# A Visual Language for Querying Spatio-Temporal Databases

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## Plan

- Visual Spatial Querying
- Presentation of Lvis
- Spatio-Temporal Extension
- Visual Queries: Examples
- Conclusion and Perspectives

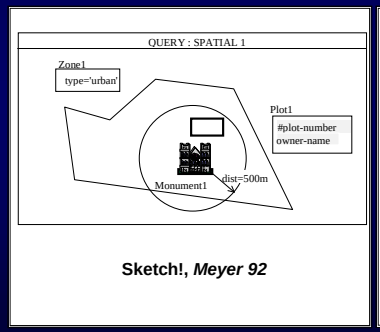
## Visual Spatial Querying

- Three main classes of query languages devoted to spatial databases :
  - Textual languages (natural, SQL and extensions)
  - Graphical languages (QBE)
  - Visual languages (Sketch!, Cigales)

## Two Approaches

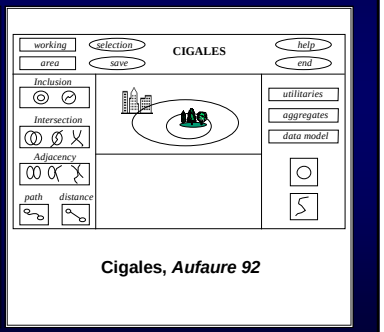
of Visual Query Languages for Spatial Databases

*Blackboard metaphor*




**Sketch!, *Meyer 92***

*Icons selection*




**Cigales, *Aufaure 92***

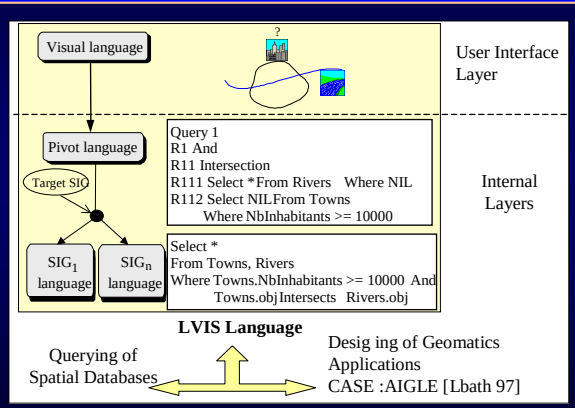
## Present Limitations

- No visual representation of databases
- Non-uniform handling of non-spatial data.
- Limited set of operators (Boolean, 3D)
- The expressive power of the query language is unknown
- Temporal aspects are not considered

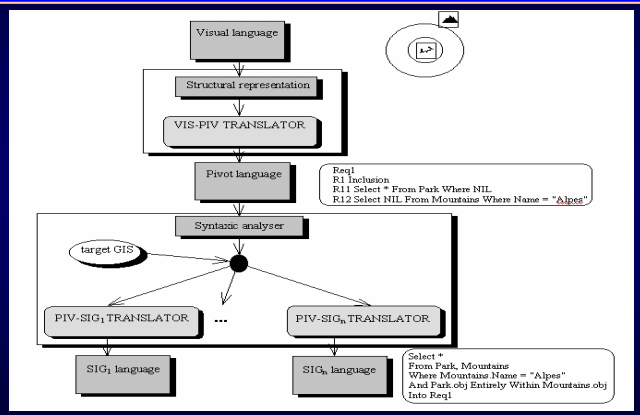
## Presentation of Lvis

- Based on Cigales [Aufaure 92]
- New operators: logical (And, Or, Not), metrical (Distance, Ray, Path), etc.
- Independent from the host query language of the target GIS plat-form
- Integrated into a customizable design environment (AIGLE, OMEGA [Lbath 97])

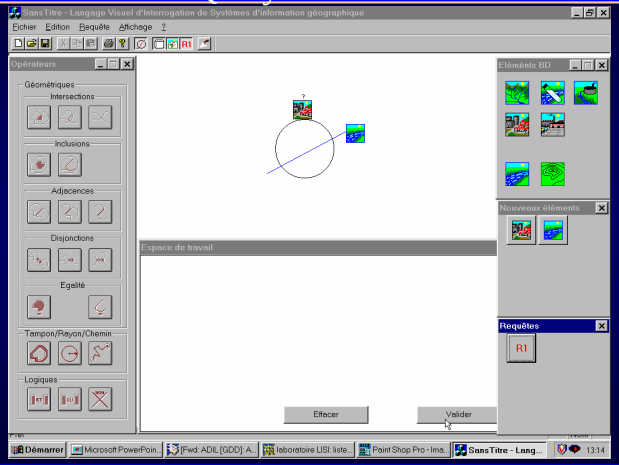
## Architecture




## Architecture



## Query validation




## Alphabet

- Spatial object types :
  2D (Polygon)  ou 1D (Polyline) 
- Operators :

| Operators | | | | | |
|---|---|---|---|---|---|
| Spatial | | Interactive selection | Set theory | Logical | Structural |
| Topological | Metrical | Point | Intersection | And | Creation |
| Intersection | Distance | Radius | Union | Or | Modification |
| Inclusion | Ray | Rectangle | Identity | Not | Deletion |
| Adjacency | Path | Any area | Difference | | Buffer zone |
| Disjunction | | | Exclus. conjunction | | |
| Equality | | | Complementaries | | |

## Icons

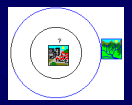
- Object types of the queried database:
  
- Objects: icon + label
  
  Lyon NR 7
- Operators: fixed pre-defined icons
  

## Visual Queries

- Elementary queries:
  No spatial criterion

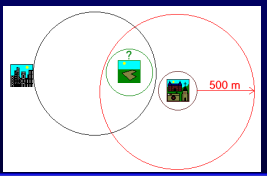

*To select the Ski resorts which are cross-country ski resorts*

- Simple queries:
  Only 1 spatial criterion




*Which Towns are located into a Riverside?*

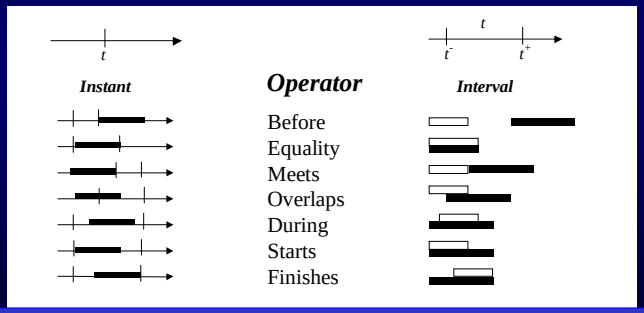
- Complex queries:
  ≥ 2 Spatial criteria




*Which Parcels are located into an Urban zone and are distant less than 500 meters from a Monument?*

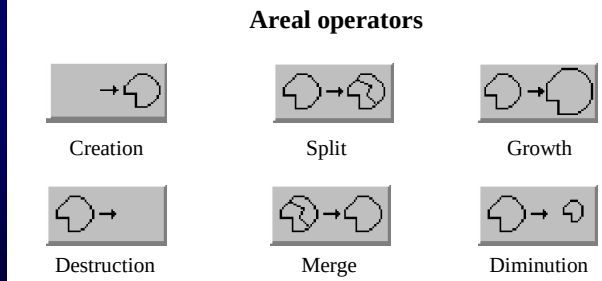
## Temporal Operators

- Time Interval Relationships [Allen 83]



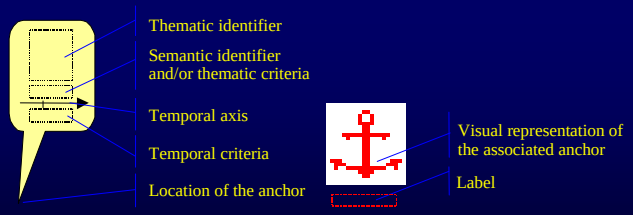

## Spatio-temporal Operators

- Life-cycle operators



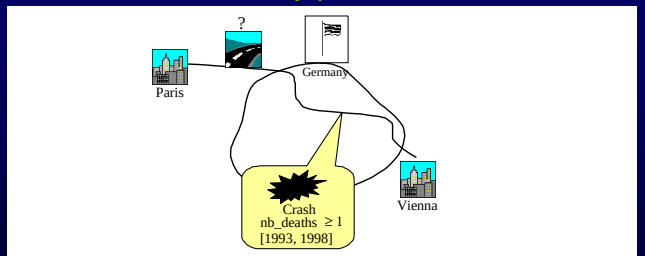

## Balloons and Anchors

- New visual metaphors to express temporal and spatio-temporal criteria



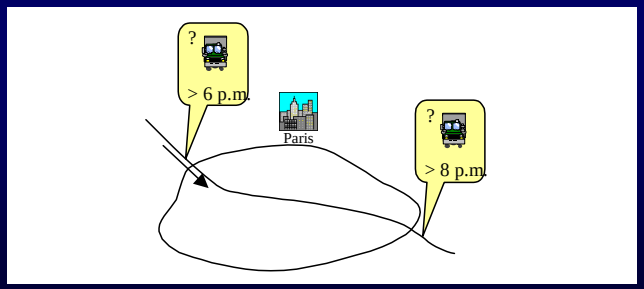

## Spatio-temporal query

*What are the dangerous paths from Paris to Vienna where there have been road accidents implying death located in Germany from 1993 to 1998?*



## Spatio-temporal query

*Which trucks did come into Paris before 6 p.m. and go out after 8 p.m.?*

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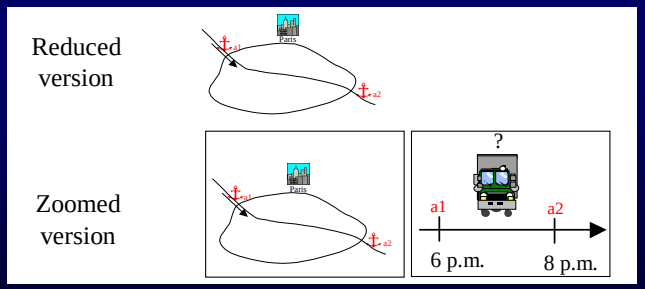


## Conclusion

- Prototype under current development:
  - Visual representation of simple spatial queries
  - Translation module of a query in the host query language of one marketed GIS
  - Visualization of the results on a map managed by the selected target GIS
  - Psycho-cognitive tests on icons in collaboration with potential users

## Perspectives

- Integration of the extensions to spatio-temporal querying
  - New temporal and spatio-temporal operators
  - New visual metaphors for representing the spatio-temporal criteria
- Implementation of complex queries
- Implementation of the graphical display of query results