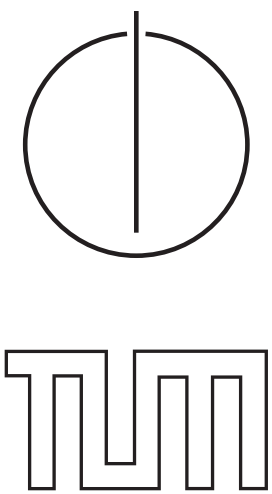
Intelligent Support for non-linear Serious Games

Bachelor's Thesis in Computer Science



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Outline

Problem Statement

- Education in general lacks technology
- Traditional instruction is not engaging enough for the “digital natives” [Van Eck, 2006]
- Design for the average user is not always the best solution [Bailey, 1982]

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Hypothesis:

Detecting problems during the learning process (with a non linear serious game) and adapting the game accordingly can enhance learning even more.

Serious Games

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Serious games are ...

"a mental contest, played **with a computer** in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives." [Zyda, 2005]

Non Linear Games

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- No strict storyboard to follow
- The player has more/full freedom
- Highly immersive (feeling of "being there" [Psotka, 1995])
- Educational importance: immersion supports learning [Zimmerman, 2000, Seah and Cairns, 2008]

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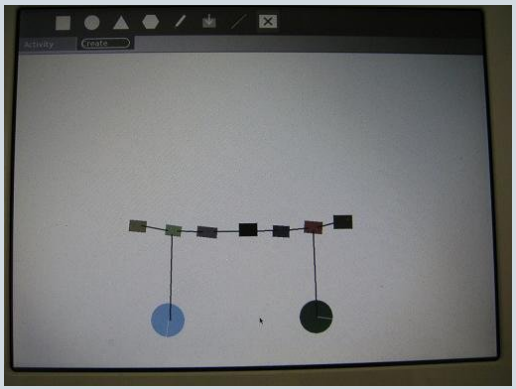
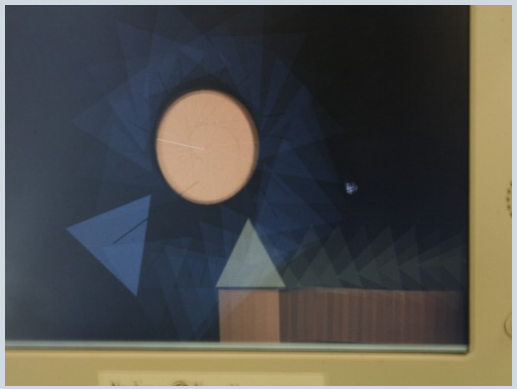
Other terms:

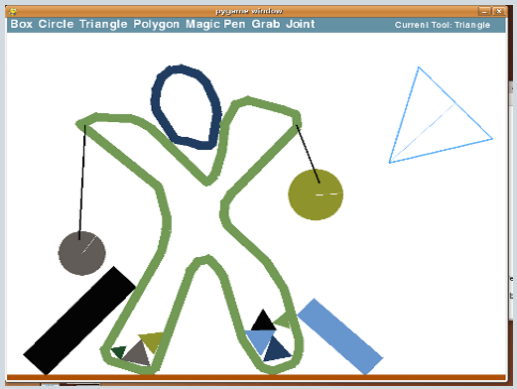
Open-World Games, Open-Ended Games, Sandbox Games or Exploratory Learning Environment

Non Linear Serious Games - Examples

Physics







Non Linear Serious Games - Examples

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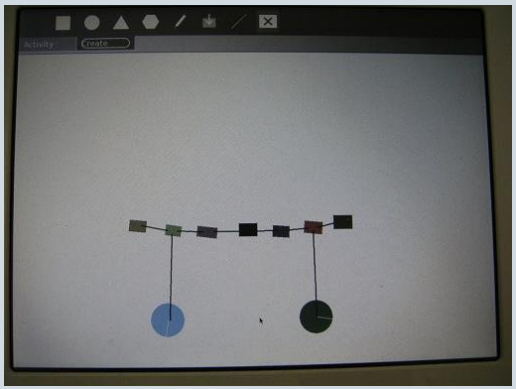

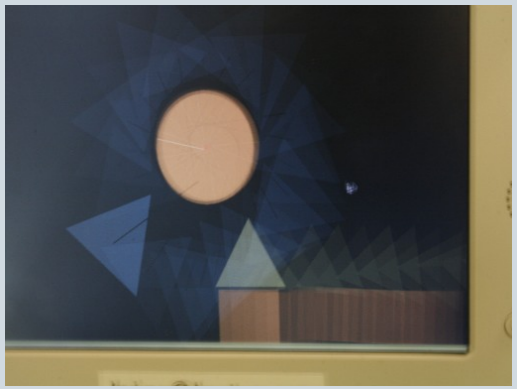

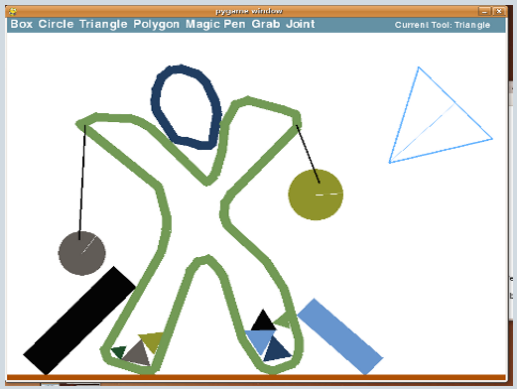

Food Force

Pedagogical Agents I

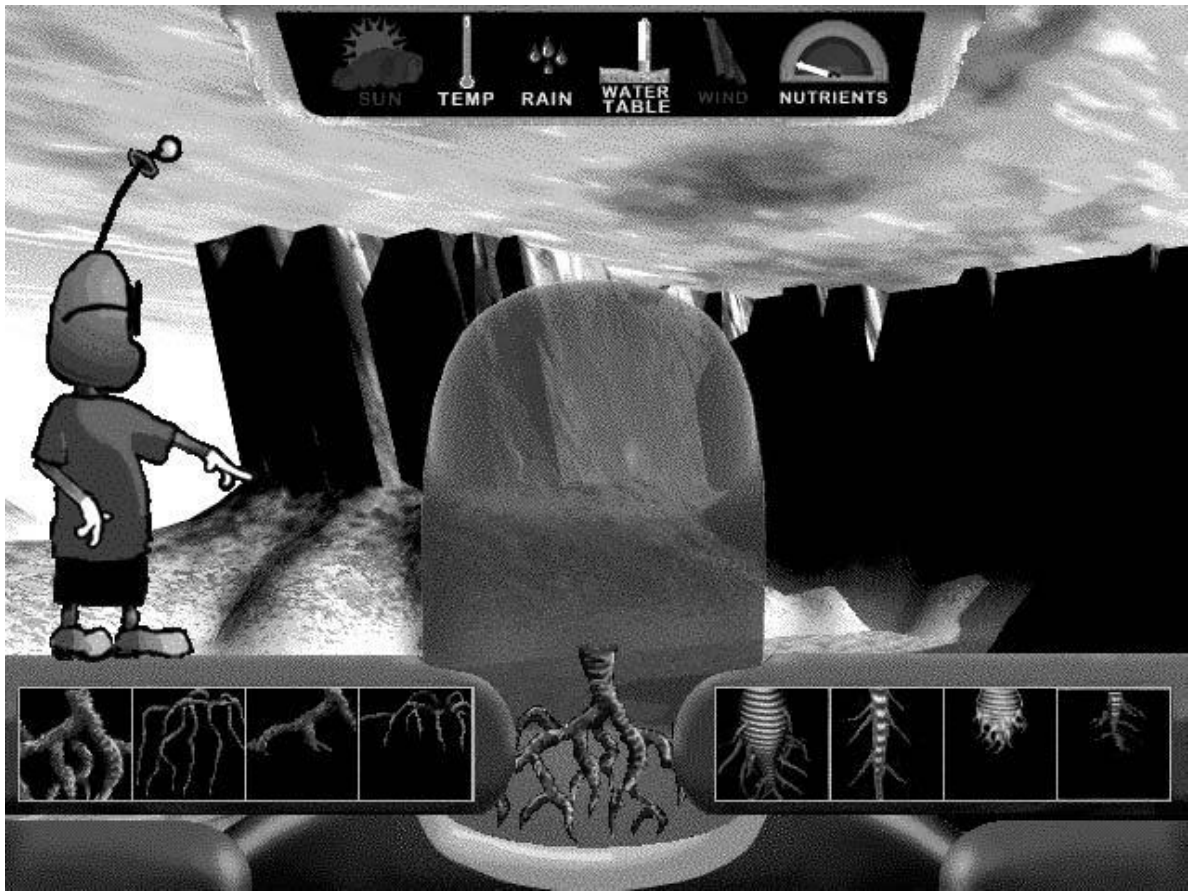

Figure: Herman the Bug, a Pedagogical Agent [Lester et al., 1997]

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Moreno et al.

Pedagogical agents can "promote constructivist learning in a discovery-based learning environment" [Moreno et al., 2000]

Intelligent Learning Framework

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Goals:

- Collect and analyze the learners actions during gameplay
- Detect problems and general behavioral patterns

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- Collect and analyze the learners actions during gameplay
- Detect problems and general behavioral patterns
- Give feedback to the learner
- “Support” the learning process
- Allow different pedagogical approaches

Use Cases

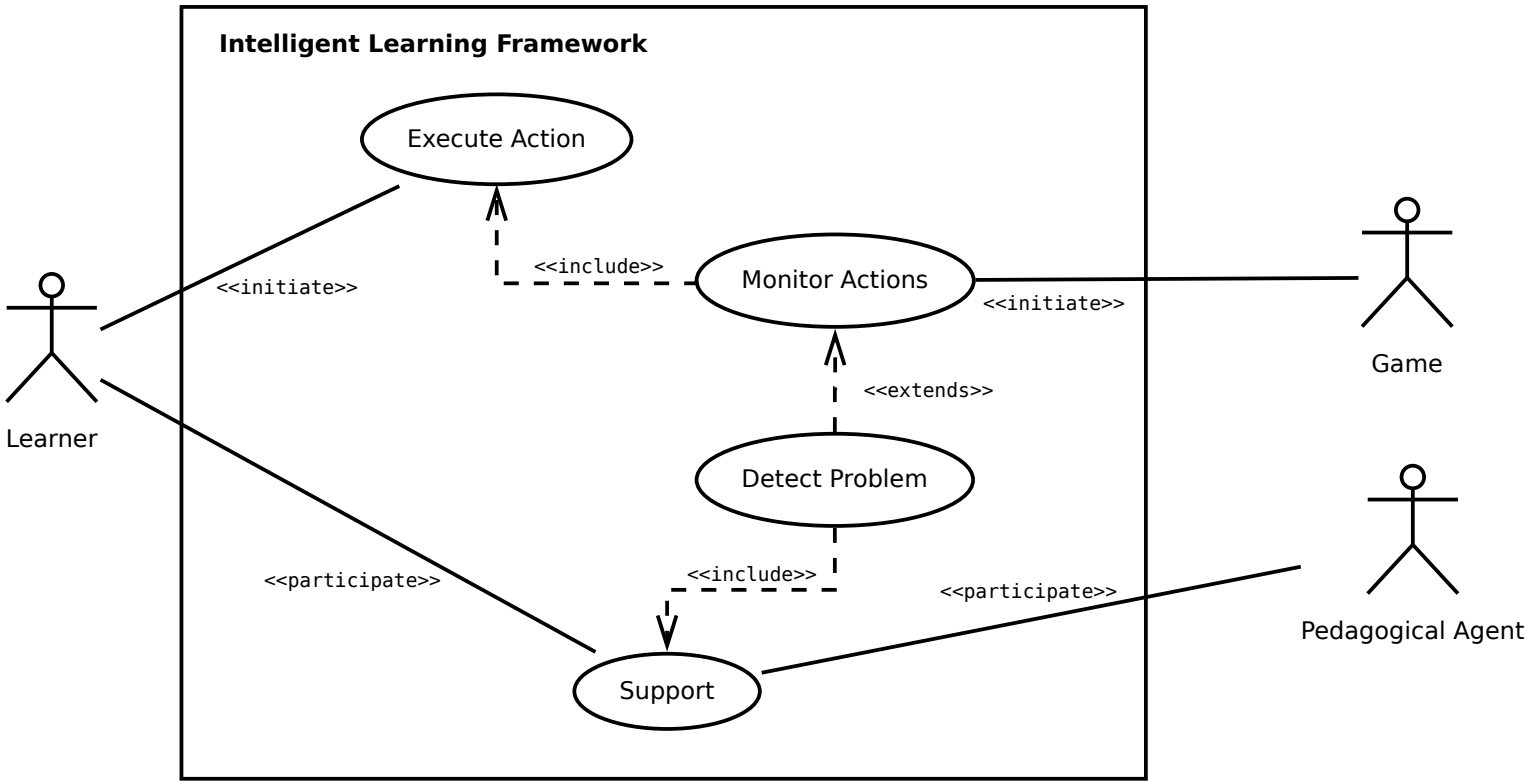

Figure: Main use cases (UML use case diagram)

Flow of Events

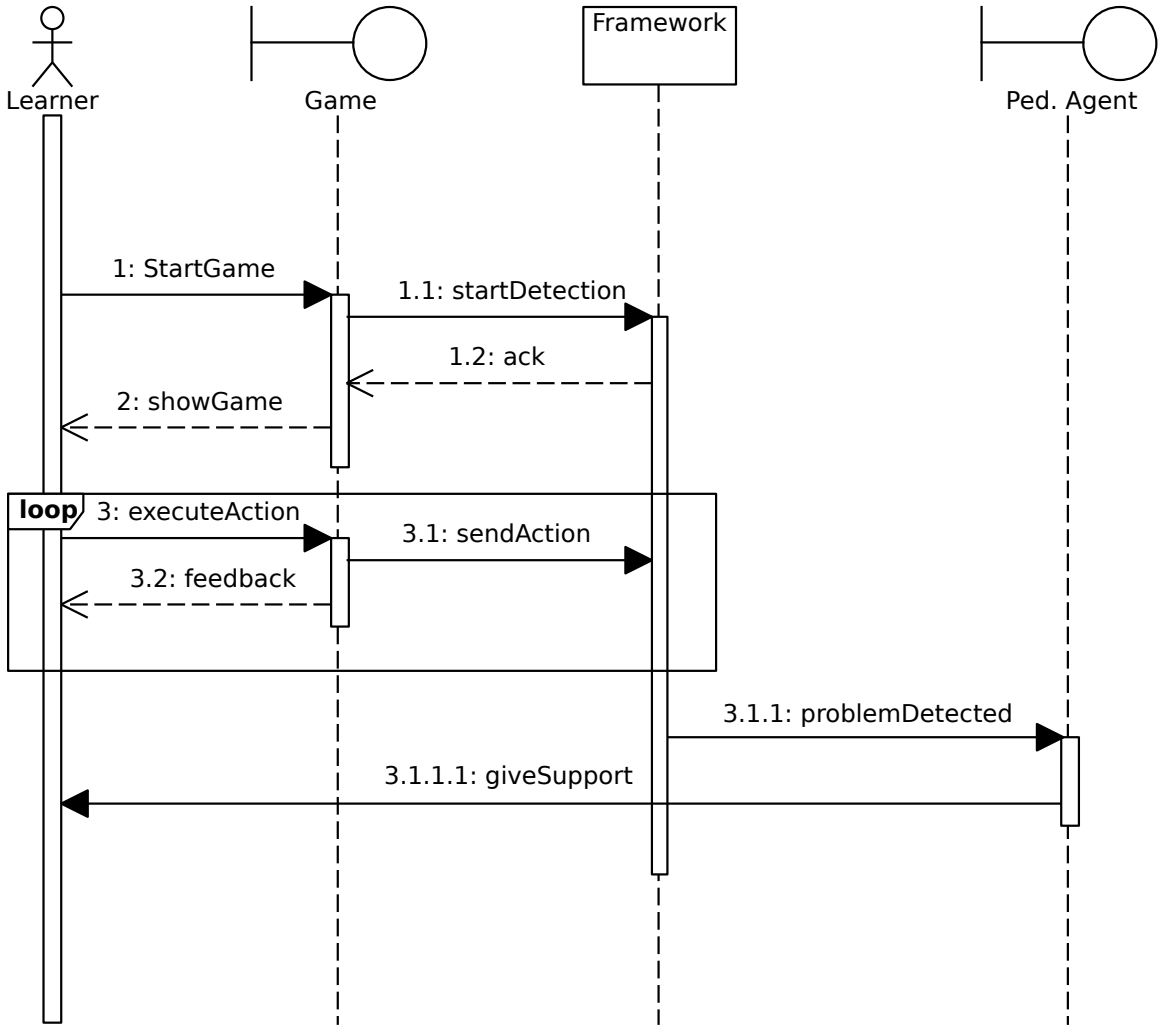

Figure: Exemplary Flow of Events (UML sequence diagram)

Action, Interaction and Event I

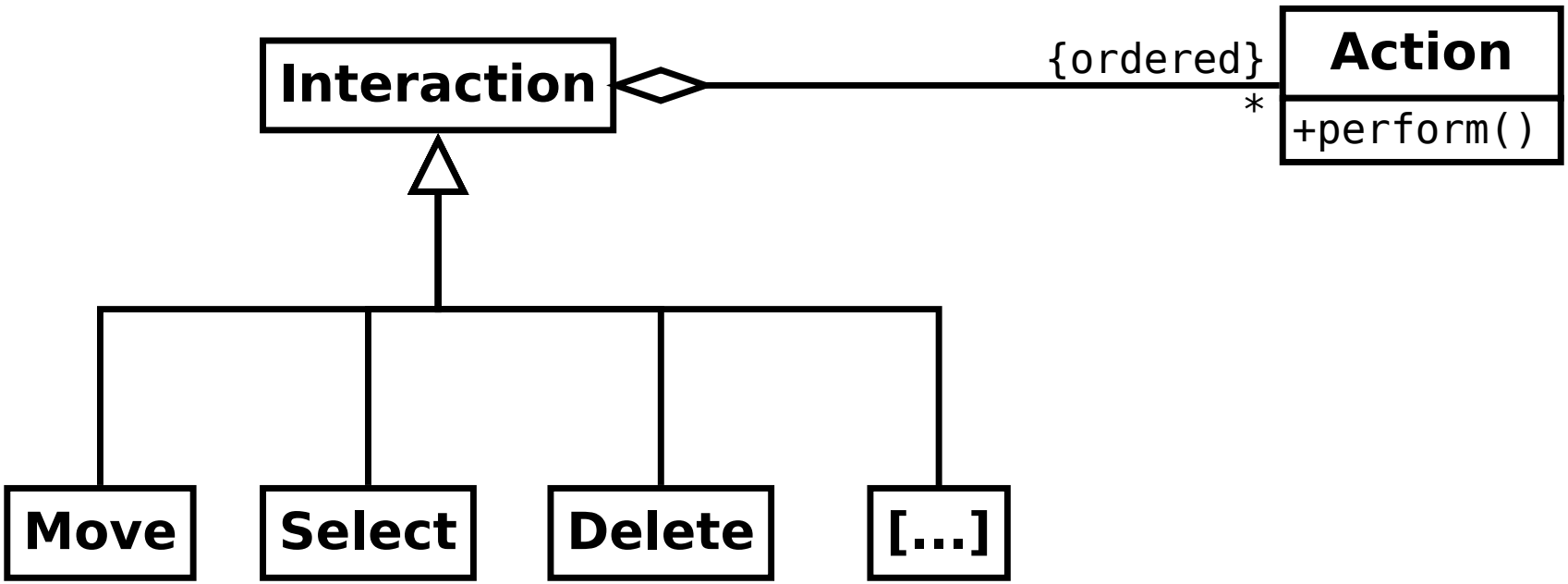

Figure: Relation between Interaction and Action (UML class diagram)

Action, Interaction and Event II

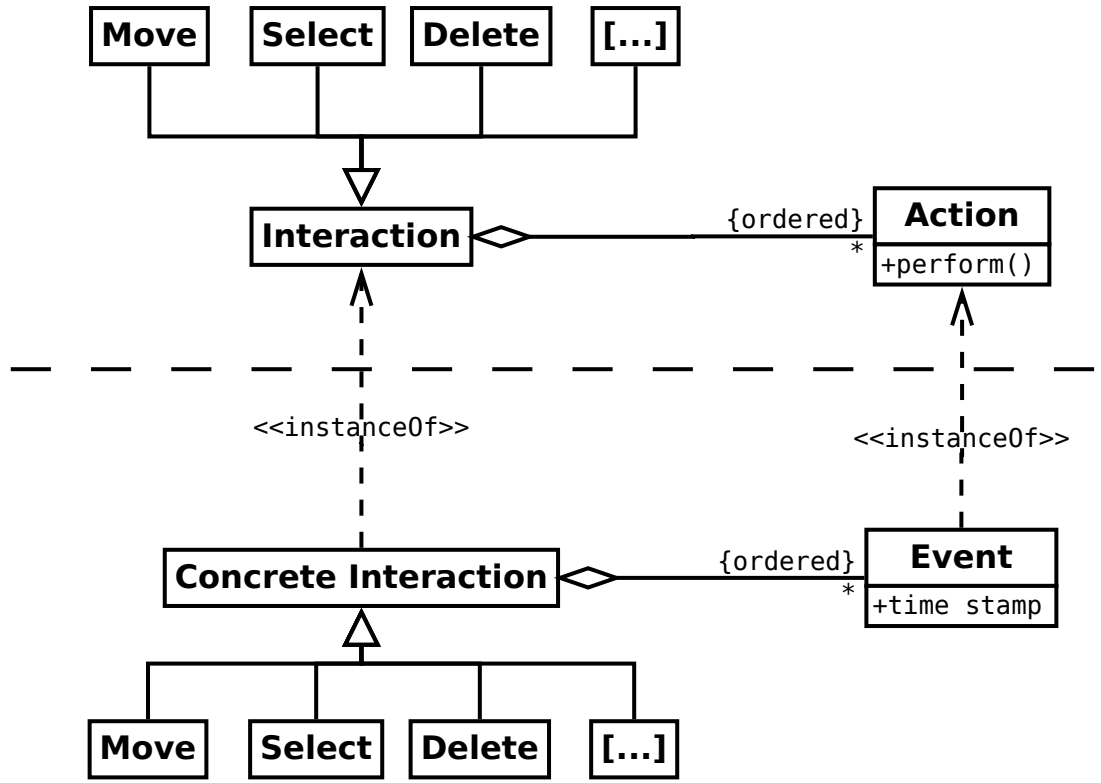

Figure: Different meta levels (UML class diagram)

Problem Detection

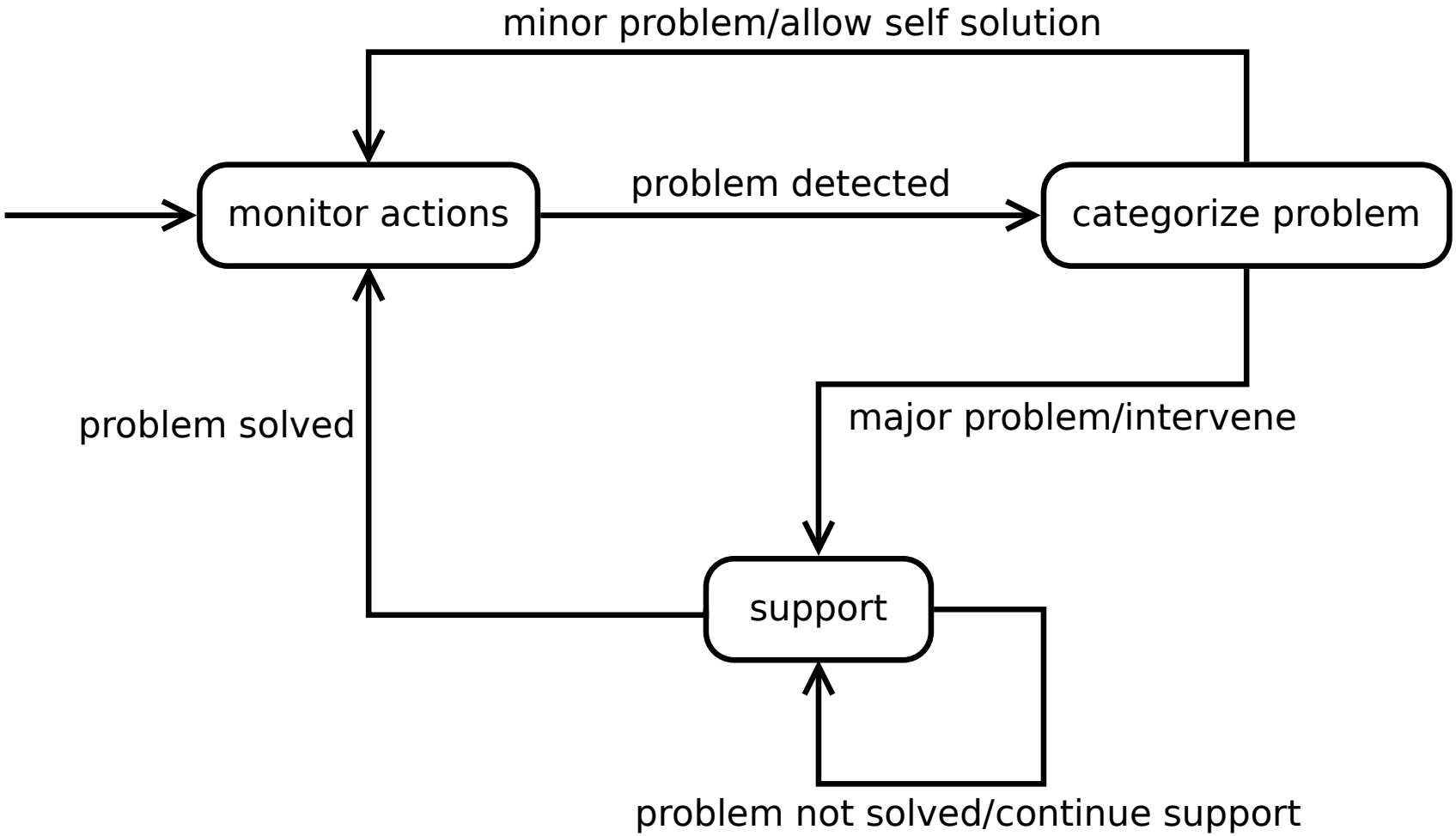

Figure: The Process of Problem Detection (UML activity diagram)

Subsystem Decomposition I

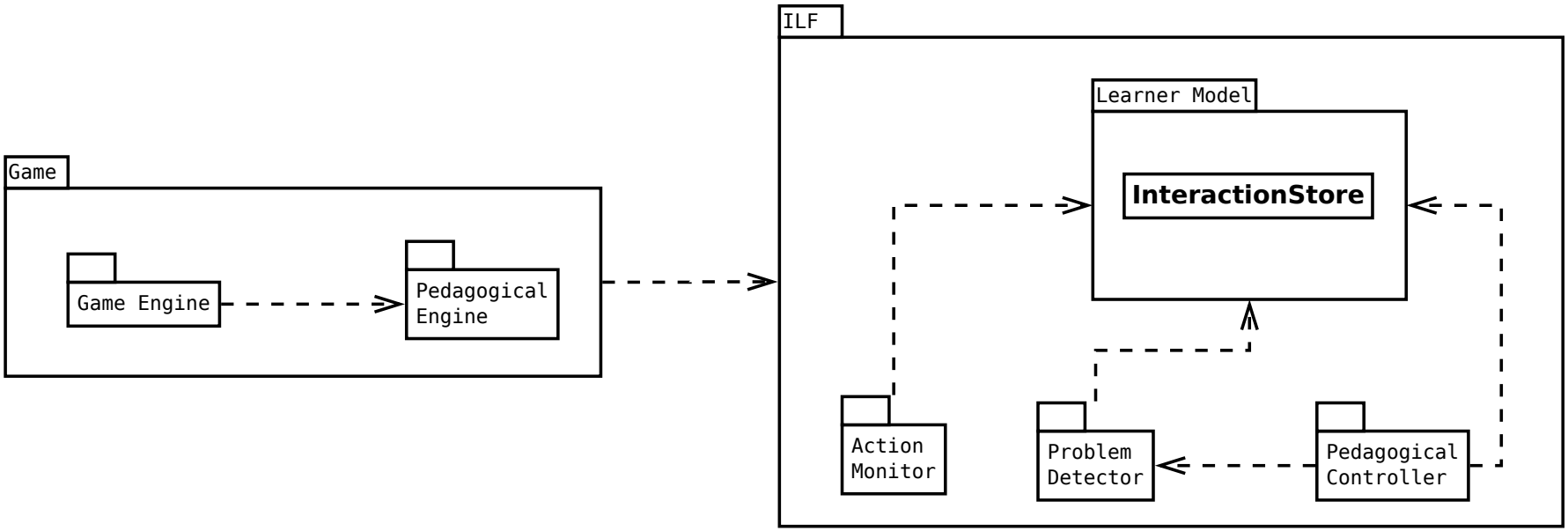

Figure: Subsystem Decomposition Overview (UML package diagram)

Subsystem Decomposition II

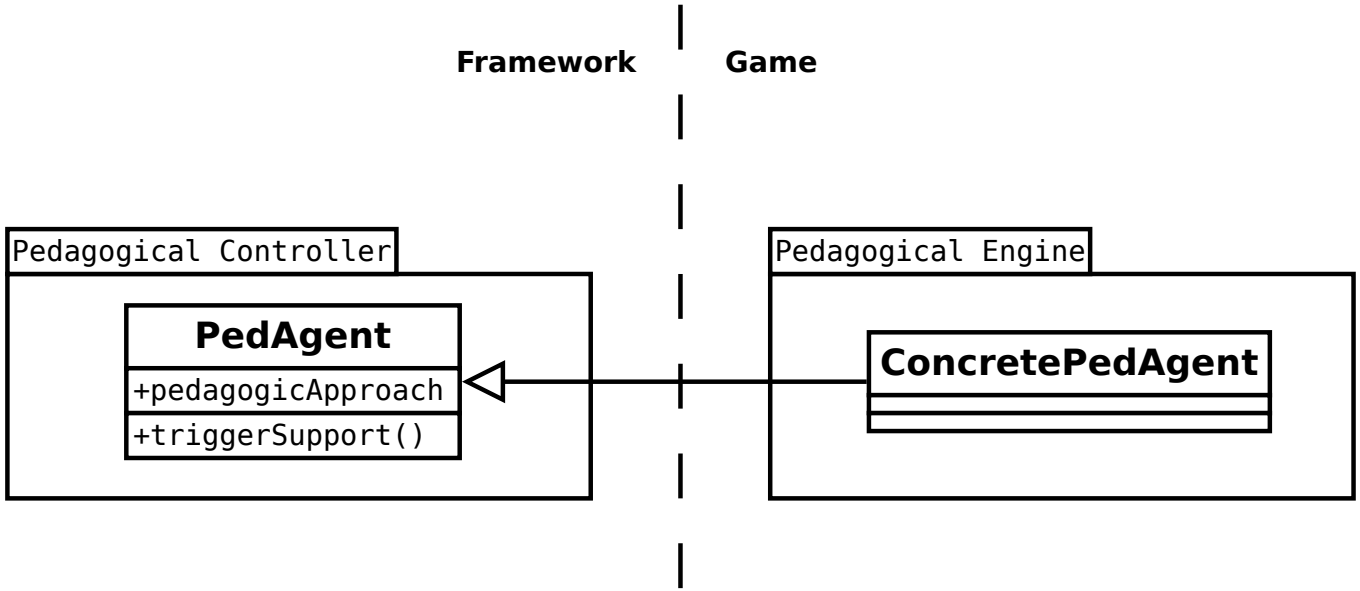

Figure: The ConcretePedAgent implements the Abstract Class PedAgent (UML class diagram)

Global Control Flow

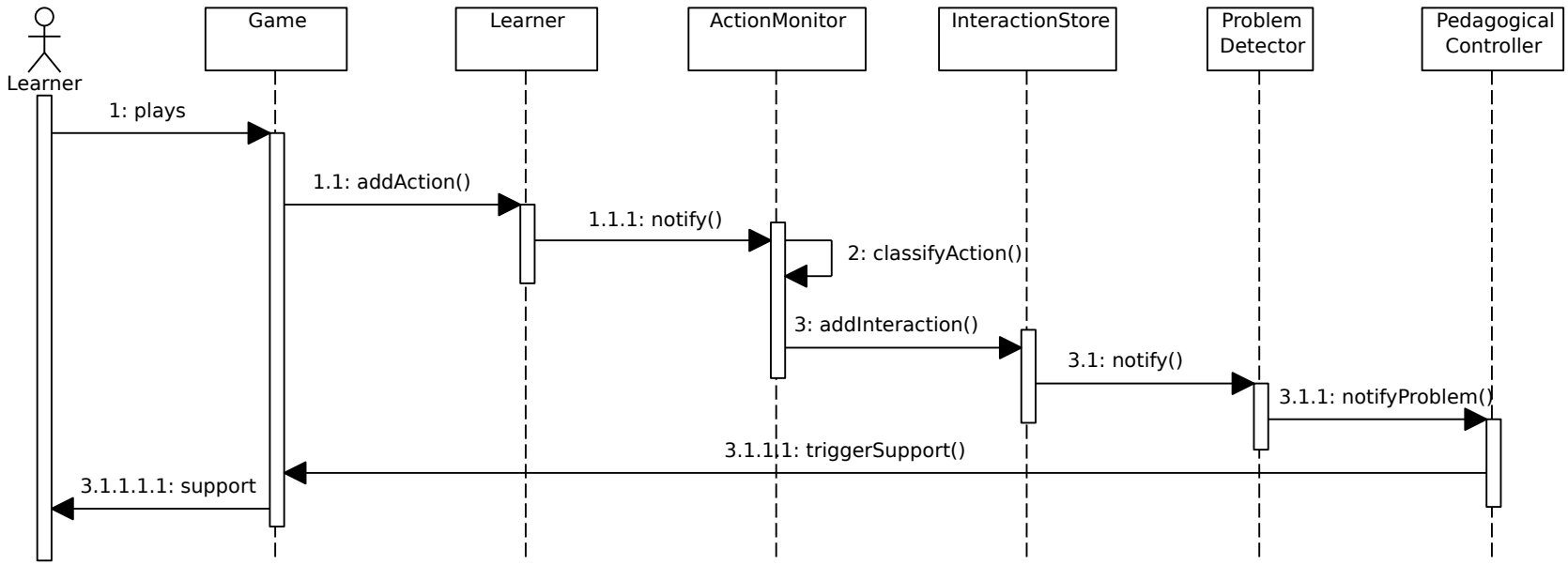

Figure: The Global Control Flow through the Subsystems (UML sequence diagram)

Future Work

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- Define a language to describe interactions and patterns
- Use AI / machine learning to learn interactions and patterns automatically
- Research how children learn and how they behave during the process (needs interdisciplinary effort with pedagogues and psychologists)
- Research and implement pedagogical agents
- Evaluate

One Laptop Per Child

- Non-profit organization
- Kicked off at MIT Media Lab
- Mission: "bring education to the poorest children of the world"
- Devices deployed until April 2009: 1.625 million
- Perfect platform for ILF: open source, specialized software for children, high impact

Contributors Program

- Provide development devices (XO's) for contributors
- Improve software - hardware usage
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START A PROJECT THAT WILL CHANGE KIDS' LIVES WORLDWIDE!

enjoy the demo...

Thanks for the attention

Literature I


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Use Case Overview

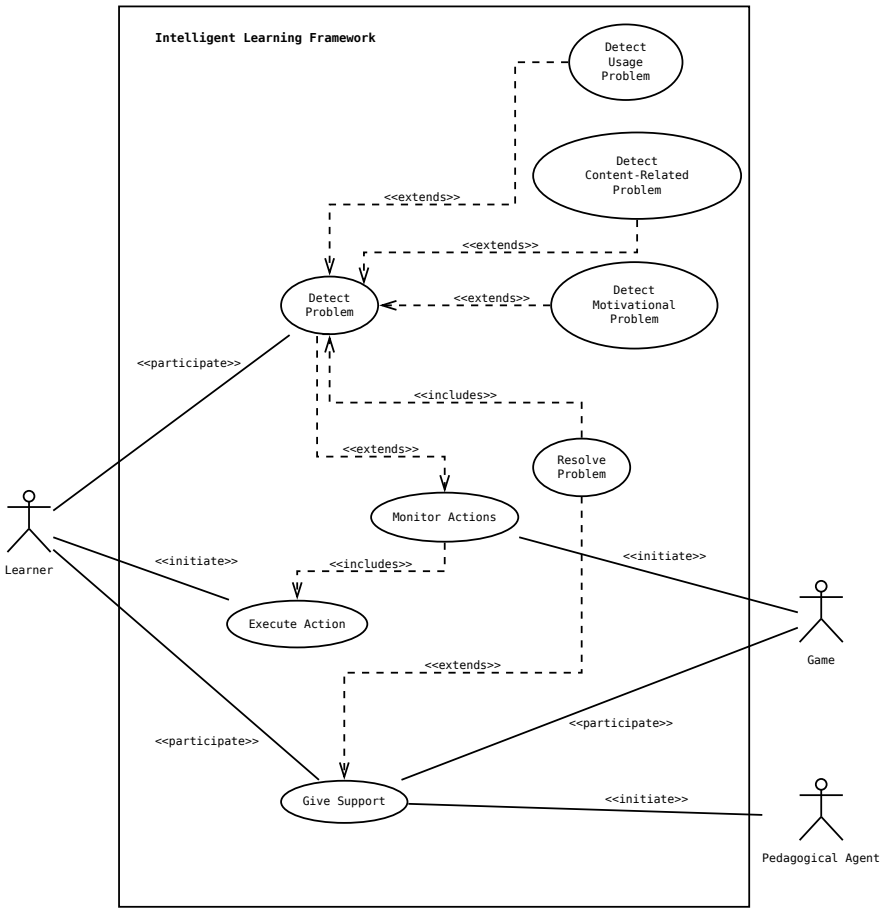

Figure: Overall use case diagram (UML use case diagram)

Object Design I

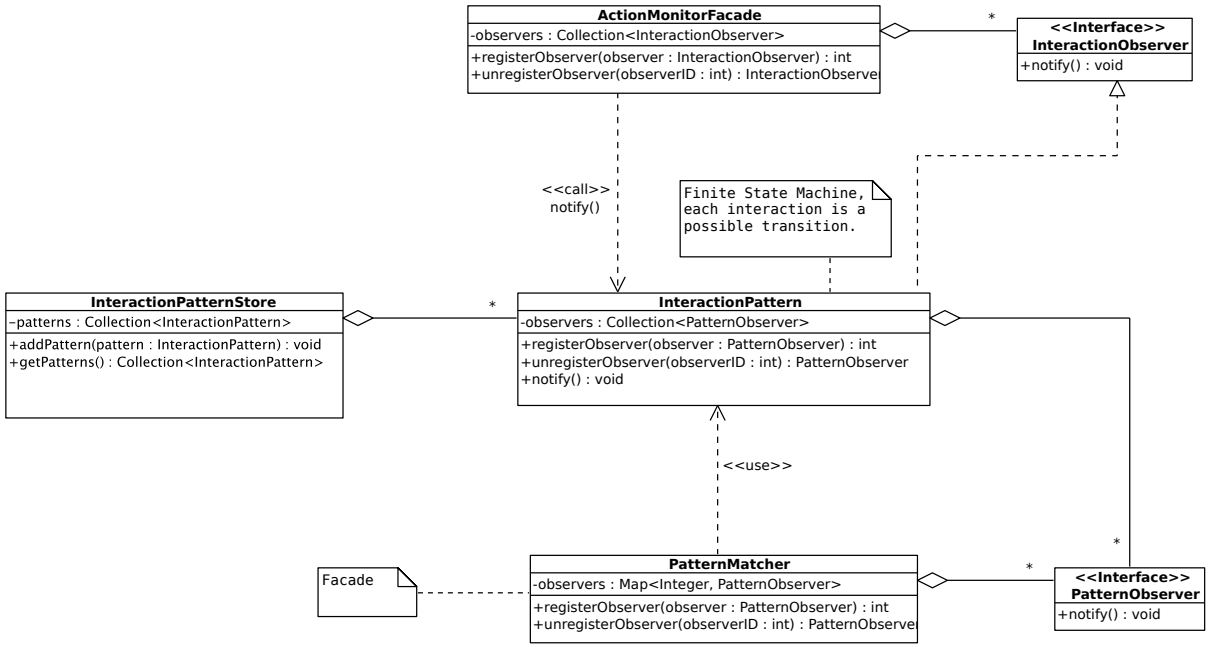

Figure: Matching Interactions to InteractionPatterns (UML class diagram)

Object Design II

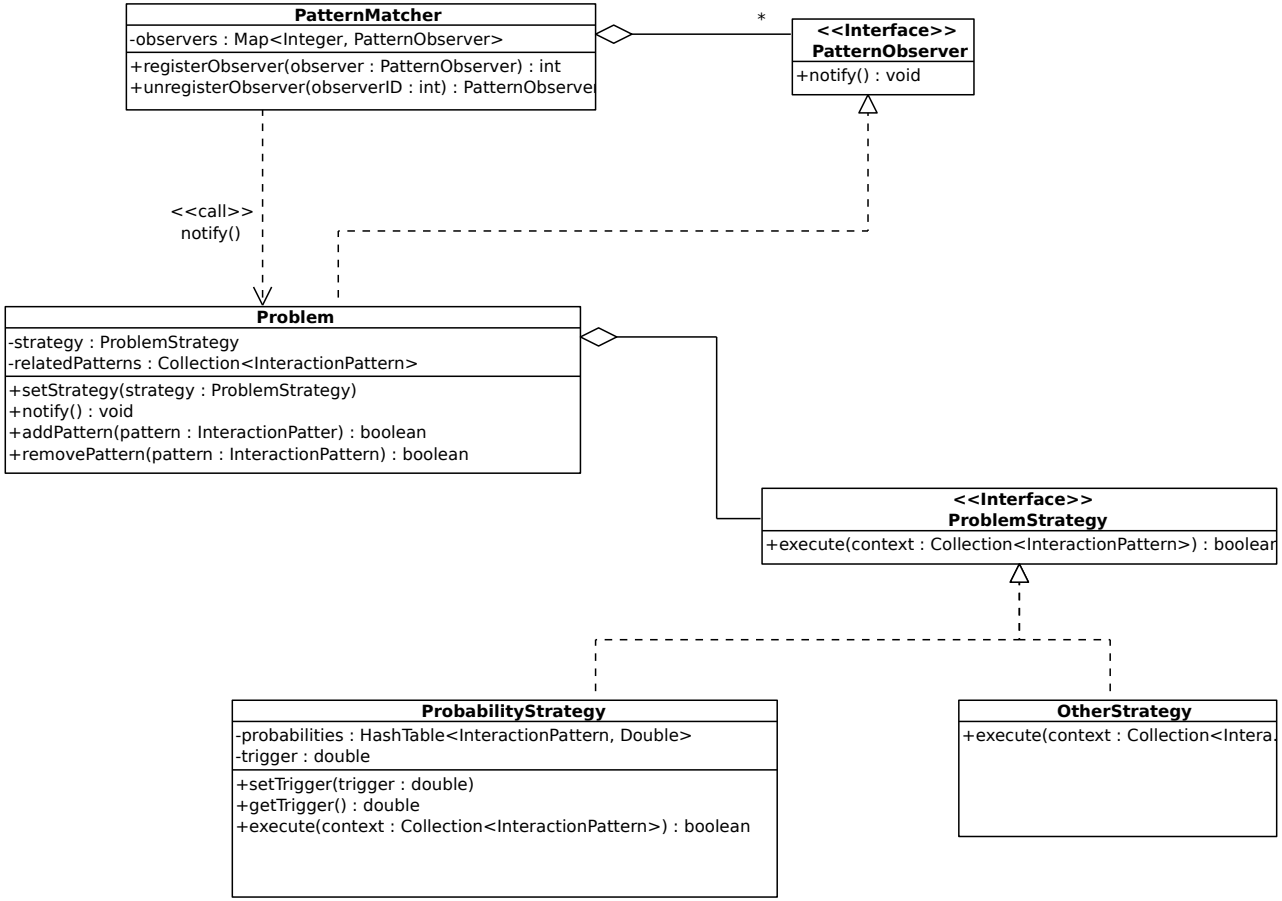

Figure: Problem Detection with Strategy Pattern (UML class diagram)

Taxonomy

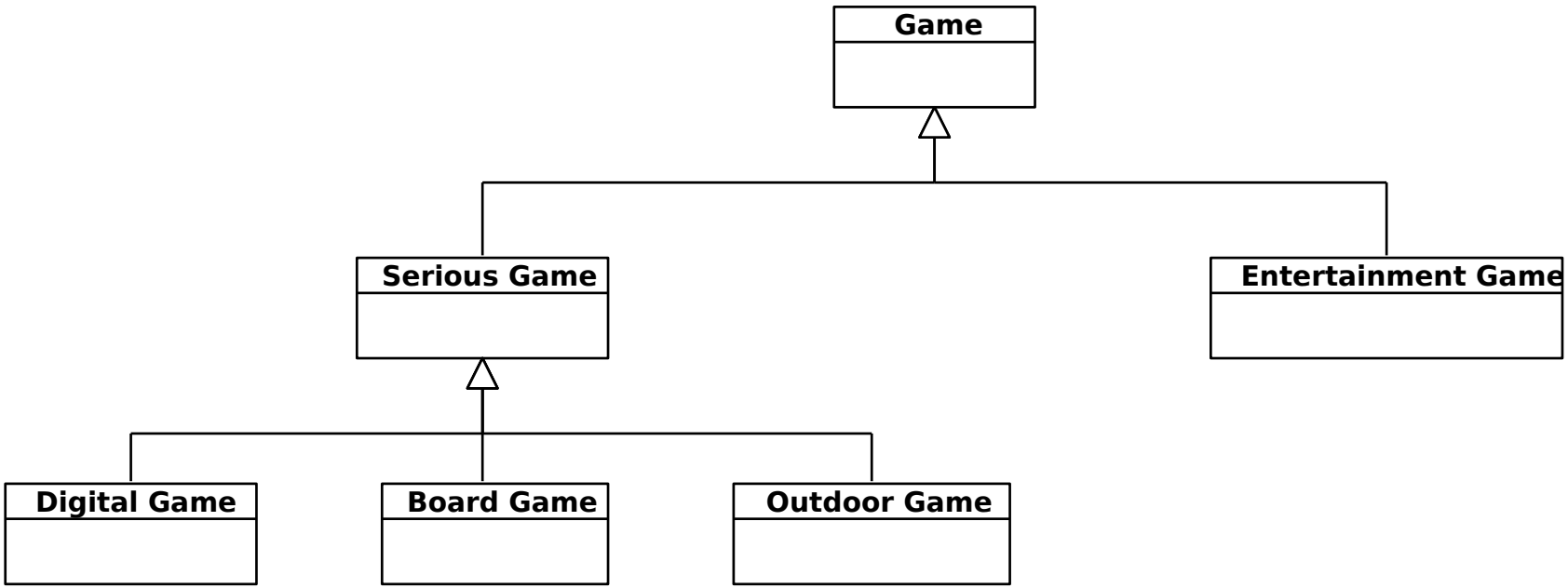

Figure: Taxonomy of Games (UML class diagram)

Example

An example from a study in the US [Bailey, 1982]:

Setup: 4063 males, randomly selected from the US population

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Setup: 4063 males, randomly selected from the US population

Round	Probe size	Body dimension
0	4063	initial probe
1	1055	standing height
2	302	chest circumference
...	...	...
9	2	arm length
10	0	–

Activity

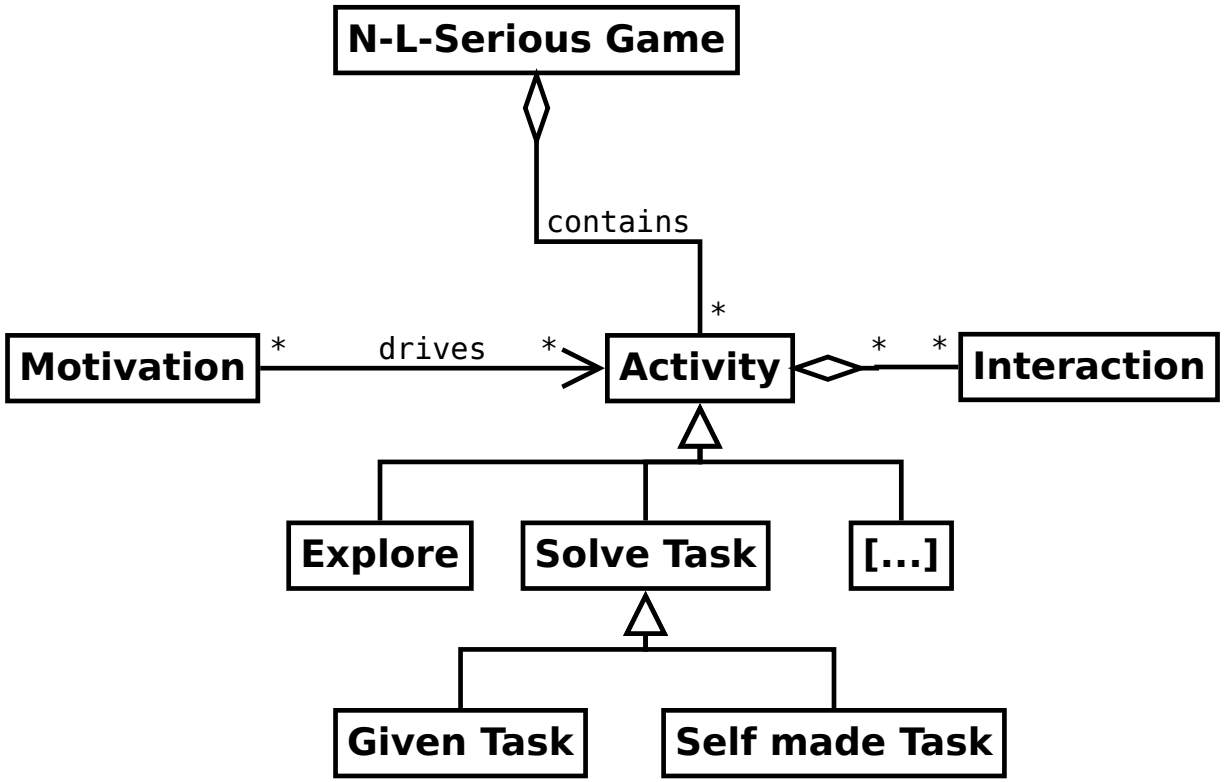

Figure: Different Activities in a Game (UML class diagram)

Functional Requirements

- Learner-Centric
- Individual Support
- Adaptive Learner Model
- Task Independent Problem Detection

Non Functional Requirements

- Usability
- Reliability
- Performance
- Supportability