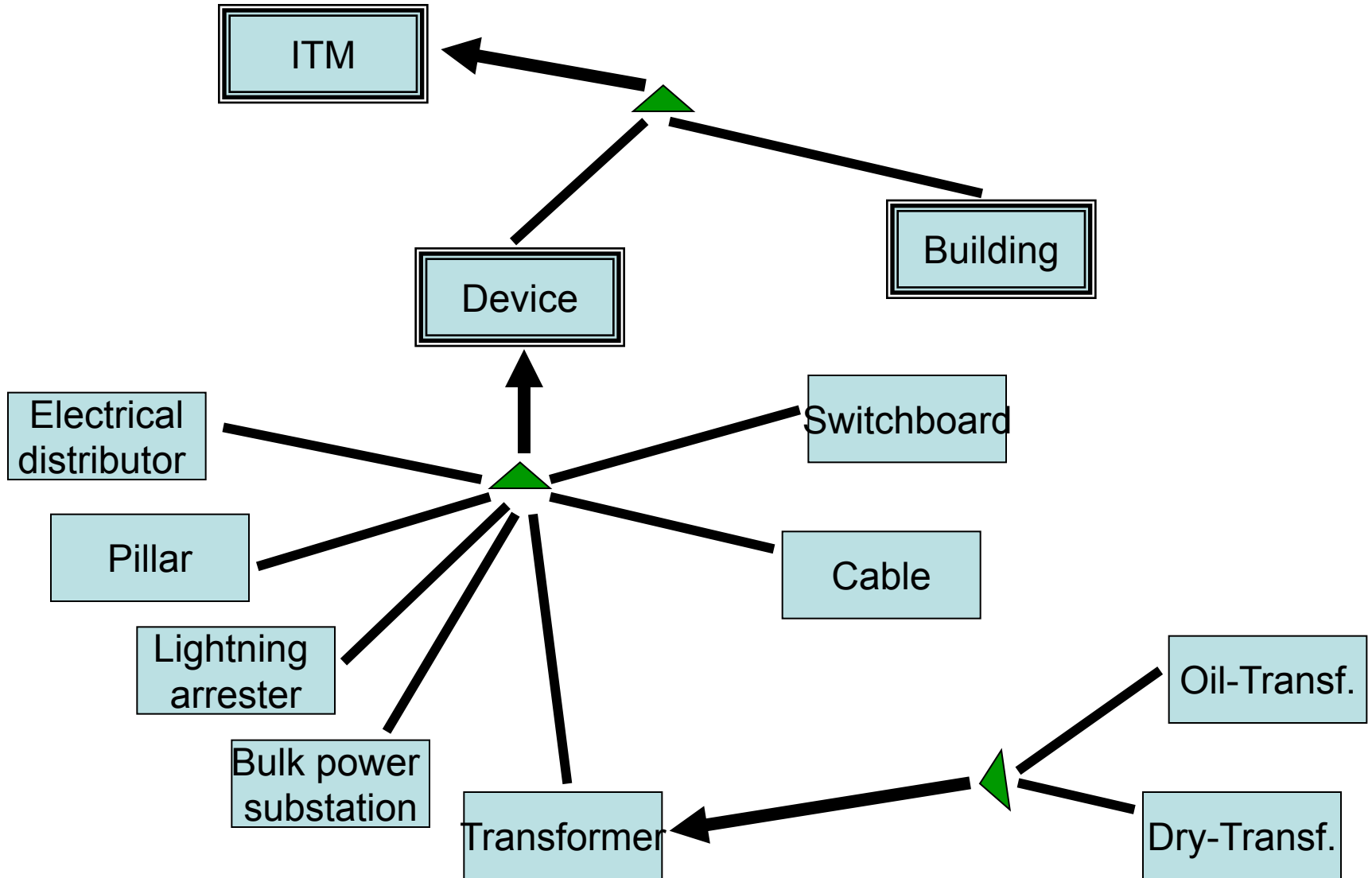
Hierarchical taxonomy of categories

- Vertebrate
  - Mammal
    - Predator
      - Feline
        » Tiger
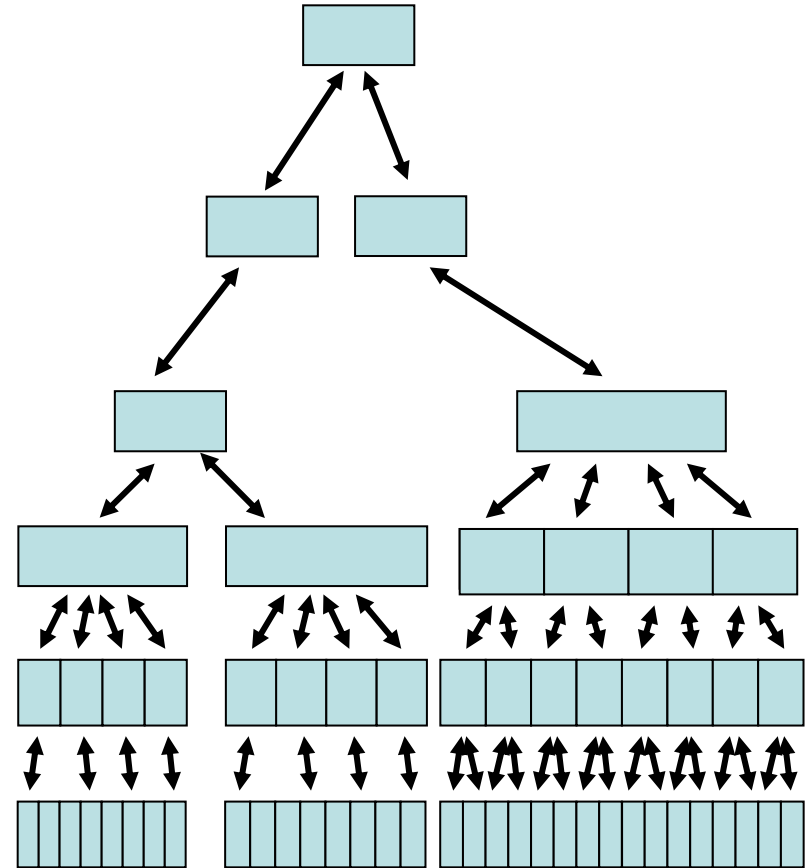
Which level in hierachical taxonomy is the most important one?

- Classical theories: categories in the middle of taxonomy are not interesting
- Lakoff: from the psychological point of view the basic level lays somewhere in the middle of the hierarchy

Superior level	animal	furniture
Basic level	dog	chair
Subordinate level	Labrador	rocking chair

Basic level:

- It is the uppermost level, on which shapes of elements of given category are perceived as the elements are alike
- It is the uppermost level, on which a simple mental figure reflects all elements from given category
- It is the uppermost level, on which a person uses nearly the same motoric actions when interacting with elements of given category
- It is the level, on which are elements of given category identified the fastest by tested persons

Basic level in hierarchical taxonomy (once more)

Superior level	animal	furniture
Basic level	dog	chair
Subordinate level	Labrador	rocking chair

- Our perception is anchored by our human dimension
- The reason of this can be explained by:
- Enactive Perception: "a dialogue" of the perceiving person and the environment/neighbourhood

Preconceptions and facts

- ***„Basic categories are objective"***

It is not true! :

- Basic categories are only „human-sized"
- Categorizing depends on the way, how people interact with surrounding objects
- … and not only on objects themselves and their attributes

How we can categorize ?

- Prototype categorizing (the base)
- Metonymic categorizing
- Use of Radial Categories

Prototype categorizing

- Tag notable elements
- Abstract from details and declare them as "invariant representations" of a set of properties
- Each element having the same or similar properties hook on the tagged elements
- The tagged element together with all on it hooked elements form Category

Prototype categorizing – cont.

- Some categories have embedded a graduation
    - Fuzzy borders
    - ***Central members = prototypes***
    - ***Central member*** has a level of belongingness into category equal to 1
    - Members distant from central ones has a level of belongingness into category smaller than 1
- E.g.: tall person, red
- …this depends on Context, often …

„Tall person"
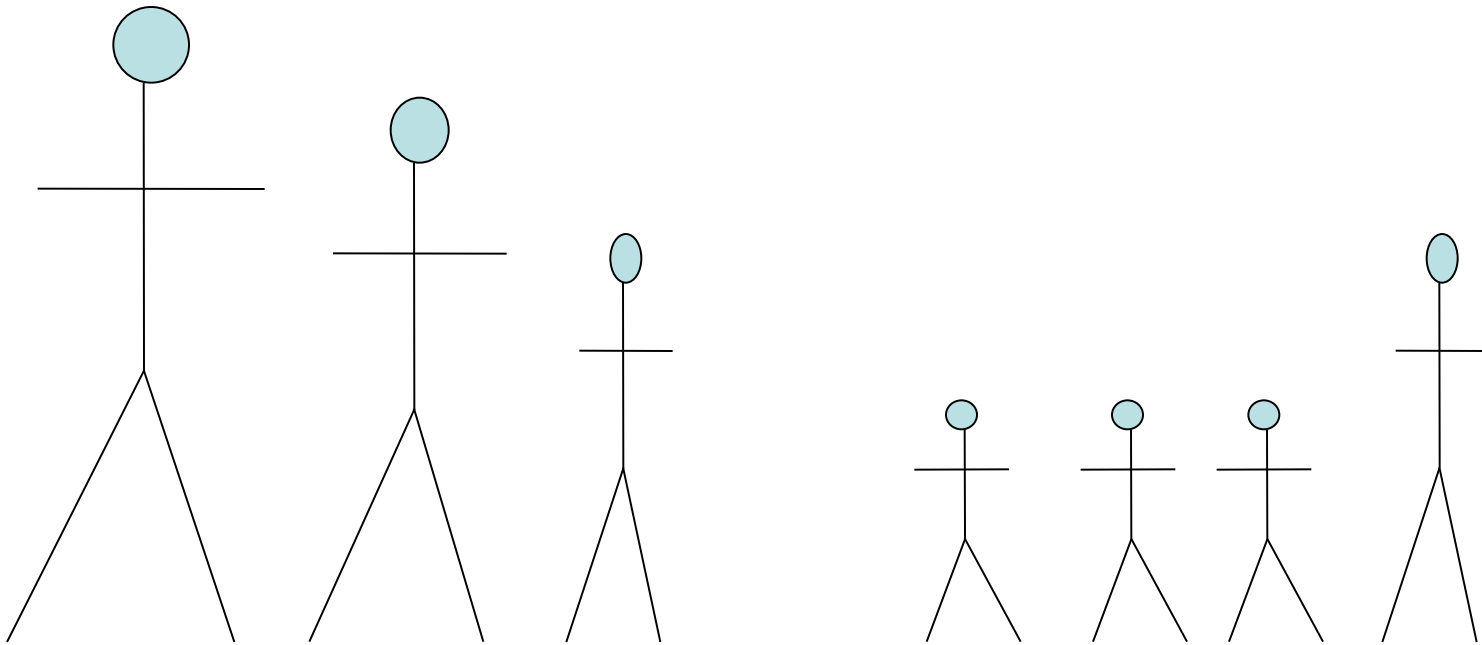
"Red"
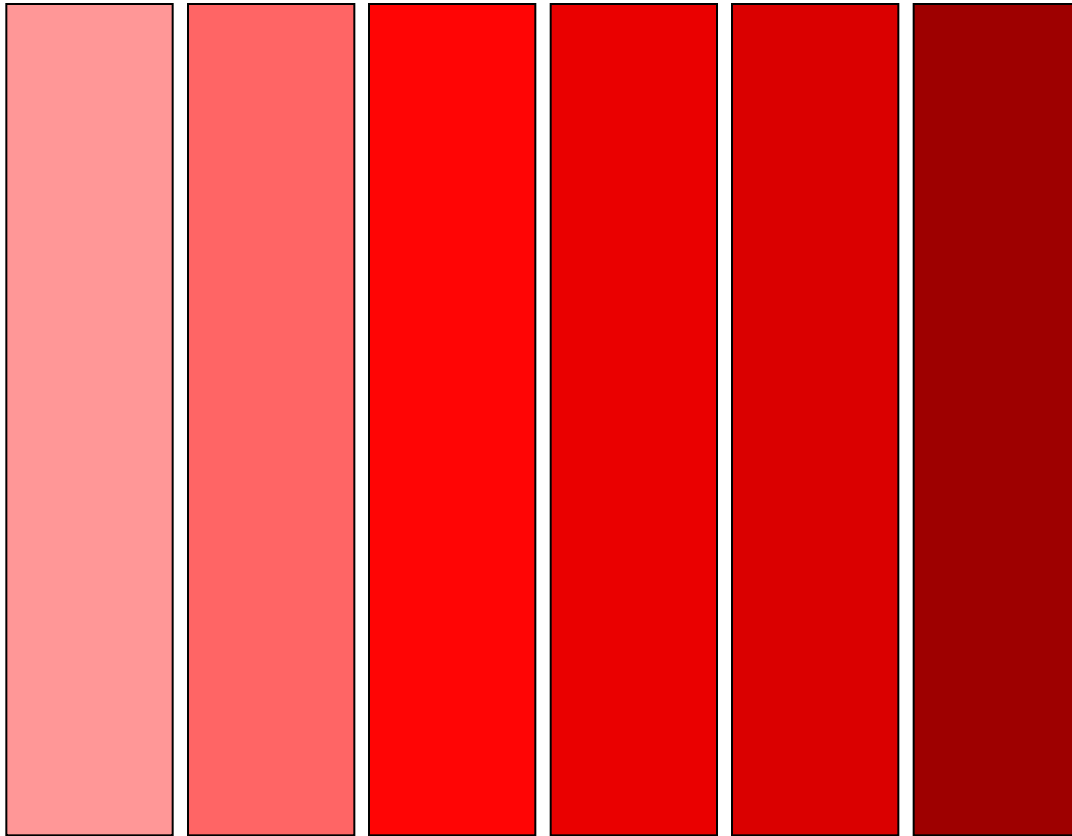
Prototype Categorizing - result

- Select the ideal representative item

- (This is the "invariant representation" of what we call "category")

- Express the fact that item *I* belongs to category *C* by connection *(I, C)* $\rightarrow$ *c*

  - where **c** is measure of certainty

- Category is no more seen as a ***container***, but it is seen as a ***hook (central member = prototype)*** to which we hang up other members

Reasons for Prototype categorizing

- Some categories has their borders set, but some members are better examples than others

- E.g.: bird: >>eagle, >>chicken, >>penguin

- Basic level depends on perceived structure "*whole-part*" and on knowledge about how *parts* work with respect to the *whole*

- Categories are not objective, nor independent on human being (**not independent on categorizing agent**).

- For categories there are important attributes, so-called *interaction attributes* : characterizing interactions of human beings (**agents**) with their neighbourhood
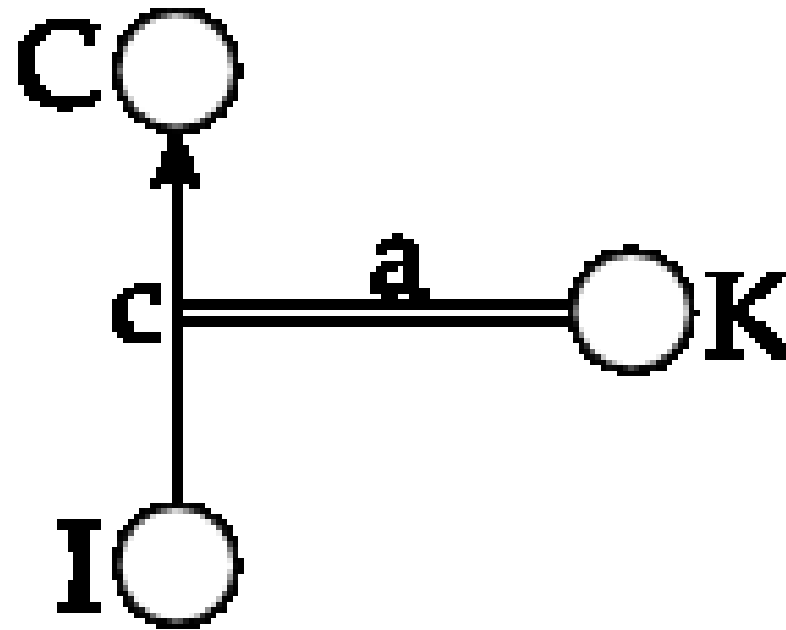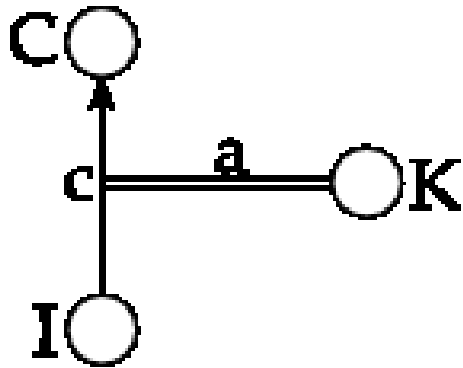
The "T"

Fig. 1: T (elementary belief)
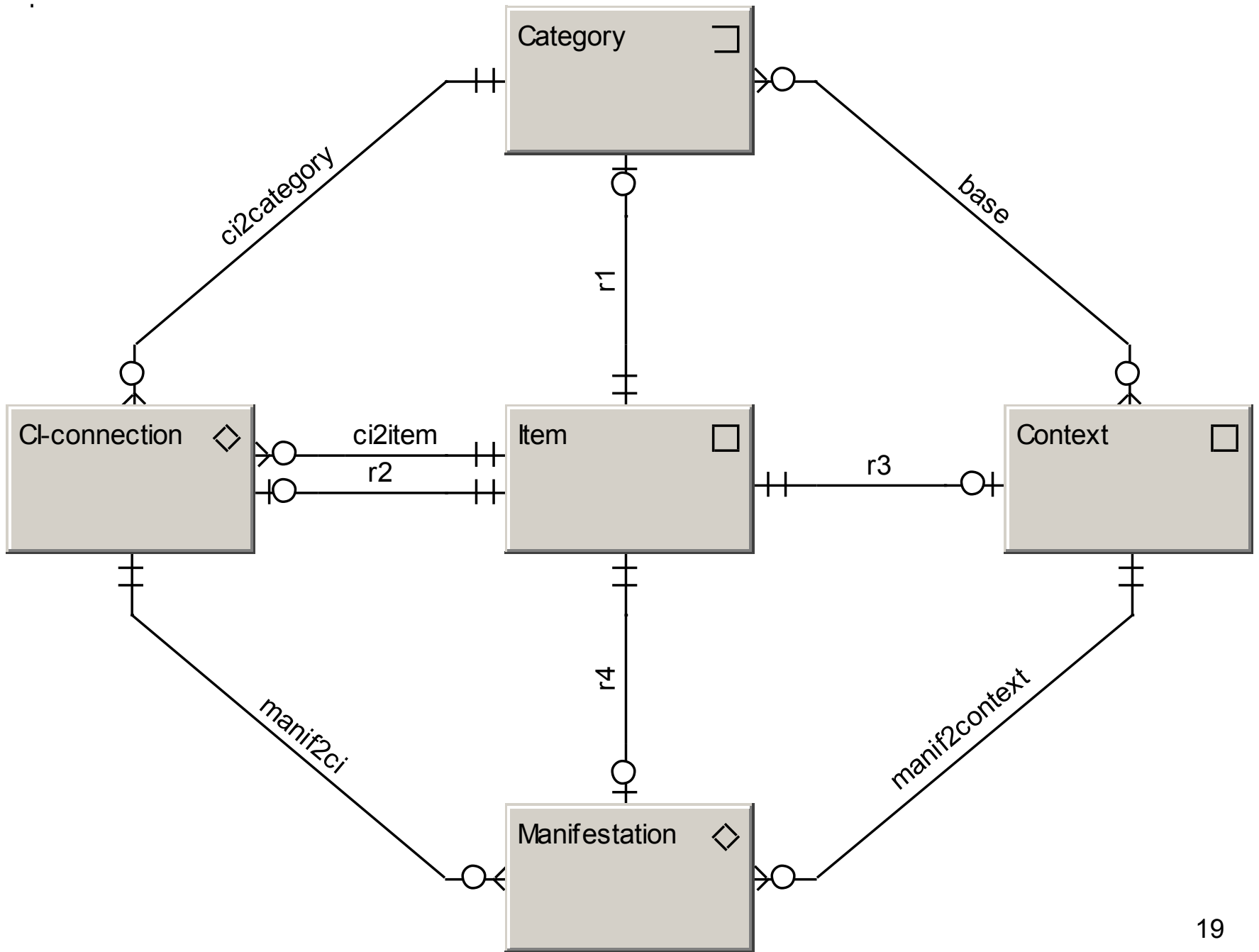
Context

Fig. 1: T (elementary belief)

- $(I, C, c = 1, a = a_{max})$ is a context.

- Let $T_1, \ldots, T_n$ be arbitrary elementary beliefs. Than $(T_1, \ldots, T_n)$, i.e. a finite sequence of elementary beliefs is a context.

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Metonymy

- „That appendix on four has fever again.“
- *One easily perceivable aspect of the object/situation is used as a representation of the object/situation.*
- Typically: A member of another (but in a way connected) category is becoming metonymical representation of the whole category for reasoning purposes.
- „White collars do not like to work by hands.“

Radial categories

- ***Central case = prototype member, clearly perceived by everyone***
- ***Many variations of this case, which cannot be specified by general rules***
- Example: "Mother"
- Central case: woman, she gave a birth, feeds by breast a child, rises a child, loves her child, is wife of a father of a child, is older than a child for one generation
- Variations: stepmother, adoptive mother, biological mother, mother-she Charley who lives with father-he Andrew, raven mother

Influence on a way of thinking

- Radial categories
- Metonymically explicated categories
- … what objects/items and which relationships we have to take into account, and which operations (distinguishing procedures) we have to execute to realize that something focused is e.g. „mother"
- Hence: category is not a primitive concept but a composite of relationships and operations
(see the deep explication of the Diamond of focus)

# category is not a primitive concept:
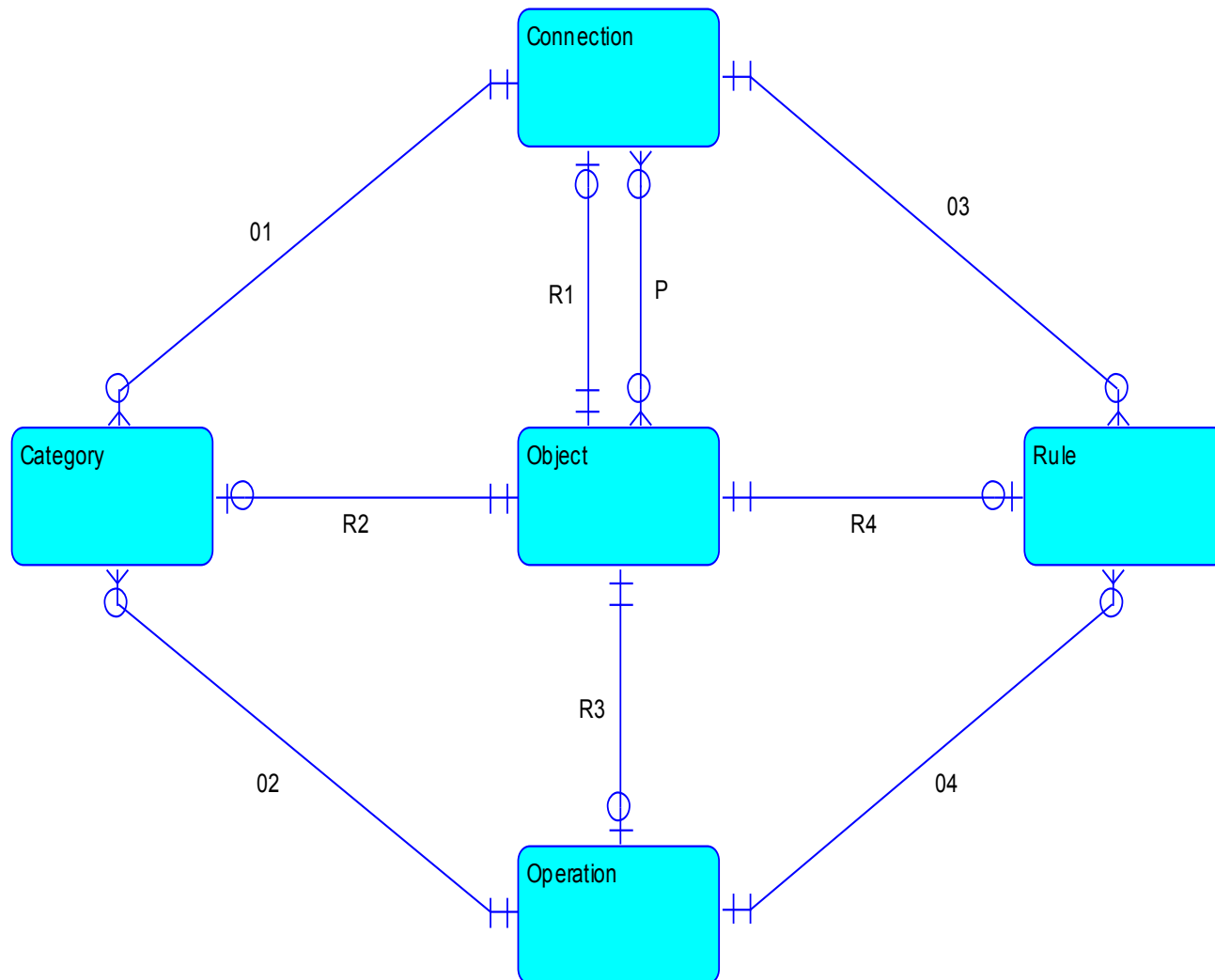
Jeff Hawkins' Hypotheses
(in his book: "On Intelligence")

- Neocortex stores sequences of patterns
- Neocortex stores patterns in an invariant form (invariant representation)
- A sequence of patterns is a pattern again
- Neocortex stores patterns in a Hierarchy (see the Fundamental Hierarchy—Diamond of Attention—and substitute "pattern" for "object")
- Neocortex doesn't distinguish between external inputs and internal inputs (the ratio ext : int is ?)
- Thus:
  Concepts are invariant representations of sequences of (elementary) patterns.

FUNDAMENTAL HIERARCHY

touch   audition   vision
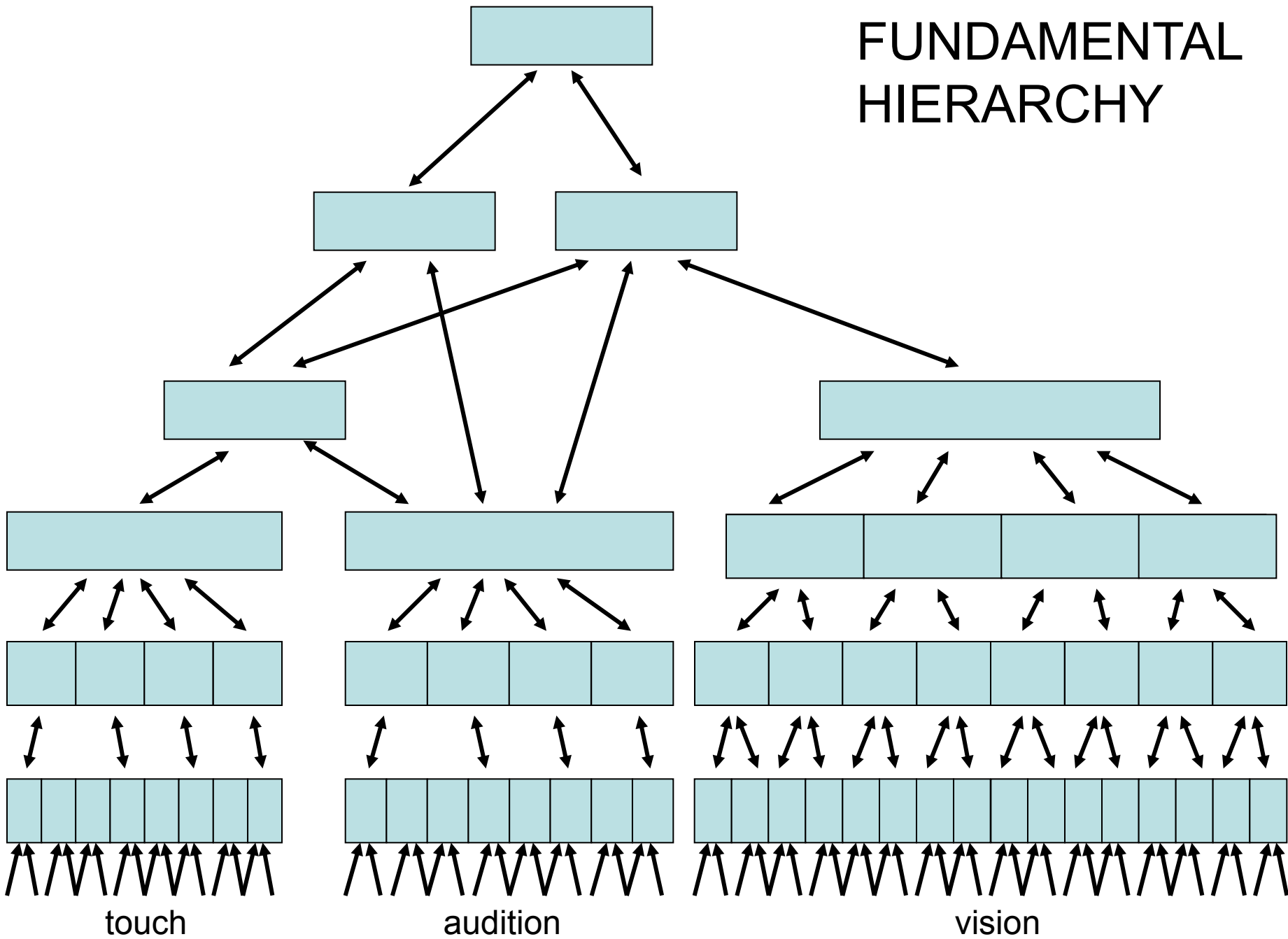
A model of Fundamental Hierarchy
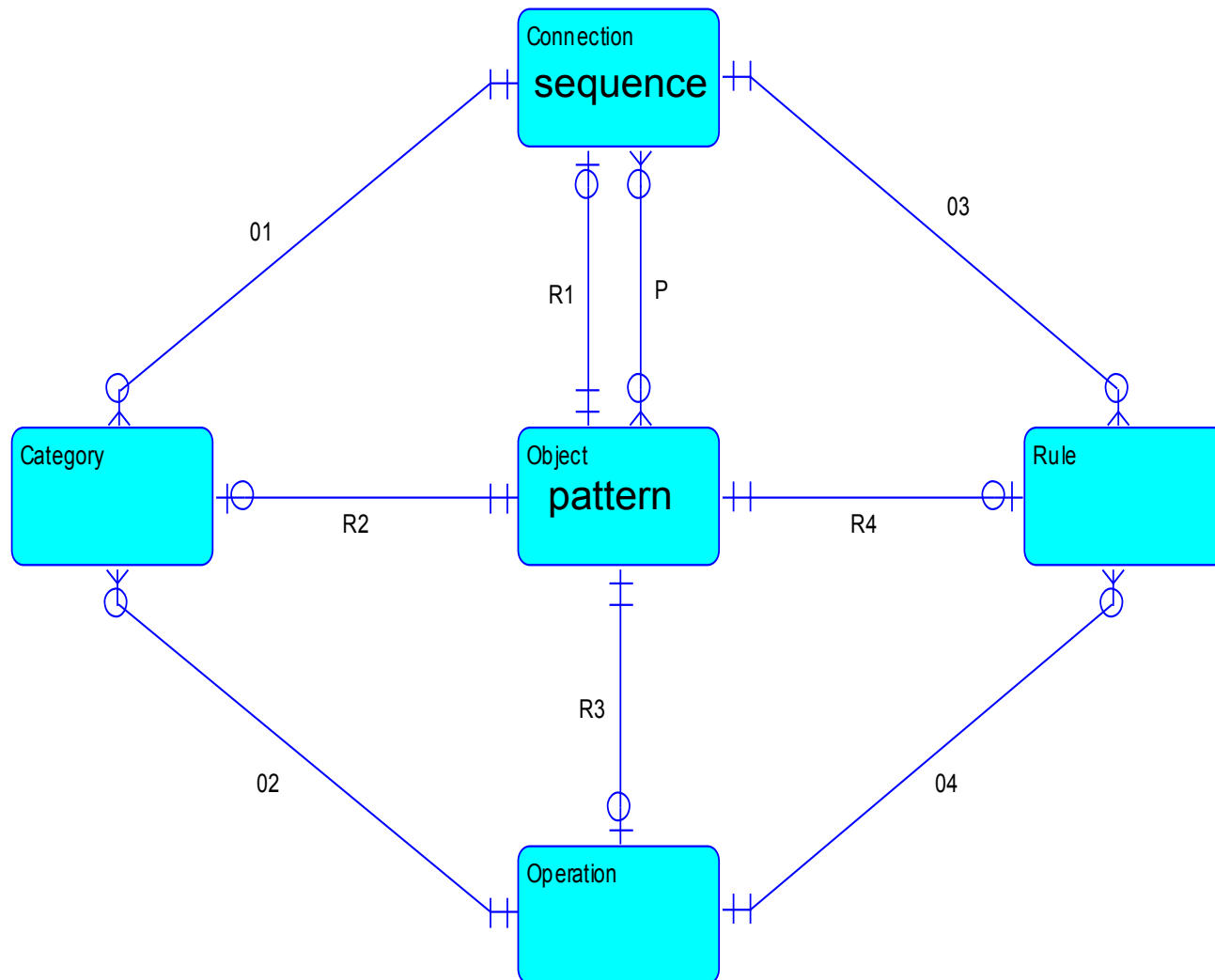
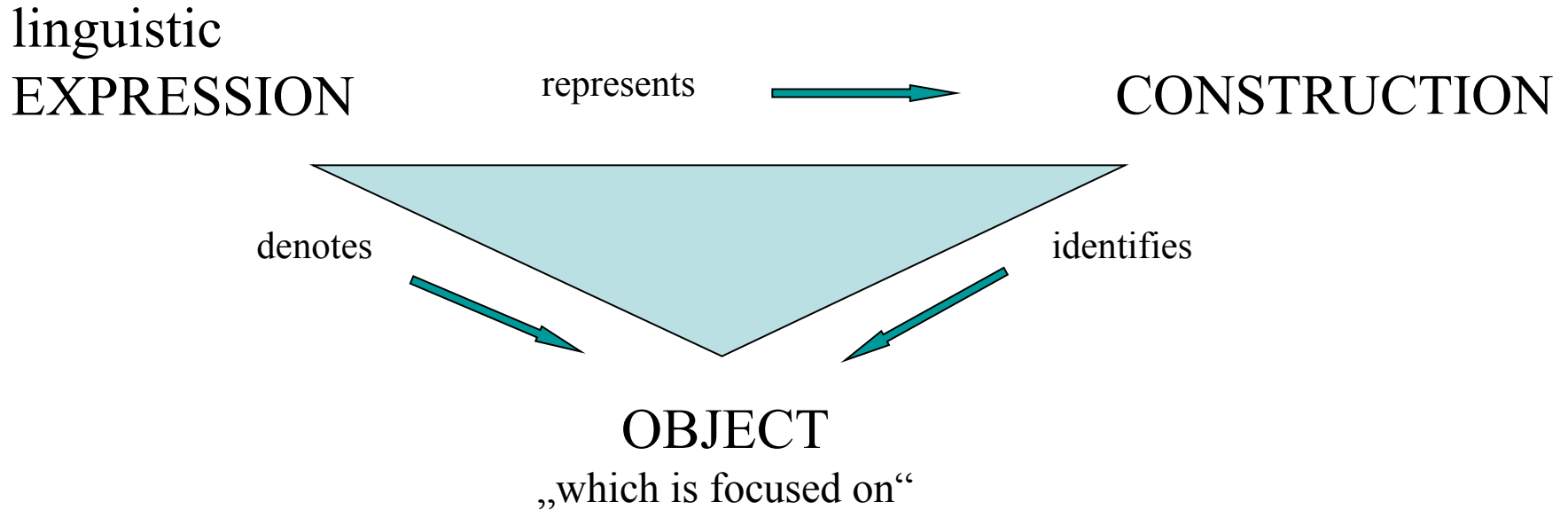# … and how we reason on this FH:
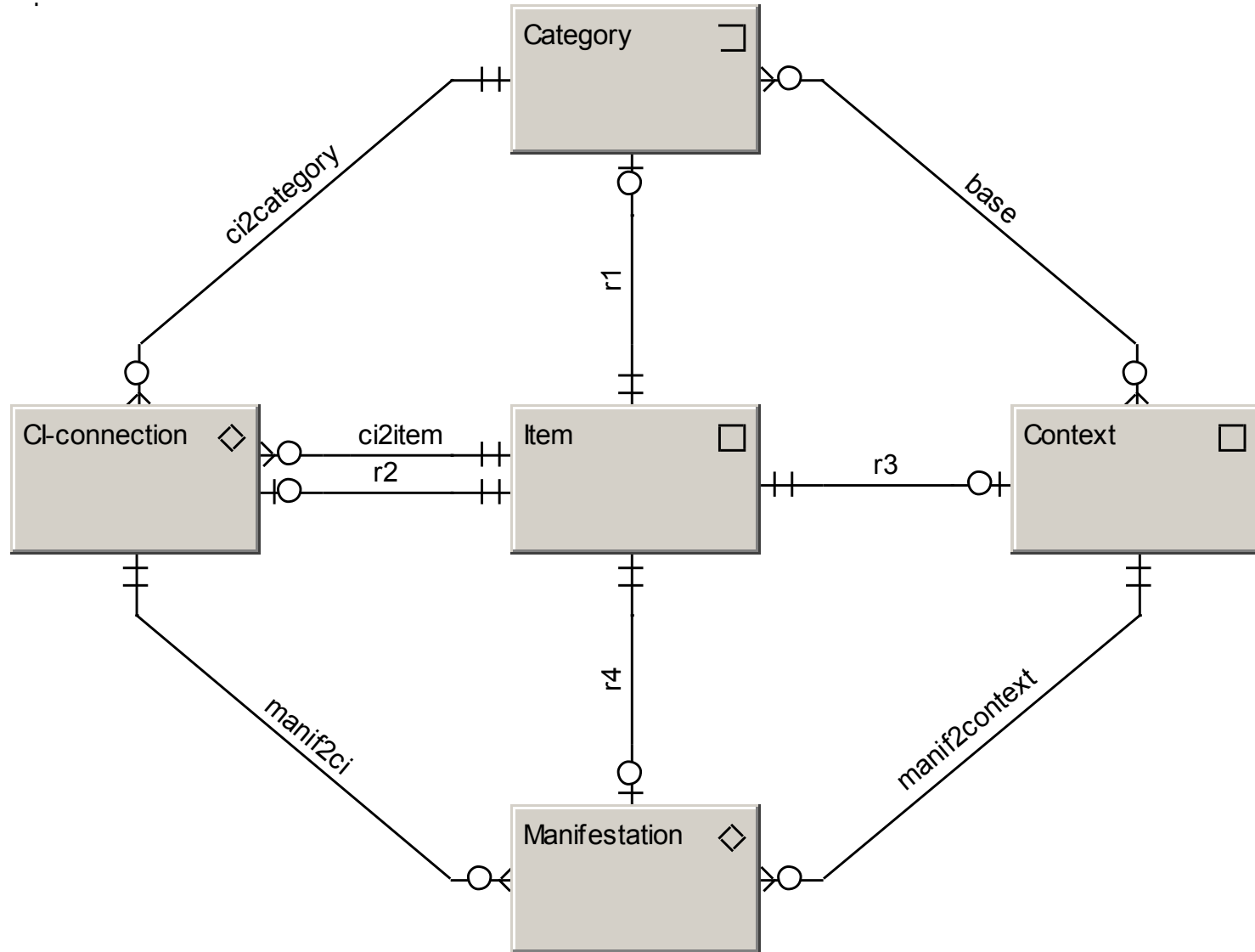
… and now the role of CONCEPTUAL MODELING in the light of Lakoff categorization

NLE analysis

linguistic
EXPRESSION   represents ⟶   CONSTRUCTION

denotes   identifies

OBJECT
„which is focused on"

Why do we understand each other while talking?
How is it possible we can translate from
one language to another?

Attention Focusing

- Modeling process (of a given Domain) is similar to a focusing of a camera objective when making photos: in front of the objective there is everything while the photo depicts clearly only these things which are focused on.

- This means:
  - over **EB** we choose particular types and we focus our attention to objects belonging to this types only
  - the model than contains constructions of these focused objects

- The focused objects are: HIT attributes and sorts

Hierarchy of types for DM

- E-types, D-types
- node types
- tuple types
- basic types
- Instances of H-types

Instances of H-types

constructed over

basic types

node types

type Bool

tuple types
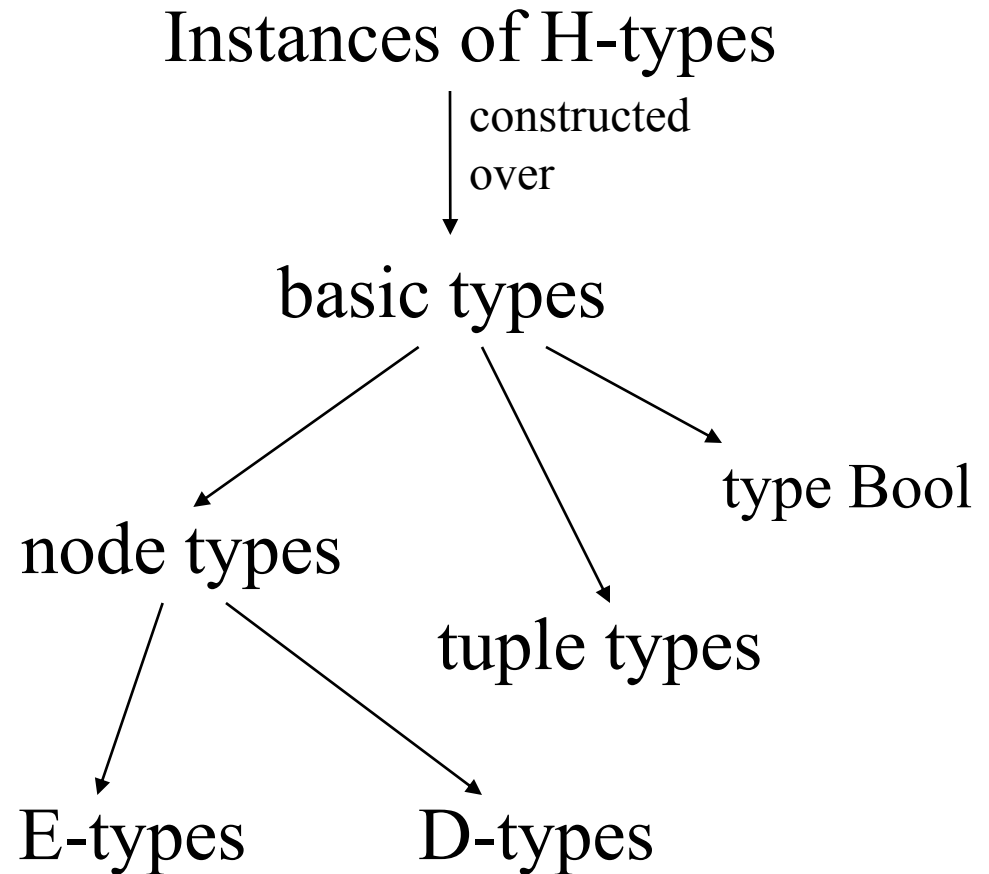
E-types

D-types

H-types

- Let $T_1,...,T_n$ are node types (not necessarily diverse), at least one of them is an E-type.

- Let S is arbitrary basic type

- H-type is each type of the form
  (a) $(\text{Wrd} \rightarrow (\text{Tim} \rightarrow ((T_1, ..., T_n) \rightarrow S)))$
  or
  (b) $(\text{Wrd} \rightarrow (\text{Tim} \rightarrow ((T_1, ..., T_n) \rightarrow (S \rightarrow \text{Bool}))))$

  (in case (b) the S must not be the Bool)

HIT-attributes

If A is an object of H-type
   i.e.
   $A / (Wrd \rightarrow (Tim \rightarrow ((T_1, ..., T_n) \rightarrow S)))$
   or
   $A / (Wrd \rightarrow (Tim \rightarrow ((T_1, ..., T_n) \rightarrow (S \rightarrow Bool))))$

then object A is called HIT-attribute.

Each HIT-attribute is an intenzion.

HIT-attribute A is constructed by

   $\lambda wt \; \lambda x_1...x_n \; \iota y \; ([A_{wt}(x_1, ..., x_n)] = y)$ in case (a)
   and
   $\lambda wt \; \lambda x_1...x_n \; \lambda y \; [[A_{wt}(x_1, ..., x_n)] \; y]$ in case (b)

Recording the semantics

- $A / (Wrd \rightarrow (Tim \rightarrow ((T_1, ..., T_n) \rightarrow S)))$

- $A = text_0(S)\ text_1\ (T_1)\ text_2\ (T_2)\ ...\ text_n\ (T_n)\ text_{n+1}$

- where $text_0$ and $text_{n+1}$ can be omitted, only, and **the whole NL expression denotes a function which returns values from S on arguments from the tuple type $(T_1, ..., T_n)$**

- And the corresponding semantic diagram …

Recording the semantics

- A / (Wrd $\rightarrow$ (Tim $\rightarrow$ ((T_1, ..., T_n) $\rightarrow$ (S $\rightarrow$ Bool))))

- A = text_0(S)**-s** text_1 (T_1) text_2 (T_2) ... text_n (T_n) text_{n+1}

- where text_0 and text_{n+1} can be omitted, only, and **the whole NL expression denotes a function which returns values from 2^S on arguments from the tuple type (T_1, ..., T_n)**

  (suffix -s distinguishes from the case (a) and tells us to read the expression using plural)

  And the corresponding semantic diagram …

Example: Operative and Tactical Marketing

- **Name of Sort: *complex solutions producer***

  Type: Kernel

  Super-Type: subject

  An object from the category (#complex solutions producer) is each subject which composes several products and solutions into a complex product. This product the complex solutions producers provide/supply to its customers. Particular solutions or products embedded in this complex product are invisible by their brands to end-customers.

- **Name of Sort:** *customer*

  Type: Kernel

  An object from the category (#customer) is every end customer who is or can be a consumer or user of our services or products. It is an agent acting on the market, which is autonomous and co-operative in a sense of holonic approach, to which attention can be reasonably paid.

- **Name of Sort:** *negotiated deal*

  Type: Associative

  An object from the category (#negotiated deal) is each representation of a relationship between (#solution), (#customer), (#customer pain/need) and (#subject) with the meaning:

  results (text description) achieved by given (#subject) while using given (#solution) for curing given (#customer pain/need) by a sale to given (#customer) / 0,1:0,M

- **Name of Connection:** *2: curing*

  Cardinality: customer pain/need -> solution: 0,M, reversely: 0,M

 Connection between entities customer pain/need and solution with the following meaning

  (#solution)-s curing given (#customer pain/need) / 0,M:0,M

Lesson learnt:

- Try to understand a phenomenon/situation/structure/ environment/behavior/… means:

- Plan and execute a Project

- The crucial part of a definition of the Project is:

- The Objective = Triple Constraint

Lesson learnt:

- **Triple Constraint is**
  - What
  - When
  - For How Much

- **The key part of it is the "What"**

- **The What is described in PM domain by the so called WBS**
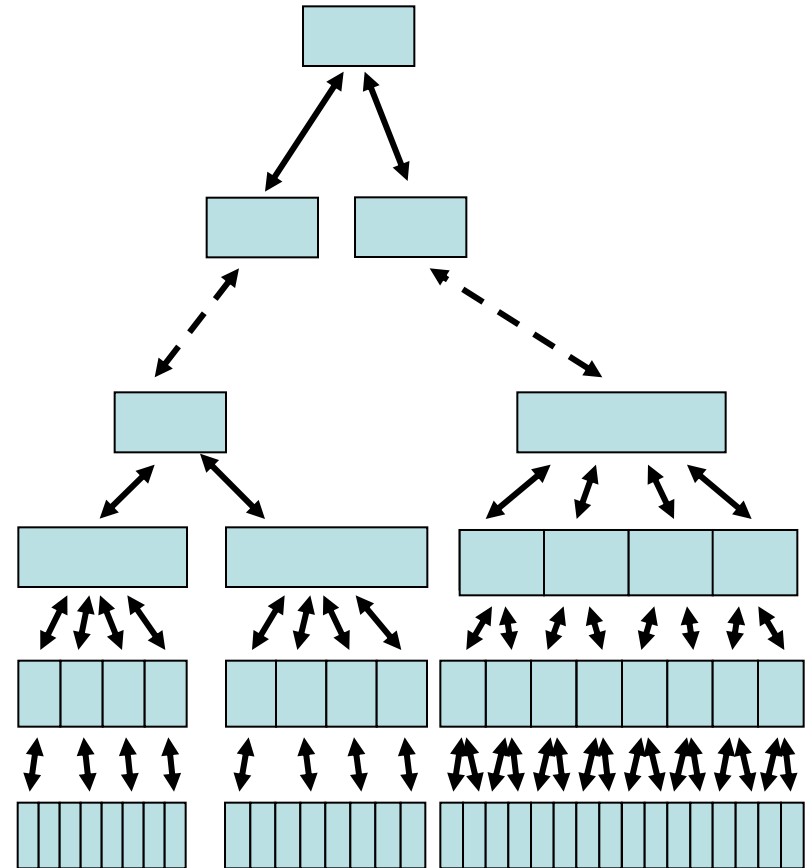
Lesson learnt – the point !

- Conceptual model is a special way to define a "WBS" of the particular problem: "to UNDERSTAND the given DOMAIN".
- This is an objective specification!
- Draw the CM in a form of WBS!

see the model from lesson 1