Development of a Geovisual Analytics environment for investigating archaeological events based upon the Space-time Cube

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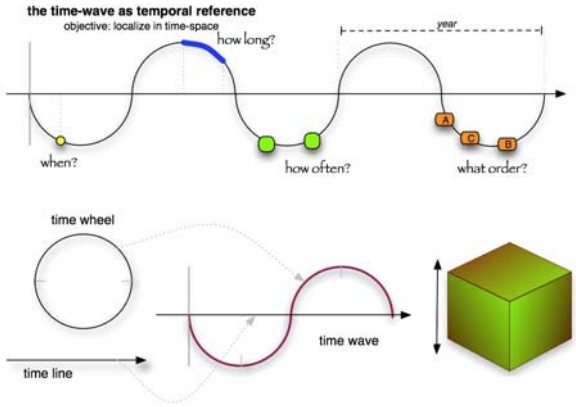
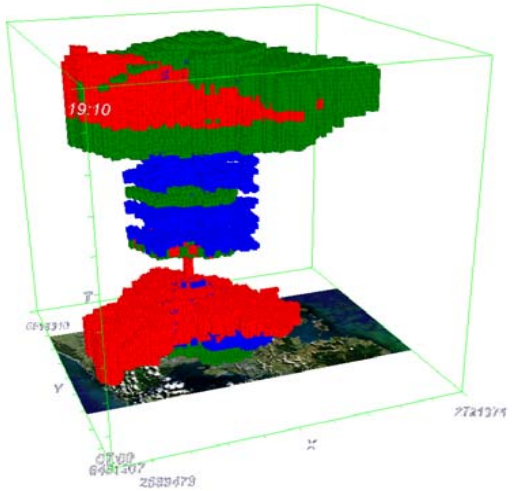
Introduction: research context

- ITC GA research focus: methods and techniques for integrating and visualizing the spatial and the temporal components of geo-data
- Temporal visual geo-representations and their link with models (extended Time Geographic Theories)
- STC as core operational tool – extensions for various application domains



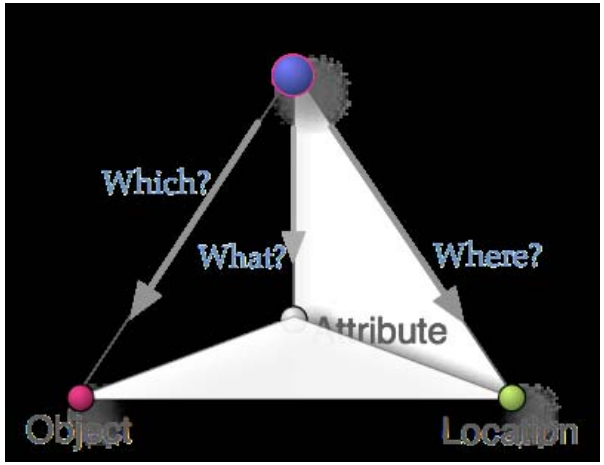


Three basic premises

- Geovisual analytics as dealing first and foremost with **geo** (spatial *and* temporal) as well as the visual;
- STC as an environment for the visualization and analysis of **space-time** data;
- Archaeology as an application domain with obvious **temporal and spatial** components, and a domain where GIT and geovisualization tools are underutilized at present;

Research questions

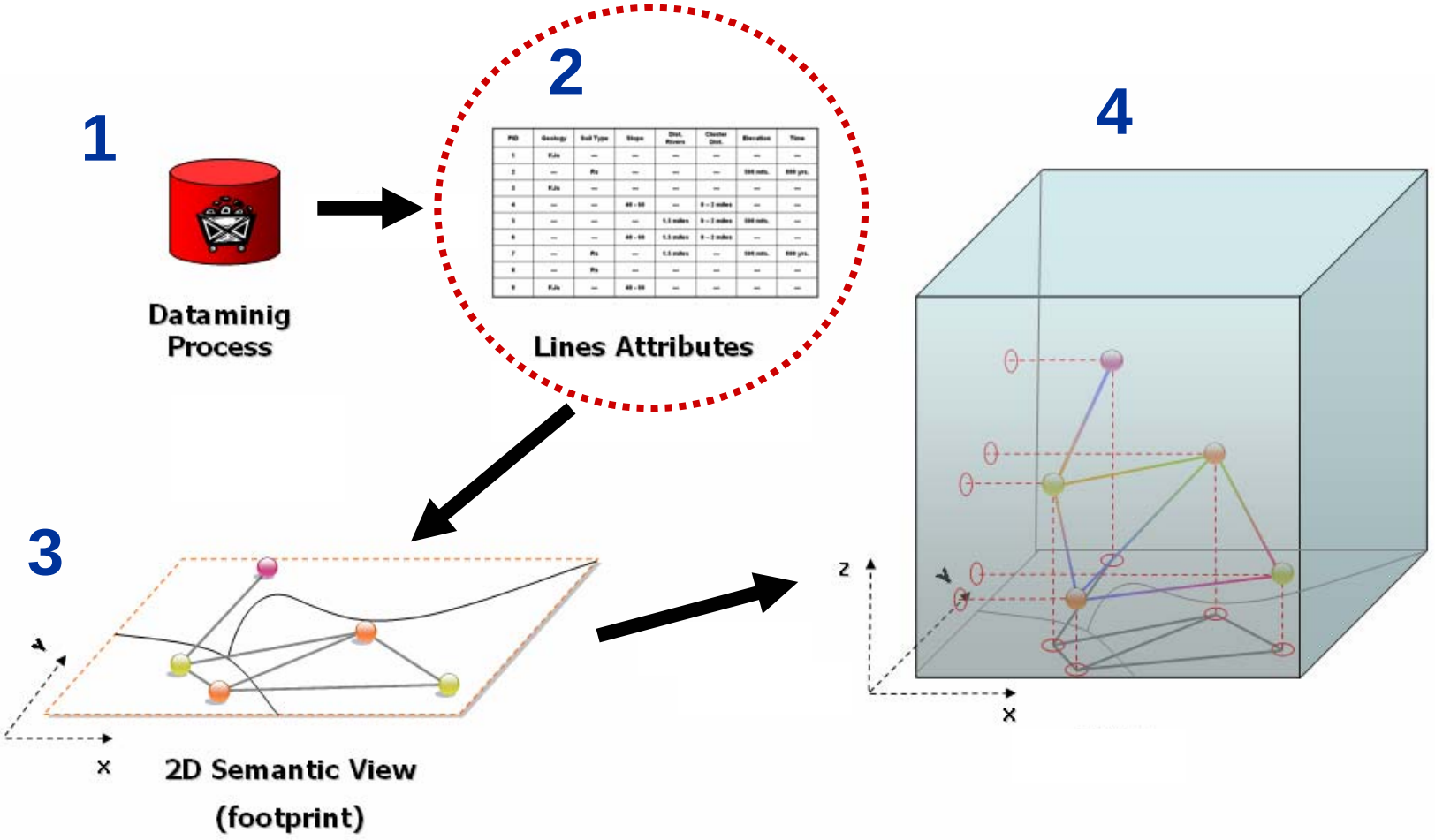
- How does archaeology currently solve these requirements?
  - What do archaeologists require in terms of spatial/temporal insights and functionality?
  - What can standard GIS do in relation to these requirements?
- What can the STC do?
  - Standard STC requires added functionality for archaeological applications



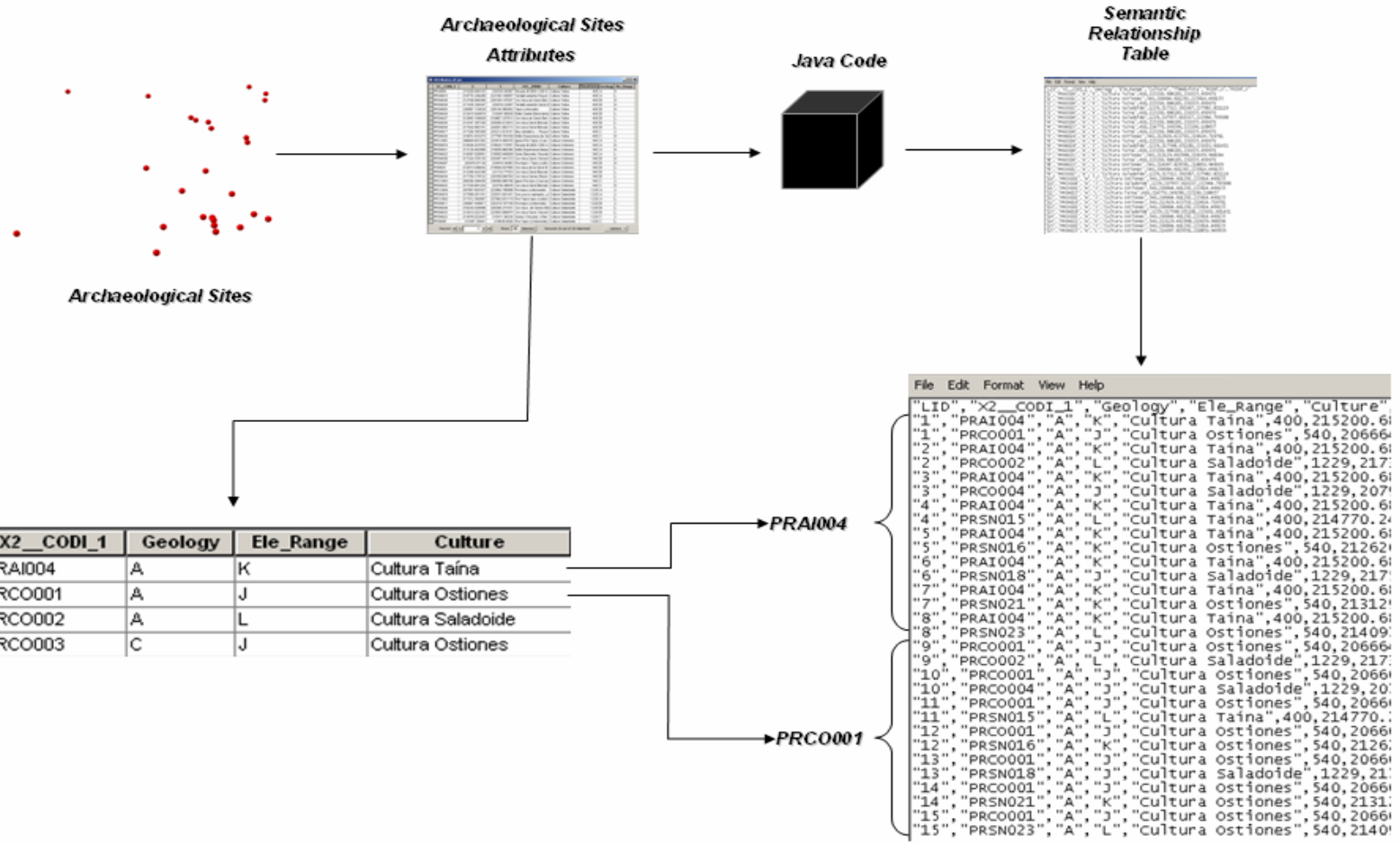
Methods

- Deploy STC with **graphical connectivity** (linking attributes)
- **Multiple linked views** for investigating context and relationships (pcp, base map, etc.)
- Use **cartographic symbology** (line thickness, colour, size, etc.) for clarifying patterns/aiding visualization
- Extend the ‘real’ 3D capabilities further by 3D stereo visualization option

Implementation

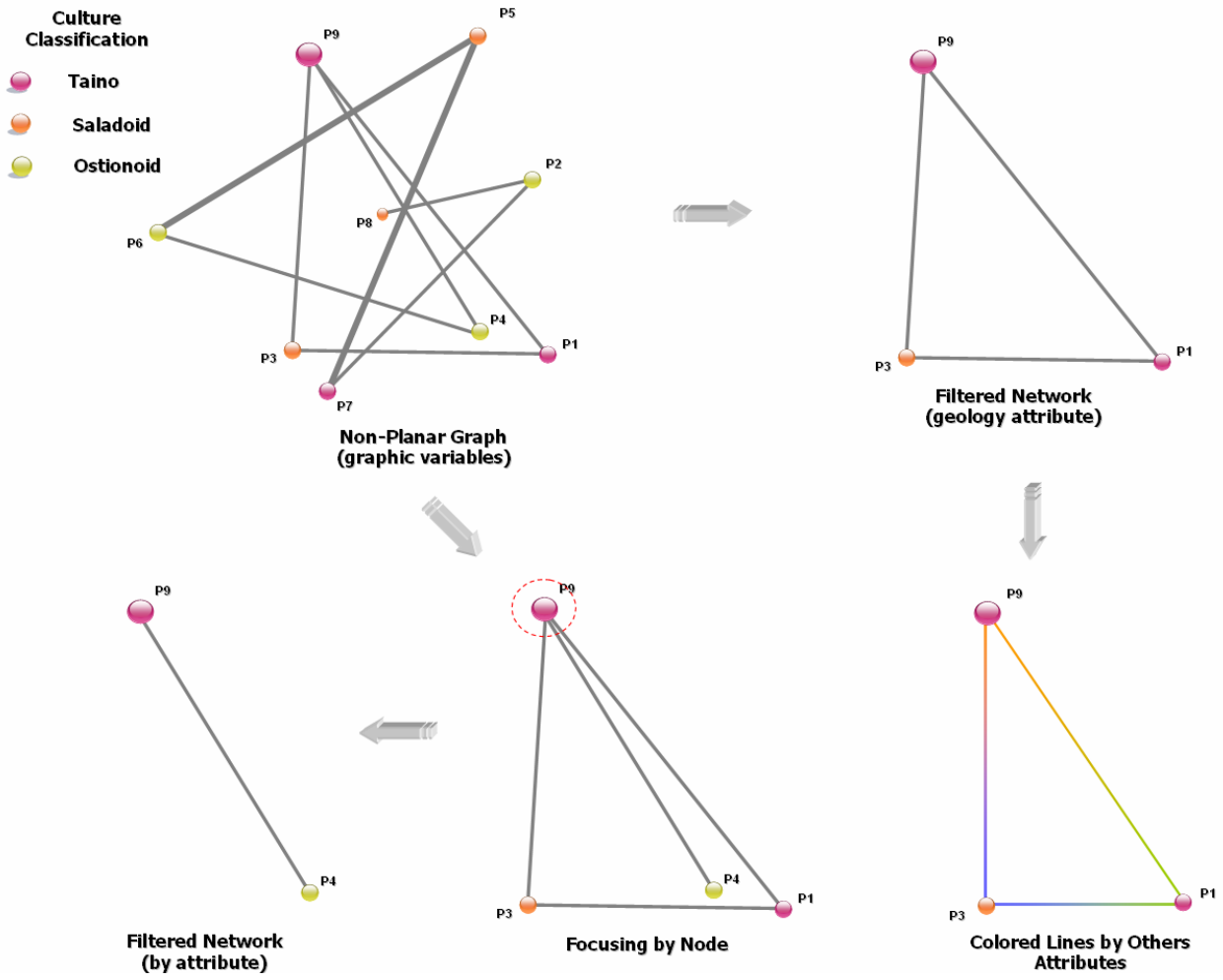


Attribute relationships



X2__CODI_1	Geology	Ele_Range	Culture
PRAI004	A	K	Cultura Taína
PRCO001	A	J	Cultura Ostiones
PRCO002	A	L	Cultura Saladoide
PRCO003	C	J	Cultura Ostiones

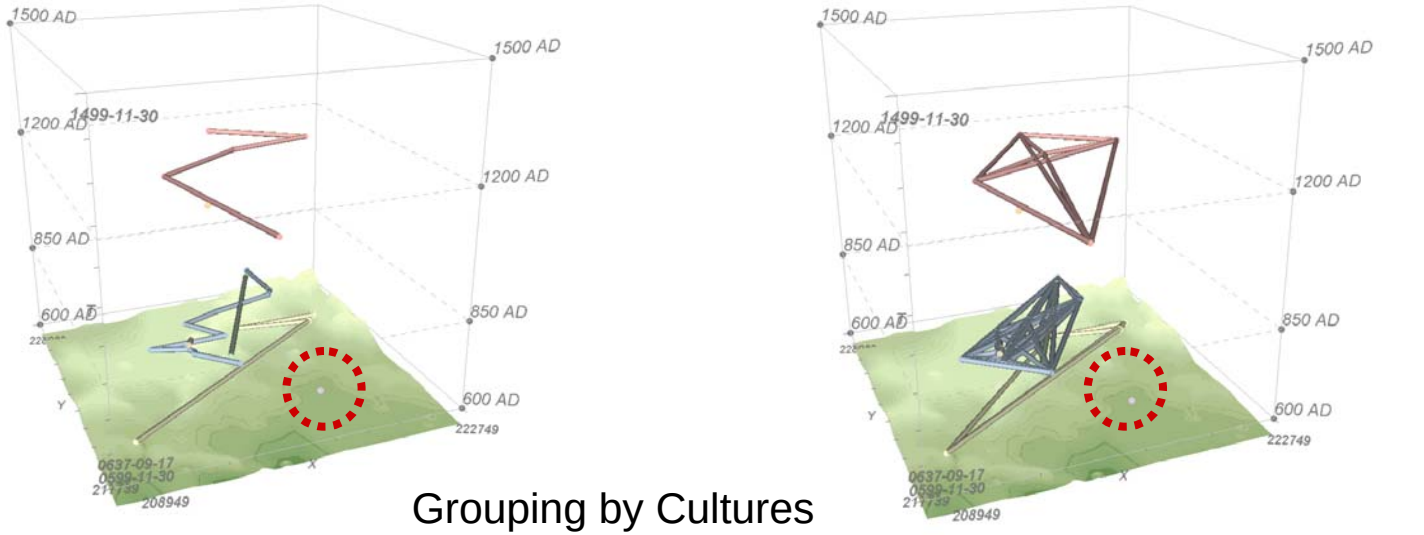
Graphic connectivity



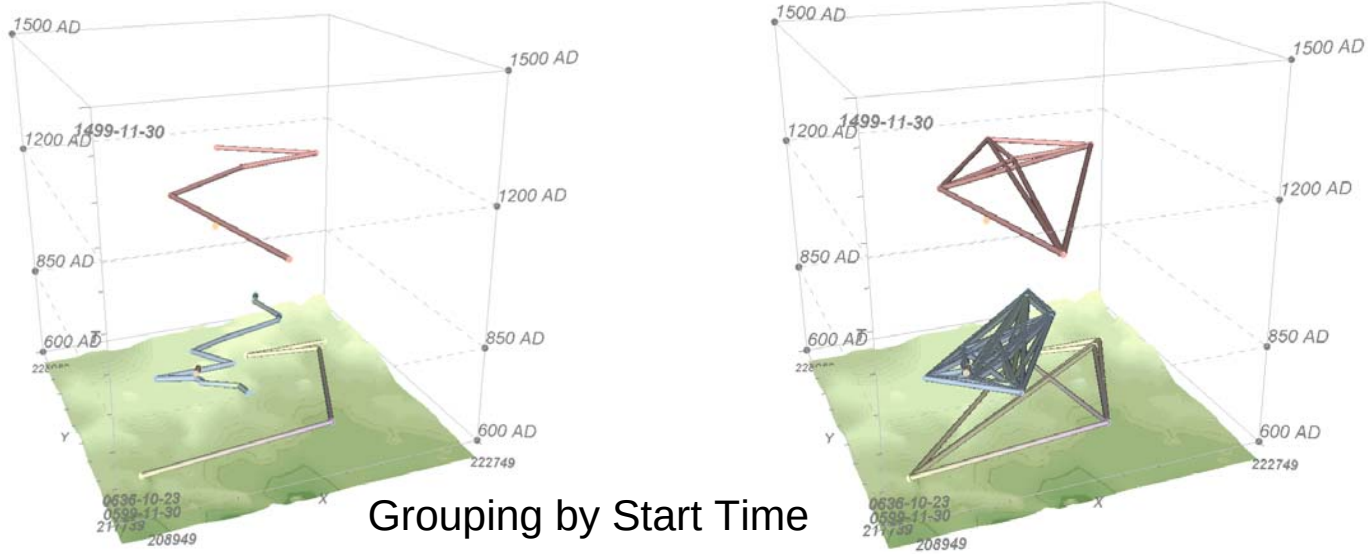
Tools and functions

Tools Name	Technique	Standard (S) Specialize (E)	Suitable (yes - no)	Implemented-(I) On progress-(P)	Search Level Elemental (E) General (G)
Select	All	S	yes	I – P (update)	E
Clipping	Lexis Pencil	E	yes	P	G
Spinning	Lexis Pencil	E	no	N/A	
Cropping	Lexis Pencil	E	yes	P=(focusing)	E
Flight trough	All 3D	S	yes	N/A	
View point fixed	Lexis Pencil	S	yes	P	E
Interactive enlargement	Lexis Pencil	E	no	N/A	N/A
Color fading	Lexis Pencil	S	yes	P	E
Length and Position Adjustment	Lexis Pencil	E (multi V)	no	N/A	N/A
Brushing	PCP	S	yes	P	E - G
Strumming	PCP	E	yes	P	E
Filtering or focusing	PCP	S	yes	I (partial) – P (update)	E
Variable assignation	PCP	S (multi V)	no	N/A	N/A
Classification and coloring	PCP	E (multi V)	yes	P	G
Dragging and repositioning	PCP	E (multi V)	no	N/A	N/A
Rotation	STC	S (3D)	yes	I	G
Zooming	STC	S	yes	I	G
Panning	STC	S	yes	I	G
Highlight	STC	S	yes	P	E
Linked Views	STC	E (multi V, 3D)	yes	P	E-G
Query Functions	STC	S	yes	I	E-G
Footprint movement	STC	E (3D)	yes	I	G
Activation of layers	STC	S	yes	I	G
Extruded surfaces	STC	E (3D)	yes	I	G
Focus node movement	Graphic Drawings	S (multi V)	no	N/A	N/A
Rapid Zooming	Graphic Drawings	E	yes	P	E
3D widgets	Graphic Drawings	E (3D)	yes	I	G
Elision	Graphic Drawings	S (multi)	yes	P = focusing	E
Reference Grids	STC	S	yes	P	G

Grouping: culture and start time

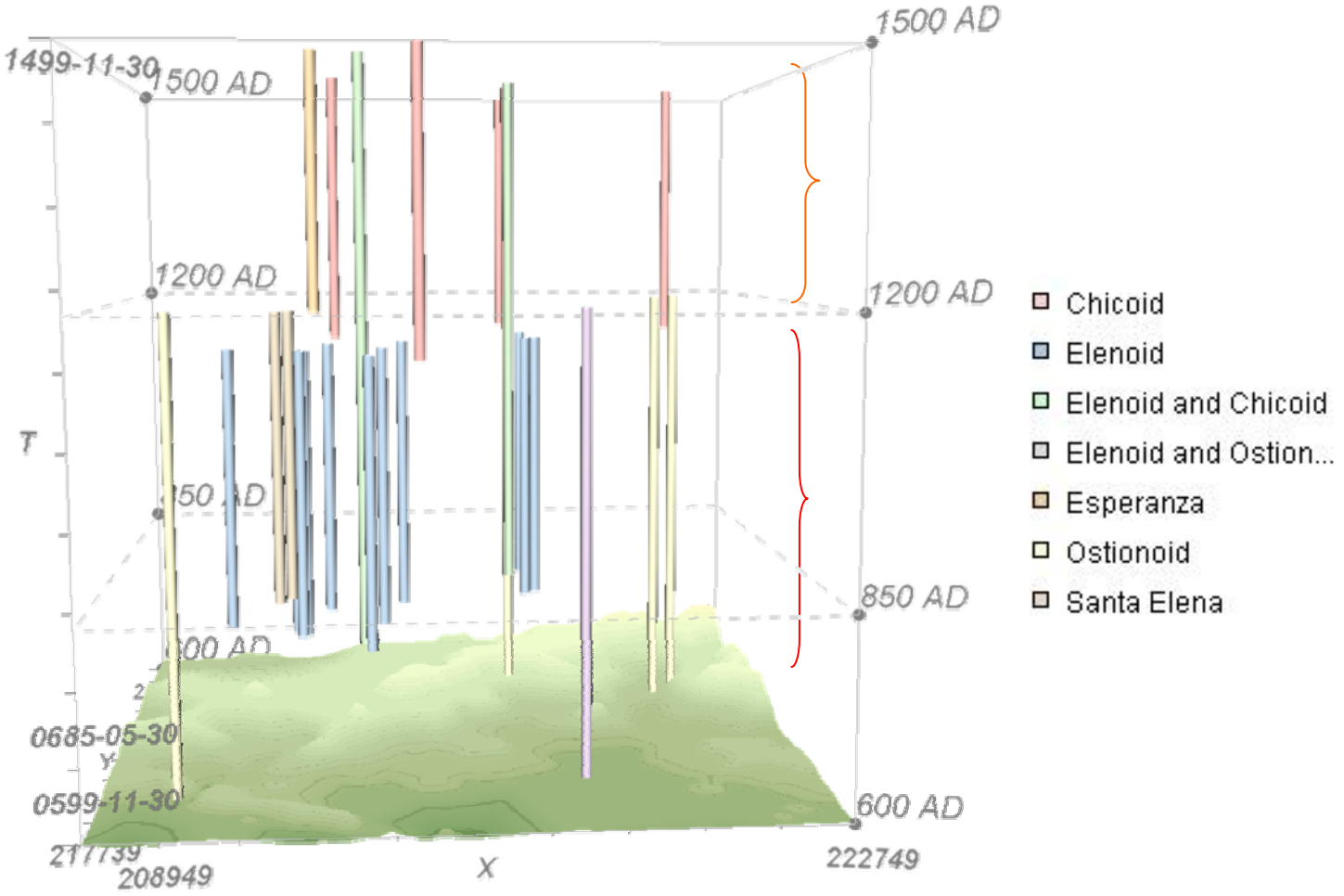


Grouping by Cultures



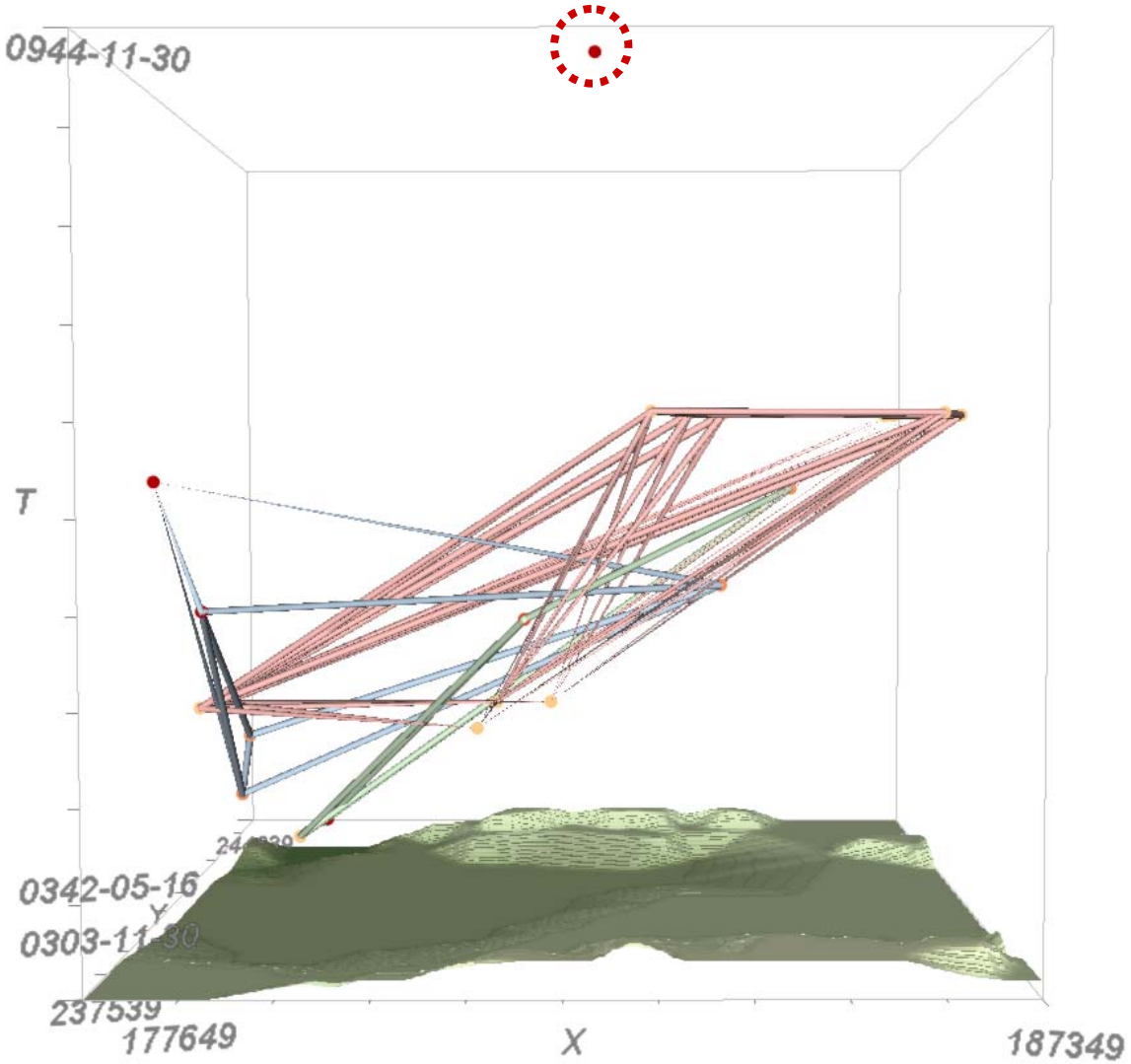
Grouping by Start Time

Station view (durations)



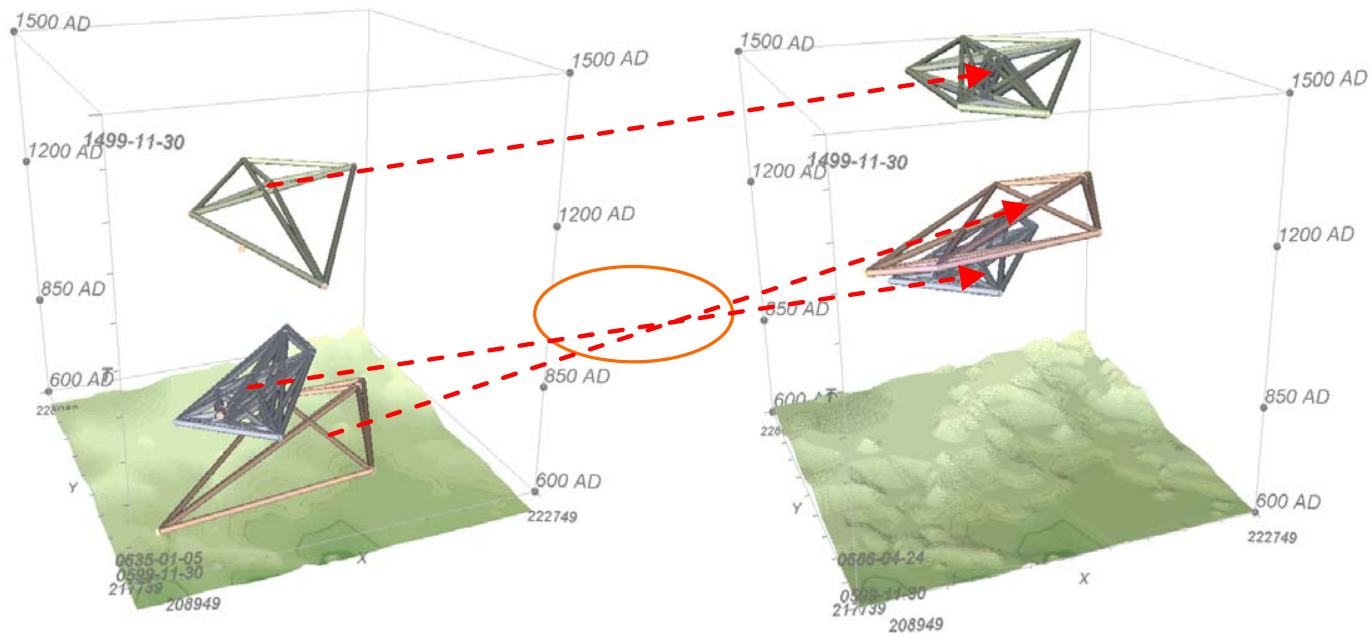
Red brace: Archaeological sites interactions 800–1200 AD.,
Orange brace: Archaeological sites interactions1200–1500 AD.

Slope, aspect, and grouping by culture



Node classifications: slope Line color: aspect Connectivity: culture

Durations and interaction by culture



Start time

End time

Cultures

- Chicoid
- Elenoid
- Elenoid and Chicoid
- Elenoid and Ostion...
- Esperanza
- Ostionoid
- Santa Elena

Evaluation

- Assessment and measurement of real value-added for STC (for Archaeological purposes)
  - Extended functionality of existing Time-geographic concepts
  - Context (map) references still needed in many cases
  - Expert knowledge required for interpretation
  - Expert review for value-added?
- Further extensions (for STC environment):
  - Implement remaining functions identified earlier
  - More powerful data(base)-mining functionality for linking attributes
  - Extend multiple linked views

Thank you !