

A socio-cultural ontology for urban development

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Methods for ontology development

- ◆ Ad-hoc
- ◆ Formal concept analysis
- ◆ Psycholinguistics (WordNet)
- ◆ Starting from a thesaurus, a Data Base, a taxonomy or other structured repositories
- ◆ Ontologies alignment
- ◆ Knowledge extraction from texts (text mining)
- ◆ Starting from philosophical categories (e.g. Sowa)

Philosophical paradigms

- ◆ Cognitive science: “knowledge is in the mind of individual persons” (Cyc, WordNet, FrameNet, Mikrokosmos, Sowa ...)
- ◆ Socio-cultural: “knowledge is social, is in communities where people enter in dialogues” (Vygotsky, Engeström, Stahl ...)

Why a socio-cultural paradigm?

- ◆ Cognitive science and artificial intelligence problems
- ◆ Considering socio-cultural issues in urbanism
- ◆ Supporting dialogism
 - Group knowledge construction
 - Conflict resolution
 - Reaching common meaning through dialog

Methodology

◆ Combination of

■ Pierce's categories

- ◆ Individuals
- ◆ Relations
- ◆ Triples

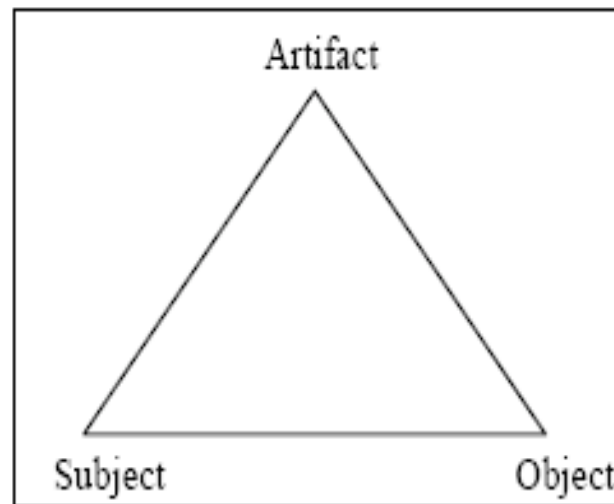
■ Engeström's theory of activity

■ Hewit's use of triangles in Engeström's diagram

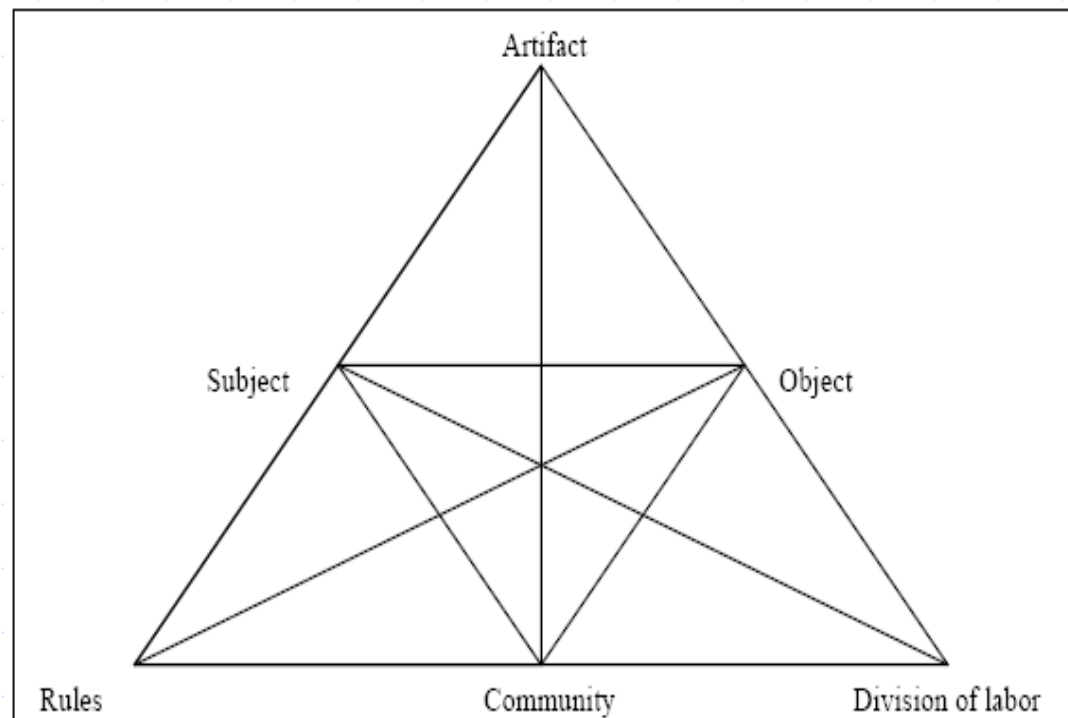
Basic Categories in Sowa's Ontology (including Pierce's categories)

	Physical		Abstract	
	Continuant	Occurrent	Continuant	Occurrent
Independent	Object	Process	Schema	Script
Relative	Juncture	Participation	Description	History
Mediating	Structure	Situation	Reason	Purpose

Vygotsky's mediating triangle



The activity diagram of Engeström



1. Individuals

- ◆ Subjects
- ◆ Objects
- ◆ Communities
- ◆ General artifacts
- ◆ Social rules
- ◆ Division of labor

Subjects

- ◆ may be classified in several ways, considering different aspects: earnings, social status, ethnicity, age, hobbies, religion, etc.
- ◆ these aspects may be either the basis of a taxonomy of concepts or of attributes. For example, a person that has a habit of walking in a park may either be a new concept, which inherits from the subject concept, or an instance of the subject having “walking in a park” as the habit attribute.

Objects

- ◆ buildings, roads, parks, cars, etc.
- ◆ each of these concepts may be the root of an entire ontology. For example, buildings may be classified in living houses, offices buildings, theaters, cinemas, sport halls, hospitals, factories, shops, etc.

Communities

- ◆ may be classified in the socio-cultural ontology according to several criteria, some of them derived from subjects' attributes like religion or ethnic group.

General artifacts

- ◆ may be physical (tools, objects with a given use, that means that a sub-concept of the object category may be meanwhile a sub-concept of the artifact category),
- ◆ symbolic (texts, prices, taxes)
- ◆ mental (e.g. imagery, visual patterns, architectural styles).

Social rules

- ◆ may be legislation, traffic rules, unwritten behavior laws or esthetics.
- ◆ Rules may also become artifacts (sub-concepts of the rule category may be also sub-concepts of the artifact category), used by objects in communities.

Division of labor

- ◆ is a basis for the taxonomy of services that assure the functioning and the quality of life of communities (providers of electricity, water and gas, teaching, police, fire department, administration, etc.)

2. Relations

subject – object (owned buildings and cars)

subject – rules

subject – community

community – rules

community – object (e.g. buildings, cars, parks)

community – divisions of labor (e.g. roles)

community – artifacts (e.g. beliefs, documents like acts)

object – artifact (property acts, blueprints)

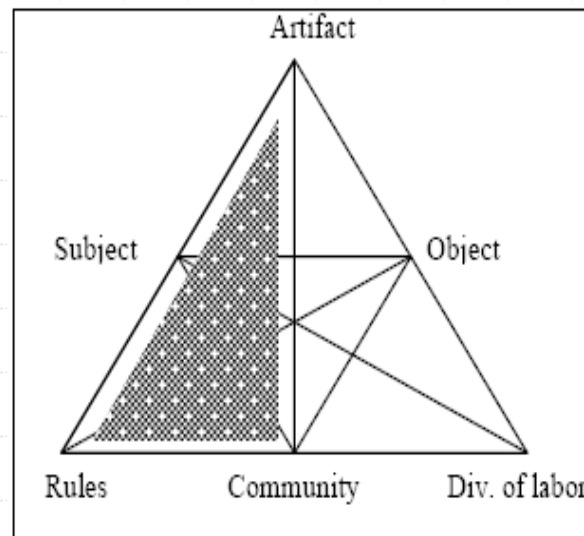
object – subject (owner)

object – rule (of use)

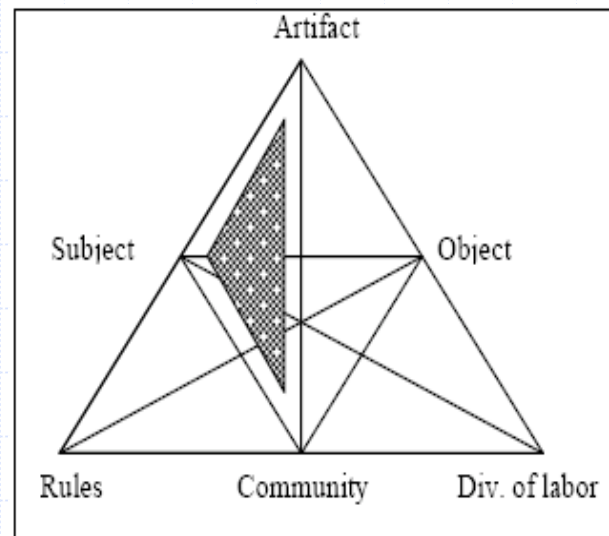
3. Triples

- ◆ May be triangles in the activity diagram
- ◆ Other mediating artifacts

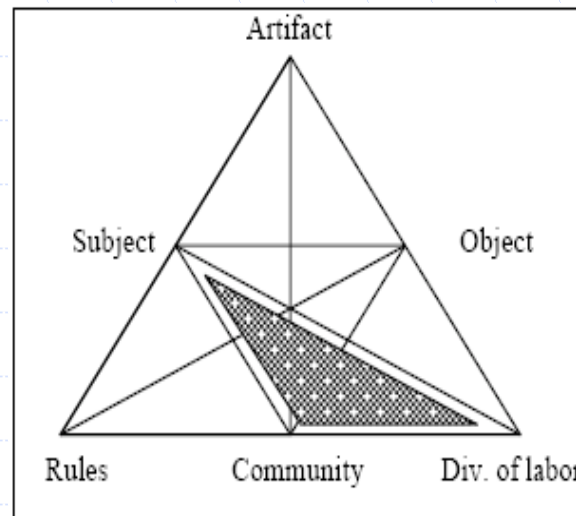
Image of rules in communities



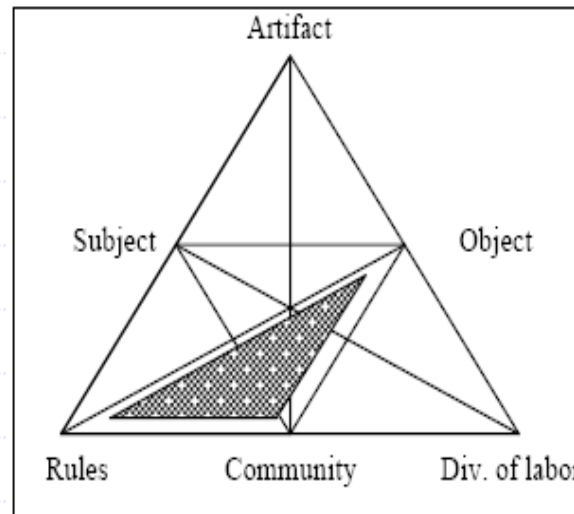
Artifacts of subjects in communities



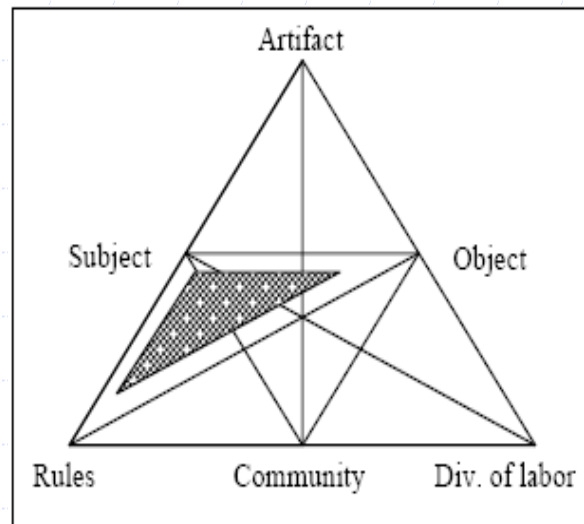
Roles of individuals in a community



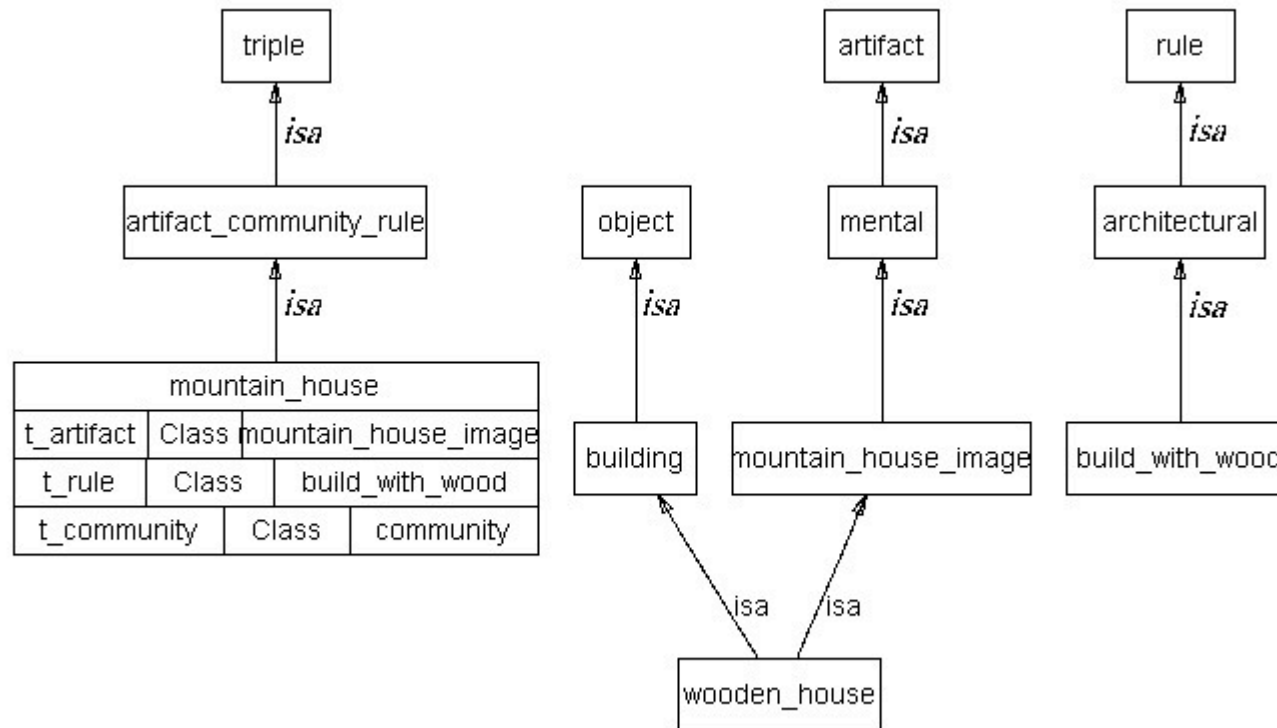
Rules for objects' use in a community



Rules (laws) that apply to an individual in relation to an object



The “mountain_house” “artifact_community_rule” triple and some related concepts.



The OWL description of the mountain_house concepts.

```
<owl:Class rdf:ID="mountain_house">
  <rdfs:subClassOf rdf:resource="#artifact_community_rule"/>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:hasValue rdf:resource="#build_with_wood"/>
      <owl:onProperty>
        <owl:ObjectProperty rdf:ID="t_rule"/>
      </owl:onProperty>
    </owl:Restriction>
  </rdfs:subClassOf>
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty>
        <owl:ObjectProperty rdf:ID="t_artifact"/>
      </owl:onProperty>
      <owl:hasValue rdf:resource="#mountain_house_image"/>
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```

The OWL description of the t_community property.

```
<owl:ObjectProperty rdf:ID="t_community">
  <rdfs:domain>
    <owl:Class>
      <owl:unionOf rdf:parseType="Collection">
        <rdf:Description
          rdf:about=
            "http://www.w3.org/2002/07/owl#Thing"/>
        <owl:Class rdf:about="#mountain_house"/>
      </owl:unionOf>
    </owl:Class>
  </rdfs:domain>
</owl:ObjectProperty>
```

Further work

- ◆ Develop the socio-cultural ontology
- ◆ Develop software for conflict management in dialogs, based on ontologies
- ◆ Ontology extraction from dialogs
- ◆ Ontology-based applications for urbanization in Romania