A Classification-Based Framework for Learning Object Assembly

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Overview

- Background and Introduction
- The CASE Framework
- Learning Object Assembly
- Learning Object Classification
- Evaluation
- Conclusion and Future Work

Introduction

- Closed sets of properties are a requirement for automatic classification and aggregation learning objects into complex assemblies
- Our work is based on the derivation of learning object properties from situated framework and subsequent methods for aggregation motivated by learning outcomes
- We propose an algebraic framework for constructing learning object assemblies using situated properties, including classification and comparison
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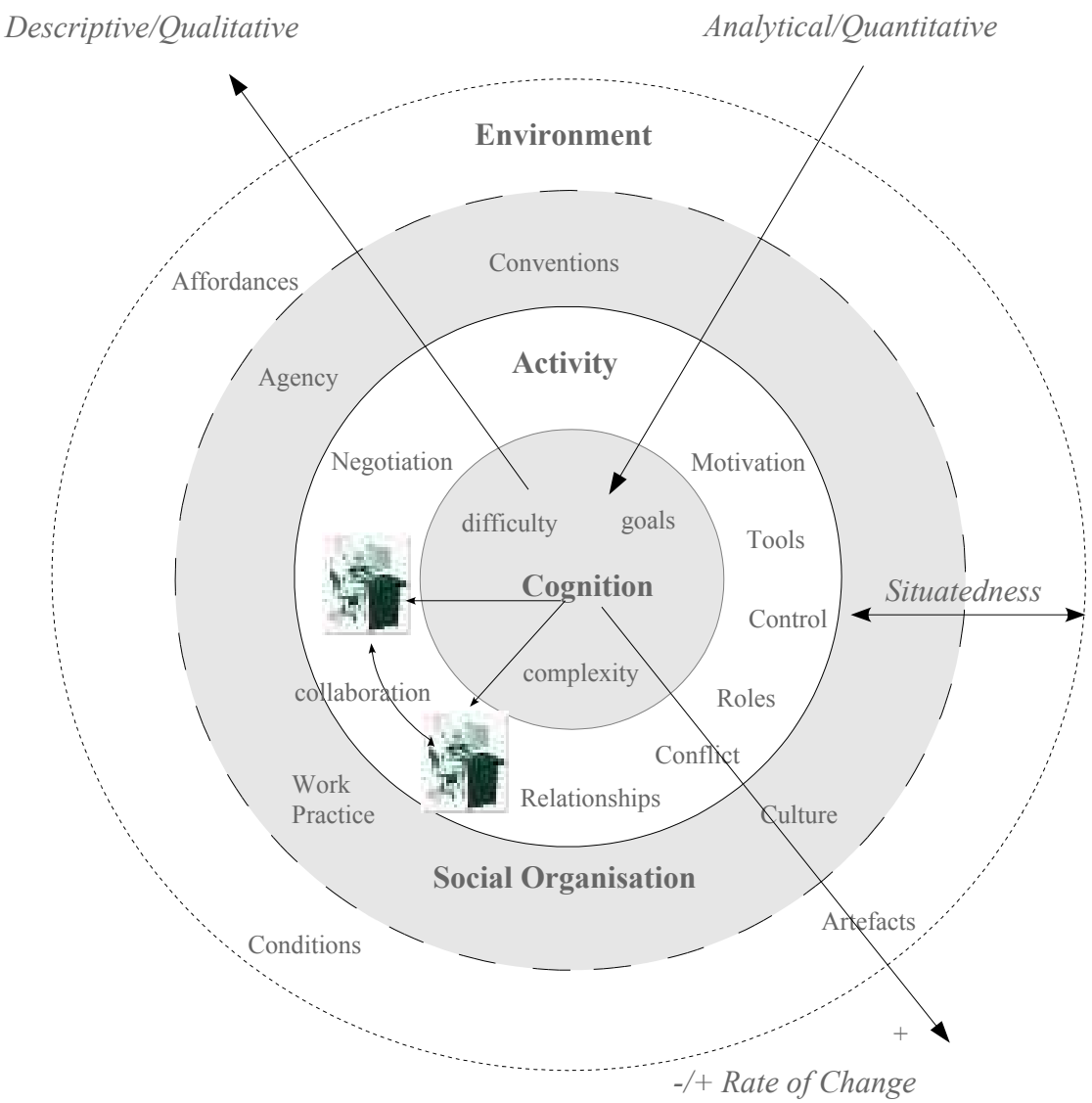
The CASE Framework (2)

- **Cognition** consists of 2 primary factors: task complexity and difficulty. These impact creation and maintenance of:
  - conscious subject goals
  - unconscious subject actions (habituated)
- **Activity** captures tool-mediated subject-motivated interaction based on Activity Theory
- **Social Organisation** emphasises culture, conventions, agency
- **Environment** is concerned with affordances, artefacts and conditions

The CASE Framework (2)



Farmer & Hughes, ICALT 2005

Learning Object Assembly

- A learning object has situational properties imbued by CASE, vis: *Obj(C,A,S,E)*
- Each CASE property has sub-properties, p_k, vis: $Obj(C(p_k),A(p_k),S(p_k),E(p_k))$
- Multi-component learning object assemblies exhibit aggregate properties, vis:

$$A \equiv \sum_{i=1}^{n} Obj_i(C(p_k),A(p_k),S(p_k),E(p_k))$$

- Sets of objects can be described in terms of their proposed learning functions and *a priori* conditions

Outcomes of Learning Object Assembly

- Learning object assembly can be performed in a number of different ways depending on the task
  - finding assemblies of learning objects which meet a defined learning outcome
  - grouping learning objects by similar or different property sets
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  - excluding learning objects from assemblies based on properties
  - deriving ranked lists of objects meeting certain requirements based on properties
  - performing preferential object selection based on a property-based weighting scheme

Similarity in Learning Object Assemblies

- Evaluating similarity and difference involves a number sub-processes
  - Explore similarity or difference between learning objects based upon the socio-technical CASE properties of learner-computer interaction
  - Evaluate structural similarity or difference between individual learning objects
  - Evaluate semantic similarity or difference between individual learning objects
  - Evaluate the content similarity or difference between learning objects
- Formal algebraic representations for these processes, using simple Euclidean distance measures and weighting

Evaluation of Contribution

- Inherent assumptions
  - attributes of a learning object can be reduced to numerical representations
    - similar to standard data clustering approaches from which we can adopt techniques
  - each learning object has a homogeneous set of attribute types and properties
- Potential benefits
  - Formalism is independent of other sub systems and implementations
  - Aggregation technique bridges system design and instructional and learning theory (Wiley, 2002)
  - Enables component re-use by providing an evaluation and assessment framework for assemblies of learning objects vis-a-vis learning outcomes

Conclusion

- Need for a closed set of properties and formal framework which can be applied to describe, classify and manipulate learning object assemblies
  - formal frameworks for properties and assembly are required for advancement beyond hand-assembled collections of learning objects
- Transformation of abstract properties from CASE into discrete attribute-value pairs for metadata schema incorporation is a current activity
- Classification weighting based on filtering, user preferences, history motivates current work on optimisation

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