Yannick Dennemont, Guillaume Bouyer, Samir Otmane, Malik Mallem

To cite this version:

HAL Id: hal-00761912
https://hal.archives-ouvertes.fr/hal-00761912
Submitted on 6 Dec 2012

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers. L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Yannick Dennemont, Guillaume Bouyer, Samir Otmane, Malik Mallem
IBISC Laboratory
40 rue du Pelvoux, Evry, France
FirstName.LastName@ibisc.fr

ABSTRACT
We propose a semantic reasoning engine for context-awareness in classic VR environments. It is currently used to automatically detect user’s interests and manage visual enhancements depending on the user’s movement.

Categories and Subject Descriptors
I.3.6 [Methodology and Techniques Subjects]: Interaction Techniques; I.3.7 [Computer Graphics]: Virtual reality; I.2.4 [Computing Methodologies]: Knowledge Representation Formalism and Methods

Keywords
Context-awareness, 3D interaction assistance, Adaptive 3D interaction,

1. INTRODUCTION
Tasks in immersive virtual environments are associated to 3D interaction (3DI) techniques and devices. As tasks and environments become more and more complex, these techniques can no longer be the same for every application. Our work focuses on 3DI assistance by adding adaptivity depending on the interaction context. To reach context-awareness, an engine has been designed, implemented with the Amine platform and tested with a Virttools application.

2. A SEMANTIC REASONING ENGINE
The engine uses rules to take decisions regarding a stored context (knowledge, events etc.). Context and decisions concern the user, the interaction and the environment. They communicate with the engine through a set of tools with a semantic description by using Open Sound Control. Tools can be actuators with perceivable multimodal effects (environment modifications etc.) or sensors that retrieve information (by monitoring the interaction, etc.). The engine uses Conceptual Graphs (CGs) which provide a good expressiveness and usability. CGs link concepts with relations, both classified in an ontology. They are used to describe rules and facts. Decision request seeks a true reaction applicable by a tool. Then, the engine aggregates its global confidence (degree of sureness) and impact (degree of perceived repercussion). A CG global confidence depends on all paths leading to a true expression of the described situation using facts, events and rules. A CG fact is certain by default or can supply its own confidence (e.g. provided by a sensor). Events confidence decreases with the ratio of their remaining validity. Rule effects confidence is equal to the rule causes average confidence, times the rule confidence itself. Finally the global confidence of a CG expression is obtained by a fusion function. With $n$ paths and Mean as their average confidence value: $\text{GlobalConfidence} = (1 - \text{Mean}) \times (1 - \frac{1}{n}) \times \text{Mean} + \text{Mean}$.

Next, the engine aggregates the decisions impact. Each tool has an initial impact which can be modified given specific cases. Initial impact equals to 0 (without any impacts) or 1 (with the most impact) are not modified. Otherwise at each applicable case, the impact is altered with a weight ($W$, 25% if not valued) $\text{impact}(n) = \text{impact}(n - 1) - W \times \text{impact}(n - 1)$ for a decrease or $\text{impact}(n) = \text{impact}(n - 1) + W \times (1 - \text{impact}(n - 1))$ for an increase. An acceptable total impact limits the decisions that can be made, which induces a knapsack problem as a last classification.

3. 3D INTERACTION ASSISTANCE
The engine is applied in a case study to automatically acquire and enhance user’s interests. Sensors describe user movement, gestures and Zones of Interest (ZOI) content. Actuators create the ZOI, change objects color or add an attraction. The engine triggers adaptations using internal rules and those tools. Thereby, a object is colored red when the user passes by or points at it and reset when the user moves far away or after time. An attraction is added to the virtual hand when the object is detected several times as its average confidence value: $\text{GlobalConfidence} = (1 - \text{Mean}) \times (1 - \frac{1}{n}) \times \text{Mean} + \text{Mean}$.

Copyright is held by the author/owner(s).
ACM 978-1-4503-1469-5/12/12.