On the Purpose of Object-Oriented Analysis

The What and How of what

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What is this about?

A critical look at:

- The relationship between OOA and OOD, and the pre-requisites for a smooth transition to design.
- The relationship between Analysis, Conceptual Modeling, and Requirements Engineering.
- Suitability: The role of objects in analysis.
What is analysis?

[Rubin and Goldberg]:

“Analysis is the study and modeling of a given problem domain, within the context of stated goals and objectives. It focuses on what a system is supposed to do, rather than how it is supposed to do it [...] . The components of the problem domain can be described as anything that the end users of the system, both humans and machines, view as part of the problem context.”

- The What and How of what
- The Problem or the Solution
[Adopted from Henderson-Sellers / Edwards, CACM-9-90]

User Requirements
Analysis

User Requirements
Specification

Software Requirements
Specification

System / Broad Design
Logical Design

Program / Detailed Design
Physical Design

what

ANALYZE

how

DESIGN
Problem-orientation:

Judgement criteria for analysis methods:

- Close to user concepts and terminology.
- Requirements, not solutions.
- Total system goals and objectives, not only computerized parts.

Problem-oriented

Target-oriented

[Hagelstein]
Claims of OOA:

1. OOA fulfills the purpose of Analysis, and
2. OOA has a smooth transition to Design.

Why:

- Adequate representation of real-world concepts, and
- a uniform modeling language.
Adequate Representation:

Depends on Domain, Goals, and Objectives.

- **Objects:**
  - Interaction-oriented systems.
  - Complex structures.

- **Processes:**
  - Functionality.
  - Flow of items.

- **Rules:**
  - Goals.
  - Constraints.
Uniform Modeling Language:

- Does not imply a uniform *Model*,
- thus, *Guidelines* must be provided.

“Uniform” does not mean “Good”

- Different objectives imply different languages.
- Analysis: Problem, Requirement Engineering.
- Design: Solution, Software Engineering.
- Uniform language: Which language to choose?
Does OOA fulfill the role of Analysis?

No, because of these “soft” problems:

- Assume pre-existing requirements.
- Lack of goals, objectives, alternative solutions, and organizational aspects.
- Target-orientation: Early focus on the system to be implemented.
- Validation has not been properly addressed.
- Lack of guidelines for the transition to design.

No, because of limitations in the “paradigm”:

- OO modeling languages are not sufficient for representing real-world concepts.
Does OOA have a smooth transition to Design?

Not necessarily, depends on goals and objectives:

- Yes, by considering the target system while doing analysis.
- Yes, at the cost of a possibly inferior analysis.

Our claim:

- Different objectives of analysis and design => different results.
- No smooth transition.
- Guidelines must be provided.
Conclusion.

- “No free lunches”
  - OOA do not satisfy both adequate analysis and a smooth transition to design.
  - Guidelines must be provided.

- Adequate representation:
  - “Objects” not sufficient.

- We recommend:
  - Analysis should be judged by different criteria than design.
  - Synthesis of paradigms.
  - Opening the “Gap” - again.
The scope of Analysis:

- Application domain knowledge.
- Objectives.
- Requirements on the environment.
- Requirements on the computer system.
Requirements to the Analysis Language:

- **Suitability:**
  
  “The ability of the language to easily describe the appropriate knowledge.”

- **Understandability:**
  
  “How the appropriate knowledge is presented.”

- **Formality:**
  
  “Well defined semantics.”
What is OOA?

“We define system analysis as the study of a specific domain of interacting objects for the purpose of understanding and documenting their essential characteristics.” [Embley et.al.]

Analysis with objects as the main building block:

- Object = identity + encapsulated state + interface

Characteristics of OOA:

- Domain Analysis and Reuse.
- Prototyping and Iterative Development.
OOA and the life-cycle:

Iterative Development:

- Validation: Rapid prototyping.
- Conceptual modeling: Still needed.

Domain analysis:

- Frameworks: Implementing a design.
- Domain-specific class hierarchies.
- Conceptual models.

<=> well known domains.
The model perspective

Adequate representation?

Traceability

Isomorphism?

Real-world

Validation

End-user

Real-world model

Veri®cation

Software model

SW-engineer
Guidelines must be provided:

- How to re-evaluate object properties.
- How and when to add and remove objects.
- How to deal with requirements not captured by the modeling language.
- Traceability of requirements.
When to use OOA

- When the requirements are given.
- Well known problems or domains.
- Small systems.
- Systems not involving organizational change.
- Complex product structures.
- Modeling interacting components.
Possible directions for OOA

- OOA incorporates requirements engineering, no implications for concepts and modeling language (OBA).
- Extend OOA concepts and modeling language (Embley et.al).
- “Kill the OO prefix”: Synthesis of paradigms.
Representing reality:

- A house sending messages to its rooms?
- Is a student a kind of person, or is it a person that plays the role student for some time?
- Is a “purchase” an object, event, or activity?
- Continuous flow as messages?