

# VISCO: Bringing Visual Spatial Querying to Reality

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VISCO Homepage: <http://kogs-www.informatik.uni-hamburg.de/~mwessel/visco.html>

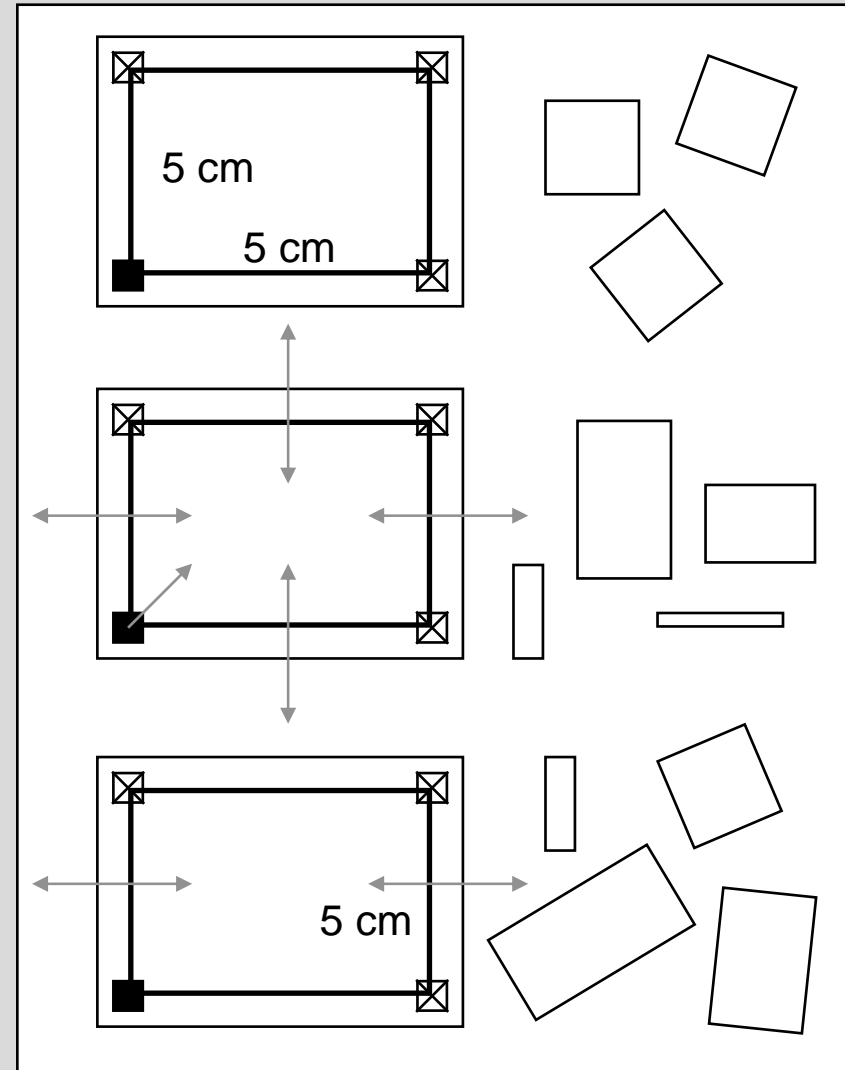
- The Visual Language VISCO
- The VISCO Prototype
  - Architecture
  - Graphical User Interface
  - Representing, Compiling and Executing Queries
    - Abstract Syntax Graph (ASG)
    - Optimizing Compiler (Petri Net Model)
- Example (Quicktime Movie)
- Conclusion

# VISCO: Vivid Spatial Constellations

## Basic Key Concepts

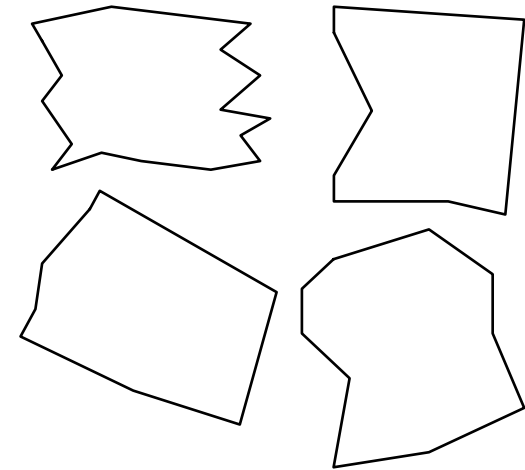
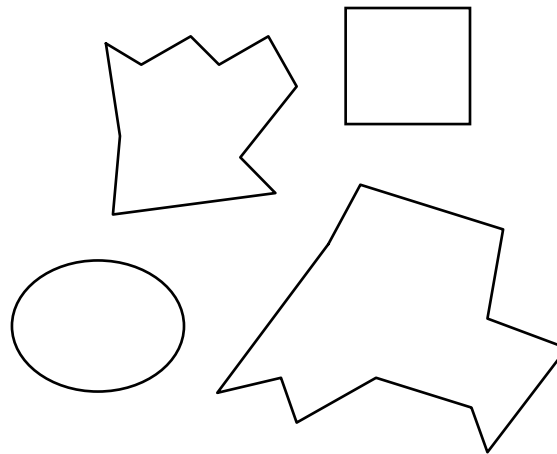
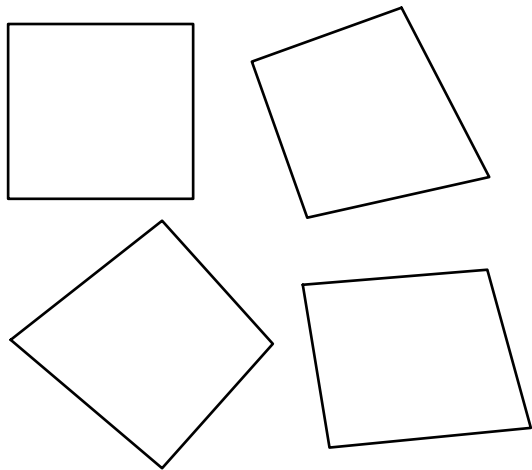
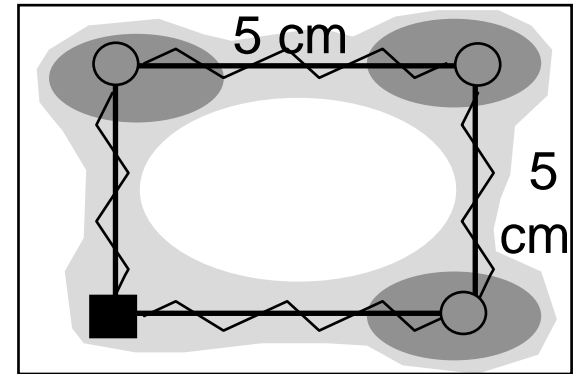
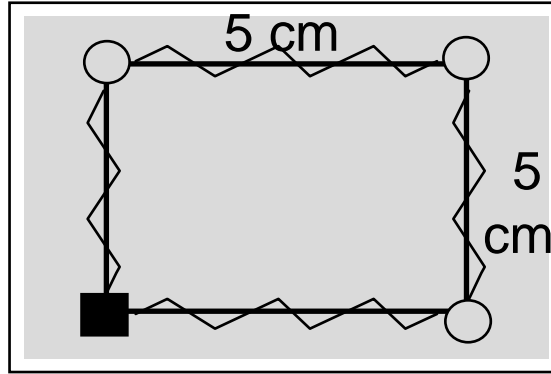
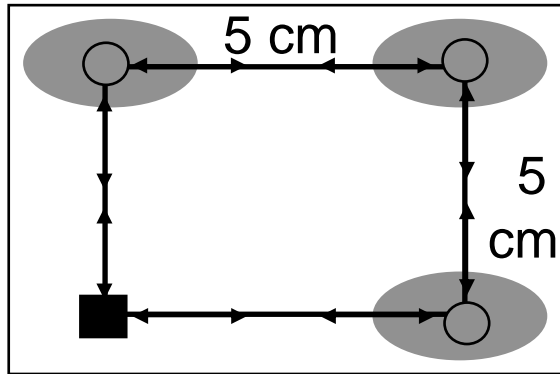
- Represent constellations (aggregates) of geometric objects
  - Describe classes of pictures through pictures, represent spatial aspects *directly*
    - adequacy, consistency, transparency
  - Extensions
    - VSQL: retrieve from spatial DB
  - Geometric objects
    - Transformable aggregates with local coordinate system, polygons & polylines, segments, points
  - Guidance of interpretation of visual aspects present in a VISCO definition
    - Physical metaphors
    - Meta objects
  - Expressive: metric, geometric and topologic relationships / constraints
    - inside / contains, disjoint, intersects

## Some Quadrilaterals




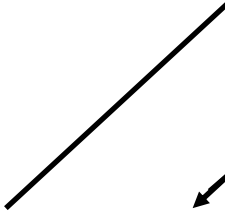
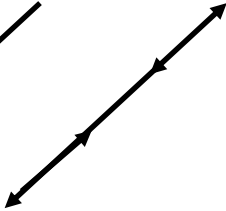
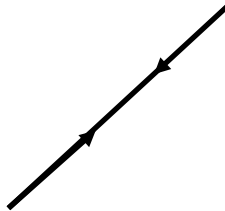
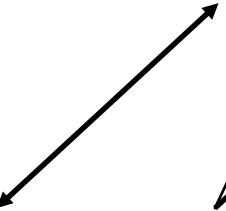
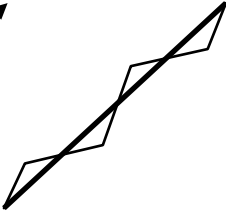
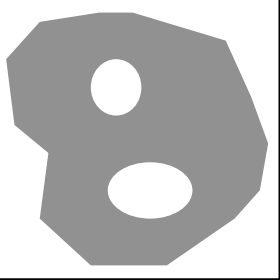
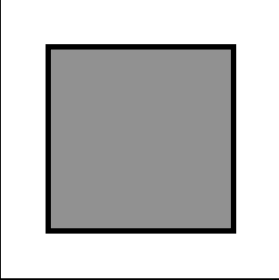
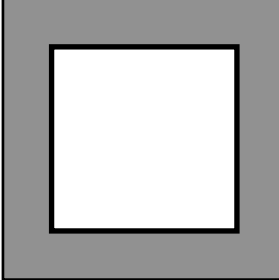
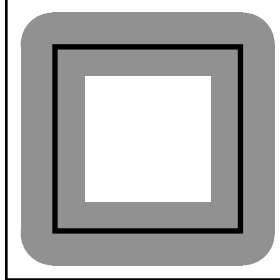
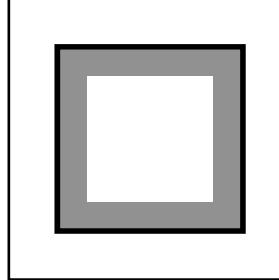
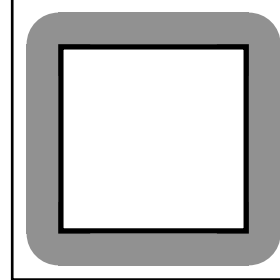
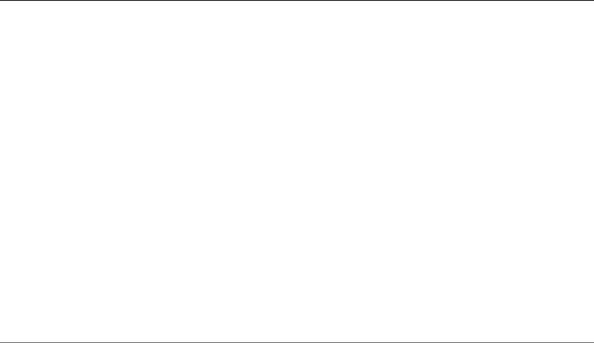
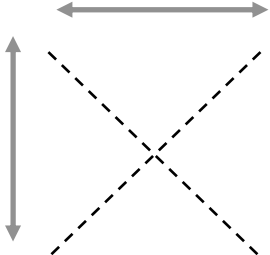
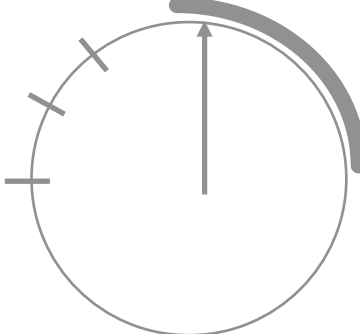


# VISCO: Concrete Shape, Arbitrary Shape, Vague Shape

Degree of Vagueness can be seen (“Mental Animation”)



# VISCO: Overview of Language Elements (Incomplete)

							
Marble	Nail	Origin	Beam	Antenna	<=-Antenna	>=-Antenna	Rubberband
							
Constant Encl.	Inner Encl.	Outer Encl.	Epsilon Encl.	Inner Epsilon	Outer Epsilon		
		<p>Lake</p> <p>Thematic Descriptor</p> <p>10 ... 100 m</p> <p>Size Indicator</p> <p>5</p> <p>At Most Constraint</p>		 <p>Scaling</p>		 <p>Arrow &amp; Scale</p>	
Transparency Film							

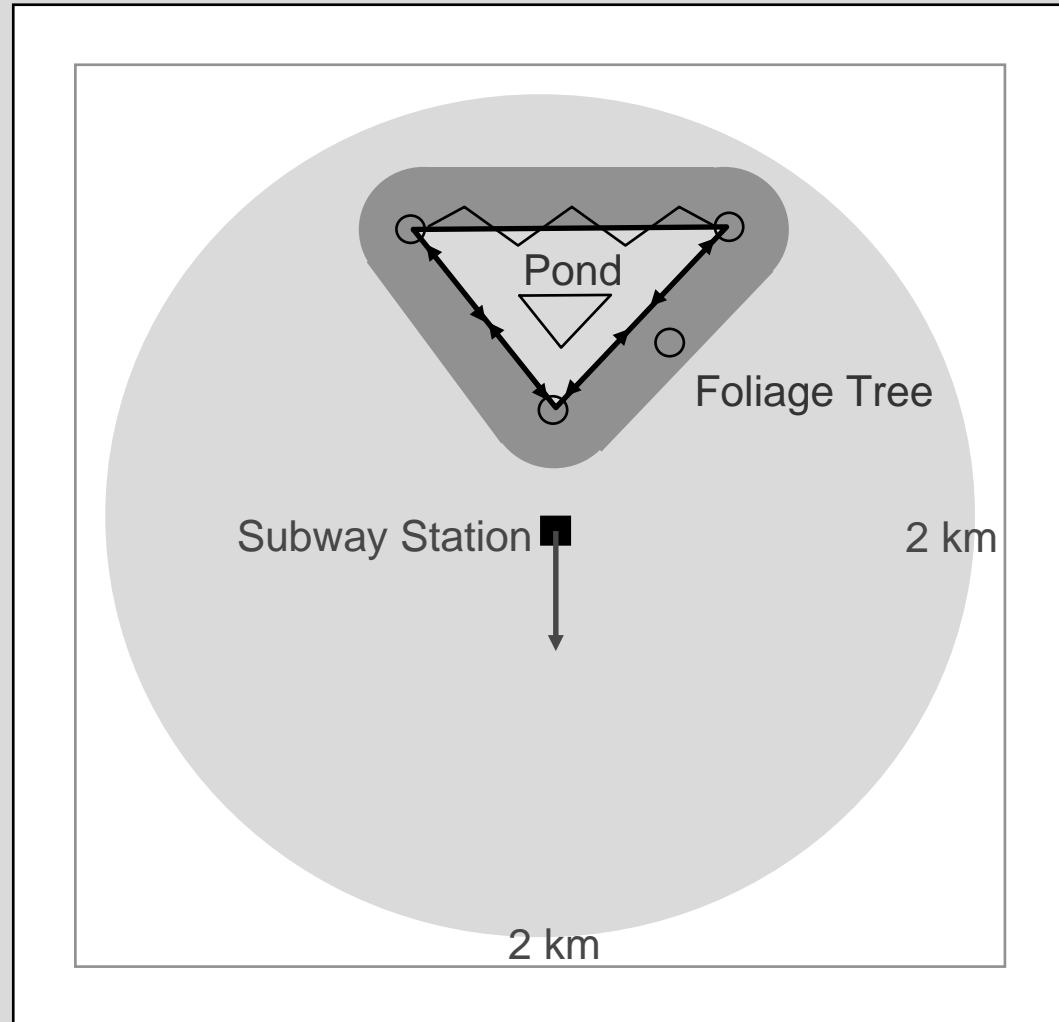
# Example Query: How to Find a BBQ Place with VISCO

## Requirements for BBQ Place

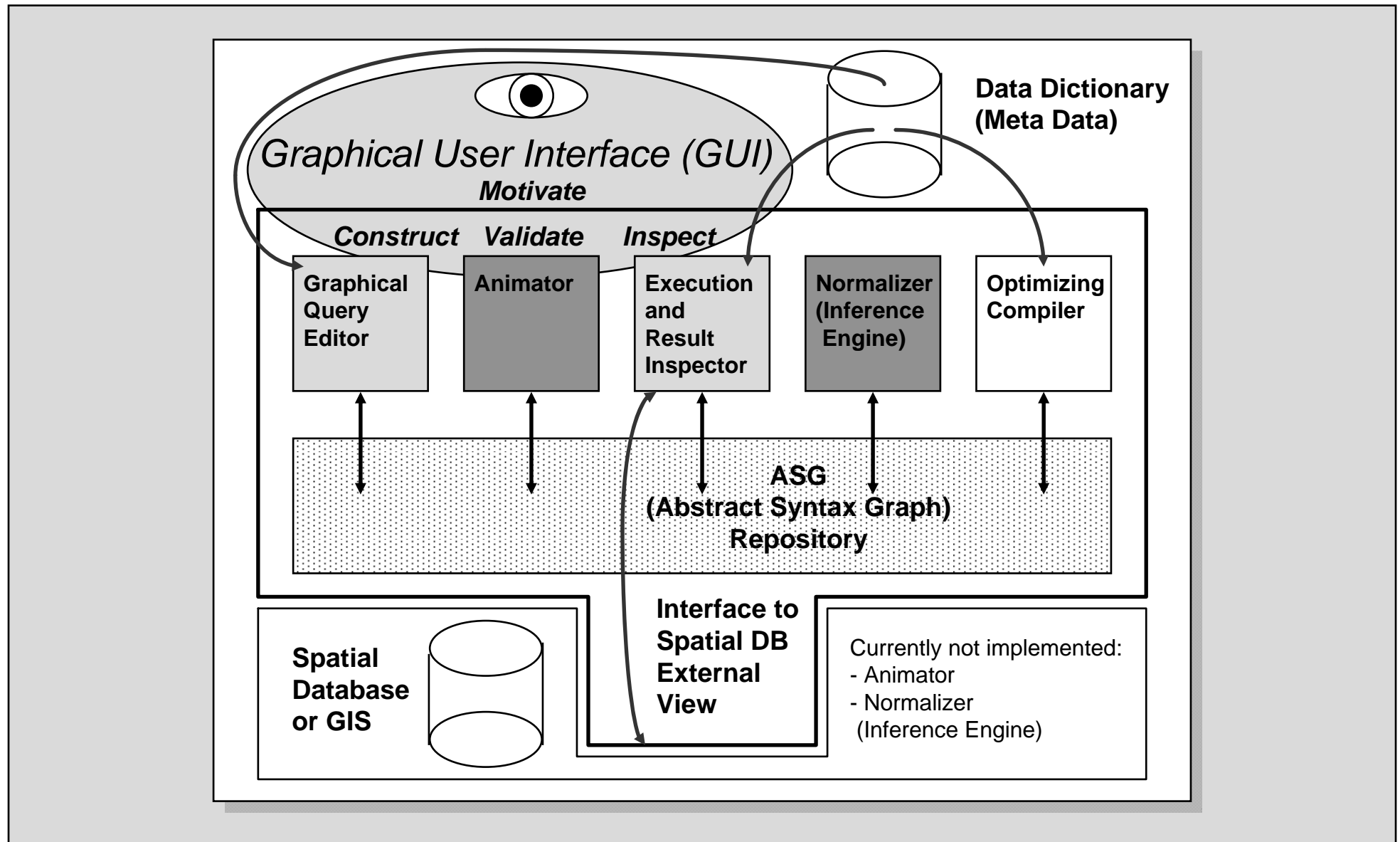
- If you don't own a car, it must be in the vicinity of a subway station, we don't want to walk much more than approx. 800 meters
- We would like to sit at a pond
- If it is a hot or rainy day, it would be good if there were some trees to protect us
- However, only foliage trees are suitable

Distinguish explicit and implicit composite objects!

## VISCO Query



# The VISCO Prototype: Logical Architecture



# VISCO GUI: The Graphical Query Editor

The image displays the VISCO GUI interface, which is a graphical query editor. The main window is titled "VISCO" and contains several panels:

- Working Area:** A large central area for editing queries, showing a map with various objects and a 2000 m scale. The map includes labels like "DB-C", "DB", "Teich nicht schiffbar", "Lackholz", and "U-Bahn-Station".
- Infos:** A panel on the right showing "VISCO Infos" with a list of warnings: "Warning: While compiling these ur", "Warning: While compiling these ur", "Warning: While compiling EXEC-5:", "Warning: Variable QUERY-COMP", "Warning: While compiling these ur", "Warning: While compiling these ur", "Warning: While compiling these ur", "Warning: While compiling these ur", "Warning: While compiling these ur", "Warning: While compiling these ur".
- Query Construction History:** A panel on the right showing a list of steps: "Step 1: Create TRANSPARENCY-0", "Step 2: Create ORIGIN-2", "Step 3: Create EPSILON-ENCLO:", "Step 4: Create MARBLE-18", "Step 5: Create MARBLE-20", "Step 6: Create RUBBERBAND-2", "Step 7: Create MARBLE-24", "Step 8: Create MARBLE-28", "Step 9: Create MARBLE-30", "Step 10: Create POLYGON-30", "Step 11: Create EPSILON-ENCLC", "Step 12: Create MARBLE-34".
- Command Line:** A panel at the bottom showing commands: "Command: Set Semantics MARBLE-34", "Command:", "Command:", and "M: Delete MARBLE-34; R: Menu.".
- Buttons:** A panel on the right titled "VISCO Buttons" containing various icons for "VISCO Objects", "VISCO Operators", and "VISCO Options".

Annotations in blue text are overlaid on the image:

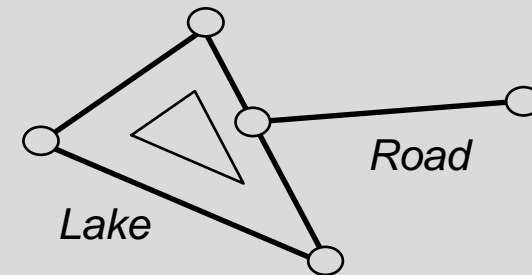
- Working Area:** Located on the left side of the main window.
- Infos:** Located on the right side of the main window.
- Query Construction History:** Located on the right side of the main window.
- Command Line:** Located at the bottom of the main window.
- Buttons:** Located on the right side of the main window.
- Objects:** Located on the right side of the main window.
- Operators:** Located on the right side of the main window.
- Options:** Located on the right side of the main window.

# Representing Queries

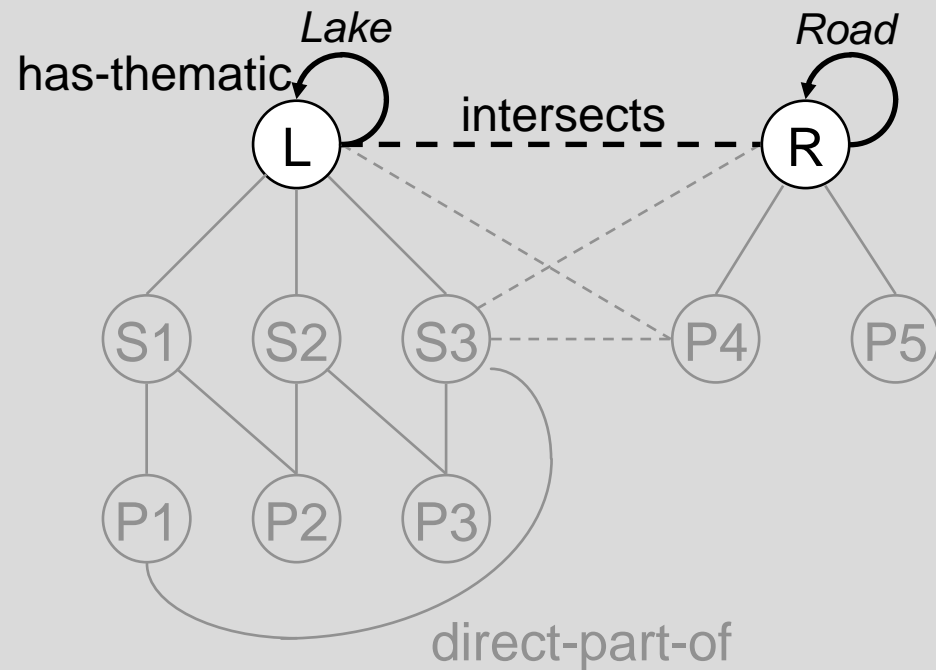
## Abstract Syntax Graph (ASG)

- Directed multi-hypergraph with attributed edges
  - Properties (unary)
    - “*has-thematic(x)*”
  - Edges (binary)
    - “*direct-part-of(p,l)*”
  - Hyperedges (tenary, ...)
    - “*intersection-point-of(p,l1,l2)*”
- ASG maintained by operator applications provided by the repository module
  - Preconditions
- Graphical query editor maps user’s interactions to internal ASG operator applications
  - History of operator applications

## Simplified Query



## Simplified ASG



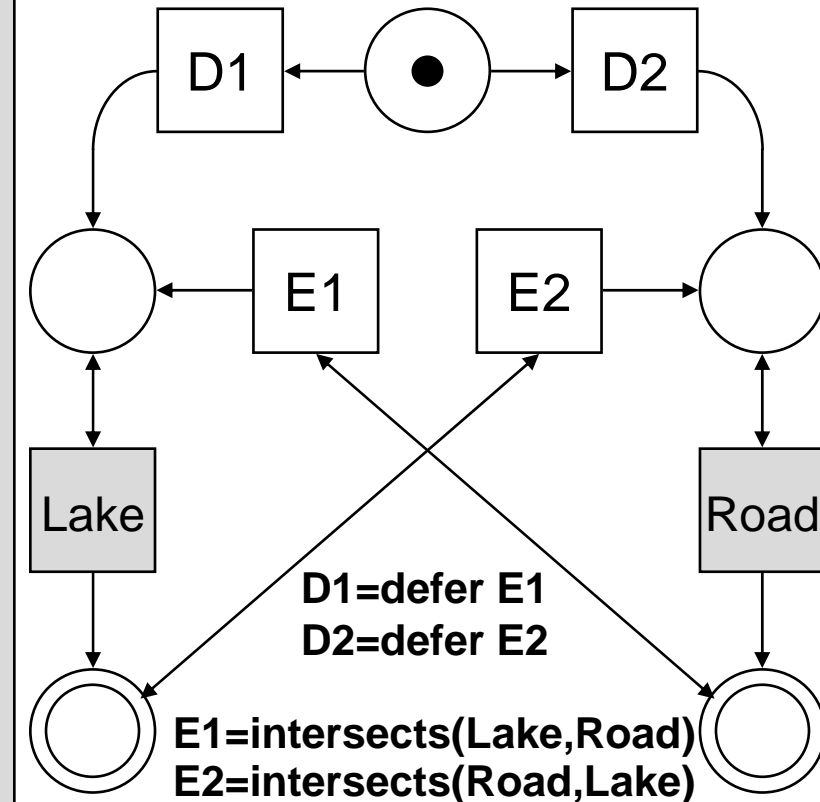


# Compiling & Executing Queries

## Plan Generation

- Use ASG to construct an execution plan
  - Order of sequence of node processing (currently, simple Backtracking)
  - Binary inverse constraints: multiple plans become possible, potentially  $n!$
  - Optimizer: find best plan by valuation
- Query objects
  - Searchable, use indexing, especially spatial indexing
- Universal objects
  - Must be constructed (components or operator arguments already instantiated)
- Geometric objects & enclosures
  - Spatial selection possible
    - e.g. use R-Tree

## Compiler: Petri Net Model



Possible **D1 - Lake - E2 - Road**  
Plans: **D2 - Road - E1 - Lake**

# Current State of Work, Conclusion & Future Work

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- VISCO prototype places additional restrictions on the (query) language VISCO
  - E.g., transformations must be uniquely determinable
    - E.g., for an universal arbitrary scalable and rotatable transparency film at least 3 non-collinear instantiatable nails are needed
- Optimizer: use more knowledge
  - Much more heuristics need to be included
  - Exploit database statistics as well as properties of spatial relations
- Missing components / modules
  - Animator
  - Normalizer / Inference Engine
    - Derive additional constraints only implicitly present, make them available for the compiler; query subsumption, reuse of query results (refine); query normalization
  - Use a “real” GIS / spatial DB
- VISCO GUI
  - Currently, too abstract for end users
  - Not evaluated yet
- However, the usefulness of the visual language VISCO has been proven