

Widgets, Planets, and Demons: The Case for the Integration of Human, Embedded, and Virtual Agents via Mediation

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We present a unified conceptual framework for the integration of **H**uman agents, **E**MBEDDED sensory-enabled robotic agents, and autonomous **V**irtual agents, which communicate via a central **M**ediator (see Figure 1). The three different agent groups may have different goals and even different tasks. The mediator takes messages from any of the three groups of agents, transforms the messages, and relays the information to the other groups. We call this unified framework, **HEV-M**. **HEV-M** formalizes this union of three disparate agent systems, and thus allows for a richer understanding of their interactions.

We motivate the creation of this architecture with three hypothetical examples: **Widget Factory**, **Planetary Rover**, and **Demon Soccer**. In **Widget Factory** humans and virtual agents control simple machines that create parts of widgets. This environment can show, for example, that minor errors in the creation of the parts can dramatically alter the resultant outcome. In **Planetary Rover** humans cooperate with virtual agents to control a robotic agent. The virtual agents utilize sensory data about their environment to make independent decisions. This environment can enable the exploration of collaborative human-robot protocols. In **Demon Soccer** human agents interact with virtual agents to control a soccer ball. The human agents play on opposing teams and attempt to steer the soccer ball in to their opponent's goal. The four wheels are controlled by four different agents, two different humans, and two different demon agents that either malignantly or randomly alter their speed and direction. This environment enables the exploration of mediation between hostile agents.

Finally, we demonstrate a working prototype of a platform (NetLogo) that supports simulated, participatory, and physical agents and will be utilized for the development of these examples. This preliminary prototype is of human and virtual agents working together to guide a robotic agent through a maze.

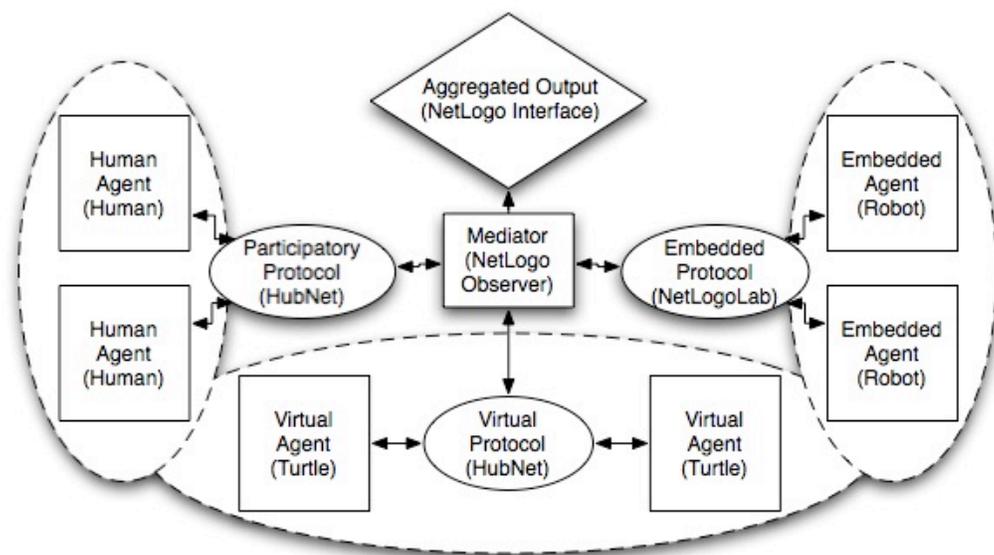


Figure 1: HEV-M Framework