

Splitting the Scene Graph

Using Spatial Relationship Graphs instead of Scene Graphs in Augmented Reality

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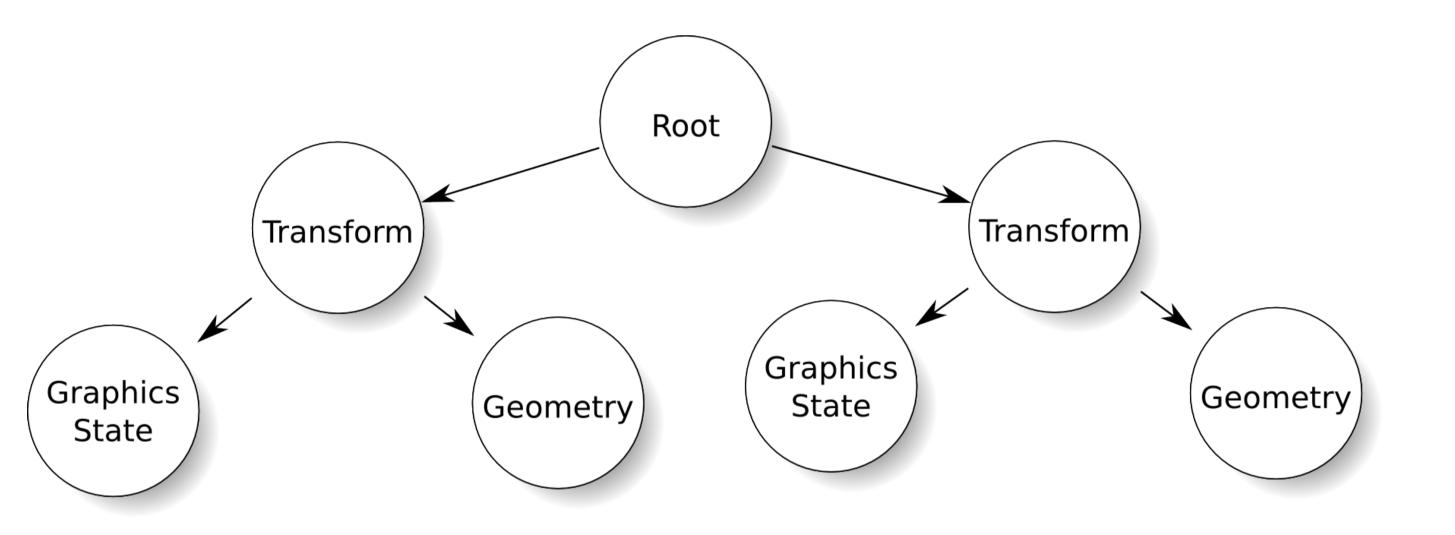
Abstraction Concepts for Augmented Reality

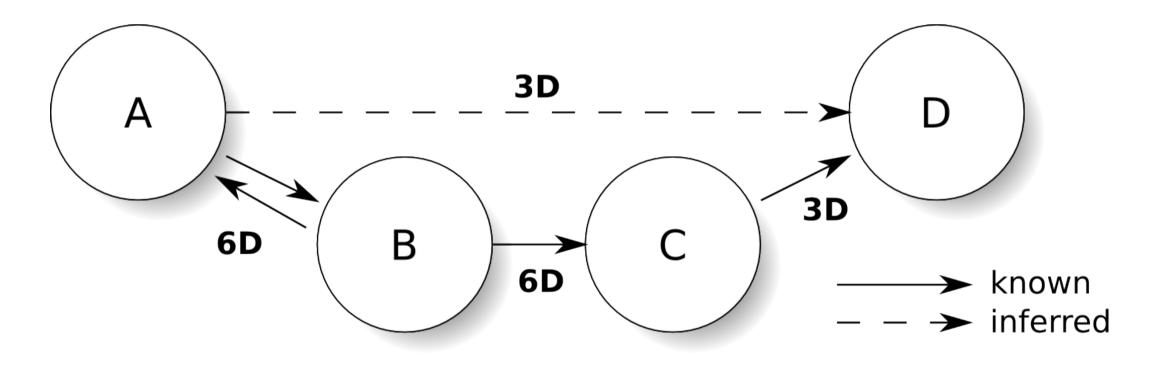
The Spatial Relationship Graph

The Scene Graph

- Generalized directed graph
- Edges \Rightarrow coordinate transformations (e.g. trackers)
- Edge attributes:
- Static/dynamic
- Known/unknown
- Type of transformation (3D, 6D, ...)
- Drawbacks:
- Large graphs with, e.g., many CG primitives infeasible
- Advantages:
- Intuitive representation of real-world setup
- Supports sensor fusion through graph-search

- Tree-like structure (sometimes DAG)
- Nodes: spatial or graphics mode states
- Traversed by depth-first search
- Drawbacks:
- No consistent representation of non-renderable coordinate systems
- Advantages:
- Fast scene traversal
- Inheritance of graphics state

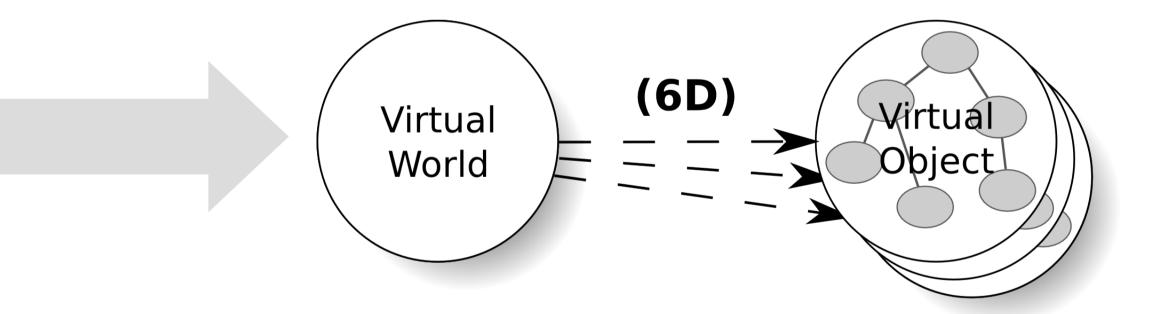




Goal: Combine the Advantages

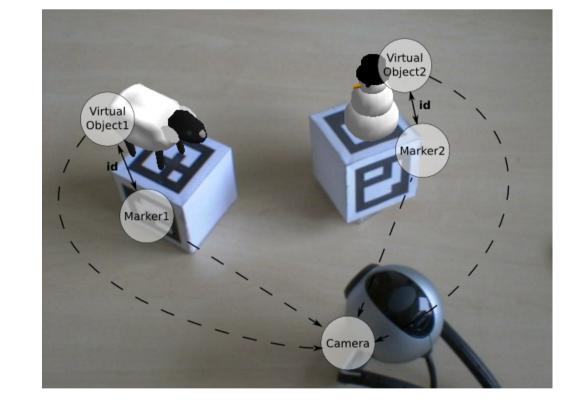
Splitting the Scene Graph

- Split scenegraph into static subtrees (no external transformations)
- Encapsulate subtrees into SRG nodes
- Construct rest of SRG as usual (trackers, markers ..)



Implementation

- Based on Ubitrack [3] + TinyXML libraries
- X3D memory representation as scenegraph
- Traversal/rendering using Visitor pattern



Results

• Drawbacks:

• State sorting of CG objects difficult

References

[1] Newman, J., Wagner, M., Bauer, M., MacWilliams, A., Pintaric, T., Beyer, D., Pustka, D., Strasser, F., Schmalstieg, D., and Klinker,

- Advantages:
- Entire AR application represented as a single graph
- Dynamic transformations from scenegraph moved to SRG
- Rendering code traverses tracked objects only
- Single object representation can be reused

G. (2004). Ubiquitous Tracking for Augmented Reality. In Proceedings of the 3rd International Symposium on Mixed and Augmented Reality (ISMAR). [2] Pustka, D., Huber, M., Bauer, M. and Klinker, G. (2006). Spatial **Relationship Patterns: Elements of Reusable Tracking and Calibration Systems**. In *Proceedings of the 5th International*

Symposium on Mixed and Augmented Reality (ISMAR). [3] Huber, M., Pustka, D., Keitler, P., Echtler, F. and Klinker, G. (2007). A System Architecture for Ubiquitous Tracking **Environments**. In *Proceedings of the 6th International* Symposium on Mixed and Augmented Reality (ISMAR).



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