

Specifying Consistency Requirements for Massively Multi-User Virtual Environments

Laura Itzel, Richard Süselbeck, Gregor Schiele, Christian Becker

University of Mannheim

{laura.itzel; richard.sueselbeck; gregor.schiele; christian.becker}@uni-mannheim.de

Problem: MMVE Consistency



Perspective of User 1

- Balance of *consistency* and *responsiveness* important
 - consistent view for all MMVE users
 - reflect actions instantaneously in the user's view

→ This balance is highly situation-dependent



Perspective of User 2

Future Work

- Detection of the Interaction Context at runtime
- Integration of the concepts into our existing consistency management framework
- Evaluation of our concepts

Interaction Context

- Update Type
 - The specific action the update represents
 - E.g., *Position Update* or *Trade*
- Affected Entities
 - The entities affected by the update, e.g. avatars or objects being involved in the interaction
 - Entities initiating interaction and those affected by the effects of the interaction
- Dependent Interactions
 - Update's dependence of and influences on other interactions than its own
 - Existing interactions as well as potential future interaction

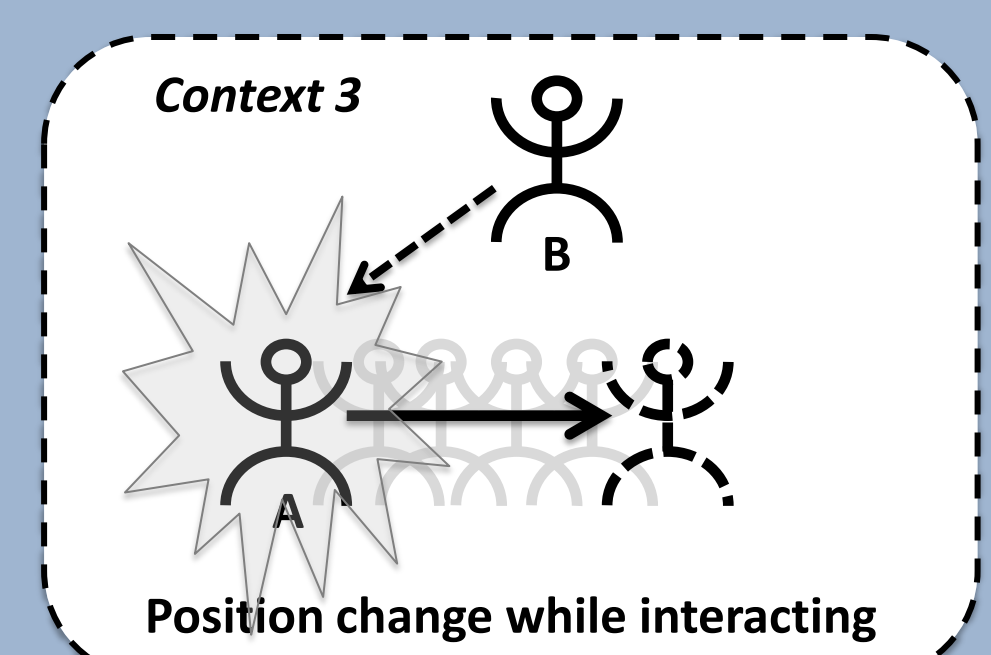
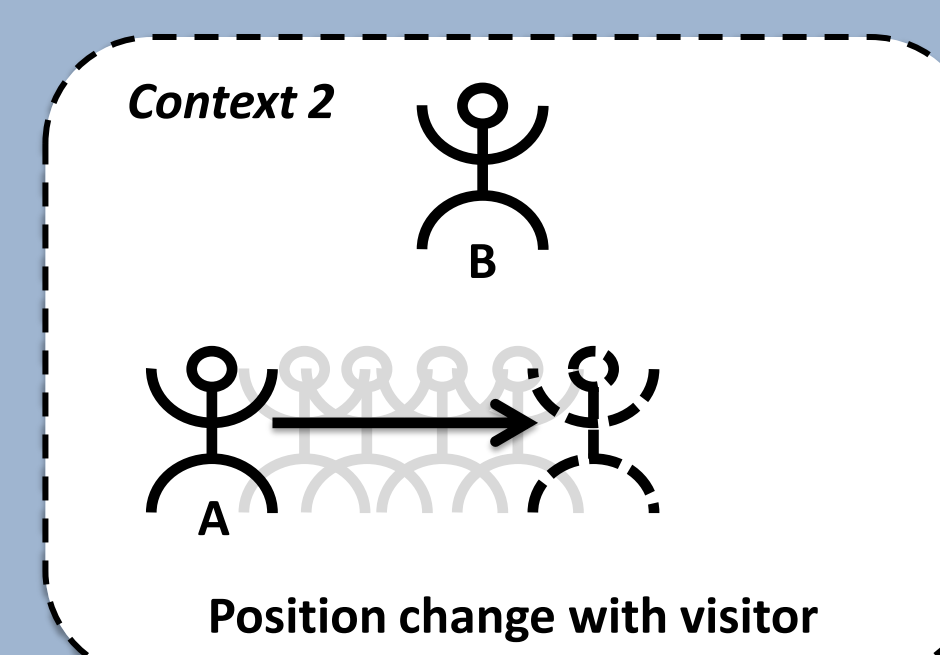
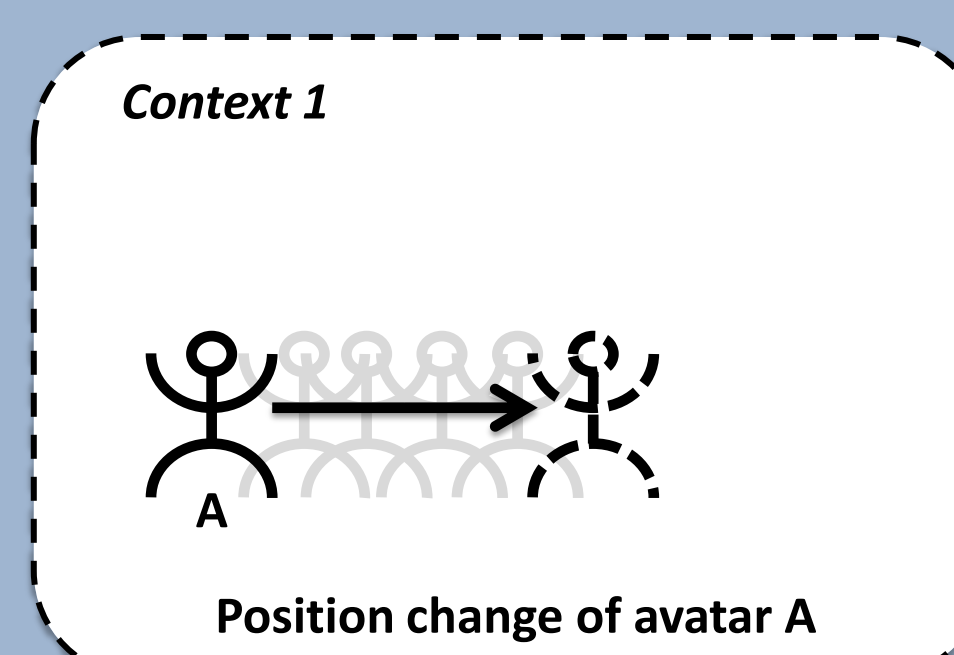
Approach: Consistency Metrics

- Inconsistency Tolerance
 - Minimal requirements for each state update in terms of the maximum state divergence tolerated
 - E.g., distance between an entities' actual and perceived position
- Interactivity
 - Update's requirements regarding responsiveness, i.e. how much latency can be tolerated
 - Maximum amount of time until the state change appears to the user
- Priority
 - Possible relaxation of the consistency requirements, in case of high system load
 - Determine for which updates the provided consistency can be reduced first

Specification Examples

To use our specification scheme, an application developer has to

- identify the set of Interaction Contexts relevant to its application
- Specify the consistency and responsiveness requirements using the Consistency Metrics



	Update Type	Affected Entities	Dependencies	Incons. Tolerance	Inter-activity	Priority
Context 1	Position Update	Avatar A	none	high	low	low
Context 2	Position Update	Avatar A & B	none	medium	medium	medium
Context 3	Position Update	Avatar A & B	yes	low	high	medium