

# Spatial Data Analysis in 3D GIS

*Working Group IV Analysis  
3D Geoinfo '07 Workshop*

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# Purpose of WG IV: Analysis

- Five Working Groups:
- **Brainstorm Discussions** on 3D Analysis;
- Define the statements of 3D Analysis – comparing to 2.5D or 2D Analyses; based on Types, algorithms, tools, etc. (Analysis in 3D Space)
- Identify open problems/issues in 3D Analysis;
- Bring any possible solutions in 3D Analysis;
- Understand important research topics

## WG IV: Analysis

- **3D Analysis** is very closed to the **3D Data models**, but focuses on the analysis aspects;
- is also related to **3D Applications**;
- However, analysis tools or algorithms are depend on the data types: representing continuous space or discrete objects in 3D;
- 3D Analysis has been done in different geographical scales: **macro-scale** (outdoor spatial analysis) vs. **micro-scale** (indoor spatial analysis);

# 3D Analysis in Macro-scale:

## • Urban Planning: Streetscape Design Simulation:



### Urban Planning

Visualization of the remodelling of the Graf-Wilhelm-Plaza in Solingen

### Cooperation

- City of Solingen
- Quick Architects
- GRI Berlin
- IKG, Univ. Bonn
- IPB, Univ. Bonn
- GeoCart

Provided by: Prof. Thomas Kolbe

# 3D Analysis in Macro-scale:

## • Visibility Analysis and others:

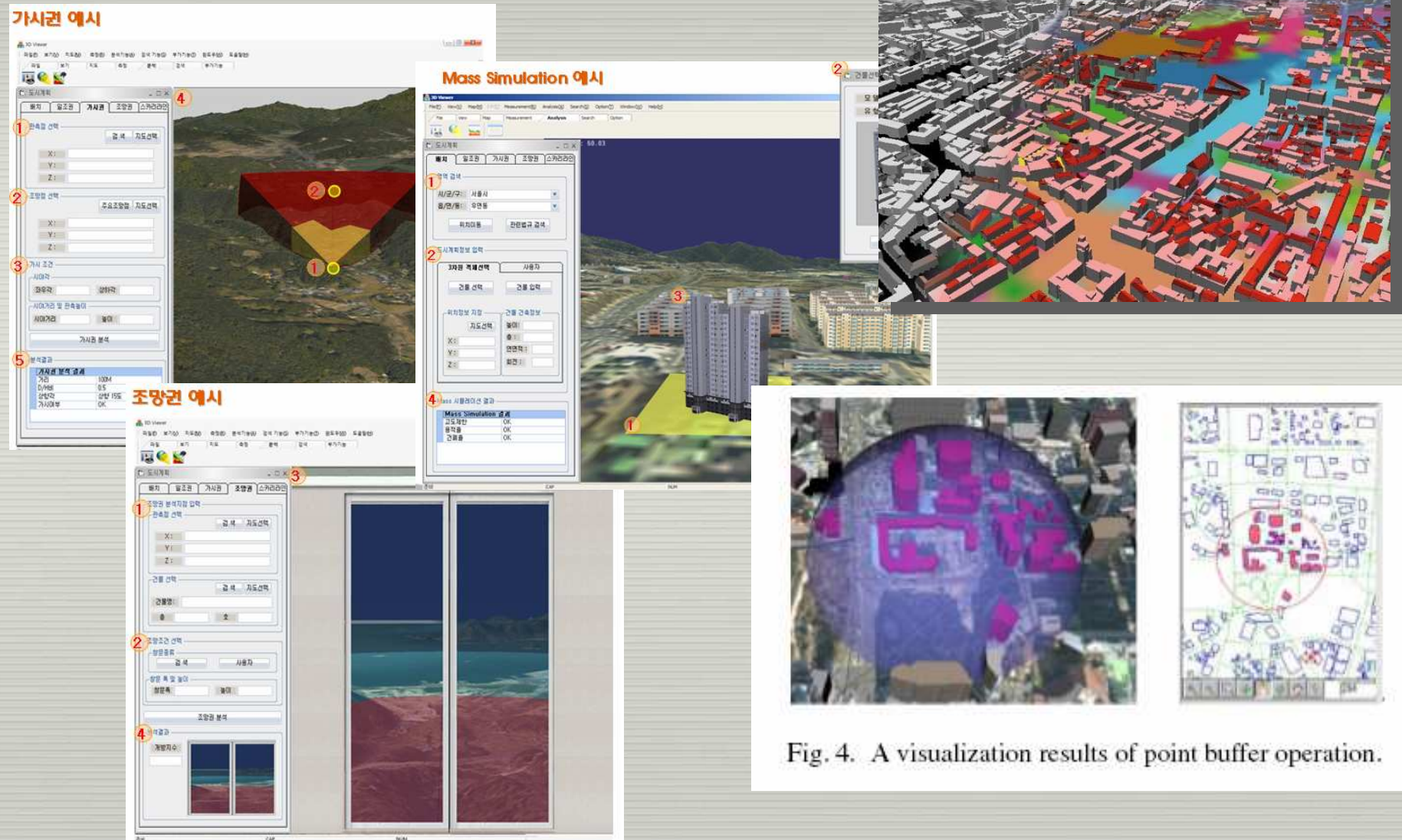


Fig. 4. A visualization results of point buffer operation.

# Indoor Representation for Micro-scale Analysis:

Real World

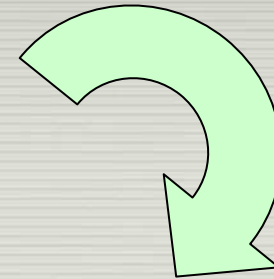


Manhattan, New York City

3-D GIS



Outdoor Representation



2-D GIS



3-D GIS  
Visualization

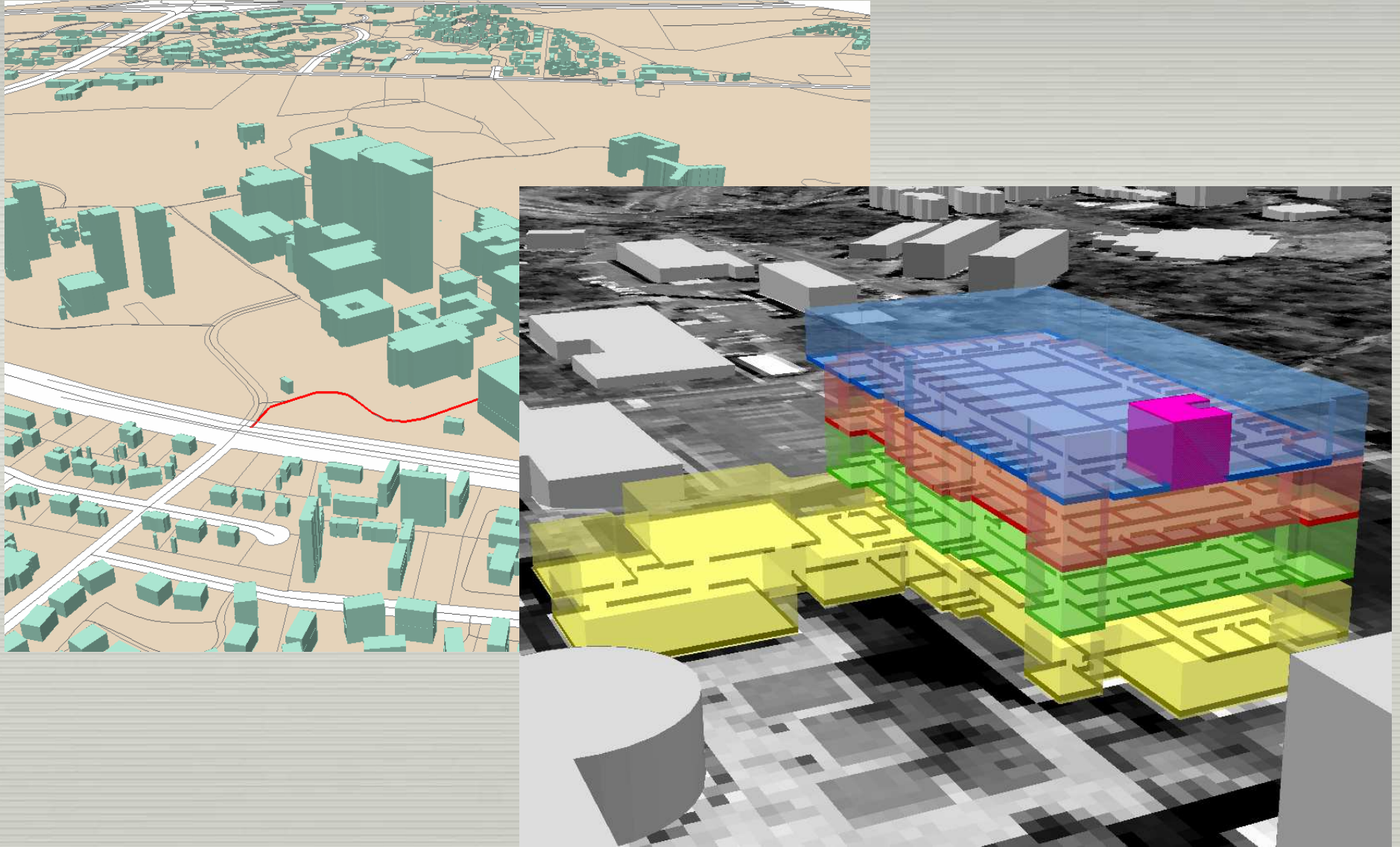


Indoor Representation



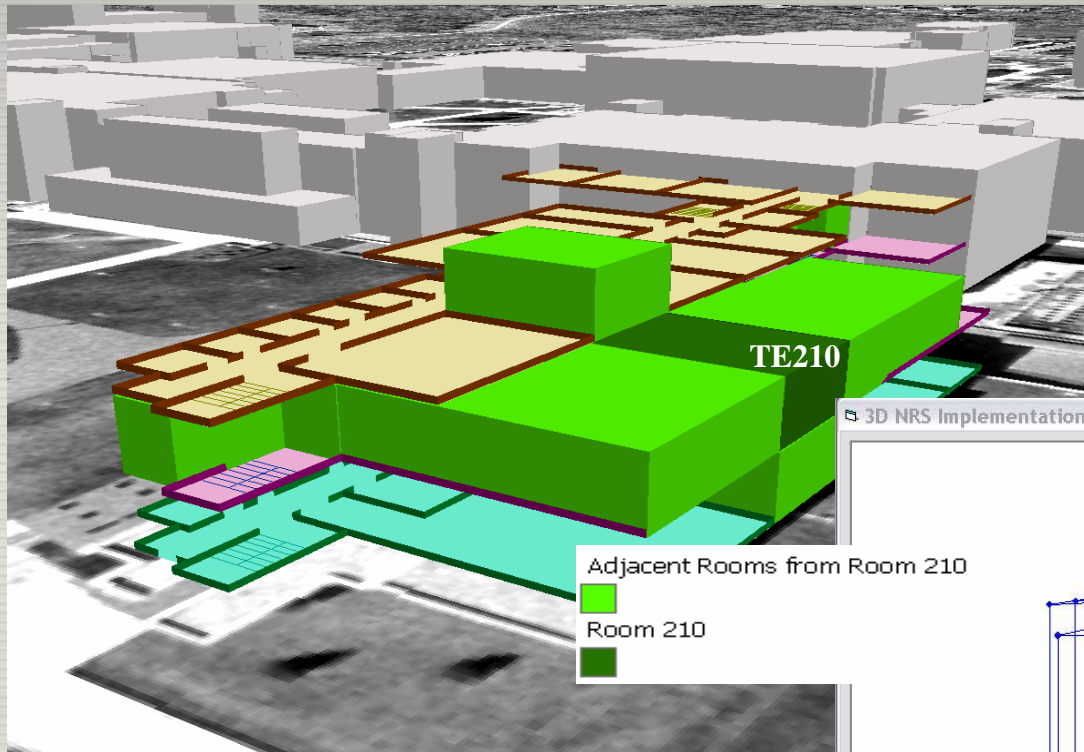
# 3D Analysis in Micro-scale:

- **Indoor Navigation:**

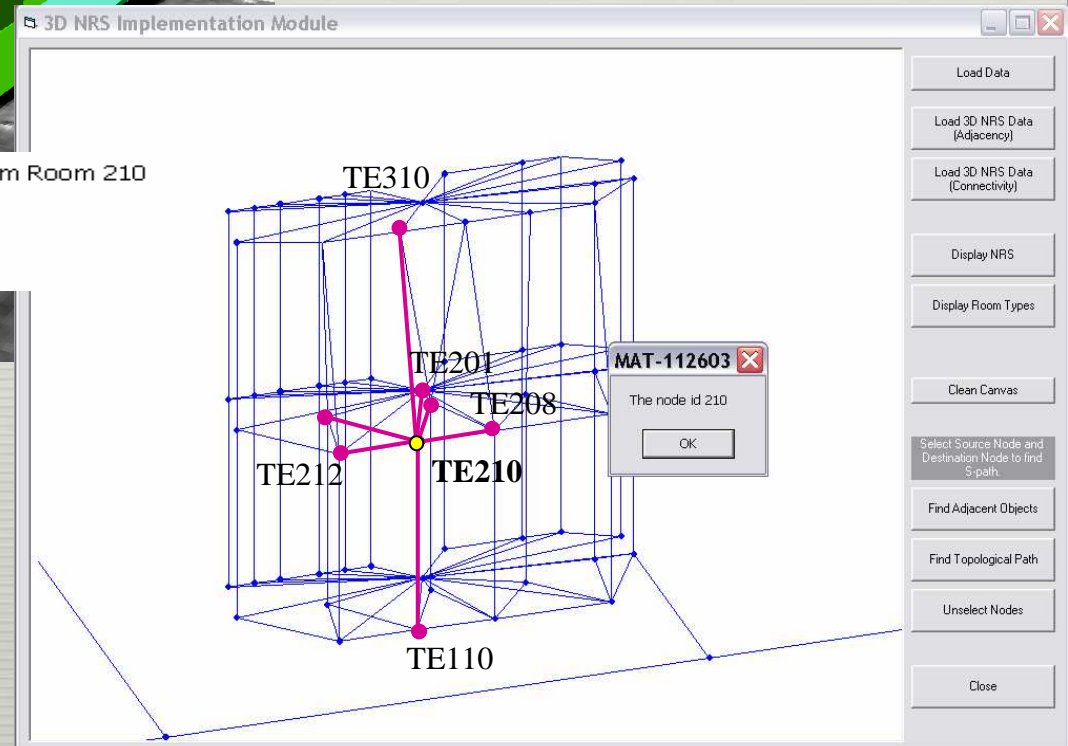


# 3D Analysis in Micro-scale:

- **Spatial Queries (Adjacency):** defining spatial neighbors



Topological Representation:



Geometric Representation:



# WG IV: Analysis

- Identify open problems/issues in 3D Analysis
  - related to 3D Data Models or
  - complex geometric computations
- Bring any possible solutions in 3D Analysis;
- Understand important research topics

# WG IV: Analysis

- Basic key functions needed to develop 3D GIS:
  - 3D spatial queries – based on geometric location and topological relationships;
  - 3D Intersections and overlays– between two 3D, 2D, 1D, or 0D combinations;
  - 3D Overlays for 3D objects (9 intersection operations)
  - 3D Buffer – from 3D, 2D, 1D, and 0D;
  - 3D Distance – geometric distance or nearness (cost-weighted distance) between two objects;
  - 3D Navigations – based on ‘time-dependent’ best route algorithms;

# WG IV: Analysis

- Basic key functions needed to develop 3D GIS
  - Geo-statistics in 3D space:
    - ‘Constrained’ 3D Spatial Interpolations? – 3D Kriging;
    - Spatial Autocorrelations;
    - Central tendency and dispersion analysis;
    - Density;
  - temporal (moving) data analysis functions;
  - Spatial operators for 3D reasoning
  - Object abstraction tools (change object’s dimensions) – such as Medial Axis Models, etc.
  - Label Placements in 3D;
  - Data Generalizations (for LoD datasets);

# WG IV: Analysis

- Basic key functions needed to develop 3D GIS
  - 3D Spatial Data Validation in DBMS;
  - Aggregation of 3D objects;
  - Surface Construction algorithms;