

Developing Virtual Heritage Applications as Normative Multiagent Systems



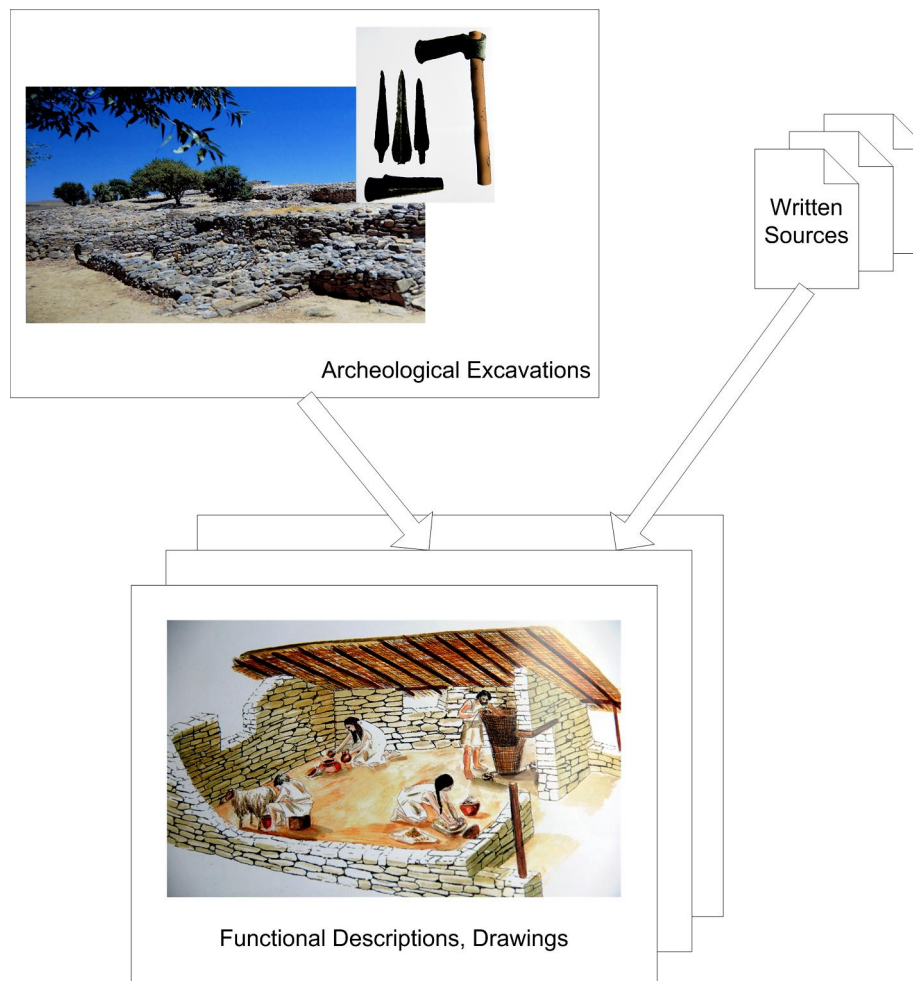
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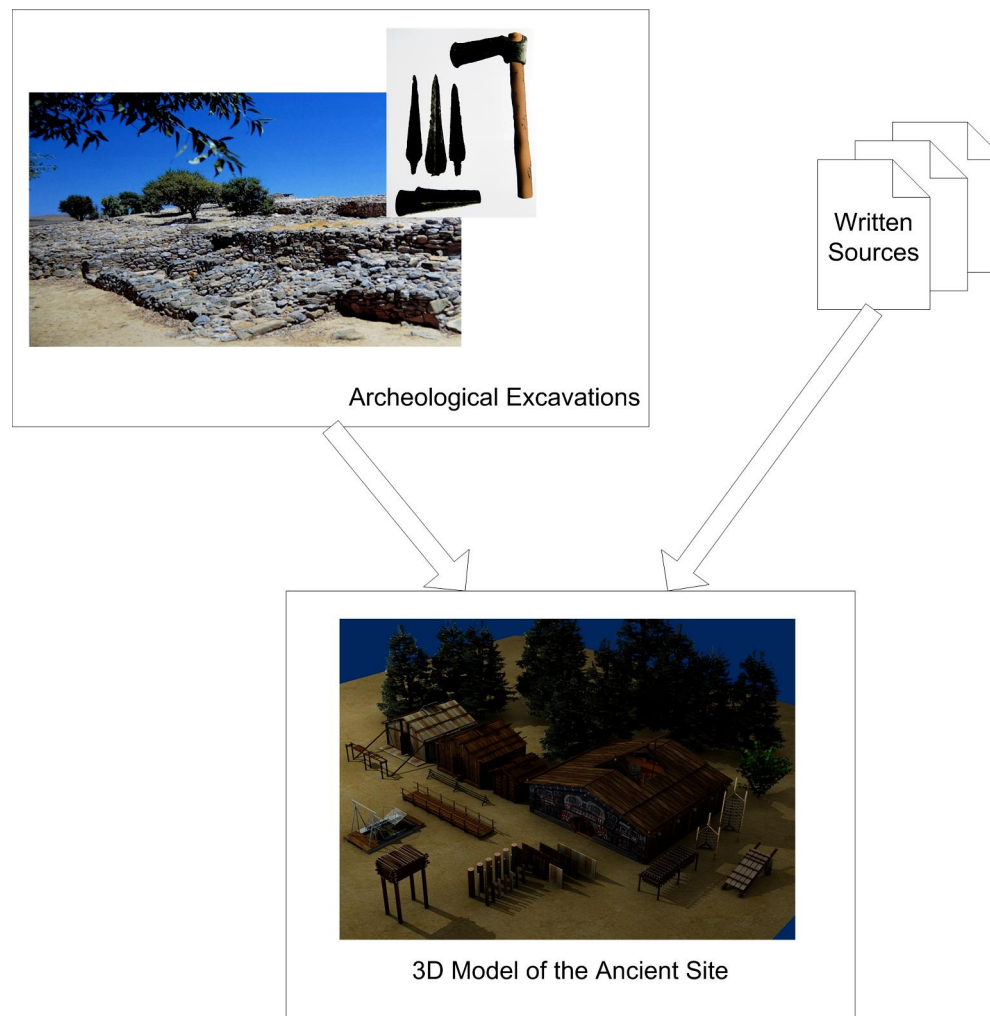
Cultural Heritage: Traditional Approaches





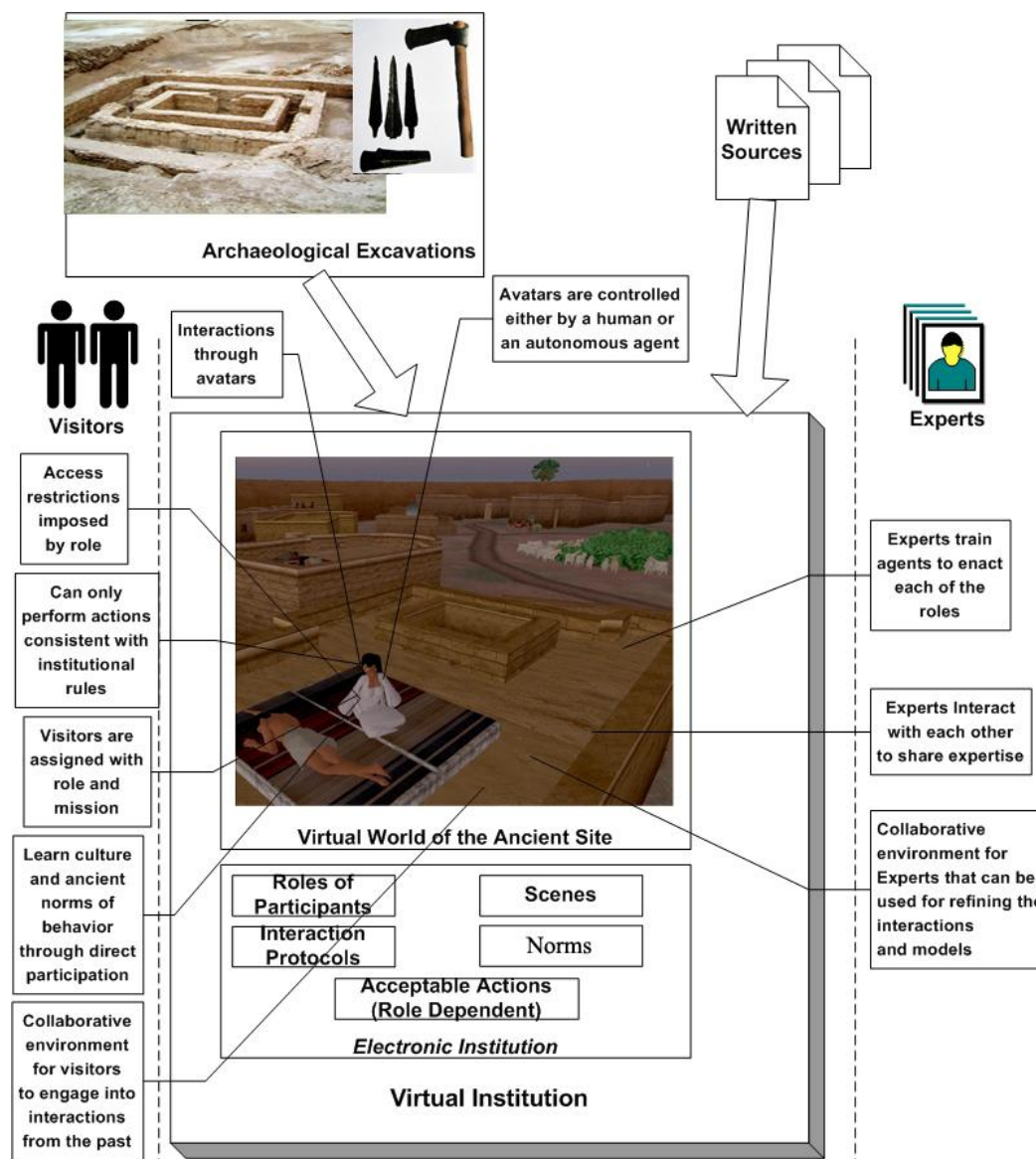
Cultural Heritage: Innovative Approaches

State of the Art





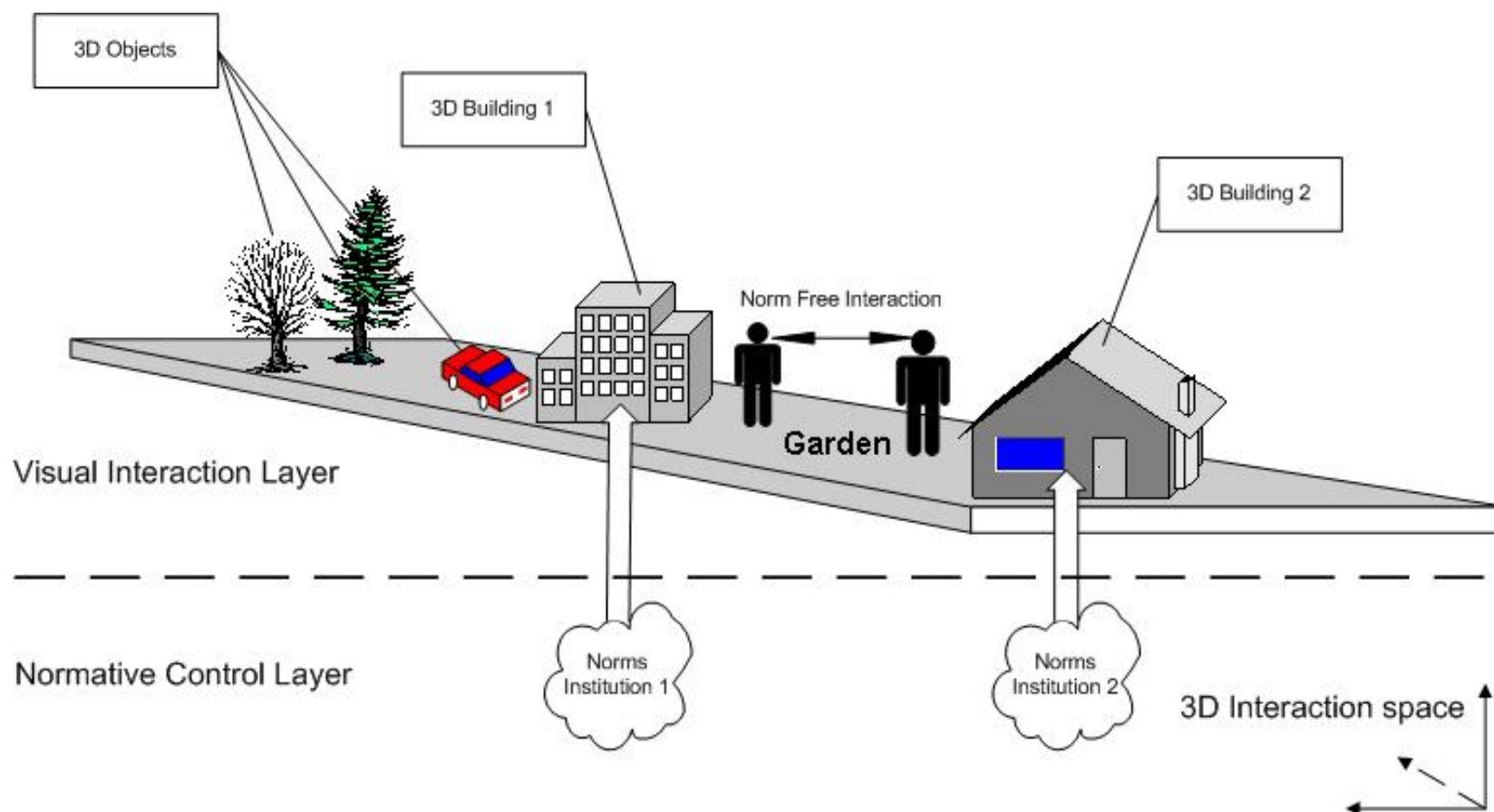
Virtual Institutions Approach





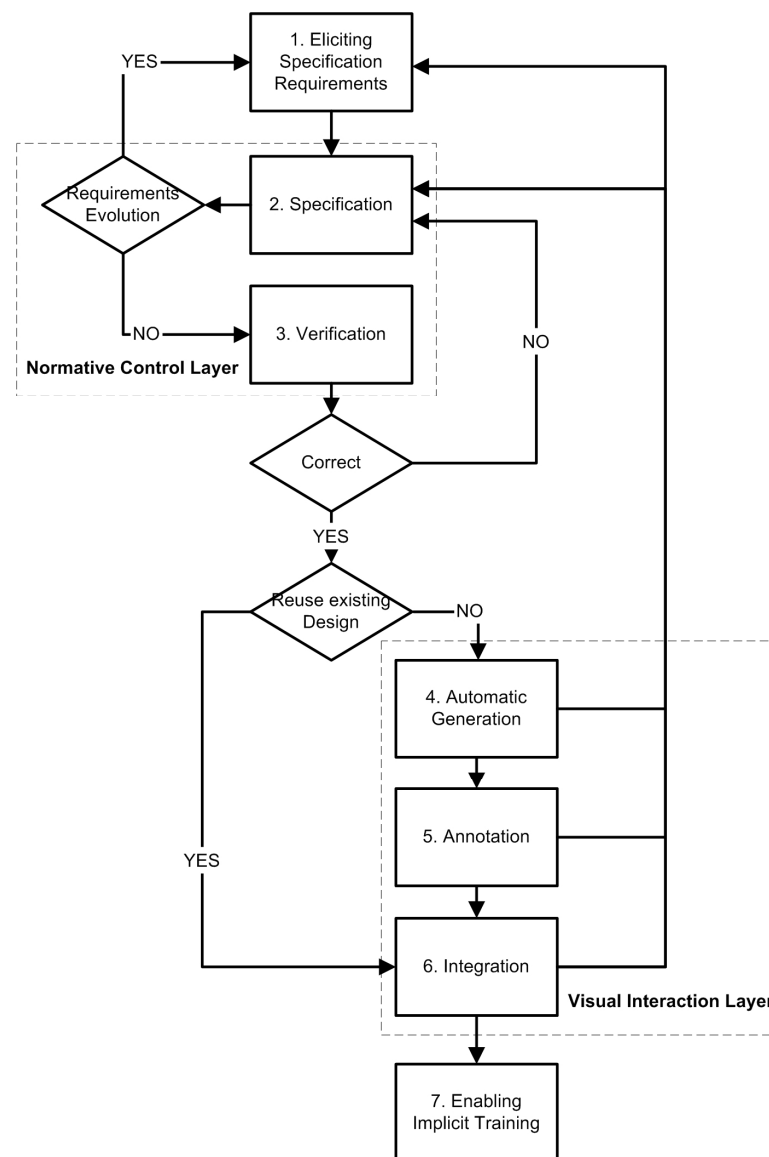
Virtual Institutions: Concept

Virtual Institutions





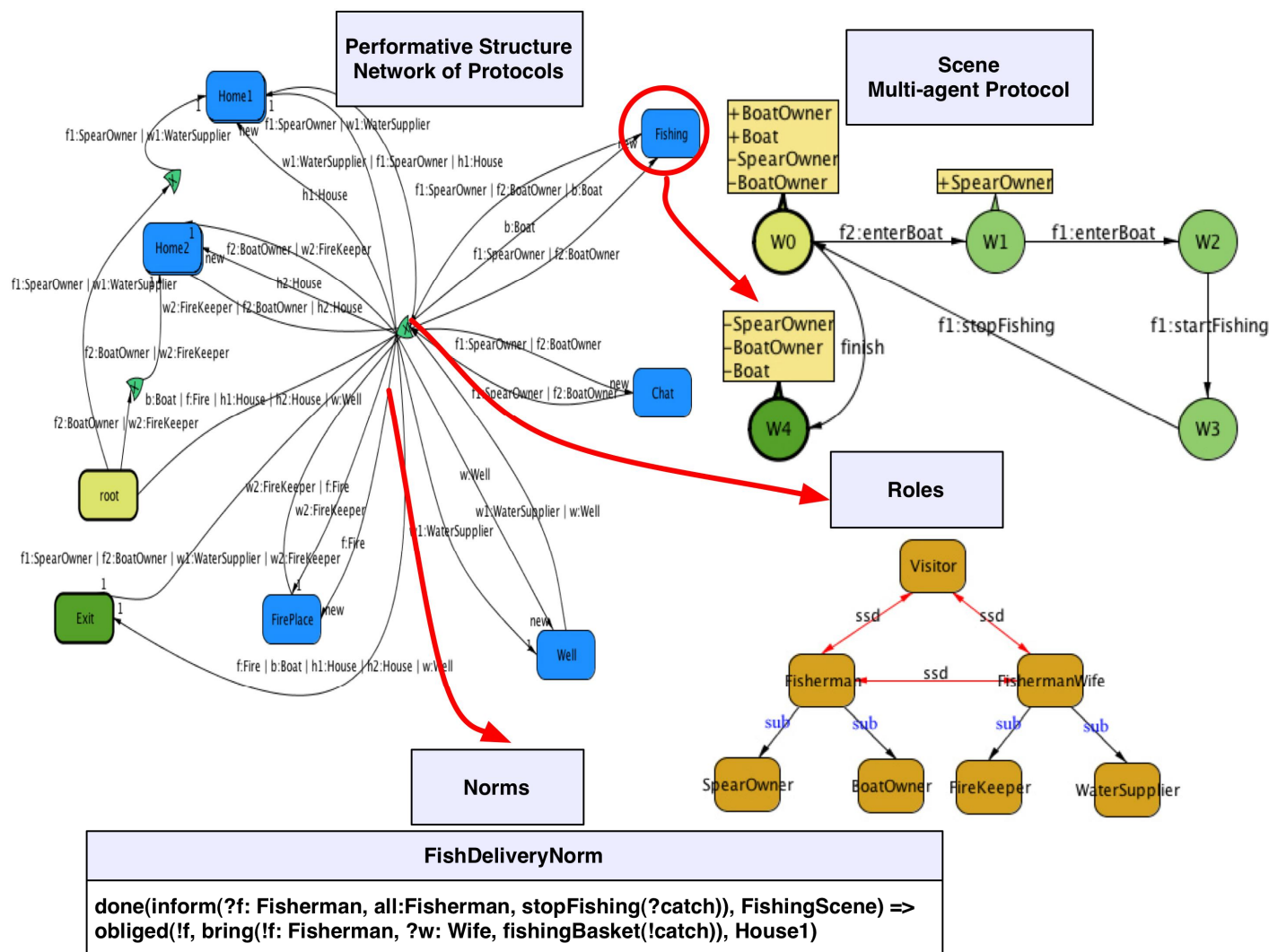
Virtual Institutions Methodology





Uruk Institution

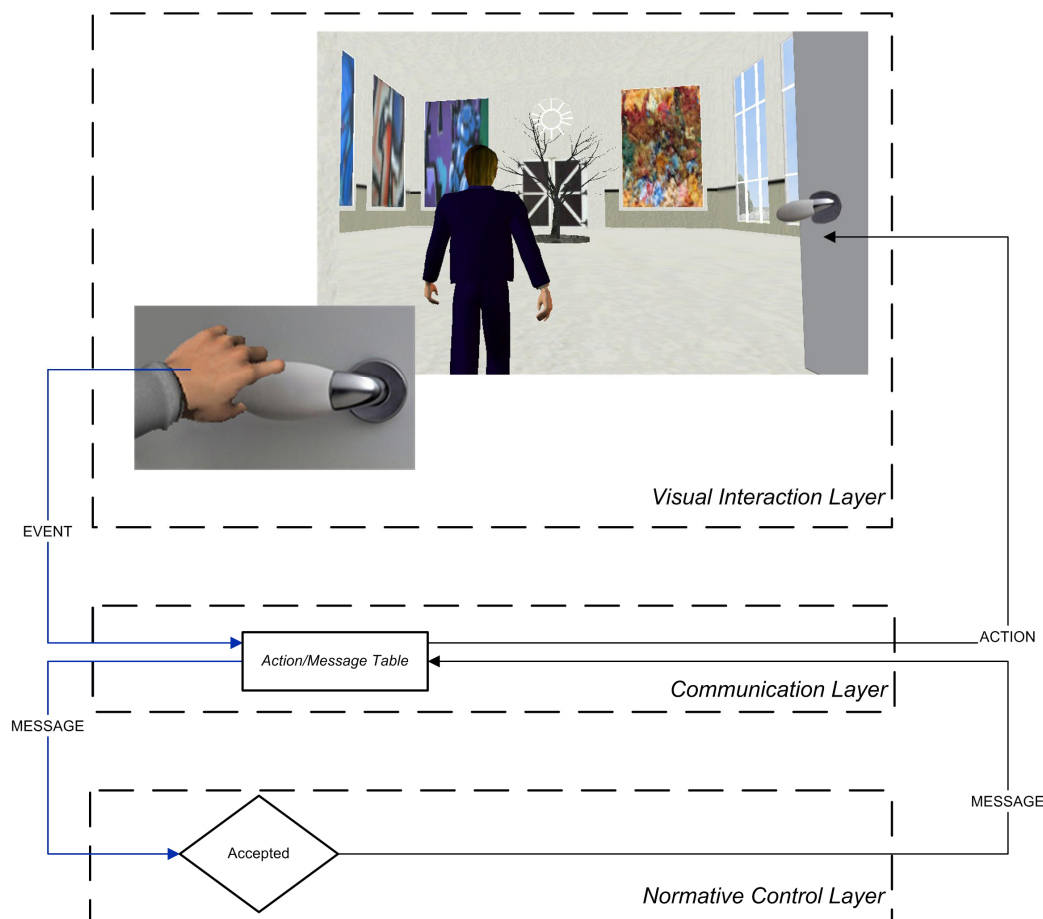
Case study: The City of Uruk





Virtual Institutions Technology

Virtual Institutions





The City of Uruk, 3000 B.C.

Case study: The City of Uruk





Summary

- Virtual heritage applications that involve autonomous agents re-enacting the way of life of ancient people should be treated as Normative Multiagent Systems.
- For design and deployment of such Virtual Worlds we developed the Virtual Institutions Methodology.
- This methodology is supplied with a set of tools that facilitate the design, development and execution of such environments.
- The Methodology was Evaluated on the implementation of the Uruk prototype visualizing the behaviour of citizens of ancient Mesopotamia, 3000 B.C..



The City of Uruk, 3000 B.C. Demo

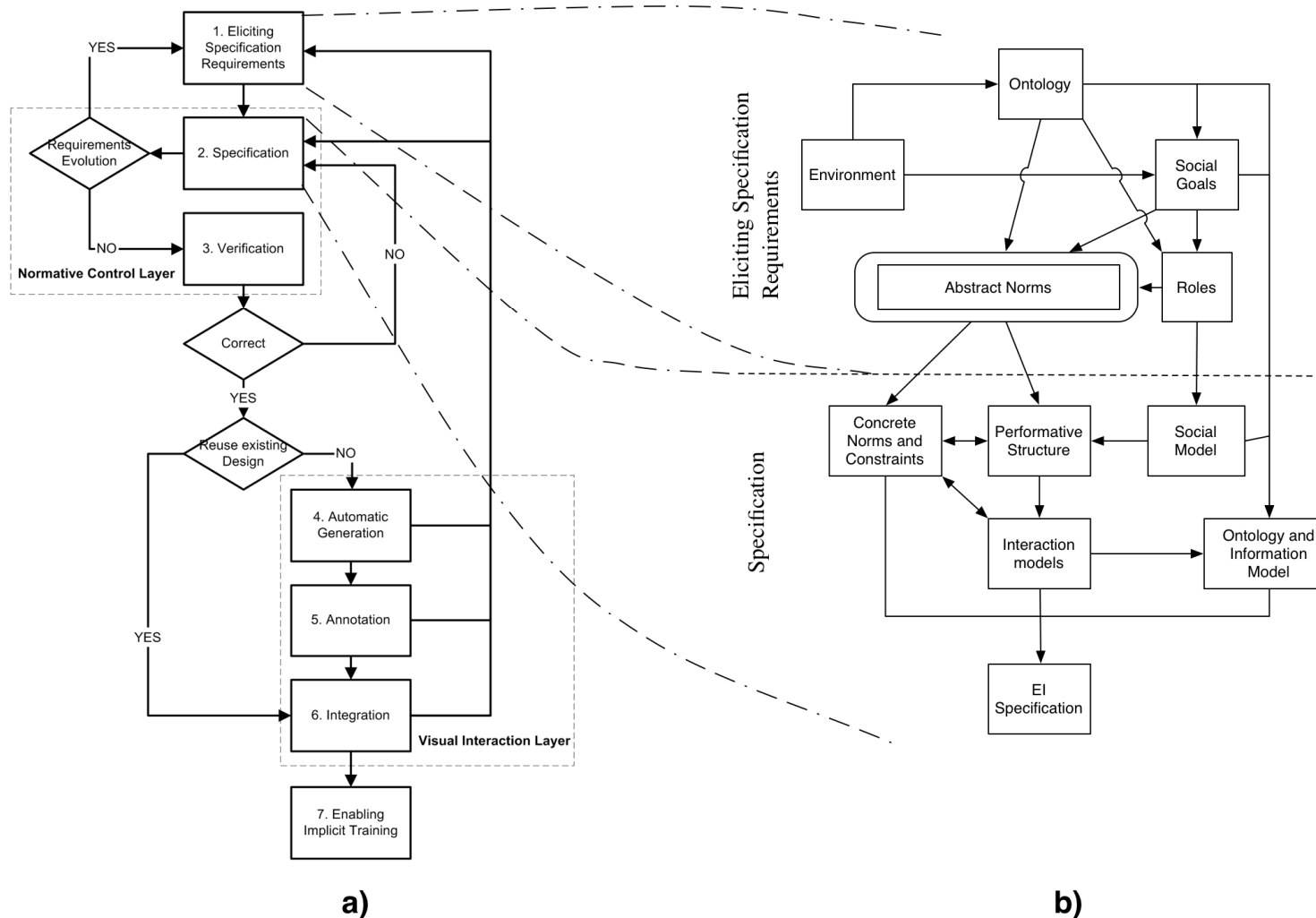
Case study: The City of Uruk





Extended Methodology

Case study: The City of Uruk





Software Requirements Document

Environment contains: boat, house, well, fire, spear, fish, river, fishing basket.

Ontology Relationships. River has fishes, baskets contain fishes, men own boats.

Social goals. Daily provision of food to cater for the city's needs.

Abstract norms. Fishermen must go daily fishing for a limited number of hours; The number of fishing baskets per household is limited to avoid overexploitation of natural resources; Women are in charge of housework; Men alone cannot go fishing; Fishing is not allowed at night; Hoarding is prohibited and punished; All men under some age are obliged to fish;

Social model. Fishermen are in static separation of duties with wives.

Performative structure. Fishermen wake up, chat, fish, eat, sleep, and back again. Wives wake up, set up a fire, collect water, cook, sleep, and back again.

Interaction model. Description of fishing. At least 2 men on a boat. When both men on a boat, its state changes to “sailing”. While sailing the fishermen holding a spear can throw it to catch fishes. If a spear gets a fish, the fisherman can remove the fish from the spear and put it in the fishing basket. The action of throwing the spear is an illocution, catching a fish is treated as an event generated by the spear. The rest treated as properties of roles, spear, and fishing baskets.

Concrete norms and constraints. Men are obliged to fish under the age of 35; one fishing basket per household max; fishing permitted between dawn and dusk; at least 2 men in a boat (this can be considered before); if hoarding (more than one fishing basket), fishermen can be prohibited to go sailing for a week.



Social Model: Uruk Agents

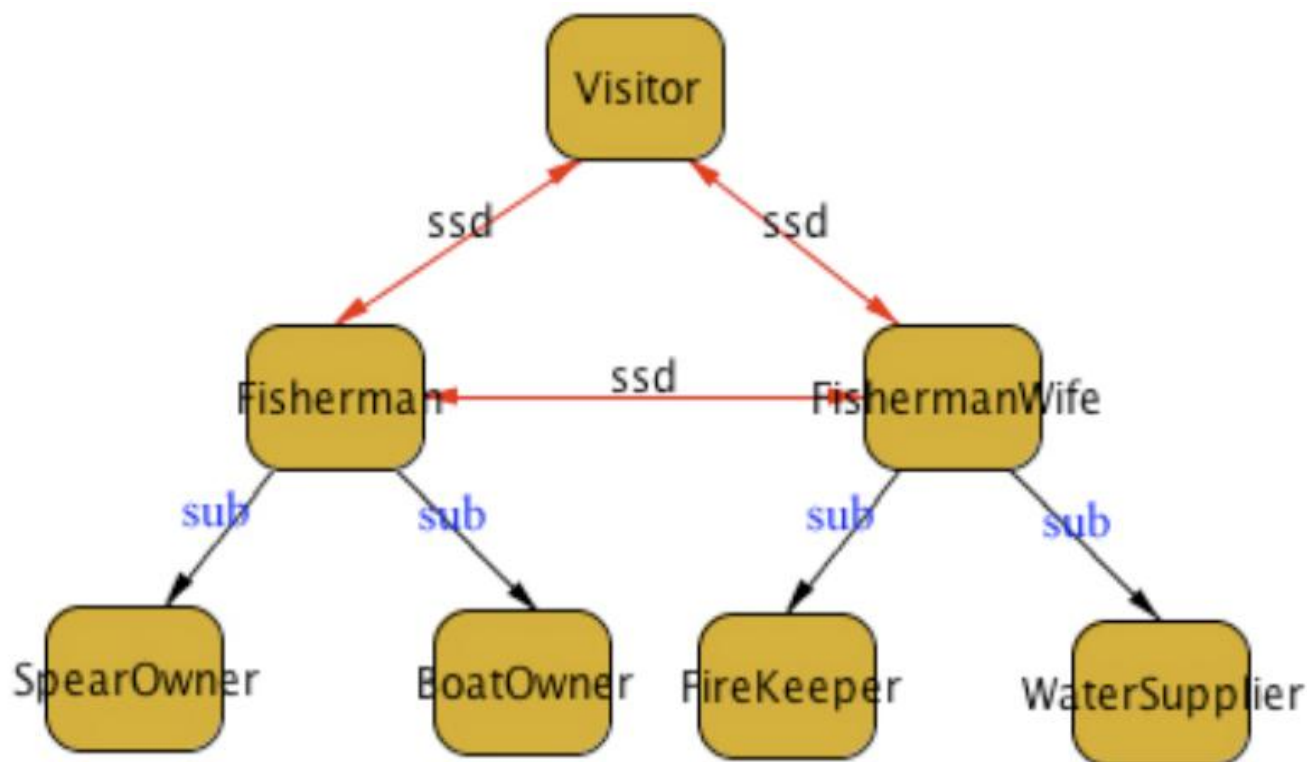
Case study: The City of Uruk





Environment Formalization: Roles

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Uruk Scenes

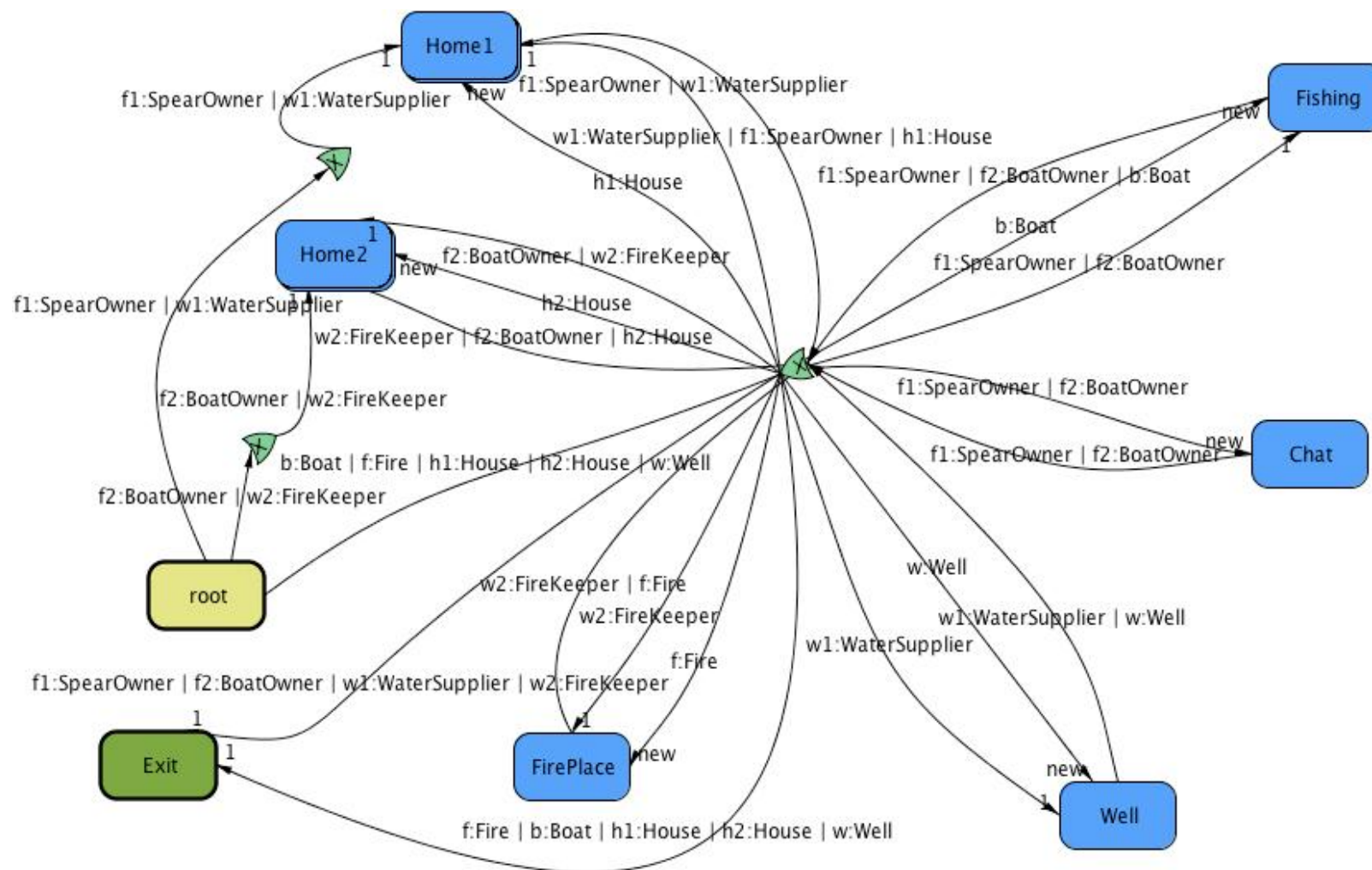
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Environment Formalization: Performative Structure

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Interaction Model: Fishing Scene Example

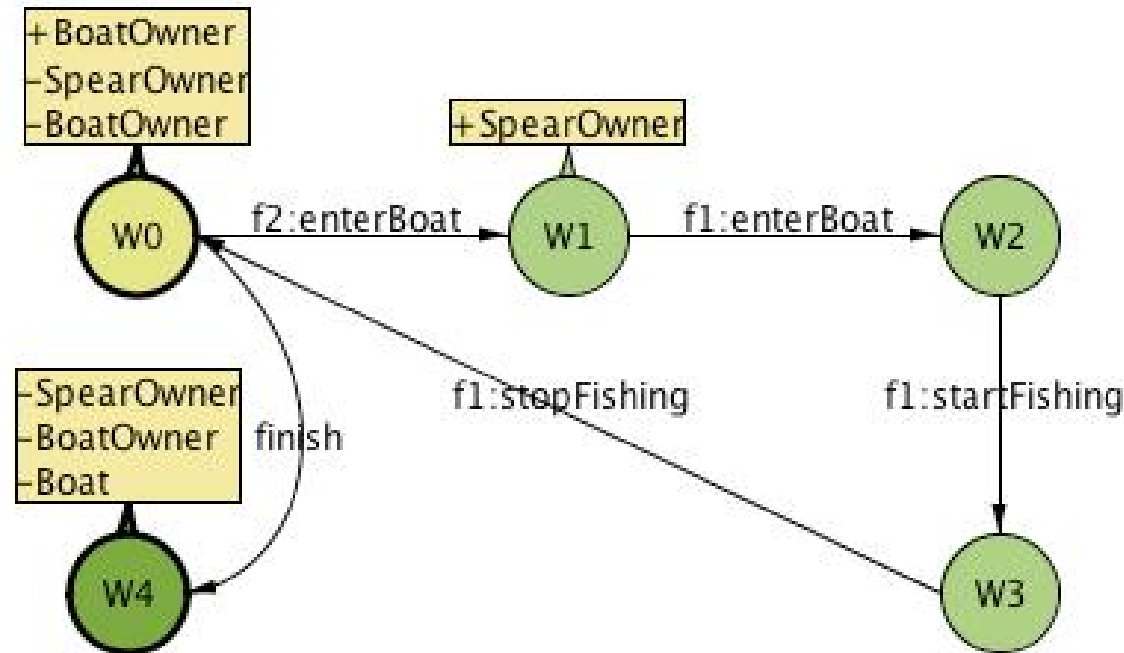
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Environment Formalization: Scenes

Case study: The City of Uruk



f2:enterBoat: (request (?f2 BoatOwner) (all all) enter)
f1:enterBoat: (request (?f1 SpearOwner) (all all) enter)
f1:startFishing: (request (!f1 SpearOwner) (all all) start)
f1:stopFishing: (request (!f1 SpearOwner) (all all) stop)
finish: (inform (?f2 BoatOwner) (all all) finish)



Environment Formalization: Norms & Ontology

Case study: The City of Uruk

▼  ontology
f → enter
f → **exit**
f → finish
f → start

Norms

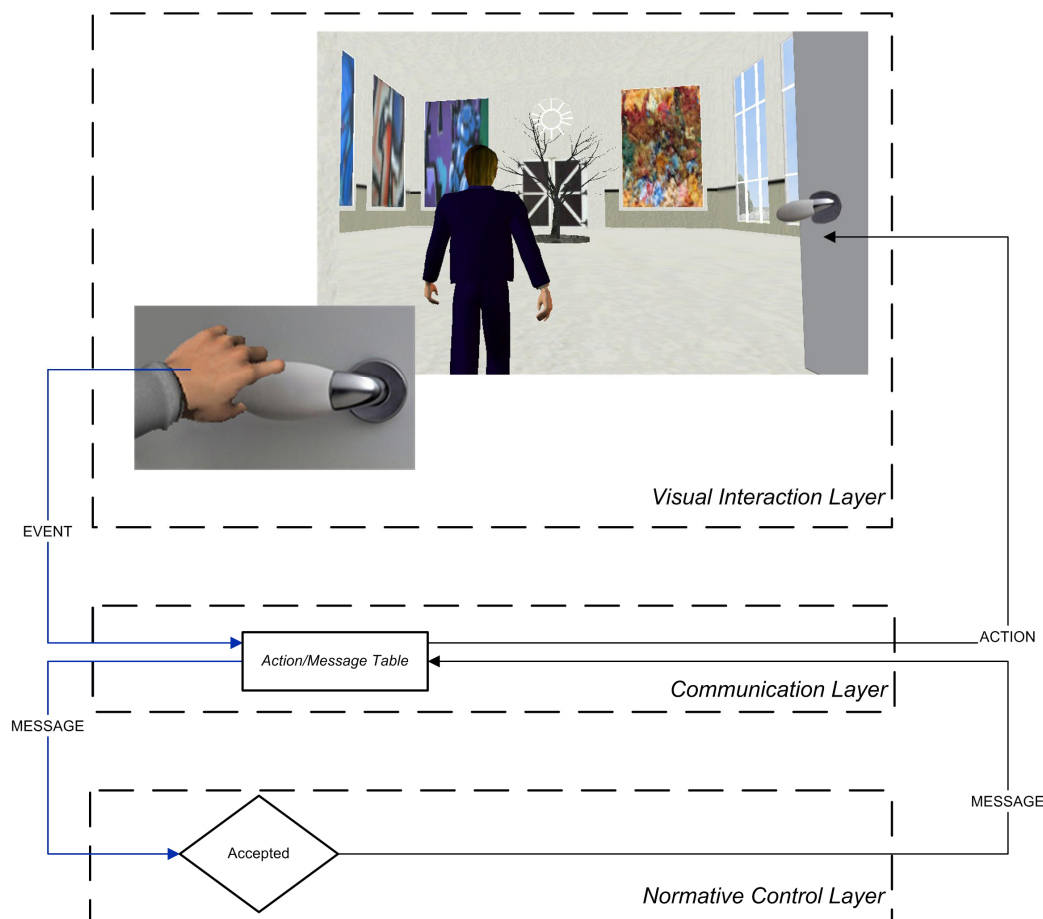
FishDeliveryNorm

**done(inform(?f: Fisherman, all:Fisherman, stopFishing(?catch)), FishingScene) =>
obliged(!f, bring(!f: Fisherman, ?w: Wife, fishingBasket(!catch)), House1)**



Deployment of Virtual Institutions

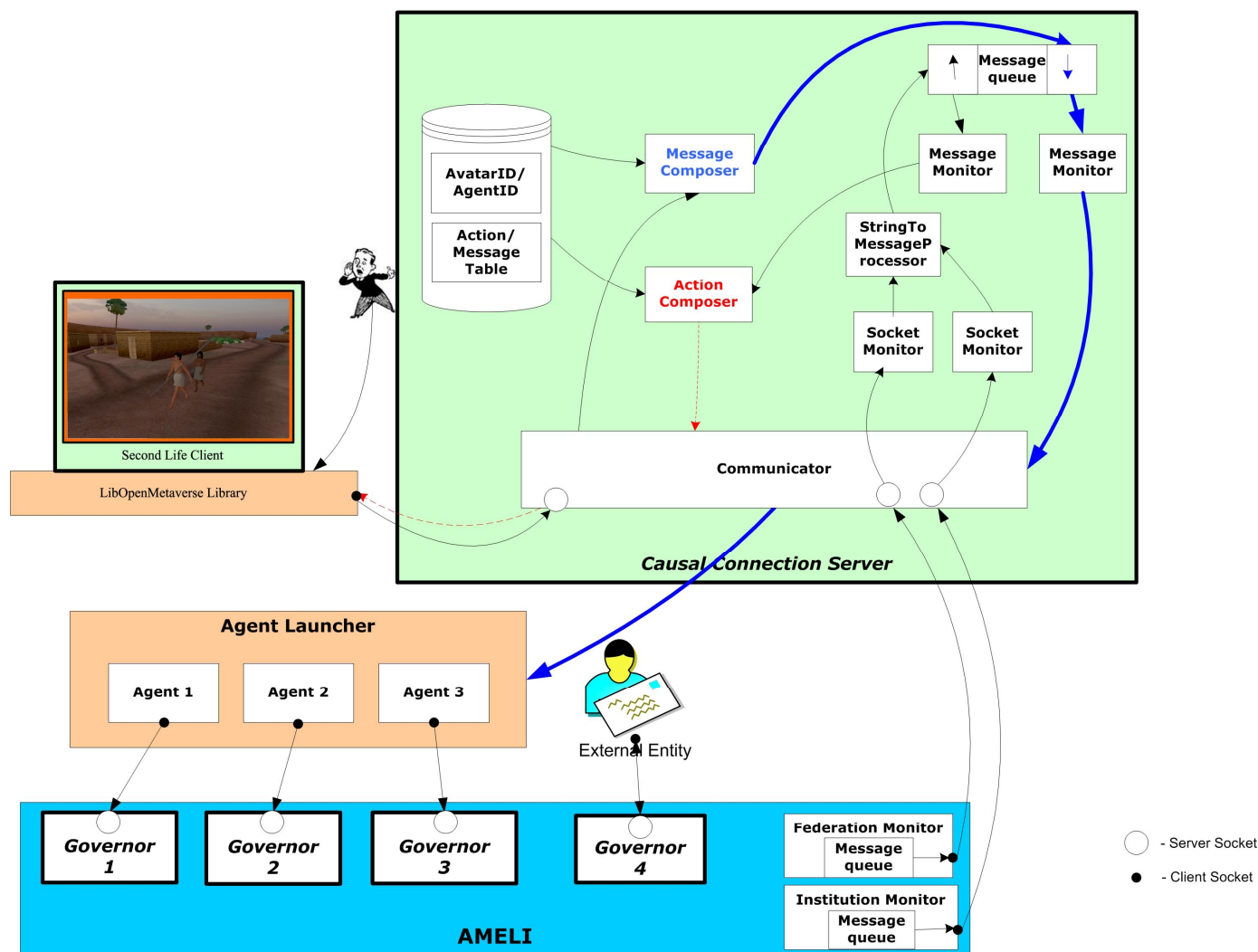
Deployment





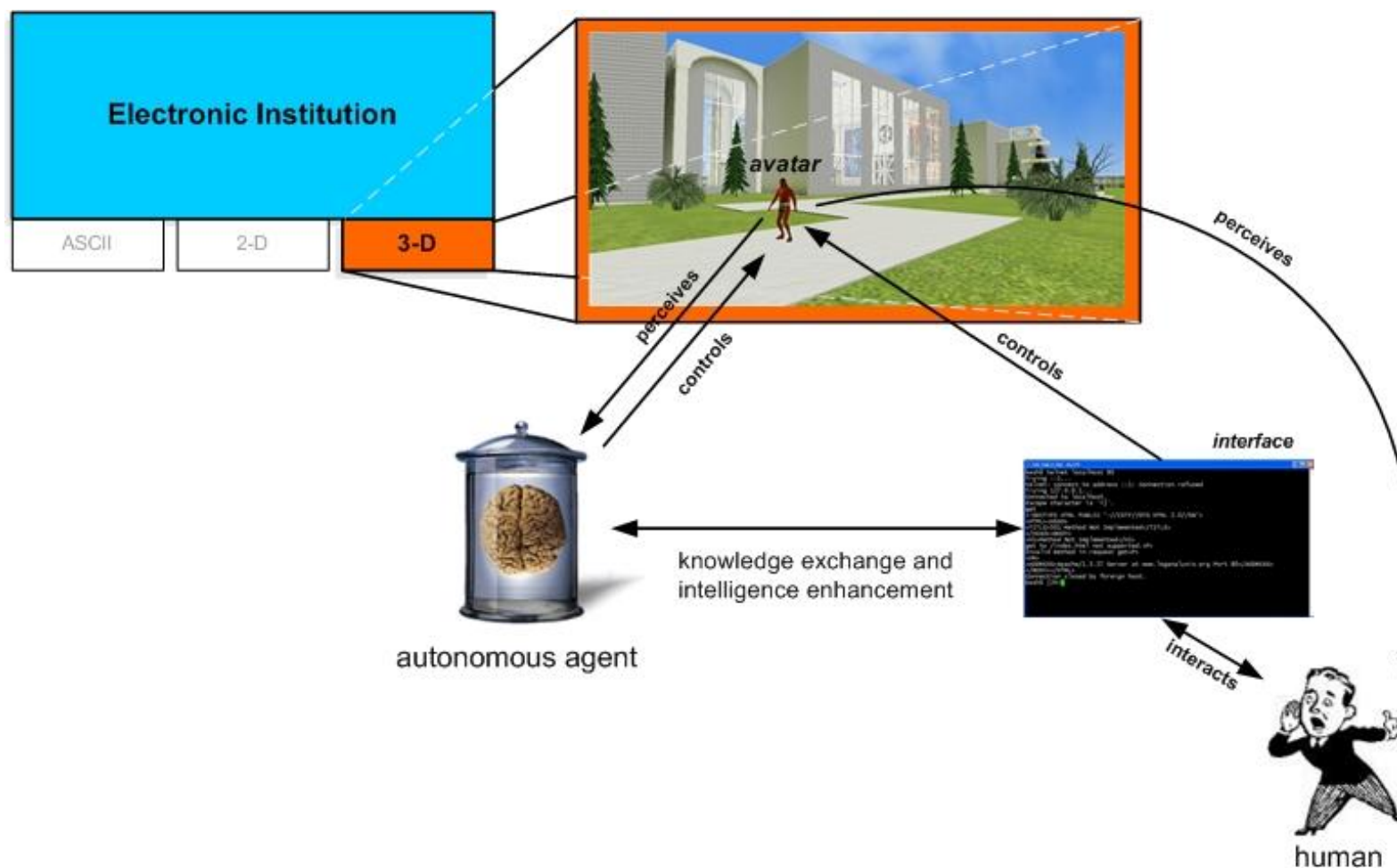
Deployment Architecture

Deployment



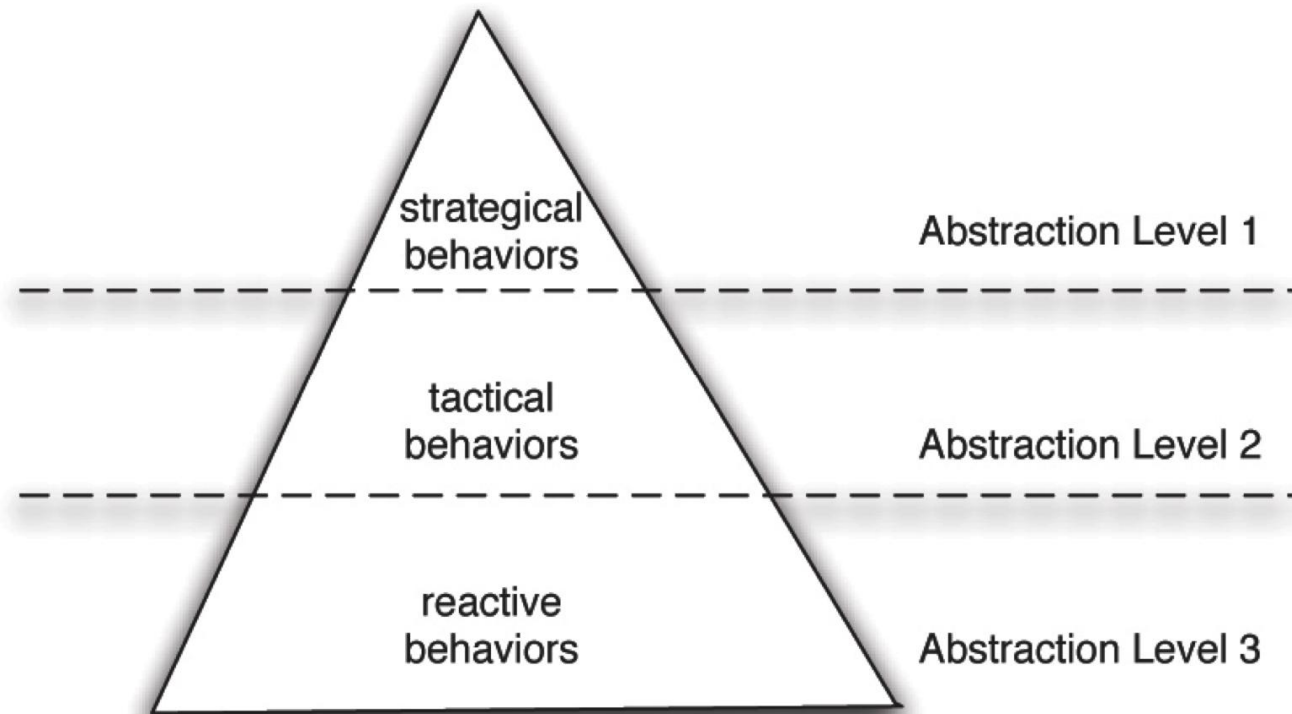


Learning Issues





Imitation Learning in Virtual Institutions





Imitation Learning in Virtual Institutions

Imitation Learning in Virtual Institutions

