

Modeling vs Encoding for the Semantic Web

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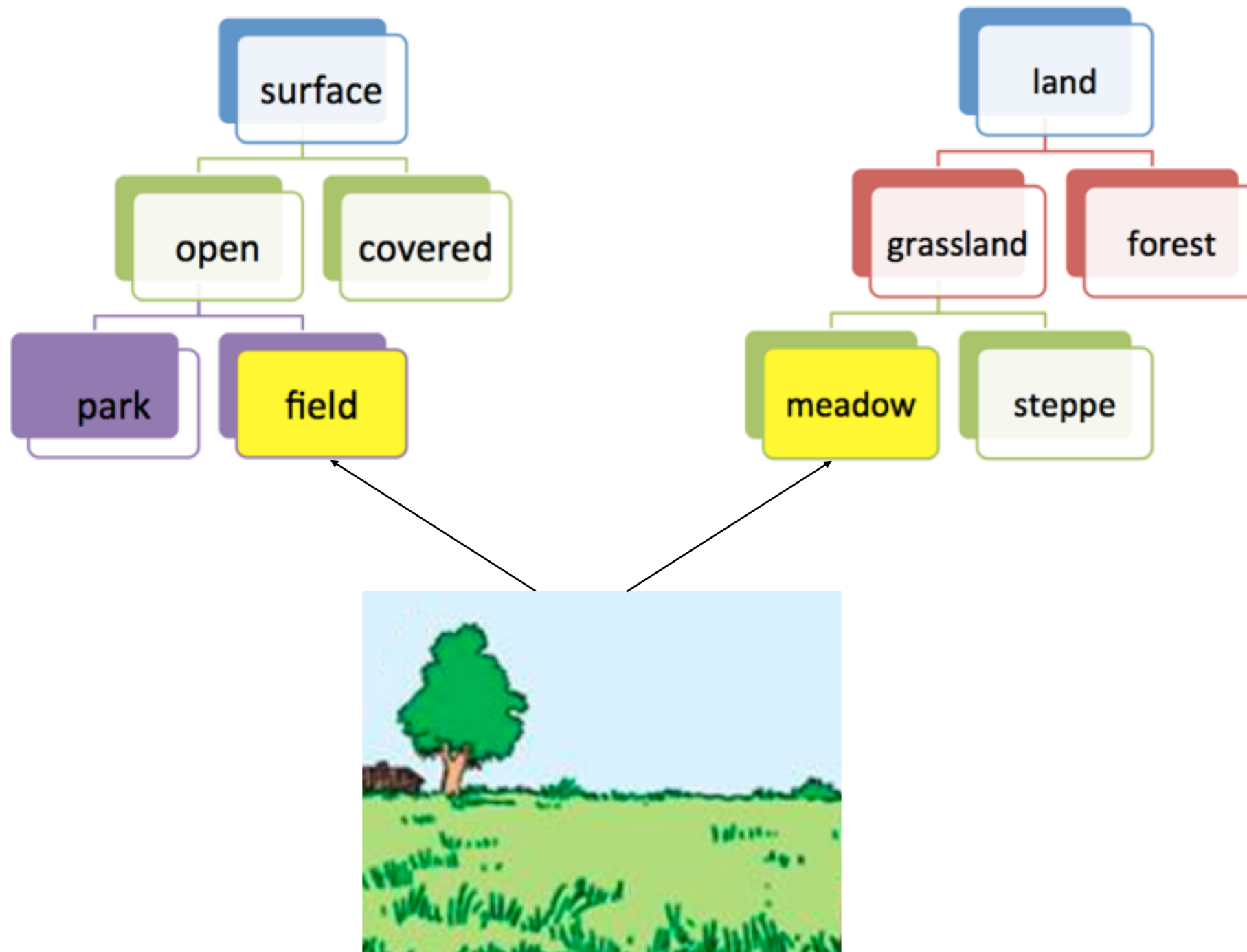
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JEFF
and
PHIL KEANE

“Is this a meadow, a field,
or a vacant lot?”

Integrating spatial information across vocabularies



Claims in the semantic web

Stated

“... ontologies are expected to be used to provide structured vocabularies that explicate the relationships between different terms, allowing intelligent agents (and humans) to interpret their meaning **flexibly yet unambiguously...**” [Horrocks et al., JWS, 2003]

”Technically, Linked Data refers to data published on the Web in such a way that it is machine-readable, **its meaning is explicitly defined, ...**” [Bizer et al., IJSWIS, 2009]

Implicit

- description logic statements are necessary and sufficient to **capture what people mean** when they use vocabularies
- ontology engineers can say something useful about the semantics of vocabularies by expressing themselves in an **encoding** language for machine reasoning
- **decidability** matters in designing semantic models.

How we are “living up” to these claims

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the semantic web bottleneck



How we are “living up” to these claims

meaningful communication

the semantic web bottleneck

concepts

words

predicates

sortals

sets

$\pi \cup \subseteq$

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NUE

throwing semantics out of the window



How we are “living up” to these claims

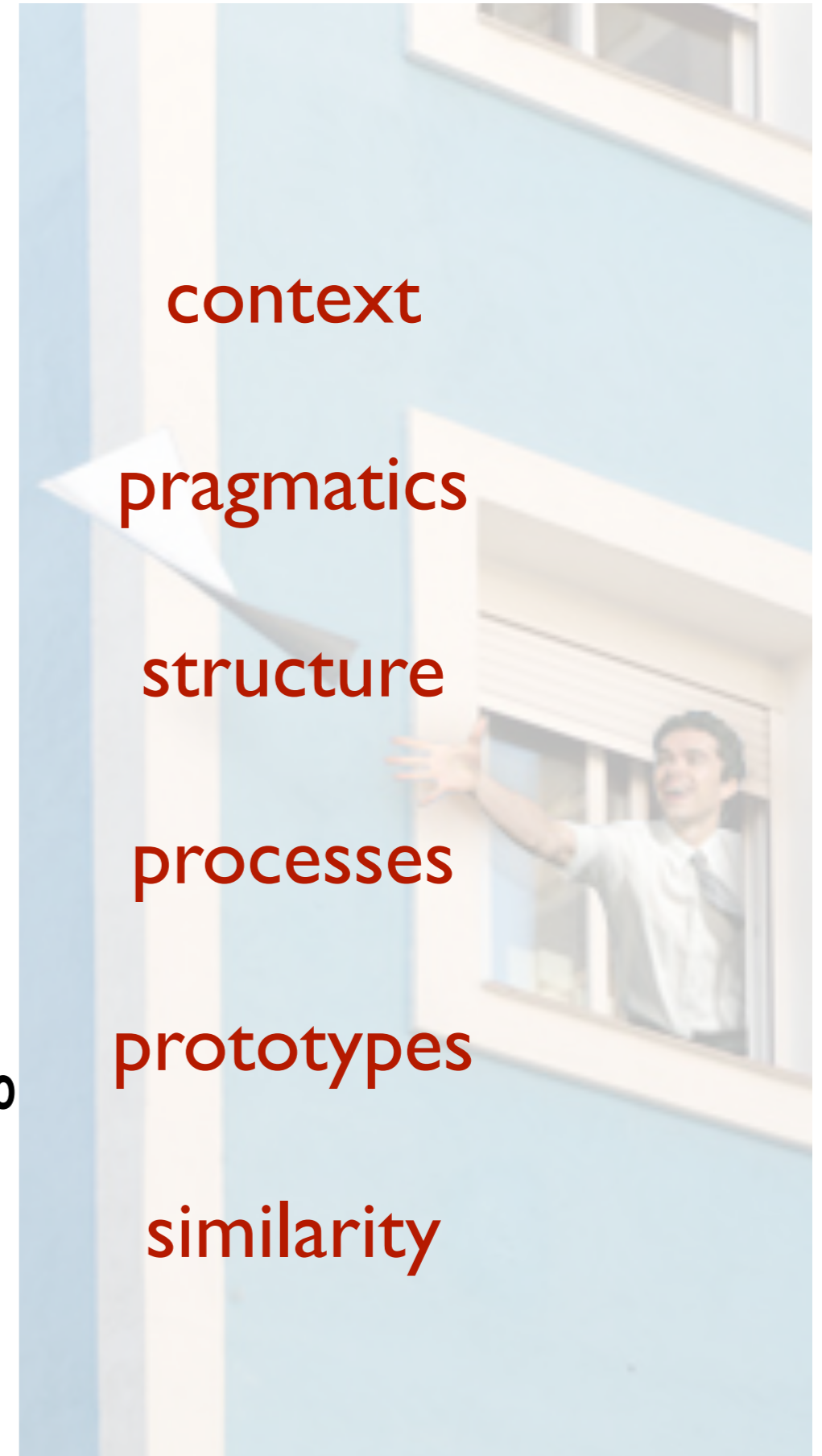
the semantic web bottleneck

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throwing semantics out of the window

context
pragmatics
structure
processes
prototypes
similarity



schema.org

Thing > Place > Landform > Mountain

A mountain, like Mount Whitney or Mount Everest

Property	Expected Type	Description
Properties from Thing		
description	Text	A short description of the item.
image	URL	URL of an image of the item.
name	Text	The name of the item.
url	URL	URL of the item.
Properties from Place		
address	PostalAddress	Physical address of the item.
aggregateRating	AggregateRating	The overall rating, based on a collection of reviews or ratings, of the item.
containedIn	Place	The basic containment relation between places.
event	Event	Upcoming or past event associated with this place or organization.
events	Event	Upcoming or past events associated with this place or organization (legacy spelling; see singular form, event).
faxNumber	Text	The fax number.
geo	GeoCoordinates or GeoShape	The geo coordinates of the place.
interactionCount	Text	A count of a specific user interactions with this item—for example, 20 UserLikes , 5 UserComments , or 300 UserDownloads . The user interaction type should be one of the sub types of UserInteraction .
map	URL	A URL to a map of the place.
maps	URL	A URL to a map of the place (legacy spelling; see singular form, map).
photo	Photograph or ImageObject	A photograph of this place.
photos	Photograph or ImageObject	Photographs of this place (legacy spelling; see singular form, photo).
review	Review	A review of the item.
reviews	Review	Review of the item (legacy spelling; see singular form, review).
telephone	Text	The telephone number.

Acknowledgments to Ross Purves

What I mean by “meaning”



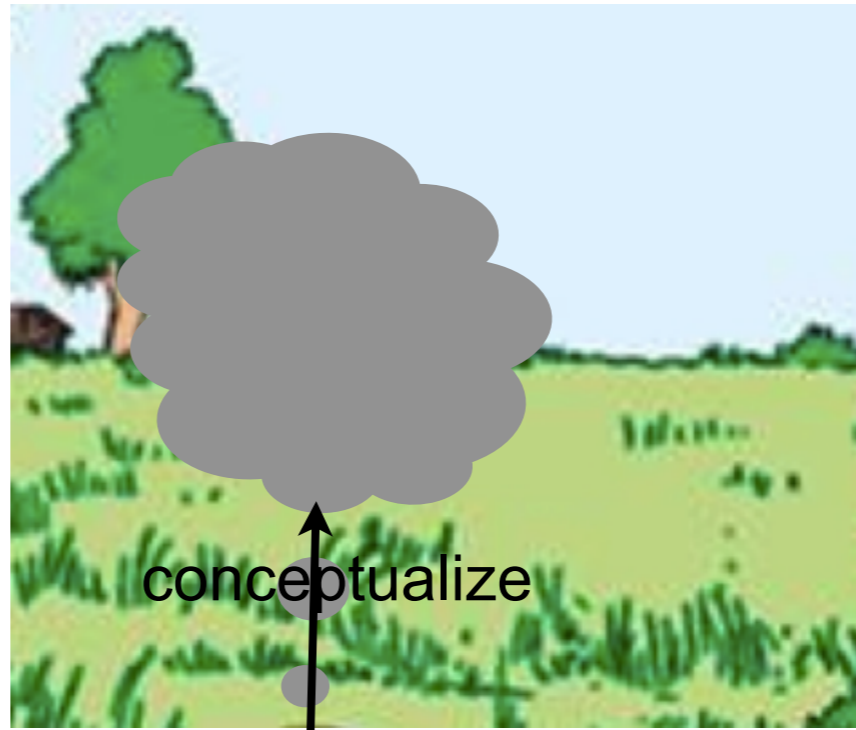
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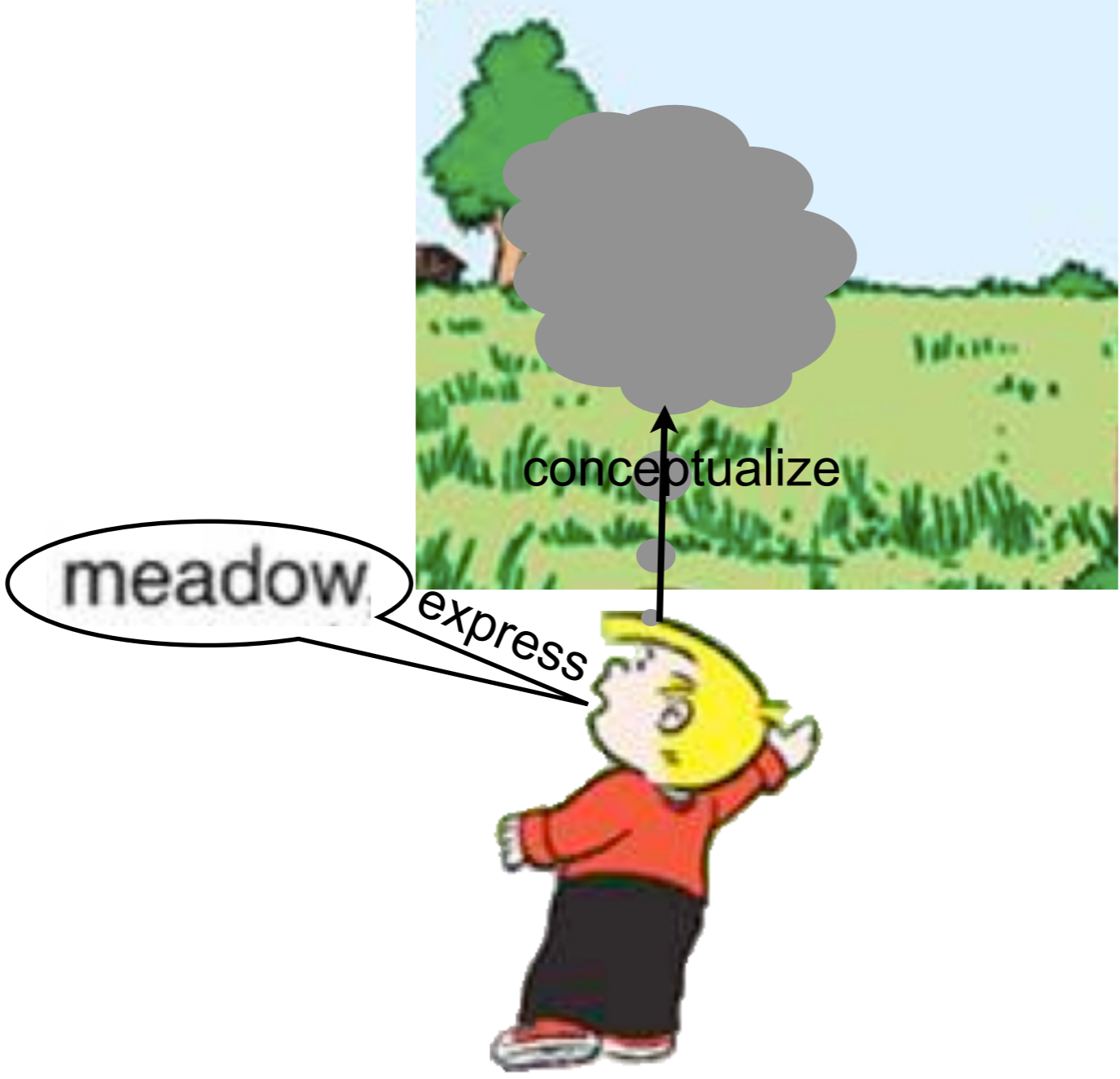
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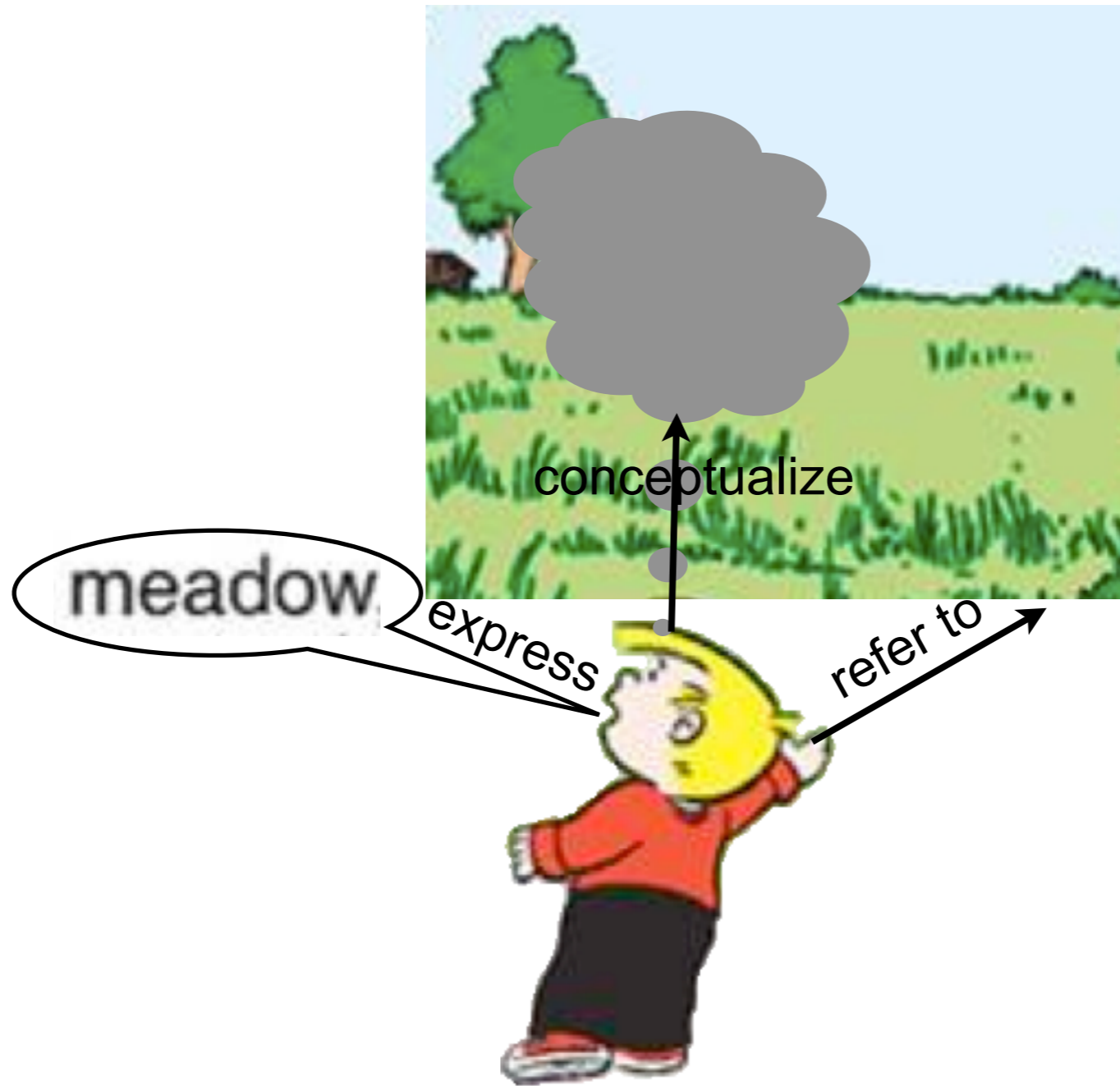
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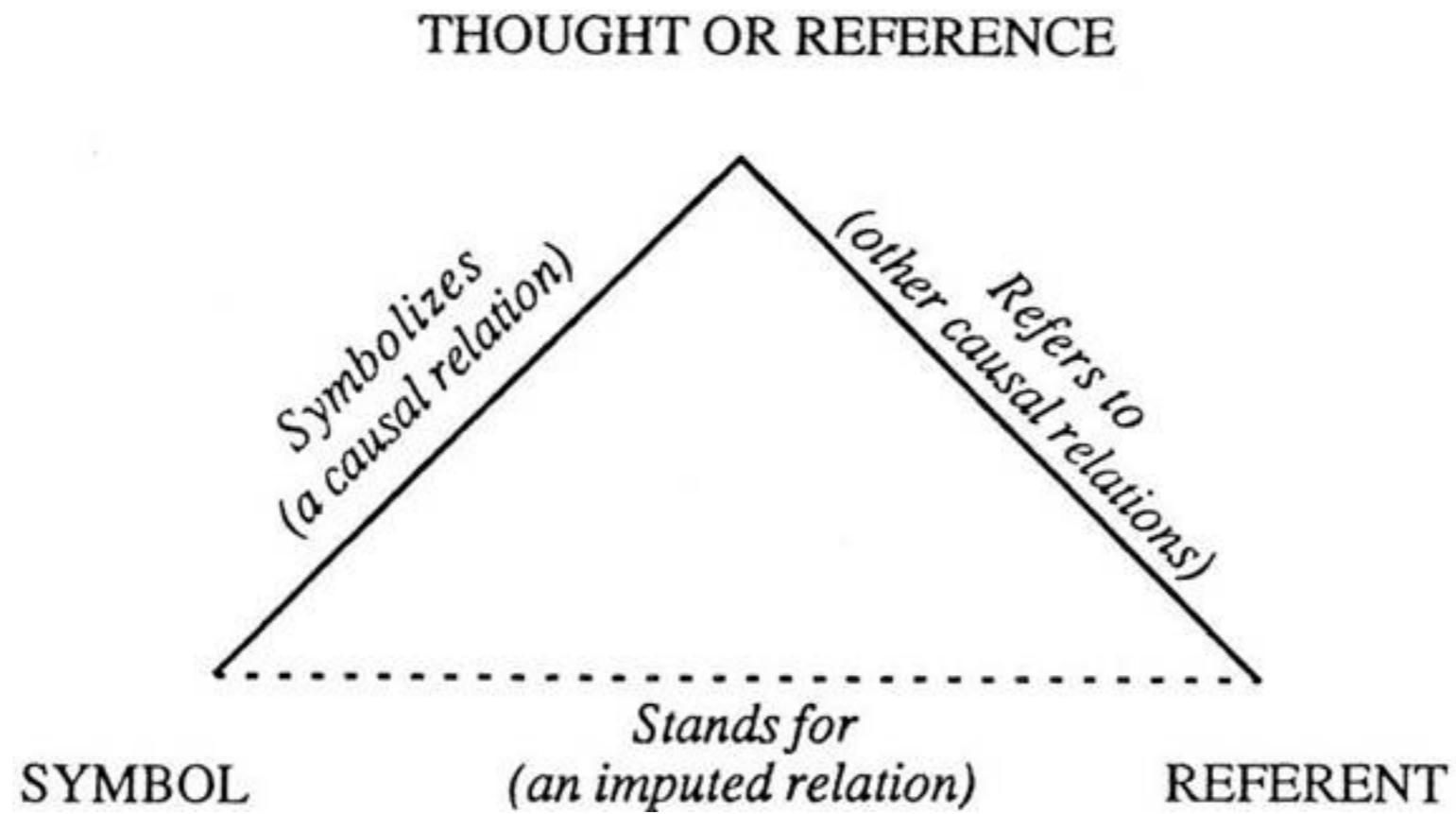
“Is this a meadow, a field,
or a vacant lot?”











The Ogden and Richards (1923) semiotic triangle

Meaning as Process

- meaning is a process, not an object [Putnam 1975]
- “words don’t mean, people do”
- information results from **referring** to things through symbols
- information users **interpret** such references
- information providers can **constrain** such interpretations

meadow := extensively used grassland [CORINE land cover class 231]

**How can
the semantic web
constrain interpretations ?**

The Standard Approach

It is **useful** to ...

- ... equate terms with classes (which are sets)
`class meadow`
- ... assign properties (sets, again) to classes
`meadow hasUse extensive`
- ... declare sub-class (sub-set) relationships
`meadow is-a grassland`

The arguments supporting this approach are based on **formalization** (rather than modeling) requirements.

But ...

It may be **harmful** to ...

- ... equate terms and classes, because terms are used in some contexts (but not in others)
`"is this a meadow or a field?"`
- ... assign properties to classes, because “some do, some don’t”
`myMeadow instanceof meadows`
`myMeadow hasUse intensive`
- ... declare sub-class (sub-set) relationships, because compositionality rarely holds
`grassland hasUse extensive`
`≠ extensive \sqcap grassland`

Resulting discussions about “**correct terminology**” are a waste of time.

Alternative Approach

It is **useful** to ...

- ... document **actual uses of vocabularies** as triples
`triples showing who calls what a "meadow"`
- ... treat these as **inconsequential type declarations**
`same piece of land could be typed "field"`
- ... define **type classes** for shared behavior as ontology patterns
`classes ARABLE, SELLABLE, BUILDABLE, ...`
- ... inherit behavior to types playing **roles**
`type meadow instantiates ARABLE, SELLABLE`
- ... reason with type classes
`field sameAs meadow, if same behavior`

A Modeling Language: Haskell

The standard modern functional language

- clean, higher order type system
- executable algebraic specifications
- multi-parameter type classes

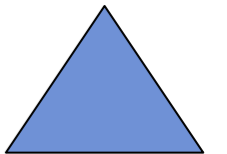
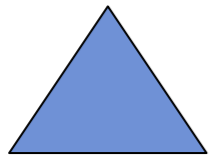
```
class (LINK link from to, SUPPORT from for, SUPPORT to for, CONTAINMENT medium link)  
=> PATH for link from to medium where  
    move :: for -> link -> from -> to -> medium -> for
```

```
instance PATH Car Link Node Node Air
```

What kinds of ontology patterns are useful?

One source: Image Schemata

Example: PATH



One source: Image Schemata

Example: PATH



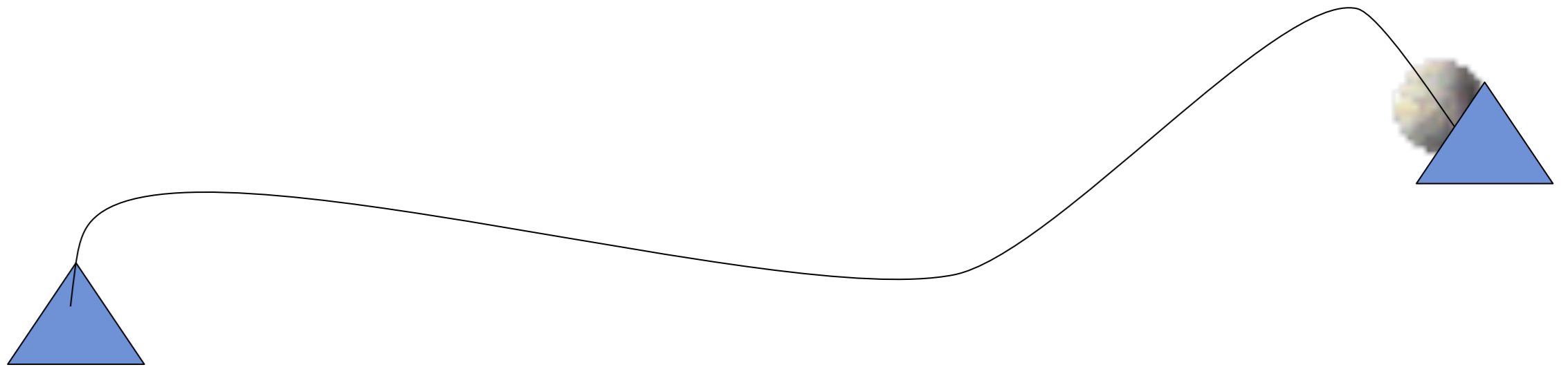
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Example: PATH



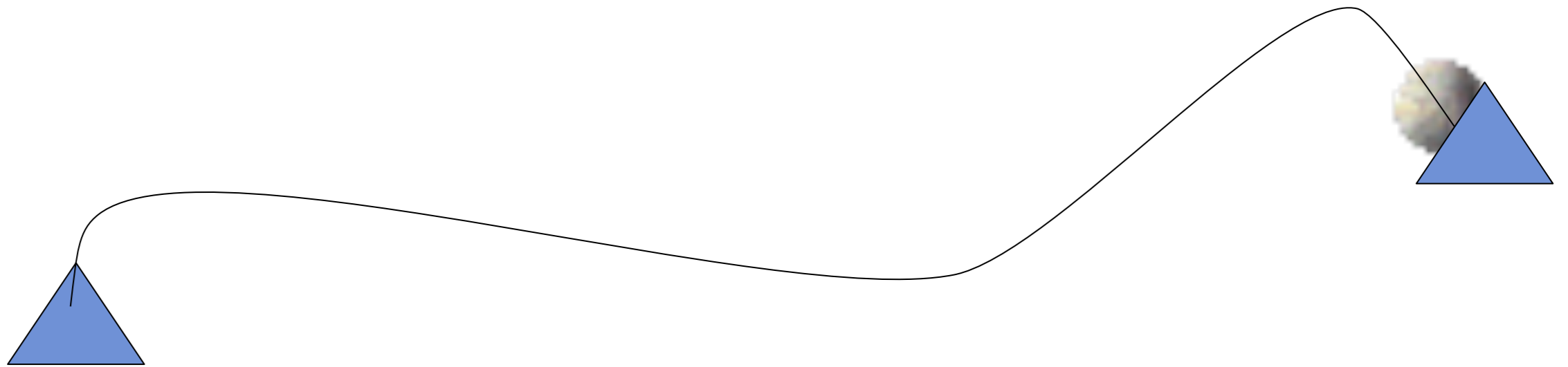
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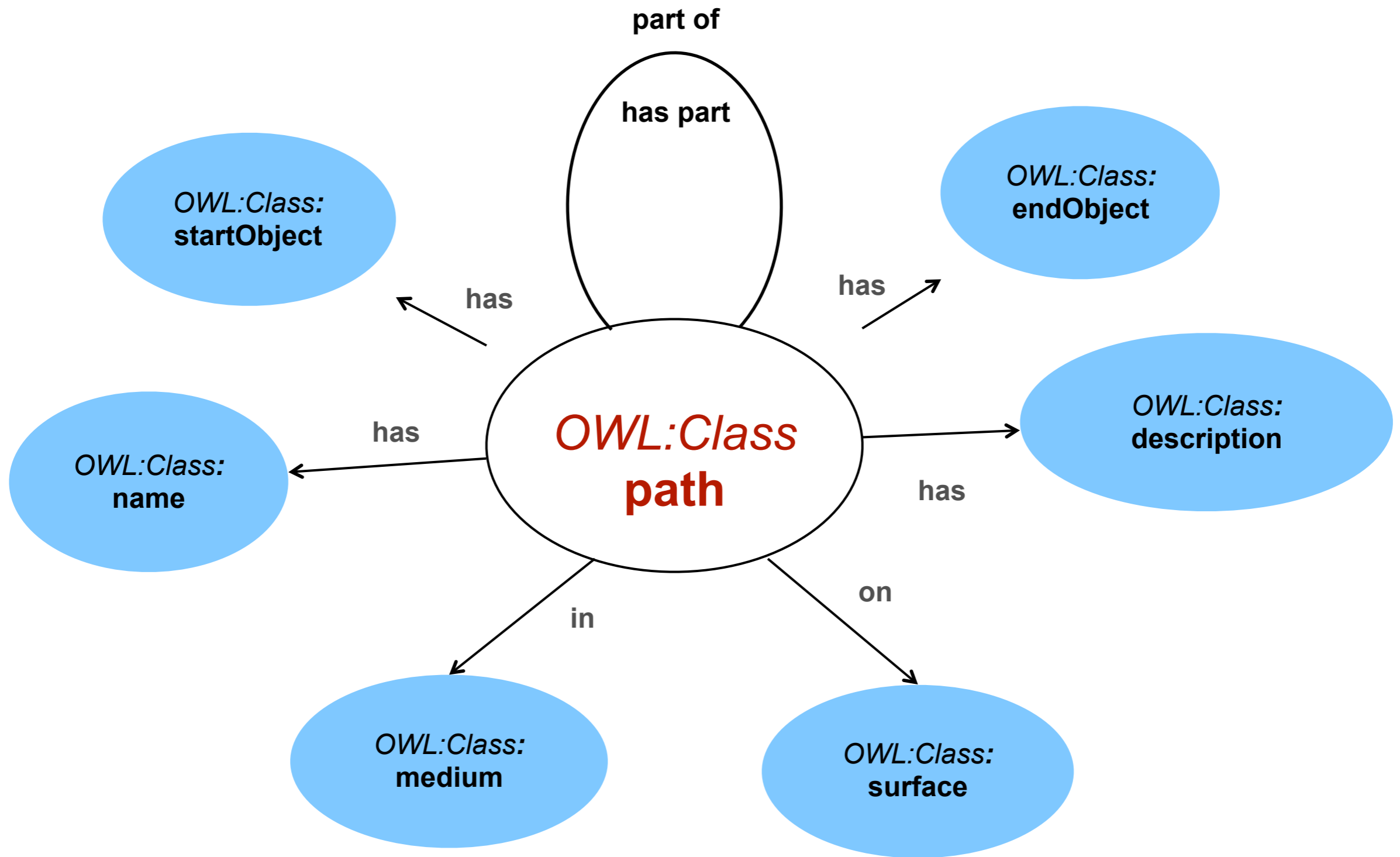


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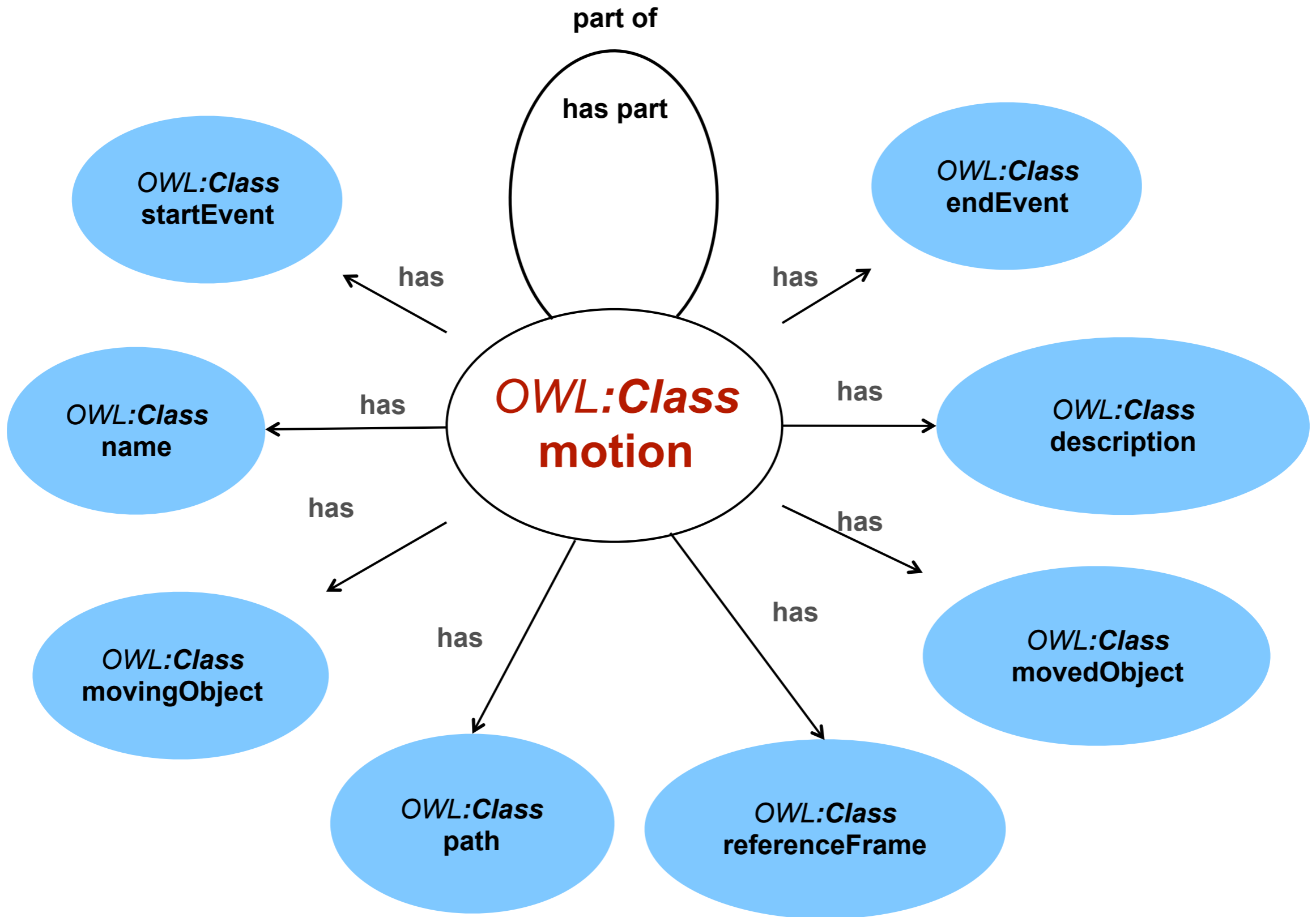
Example: PATH



- structured, invariant, compositional, physically grounded ...
- (re)capture some context, pragmatics, processes, prototypes
- more examples:
link, containment, support, center-periphery, part-whole, ...



Cardinality of all relations [0..m]



Cardinality of all relations [0..m]

Conclusions

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3. I propose to constrain interpretations through second order **type classes** (as ontology patterns).
4. These provide **small theories**, easily combinable, for **big data**.
5. Specifications have started at the GeoVoCamp series (Santa Barbara, Dayton, ...): <http://vocamp.org/wiki/GeoVoCampDayton2012>.



But, will this solve the
fax-number-of-mountains
problem?





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Yes! mountains are
endObjects of PATHs for hiking (not faxing)





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Thank You!