



Geo-Temporal Networks and Visualization

Prof. L. Richard Carley

carley@ece.cmu.edu



Carnegie Mellon

Center for Computational Analysis of
Social and Organizational Systems
<http://www.casos.cs.cmu.edu/>



Representing Geospatial Information – Two Strategies

- Standard Strategy
 - Only location nodes can have coordinate information
 - Nodes that are connected to that location via a “node -> location” link are said to be in that location
- Per Node Strategy
 - Any node can have coordinate information or not it is just another attribute of the node
 - Links are just links. They don’t imply any special relationship beyond what they’re already meant to imply
- If your data lacks geospatial attributes, you can specially configure your data to work with GIS. This is called “The Hard Way”



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Representing Geospatial Information: Standard

- Nodes of type "Location" are checked for attributes
 - "latitude" and "longitude"
 - "mgrs" – Military Grid Reference System
 - "utm" – Universal Transverse Mercator coordinates
 - This are all systems for identifying a specific spot on the Earth
- All networks to/from a node of type "Location" are "is-located-at" networks
- This method is handy when you're working with more general locations that multiple entities can inhabit. It allows for a type of aggregation before the map is even opened; e.g., if your locations are cities there can be many people in a city at once.

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Representing Geospatial Information: Per Node Approach

- Multiple nodesets are checked for attributes
 - "mgrs"
 - "latitude" and "longitude"
 - "utm"
- If only "Location" nodes are found, it defaults to the "old" default. If multiple nodesets are found, it uses the "new" default.
- This method tends to be preferred when you want each entity to have its own location. Data acquired directly from a GPS, for example.

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Representing Geo-Temporal Data

- Remember – over-time meta network
 - A group of meta networks
 - One for each point in time
 - Alarm clock symbol for over time data
- For Location + Time just use both
 - Keep group of meta networks with time stamps
 - Add Locations to each meta network

Click <+> on tree widget to show Keyframes in dynamic meta-network

Each keyframe represents interactions that occurred at some point in time

Meta-Network Manager

- Roger Federer 2010
 - IkeNet3
 - 20080901
 - EAGENT : size 87
 - EMAIL : size 142
 - eAgent2eAgent
 - AGENT2EMAIL
 - email2agent
 - 20080902
 - EAGENT : size 104
 - EMAIL : size 367
 - eAgent2eAgent
 - AGENT2EMAIL
 - email2agent
 - 20080903
 - EAGENT : size 64
 - EMAIL : size 209
 - eAgent2eAgent
 - AGENT2EMAIL
 - email2agent
 - 20080904
 - 20080905

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Geo-Temporal Network Visualization

- Reminder – Representing time and location in ORA
 - Location via <lat,lon> or relational locations
 - Time via timestamp on meta network for each time period
- Example: Indiana Jones – “Raiders of the Lost Ark”
 - Hands on walk through of Spatio-Temporal Visualization
 - Demonstrate putting vectors on a map strategy

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Start with an Example

- This dataset is a mapping of the 1981 movie "Raiders of the Lost Ark"
- It is a dynamic meta-network containing 27 different time periods
- Each time period contains the same 19 locations and 9 characters
- Each differs from another in two ways
 - The links present/not present
 - The timestamp

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Click |> on tree widget to show Keyframes in dynamic meta-network

Each keyframe represents interactions that occurred in a time period

Keyframe dates range from 5/1/1936 – 6/11/1936

NOTE – you can create Keyframes in a Meta-Network by right clicking in the white space in this panel while the desired Meta-Network is selected.

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Launching Over Time Viewer

ORA 3.0.9.9.107

File Edit Preferences Data Management Generate Networks Analysis Simulations **Visualizations** System Help

Meta-Network Manager Dynamic-Meta-Network: Raiders of the L...

Name Raiders of the Lost Ark
 Filename ... 2019 Reminga - Data and Slides/...
 Generate Reports... Visualiz...
 Keyframes and deltas time stamped by
 Nodeset characters nodes d...
 Statistics:
 Keyframe count: 27
 Delta count: 0
 Earliest date: 1026-11-01 12:00:00

Select <View Networks Over Time...>
 on <Visualizations> menu to get a
 feel for flow and complexity over time

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Over Time Viewer

Click <Show Arrows> icon
 to see directionality of
 interactions

eyepatch_man
 major_toht
 belloq
 indiana_jones
 marion_ravenwood
 simon_katanga
 sallah
 colonel_dietrich
 monkey

bantu_wind
 cairo-bar
 cairo-docks
 desert_road
 cario-omars_square
 cairo-streets
 cairo-sallahs_house
 tanis-marions_tent
 tanis-indys_dig
 tanis-nazi_dig
 tanis-airstrip
 greek_isle-tabernacle
 greek_isle-road
 nepal-raven_saloon
 peru
 washington_dc
 san_francisco
 new_england
 berlin

Interactions in Time Period 1

Freeze Network, then place nodes

Set parameters of
 <Network Over Time>
 dialogue, then click
 <Play> to "watch".

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Over Time Viewer

Interactions in Time Period 9

Set parameters of <Network Over Time> dialogue, then click <Play> to "watch".

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Over Time Viewer

Interactions in Time Period 11

Sped up Animation

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Over Time GIS Viewer

File Edit Preferences Data Management Generate Networks Analysis Simulations Visualizations System Help

Meta-Network Manager

Dynamic-Meta-Network: Raiders of the L

Raiders of the Lost Ark

Name Raiders of the Lost Ark

Filename ... 2019 Reminga - Data and Slides/...

Generate Reports... Visualiz...

Keyframes and deltas time stamped by

Nodeset characters nodes d

Statistics:

Keyframe count: 27

Delta count: 0

Earliest date: 1936-11-01 12:00:00

Latest date: 1936-12-04 12:00:00

Measure Charts...
View Measures Over Time...
View Networks Over Time...
View Networks Over Time in 3D...
View Network Distance over Time...
Vector Maps
Network Drill Down...
Node Cloud...
Color Grid...
Network Block...
GeoSpatial Networks...
Region Viewer...
View Trails...
View Trails in GIS...
View Networks

Suppose you actually wanted to see the characters on a Map?

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Trail Displayed on GIS Viewer

Hide links with value: Less Than 0.00

Ora-GIS

GIS Layer Manager

File Layers Options

Dynamic Network Layer

- Location
- indiana_jones
- marion_ravenwood
- sallah
- simon_katanga
- belloq
- major_toht

GIS Layers

Move Up Move Down

Hint: Thicken Lines, Add Arrow Heads, show Labels

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Indy's Trail

Use GIS Layer Manager to turn off all but Indy and Location
 Now we see just his trail around the world

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Indy in the Middle East

Note break in Trail

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Where is Marion?

Ora-GIS

Click on GIS Layer Table to Add in Marion

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Zoom in on Egypt

Cairo to Valley of the Kings

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Displaying Trails on 3D Globe

Trails - Ora-GIS Visualizer

File Modify Network Analyze Network Tools Map Options Shapefiles Options Help

Font Size 10 Minimum

Hide links with value: Less Than 0.00

- Show Links
- Show Labels
- Show Arrows
- Toggle Map Grid
- Change Background Color
- Cluster by Attribute
- Cluster by Area of Influence
- Toggle Cluster Appearance
- Use 2D Visualization (JMap)
- Use 2D Visualization (Openmap)
- Use 3D Visualization (NASA WorldWind)

(i) Indiana Jones Tue Nov 24 12:00:00 EST 1936; Indiana Jones Mon Nov 23 1936; Marion Ravenwood Tue Nov 24 1936; Marion Ravenwood Mon Nov 23 1936

NASA Whirlwind – used for 3D drawing (CAUTION – requires high bandwidth to work correctly)

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Explore Indy's Trail...

Ora-GIS Visualizer

File Modify Network Analyze Network Tools 3D Options Options Help

Font Size 10 Node Size 1 Link Width 1

Arctic Ocean

North Pacific Ocean

EUROPE

(L) Marshall College

North Atlantic Ocean

South Pacific Ocean

(L) Eyebrow of the Jungle

SOUTH AMERICA

South Atlantic Ocean

2000 Km

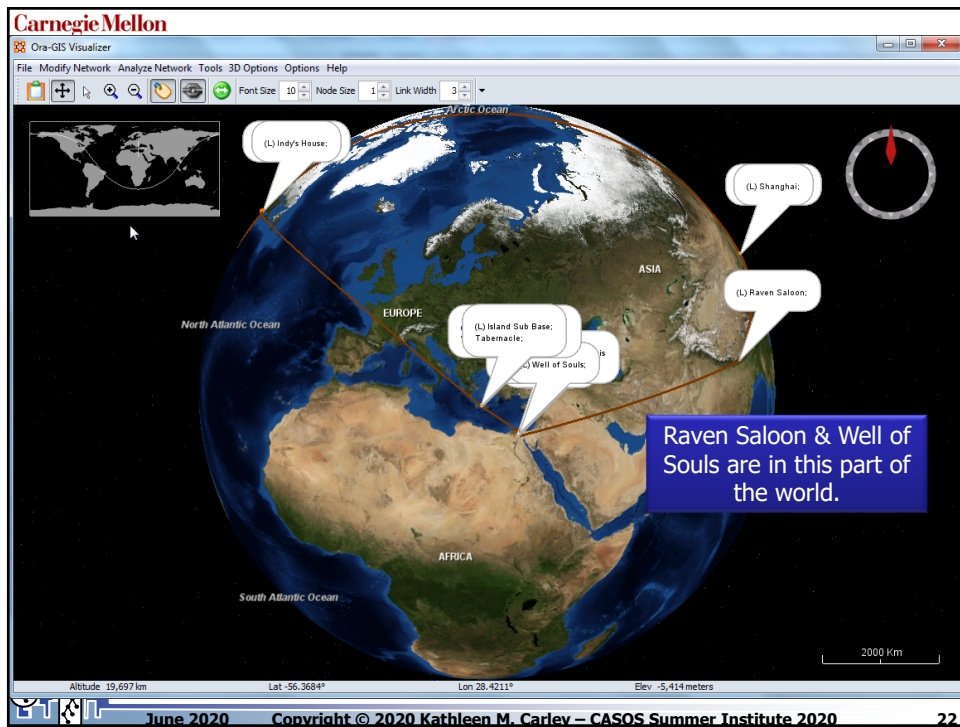
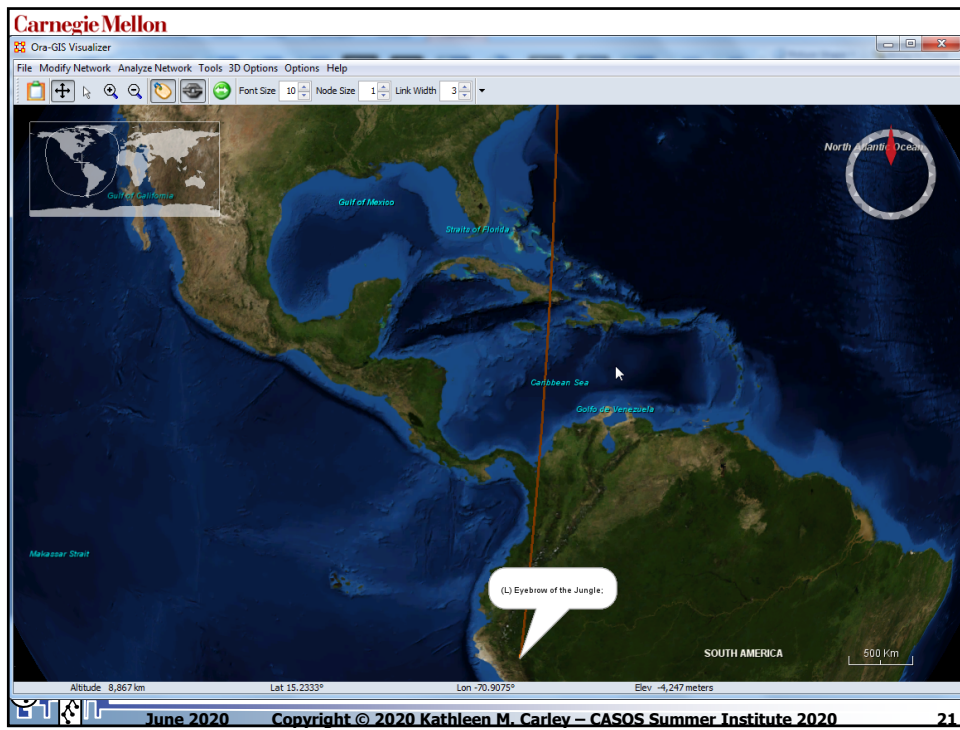
Altitude 19,070 km Lat 42.7127° Lon -128.1662° Elev -3,122 meters

Movie starts in Eyebrow of the Jungle...

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Conclusions

- ORA
 - Understands Geo-Temporal Network Data in the form of sets of Meta Networks in the Form of Key Frames
 - ORA can carry out analysis taking into account both temporal data and location data
- Visualization of Geo-Temporal Data is quite difficult
 - Animated vectors connecting nodes to locations over time
 - Animated vectors drawn on a map
 - Labels show node name and timeline of events
 - Loom plot
 - Shows time as vertical axis but locations are categorical columns
 - For more Loom, see talk on Friday

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