# Table of Contents

1. Introducing GraphXR ................................................................. 1
   1.1. What’s New in GraphXR 2.2.1 ............................................. 2
2. Getting Started in GraphXR ....................................................... 7
   2.1. Create a GraphXR User Account ............................................ 7
   2.2. Log in to GraphXR ............................................................... 9
   2.3. Log out of GraphXR ............................................................. 9
3. Using GraphXR Projects .......................................................... 10
   3.1. View a Demo Project .......................................................... 11
   3.2. Create a Project ............................................................... 11
      3.2.1. Creating a project connected to a Neo4j database ............. 11
      3.2.2. Creating an unconnected project ................................... 14
   3.3. Using the blank project ...................................................... 15
4. Using the Graph Space ............................................................. 16
   4.1. Main Menu ................................................................. 17
   4.2. Legend Menu ................................................................. 19
   4.3. Context Menu ............................................................... 20
   4.4. Desktop Shortcut Keys ...................................................... 22
   4.5. GUI Navigation Controls .................................................. 23
5. Loading or Importing Data ....................................................... 24
   5.1. Pulling Data from a graph database (Neo4j) ......................... 24
      5.1.1. Pull data using a Cypher query .................................... 24
      5.1.2. Pulling data with a keyword search ............................... 26
      5.1.3. Pull Nodes by Category or Relationship ......................... 27
      5.1.4. Expand data connected to a node .................................. 27
   5.2. Load or Import Data from Saved Files ................................. 29
      5.2.1. Import by Drag and Drop ............................................ 29
      5.2.2. Import using the Data Tab .......................................... 29
      5.2.3. Load a GXRF file ..................................................... 31
10.1. Creating a New Tag ................................................. 63
10.2. Changing a tag color .............................................. 64
10.3. Adding nodes to a tag .............................................. 64
10.4. Cleaning all tags from selected nodes ......................... 65
11. Adding or Deleting data ............................................. 66
  11.1. Adding a node or edge ......................................... 66
    11.1.1. Adding a node ........................................ 67
    11.1.2. Adding an Edge ...................................... 69
  11.2. Deleting data from the graph space ......................... 71
    11.2.1. Deleting selected data ................................ 71
    11.2.2. Leaf Trimming ......................................... 71
    11.2.3. Deleting all data using Clear ....................... 72
12. Using Tables ......................................................... 73
  12.1. Using a basic table in the Table panel .................... 74
  12.2. Using an Enhanced Table .................................... 74
13. Transforming Graph Data ............................................ 77
  13.1. Using \( f(x) \) .................................................. 78
    13.1.1. Running preset \( f(x) \) formulas .................... 78
    13.1.2. Running a custom \( f(x) \) formula .................. 80
  13.2. Using Extract .................................................. 83
  13.3. Using Aggregate ............................................... 85
  13.4. Using Merge .................................................... 88
  13.5. Using Link ...................................................... 89
  13.6. Using Shortcut ................................................ 91
  13.7. Using the Connector .......................................... 94
14. Running Graph Algorithms ........................................... 96
15. Working with Layouts ............................................... 98
  15.1. Pinning Nodes .................................................. 98
  15.2. Force Directed Layout ....................................... 99
  15.3. Parametric Layouts ........................................... 100
  15.4. Geometric Layouts ............................................ 101
  15.5. Tree Layout .................................................... 102
  15.6. Category Layout ............................................... 103
16. Using Geospatial Maps .............................................. 104
  16.1. Using Show Map ............................................... 106
  16.2. Flying to a Search Location ................................. 107
Chapter 1. Introducing GraphXR

GraphXR is a browser-based visualization application that brings unprecedented speed and flexibility to the exploration of graph data in both 2D and XR. GraphXR displays data represented as nodes connected by edges in an interactive virtual 3D graph space, and provides a powerful set of tools to explore and modify the data.

GraphXR enables you to:

- Seamlessly import graph data from a graph database or other source (CSV, SQL, etc.).
- Navigate and Select data efficiently in the graph environment.
- Model data dynamically using its powerful suite of data operators to transform graph data.
- Explore graph connections through widely used graph algorithms, including PageRank and Shortest Path.
- Display data in a variety of layouts in the graph space, including geospatial mapping, parametric layout, and time series display.
- Save, share, and export data as a view, Neo4j database, or flat table.
1.1. What's New in GraphXR 2.2.1

The GraphXR 2.2.1 release provides major new features that let you work with data seamlessly and intuitively within a GraphXR project, including:

**Transform.** The new Transform panel delivers powerful graph-based data operators organized in f(x), Extract, Aggregate, Merge, Link, ShortCut, and Connector tabs. These provide functionality previously available only in Excel, an RDBMS, or a big data environment such as MapReduce or Spark. You can perform these data operations directly within GraphXR, on either selected data or full datasets.

**Graph Algorithms.** The new Algorithm panel delivers a suite of widely used Path Finding, Centrality, and Community Detection graph algorithms. With a click you can add results such as PageRank, Shortest Path, and many others to graph data.

**Snapshots.** The new SnapShots feature lets you save snapshots of data to local memory as you work. You can save a set of snapshots as a zipped archive, and you can re-load a snapshot in seconds.

**CSV Mapping.** The CSV (and SQL) tabs in the Query panel now include a Mapping Editor. You use it to create, save, and edit mappings, which define the categories and relationships to be applied to data queried from a CSV file or SQL database.

**Composable Filters.** The streamlined Filter panel lets you layer multiple filters on any numerical property, including time series. You can scrub through any filter, enabling you to playback a timeline or other property like a video.

**Enhanced Tables.** The new Enhanced Table feature lets you select, edit, reorganize, and export data in tabular form.

**Geometric Layouts.** New geometric layouts let you display selected nodes in a Line, Circle, Grid, or Cube. You can apply different geometries to subsets of data in a single view, and this can help you visualize complex connections in graph data.

**Add a Node or Edge.** The new Add Node and Add Edge icons in the context menu let you define and add individual nodes and edges, one at a time, directly in GraphXR.

**Optional Connection to Neo4j.** Creating a named project no longer requires a connection to a Neo4j database.

**Save to Neo4j.** From the Data tab, you can save directly to a Neo4j database.
1.2. Graph Data Basics

A graph database models a network of entities and connections in your data. The network can reveal connections in your data that are difficult if not impossible to discover using older relational database models. Specifically, the ability to model connections, their direction, and their transitive connectedness (e.g. A, to B, to C, to D) enables powerful new ways to view, use, and extend data.

1.2.1. Anatomy of Graph Data

Graph data are composed of three elements: **nodes**, **edges**, and **properties**.

**Nodes** are entities, such as **people** or **events**. Each node is represented in the graph space by a circle. In GraphXR, a node can display an icon, portrait image, or caption. All nodes of a given type comprise a **Category**.

**Edges** are connections between nodes, such as **took_place_at** or **purchased_by**, represented by a line connecting two nodes. All edges of a given type comprise a **Relationship**. Directed relationships such as **parent_of** have an arrow at one end, while directionless ones such as **friends_with** do not.
Properties are attributes, such as *name* or *color*, that may be associated with nodes or edges. Property data can be in the form of numbers, text, geospatial coordinates, date or time.

1.2.2. Importing Graph Data

GraphXR enables you to work with multiple data sources in a shared environment.

You can pull graph data directly from a graph database (for example, using a Cypher query or keyword search on a Neo4j database), or import it from other sources including CSV, SQL, Hunchly, Maltego, and 3rd party APIs. Data pulled from a graph database will include its schema, that is, its defined categories, relationships, and properties.

When you import data that has no associated schema, for example a CSV file, each row in the table is imported as a node of a single default category.
You can instead query a CSV file or SQL database, and in that case you must create a data **mapping** in GraphXR using the **Mapping Editor** available in the **Query** panel's **CSV** or **SQL** tabs.

The mapping need not be fully defined; you can edit it later and re-run the query. When you create and save a mapping, it appears on the dropdown list in the mapper interface.
1.2.3. Working with Data

GraphXR provides powerful and flexible ways to work with data in the graph environment. You can:

- Navigate the desktop graph space to inspect, select, filter, edit, and delete data.
- Create, refine, or extend a data model directly in GraphXR using data operators in the **Transform** panel.
- Run widely used graph algorithms available in the **Algorithm** panel.
- Create powerful data visualizations using options including:
  - Geospatial mapping
  - Filtering on date and time, or other numerical properties.
  - Displaying data in parametric layouts, including a 2D or 3D scatter plot, tree view, or geometric **Line**, **Circle**, **Grid**, or **Cube** layouts.
- Save and share your graph data through **Snapshots** or data **Views**, a **Snapshot** .ZIP archive, GXRF, or CSV archive, or Neo4j database. You can also export a mapping as a .JSON file, and import it when you re-load its data.

1.3. Supported Environments

WINDOWS, MAC OSX, AND LINUX

- The GraphXR client runs best in Google Chrome. Compatibility with other browsers may vary.

OCULUS RIFT, HTC VIVE, AND WINDOWS MIXED REALITY

- The GraphXR client includes Beta support for Virtual Reality (VR) hardware in the Google Chrome browser via WebXR.

CLOUD, PRIVATE CLOUD, AND ON-PREMISES DATA HOSTING

- GraphXR Explorer and Analyst editions support local and cloud storage. In addition, GraphXR Enterprise is available via on-premises or private cloud deployments.

For More Information

Please visit [Kineviz GraphXR](https://www.kineviz.com/graphxr) or contact [Kineviz](https://www.kineviz.com).
Chapter 2. Getting Started in GraphXR

To begin using GraphXR, create a user account and then log in through Google Chrome.

2.1. Create a GraphXR User Account

Creating a user account differs depending on your GraphXR edition:

- For GraphXR Explorer and Analyst editions, go to GraphXR Login to create an account.
- For GraphXR Enterprise, contact your systems administrator for login credentials.

To create a user account:

1. In your Chrome browser, visit the GraphXR Login page and click Sign Up.

NOTE

If you use Neo4J graph databases, you can install a GraphXR application in your Neo4J desktop. For information, please visit Neo4J Graph Applications. User registration will be the same.
2. In the sign-up form, enter the information required to create your user account.

![Sign-up form]

- Your **Email**. You’ll use this to log in.
- A **Password**.
- The password again, in **Confirm Password**.
- Your **First Name** and **Last Name**.
- Your **City**.
- Click the **Terms of Use** checkbox.

3. Click **Sign Up**.

A message indicates that your account was successfully created (or flags errors you must fix).
2.2. Log in to GraphXR

Once you have registered as a user, you can log in.

To log in to GraphXR:

1. In your Chrome browser, visit the GraphXR login page.
2. Enter your user name (typically, the Email used to create the account) and your Password and click Log In.

The Projects page displays. This is the GraphXR home page, where you:

- Review and manage existing projects.
- Create a graph database project which can optionally be connected to an existing Neo4j database, or open a Blank project.
- Click on a project to enter its graph space.

2.3. Log out of GraphXR

To log out of GraphXR:

- In the Projects page, select Log Out from the user menu at the top right side.

**NOTE** You can also log out using a logout icon available in the graph space.
Chapter 3. Using GraphXR Projects

The Projects page is your portal to graph spaces for individual projects.

The menu at the top of the Projects page lets you access your GraphXR account, edit user information or log out. The Feedback button logs questions and comments for administrator review and response.

The body of the Projects page includes the following areas:

- **New Project**, where you can:
  - Create a new project and optionally connect it to a Neo4j database.
  - Select Demo to connect a currently unconnected Neo4j demo database.
  - Open a Blank project, which is not named and is not connected to a Neo4j database.

- **Demo Projects**, which displays above the New Project area when you select a demo project from those available. It also includes the Select Demo dropdown.

- **Your Projects**, which displays above any connected Demo Projects when you create a new project. It also includes the button to Create a new project.

- **Recent Projects**, which displays projects you have recently opened.
3.1. View a Demo Project

To get started with GraphXR, you can explore available Demo projects.

To open a Demo project:

1. Click the dropdown next to Select Demo and select a demo project.

   The project appears in the Your Projects area.

2. Click the demo project to enter its graph space.

   The graph space will be empty when you open it.

3. Click the Information icon near the lower left corner of the screen for a tour and overview of GraphXR, or simply explore on your own.

   **NOTE** For more information, please visit our YouTube GraphXR Tutorials.

3.2. Create a Project

You can create a new GraphXR project and either immediately connect to a Neo4j database, or leave the project unconnected.

3.2.1. Creating a project connected to a Neo4j database

You can connect a new project to an existing Neo4j graph database by specifying the database and server details. Once the connection is established, you can review the new project’s settings and enter its graph space.

To create a project connected to a Neo4j database:

1. In the Projects page, click the + icon next to Create under either New Projects or Your Projects.
2. In the dialog that appears, click the **Configure Neo4j Instance** checkbox.

3. Enter the information required to connect to the project’s Neo4j database:

   **Project Name**: Descriptive name, (e.g., the name of the Neo4j database).

   **Neo4j DB Host**: Host address, (e.g., a url such as `localhost`, or other host location). Do not include https://, bolt://, or :(port number) here.

   **Bolt Port**: (e.g. 7687)

   **Neo4j DB Username**: DB user name

   **Neo4j DB Password**: DB password

   **Connection Type**: Either:

   - **Browser direct connection**: GraphXR connects to the Neo4j DB directly through the browser. HTTPS is required to be on for Neo4j, and this is the preferred connection type.

   - **Through GraphXR server connection**: Data flows from the Neo4j DB through a GraphXR server to the browser. In this mode you can share the project. HTTPS is optional for the Neo4j DB.
4. Click **Confirm**.

The new project appears in **Your Projects**.

You can now:

- Click the **Settings** icon, labeled **APOC Search Index Config**, to use Neo4j’s indexing plugin to configure the allowed search terms for the project in GraphXR. You can modify this setting at any time.
- Click the project’s **Edit** icon to edit the project’s Neo4j information.
- Click the project’s **Lock** icon to enable (or disable) sharing.
- Click the **Trash Can** icon to delete a project. This deletes only the project, not its Neo4j database.
- Click anywhere on the project name to enter the project’s graph space and begin pulling data from the Neo4j database.

**NOTE**

You can share one or more data views from a Neo4j-connected project with another user. The Share user has access only to the project and the data views that have been saved. When sharing is enabled, the following sharing icons appear on the project label: **GotoShare**, to enter the project graph space in a shared state. Clicking the icon displays a list of available shared data views, if any. Choose a view from the list to enter its graph space. **Invite**, to invite other users to share the graph space. **UI Config**, to configure UI elements displayed in the shared space. For more information, please see **Using Data Views**.
3.2.2. Creating an unconnected project

You can create a project without connecting it to a Neo4j database. This is useful for importing and working with data available in a variety of formats (e.g. CSV, SQL, JSON, GraphXR's GXRF format, and others).

You can import many types of data using drag and drop, or query specific data using the Mapping Editor. For details, please refer to Querying CSV or SQL data using Mappings.

NOTE A blank project can be used in a similar way, and may be preferable in some situations.

To create an unconnected project:

1. In the Projects page, click the + icon next to Create in either the New Project or Your Projects area.

2. In the Project Name text box, enter a descriptive project name. See that Configure Neo4j Instance is not checked.

3. Click Confirm.

The new project appears under Your Projects. Click on it to enter its graph space.
You can now:

- Import data by drag and drop. Data with no associated graph model, such as a flat CSV file, will be loaded as a set of unconnected nodes of a single category, with column headings assigned as properties. You can then redefine and add useful categories, relationships, and properties directly in GraphXR.

**NOTE** You can load many file formats by drag and drop. For details, please see Import by Drag and Drop.

- Import data by query on a CSV file or SQL table using the Mapping Editor.
- Import snapshots, GXRF, or CSV archives saved from other GraphXR projects. These will contain defined categories and relationships that existed when the data was saved.

### 3.3. Using the blank project

A blank project can also be used to immediately enter the graph space without connecting to a database. You can import graph data saved in snapshots, GXRF, CSV archives, and other formats, and you can export data at any point.

**To use a blank project:**

- On the Projects page and New Project area, simply click the Blank tab to enter the graph space. You can now:
  
  - Import data by drag and drop.
  
  - Import data by query on a CSV file or SQL table using the Mapping Editor.
  
  - Import snapshots, GXRF, or CSV archives saved from other GraphXR projects. These will contain defined categories and relationships that existed when the data was saved.
Chapter 4. Using the Graph Space

A GraphXR project represents a 3-dimensional, functionally infinite graph space. To enter the desktop graph space:

- On the Projects page, either click a project name, or the Blank project.

When you first open a project, the space is empty. You can query a connected database (if any), or import external data in various formats.

Menus and controls available in the desktop graph space include:

- A main menu along the left vertical edge of the space, to open panels for importing, transforming, and displaying data.
- A legend menu, along the top right side of the space, which lets you select nodes by category, tag, or property, and edges by relationship.
- A context menu, along the bottom of the space, which displays the tools available to use on the data currently selected in the graph space.
- A set of GUI Navigation controls, at the bottom right, which enables 3D navigation within the graph space.
4.1. Main Menu

The main menu on the left edge of the graph space provides access to menu panels, some of which are divided into tabs. Simply click an icon to display its panel.
The **Main** menu panels include:

- **Project** panel, which includes:
  - **Category** and **Relationship** tabs, to enable you to pull nodes or edges of those types from the database and modify their display in the graph space.
  - **Property** tab, to show property names in use for categories and relationships.
  - **Settings** tab, to control the display of edges and the size of nodes, to show or hide the **Snapshot** dialog, **Pin** icon, and node information, and to select default or custom icon sheets for nodes.
  - **Data** tab, to import data in standard formats such as CSV and GXRF, save data as a CSV archive, GXRF, or Neo4j database, and to save data views to the server in the GXRF format.

- **Query** panel, to enter and save Cypher queries on a Neo4j database, and to run queries on a SQL database, CSV file, or a JSON or Gremlin environment. The **SQL** and **CSV** tabs include the **Mapping Editor** to import, edit, create, and save mappings to be applied to the data from a CSV file or SQL database.

- **Transform** panel, to transform graph data directly in GraphXR. This powerful suite of data operators includes the following tabs:
  - **f(x)**, to execute functions similar to formulas in Excel and SQL, and functions in MapReduce frameworks. You use this to provide a mathematical formula to transform one column of data to another.
  - **Extract**, to extract properties from existing nodes into new nodes.
  - **Aggregate**, to collect properties from a starting node’s neighboring edges and nodes, apply a calculation, and write the result back to the starting node as a property.
  - **Merge**, to combine two nodes with matching properties to a single node.
  - **Link**, to connect nodes with the same property values. This can be used to bring two different data sets together, and also to draw explicit connections among nodes of the same type.
  - **Shortcut**, to connect two nodes that share a common neighbor with a new link. You can use this to simplify the graph.
  - **Connector**, to provide access to external applications for gathering or transforming data.
• **Table** panel, to view **Category** or **Relationship** data in a searchable tabular format. **Enhanced Tables** let you select, sort, edit, reformat, and then export the edited table.

• **Layout** panel, to modify and apply **Force**, **Parametric**, **Geometric**, **Tree**, and **Category** layouts to all or part of your data.

• **Filter** panel, to hide data by **Node** or **Edge** properties using multiple composable filters, including timeline filtering.

• **Algorithm** panel, to run **Path Finding**, **Centrality**, and **Community Detection** graph algorithms and add the result to nodes or edges as a property value.

• **Map** panel, to work with geospatial data on a world map. Nodes with latitude and longitude coordinates are automatically dropped onto the map.

**TIP**  
Mouse over an icon to display its label, or click the **Main Menu** icon at the top left to show or hide the icon labels.

### 4.2. Legend Menu

A legend menu at the top right corner of the space lets you review and select data you’ve loaded into the graph space by **Category**, **Relationship**, **Tag**, or **Property**. The **Category**, **Tag**, and **Property** tabs list the number of currently selected and total nodes for each defined entity. Likewise, the **Relationship** tab lists the number of currently selected and total edges for each defined relationship.

You can use the list items to:

• Select all the nodes for a category, tag, or property, or all the edges for a relationship. As you add or subtract from your selection, the number selected is immediately updated.

• Set a different icon style or color for listed data (i.e. a specific category, relationship, tag, or property) on the fly.
4.3. Context Menu

The context menu at the bottom of the graph space displays icons for actions available to the data currently selected in the graph space. For example, before you load any data, only the Add Node icon appears. Once you load or create a node, more icons appear. Some menu items are available only when you select data, and some only when you select a single node, or a node that has a url and weblink.

After you bring data into a project, added context menu items are:

- **Delete.** Deletes selected nodes and edges.
- **Select Visible Nodes.** Selects all nodes currently visible in the graph space (i.e. those not hidden by de-selecting the Visible checkbox for a category or relationship, or by using Hide Selection).
- **Disable/Enable Force Layout.** Toggles between applying and freezing the force directed physics layout.
- **Fly To.** Zooms in on the center of the graph data if no nodes are selected, or the center of a group of selected nodes, or a single selected node.
- **Leaf Trimming.** Deletes nodes with zero or one edge.
- **Add Node.** Displays a dialog to define and add a single node.
- **Add Edge.** Displays a dialog to define and add a single edge between two nodes.
- **Clear.** Removes all data from the graph space.
- **Pin** or **Release.** Toggles between pinning nodes to a location in the space, or releasing nodes from being pinned. The badge on the icon shows how many nodes are currently pinned (or released).
When you select any set of nodes, you see the following additional icons:

- **Trace Neighbor.** Displays a slider to select nodes connected through a number of steps.
- **Tag.** Opens the Create Tag dialog to tag any set of selected nodes.
- **Expand.** Opens the Expand with relationships dialog to pull additional nodes from the database that are connected to the selected nodes. You can select any or all of the relationships that connect the nodes.
- **Inverse.** Selects all nodes not currently selected. The badge at the upper right of the icon shows how many nodes are currently selected.
- **Hide Selection.** Hides selected nodes and edges.
- **Un-Hide Selection** After you hide nodes, restores hidden nodes and edges to the graph space and de-selects them.

When you select a single node, you see the following additional icons:

- **Annotate.** Opens the Add Annotation dialog for a single selected node, and lets you add an Annotation or Attribute.
- **Information.** Opens an information window for a single selected node. Detailed information displays about the node's Properties and Neighbors, and you can add properties if desired.
- **Image and Link.** These two icons appear if an image and/or url is attached to a node. Select a node and click Image to display a small image in the graph space close to its node, and click again to hide the image. Click WebLink to open a browser window to a linked image or webpage.

**TIP** You can right-click at any time to use a floating context menu for your current data selection.
### 4.4. Desktop Shortcut Keys

Keyboard and mouse shortcuts are provided for navigation controls, most items in the context menu, and a few other controls, as shown in the following table.

**Table 1. Shortcut Keys for Navigation and Data Manipulation**

<table>
<thead>
<tr>
<th>Action</th>
<th>Shortcut Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pan</td>
<td>Left mouse click drag or 1+Left mouse click drag</td>
<td>Pan right, left, up or down.</td>
</tr>
<tr>
<td>Zoom</td>
<td>mouse scroll or 2+left mouse click drag</td>
<td>Drag up to zoom in, down to zoom out.</td>
</tr>
<tr>
<td>Rotate</td>
<td>right mouse click drag or 3+Left mouse click drag</td>
<td>Rotate right, left, up or down, centered on a selection, or the center of all nodes.</td>
</tr>
<tr>
<td>Stepwise Move</td>
<td>Arrow key click (right, left, up, down)</td>
<td>Move a step right, left, up, or down.</td>
</tr>
<tr>
<td>Fly to node</td>
<td>Ctrl+0 (zero)</td>
<td>Zoom in on a selection of one or more nodes.</td>
</tr>
<tr>
<td>Reset view</td>
<td>Alt+Shift+R</td>
<td>Reset entire view.</td>
</tr>
<tr>
<td>Show info</td>
<td>Ctrl+I</td>
<td>Displays the information window for a selected node</td>
</tr>
<tr>
<td>Hide menu</td>
<td>Esc</td>
<td>Hides a panel (i.e. Project, Table, etc.) or information window.</td>
</tr>
<tr>
<td>FullScreen</td>
<td>Ctrl+F</td>
<td>Enter full screen mode.</td>
</tr>
<tr>
<td>Select all nodes</td>
<td>Ctrl+A</td>
<td>Select all visible nodes.</td>
</tr>
<tr>
<td>Deselect all nodes</td>
<td>Alt+A or Double click empty space</td>
<td>De-select all visible nodes.</td>
</tr>
<tr>
<td>Select a node or nodes</td>
<td>Left mouse click or Left mouse click drag</td>
<td>Select one or more nodes.</td>
</tr>
<tr>
<td>Add a node or nodes</td>
<td>Shift+Left mouse click or Shift+Left mouse click drag</td>
<td>Add one or more nodes to a selection.</td>
</tr>
<tr>
<td>Subtract a node or nodes</td>
<td>Alt+Left mouse click or Alt+Left mouse click drag</td>
<td>Remove one or more nodes from a selection.</td>
</tr>
<tr>
<td>Drag selection</td>
<td>5+Left mouse click drag</td>
<td>Drag selected nodes and edges in the graph space.</td>
</tr>
<tr>
<td>Invert selection</td>
<td>I or Shift+I</td>
<td>Toggle to select nodes not currently selected.</td>
</tr>
<tr>
<td>Action</td>
<td>Shortcut Keys</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------</td>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td>Expand</td>
<td>Ctrl+X</td>
<td>Pull nodes connected to the selected nodes.</td>
</tr>
<tr>
<td>Leaf Trimming</td>
<td>Ctrl+L</td>
<td>Remove nodes with only one connection. Enter key again to restore trimmed nodes.</td>
</tr>
<tr>
<td>Pin or Release</td>
<td>Ctrl+P</td>
<td>Toggle to pin, or release pinning of selected nodes.</td>
</tr>
<tr>
<td>Delete selection</td>
<td>del or backspace</td>
<td>Deletes selected nodes and edges.</td>
</tr>
<tr>
<td>Clear graph</td>
<td>Ctrl + Shift + C</td>
<td>Remove all data from the graph space.</td>
</tr>
</tbody>
</table>

**TIP**
Click the **Shortcut Key** icon at the lower left of the project page to display keyboard shortcuts.

### 4.5. GUI Navigation Controls

The GUI navigation panel at the bottom right of the graph space provides controls for navigating the 3-dimensional graph space as follows:

- **Move Right, Move Left, Move Up, Move Down**
- **Move Reset**
- **Rotate Left or Rotate Right**
- **Zoom In or Out**
Chapter 5. Loading or Importing Data

When you open a GraphXR project, the graph space will be empty. To bring data into the space you can do one or more of the following:

- Pull data from a graph database (e.g. Neo4j) connected to your project.
- Import or load data files using the Data tab in the Projects panel.
- Query a CSV file or SQL table using CSV or SQL tabs in the Query panel. You must use the Mapping Editor to create a new mapping or use an existing one.
- Load a saved Snapshot archive by dropping its .ZIP file onto the graph space. A snapshot archive contains a full set of snapshots of the graph space that were saved during a work session.
- Load a saved data View. The Data tab in the Projects panel lists available views.

NOTE: When you exit a GraphXR project, the data are cleared from the graph space. You can, however, save graph states you may want to return to. For details, please refer to Saving Data.

5.1. Pulling Data from a graph database (Neo4j)

To pull data into the graph space from a graph database connected to the project you can:

- Enter and run a Cypher query in the Cypher tab of the Query panel.
- Enter a keyword search of node properties in the database and pull the resulting nodes.
- Pull nodes and edges 25 at a time by selecting a category or relationship in the respective tab in the Project panel and clicking Pull.
- Use Expand in the context menu to pull data connected to a specific node.

5.1.1. Pull data using a Cypher query

Cypher is a query language developed in tandem with Neo4j. It has quickly achieved wide use, and is a standard for querying graph databases. In GraphXR, the Cypher tab of the Query panel lets you enter, create, run, and save Cypher queries.
You can:

- Enter a Cypher query and click the **play** icon on the right to run it.
- Save a query by clicking the + icon. The saved query appears on a drop down menu.
- Run a saved query by selecting it on the drop down and clicking the **play** icon.

All GraphXR projects include the following default Cypher query to pull the first 100 nodes from the database:

```
MATCH (n)-[r]-(m) RETURN * LIMIT 100
```

**TIP**  
To see more example Cypher queries, open the demo projects.

**NOTE**  
For more information about Neo4j and the Cypher query language, please visit [Neo4j: Cypher Basics](#).

**To pull data by Cypher query:**

1. Click the **Query** panel icon, which opens with the **Cypher** tab showing.
2. Either enter a Cypher query or select a saved query using the drop down arrow.
3. Click the **play** icon to run the query against the current database.

**NOTE**  
Check **Load Inner Relationship** to display the relationships between nodes pulled by a query.

The data appear as nodes with their relationships in the graph space.

4. Click the + icon to save a new query or one that you’ve edited.
5.1.2. Pulling data with a keyword search

You can use the search field at the top right corner of the graph space to pull data using a keyword search term. The icon at the right of the search field lets you toggle between **Searching from Database** or **Searching from Graph**, to search the data already in the graph space.

| NOTE | To search a Neo4j database, the search terms must first be indexed in the database. To review and edit search terms, click the **Config Search Index** icon to the right of the database icon, to display the **APOC Search Index Configuration** page. |

To pull data using a keyword search:

1. Enter a keyword in the search bar at the top left corner of the graph space, and press return.

A list of data matching the search keyword appears below the search field in alphabetical order by category.

2. Click the arrow to the left of a category to view the itemized results.

3. Click an entity from the list to add its node to the graph space, OR,

   Click the + icon to the right of the label to add all the items in that list.

| TIP | When you add data, the nodes remain selected in the graph space until you add more data. If you want to immediately remove the data you just pulled, you can press delete while these nodes are still selected. |

4. Click the x in the search bar to clear the search and return to the graph space.
5.1.3. Pull Nodes by Category or Relationship

You can pull 25 nodes at a time from a particular category or relationship appearing in the Category or Relationship tab of the Project panel.

To pull data by Category or Relationship:

1. Click the Project panel icon.
2. Click the Category or Relationship tab, and click one of the Category or Relationship items to select it.
3. Click Pull to pull 25 nodes associated with that category or relationship.
4. For added samples, click again, as many times as you want.

NOTE  This may be useful for initial data exploration; however a query gives you more control of sampling.

5.1.4. Expand data connected to a node

The Expand icon in the context menu at the bottom of the graph lets you pull additional data from the database that is connected to a selected node or group of nodes. Expand is available once you pull some graph data into the graph space.

To pull data using Expand:

1. Select one or more nodes in the graph space.
2. Click the Expand icon.
The **Expand with Relationships** dialog displays.

3. Click the checkbox next to a relationship name to pull nodes connected by that relationship **OR**

Check **All** to pull nodes with all relationships to the selected nodes. To limit the number of nodes, enter a number in the **Limit** field.

4. Click the **Expand** button.

If no additional nodes are connected to the selected nodes, a message displays that the relationships are already fully expanded.
5.2. Load or Import Data from Saved Files

GraphXR enables you to load or import data through:

- Drag and drop, for CSV and GXRF files, Snapshot archives, JSON files, etc.
- The **Import** or **Load** features in the **Data** tab of the **Projects** panel. You can:
  - **Import** a file (e.g. CSV, .mgtx, etc.) by navigating to the file and opening it.
  - **Load** data saved in GraphXR's .GXRF format.
  - **Load** data saved as a data View.

5.2.1. Import by Drag and Drop

Data types you can drag and drop directly into GraphXR include GraphXR's GXRF format, CSV flat files, case files exported from Hunchly, and Maltego files in the .mtgx format.

**To import by drag and drop:**

- Navigate to a file, select it, and drop it on the graph space.

5.2.2. Import using the Data Tab

The **Import** button in the **Data** tab of the **Project** panel lets you select an external data file and load all its data.

You can import or load data in GraphXR's GXRF format, CSV files, and data in various other standard formats.

**NOTE**  Most of these types of data can also be loaded by drag and drop.
To Import data through the Data tab:

1. Go to the Project panel and click the Data tab.
2. Click Import.
3. Navigate to the file, and click Open.

For data without defined categories or relationships, a node is created for each line of data. All nodes are assigned a default category named according to the file type and file name, and assigned properties corresponding to column headings.

For example, importing Lines.csv causes all the nodes to be assigned a single category named csvImport_Lines. Since no relationships will have been defined, no edges will appear connecting the nodes.

If GraphXR cannot import the data, an alert message displays.

**NOTE**
Starting with unconnected nodes, you can create connected graph data directly in the graph space using GraphXR’s navigation, selection, and transformation tools. In particular, the Transform panel provides powerful ways to create and/or simplify categories and properties as well as relationships.
5.2.3. Load a GXRF file

A .GXRF file contains graph data saved in GraphXR's native format from a project's graph space.

To load a GXRF file:

1. In the Project panel, click the Data tab.
2. Click Load GXRF, navigate to the file, and click Open.

**NOTE** You can also load .GXRF files by drag and drop.

5.3. Querying CSV or SQL data using Mappings

If you have data model that maps to all or part of a CSV file or SQL table, you can use the Mapping Editor to create a mapping that queries the data of interest and defines its categories, properties, relationships, and key values.

In the CSV tab, you:

- Load a CSV or SQL file to be queried.
- Create and save one or more data mappings for that file.
- Import a mapping saved in a JSON file.
- Edit or delete a saved mapping.
- Select a mapping and load the results to GraphXR as graph data.

To create a new mapping or edit an existing one, you use the Mapping Editor window to:

- Create, edit or delete a saved mapping.
- Export a mapping as a JSON file.
5.3.1. Creating a Mapping

In the simple example that follows, the CSV file contains a list of photographic images taken at various times and places by various people. We’ll create a simple mapping that creates Image and Place categories, maps data from the CSV to properties for each category, and creates a taken_at relationship between the categories:

**Image → taken_at → Place**

We must first load the CSV file using the Query panel and CSV tab. Then in the Mapping Editor, we create the categories and select data from the file to be mapped to properties for each category. With the categories created, we can create the relationship and map data from the CSV file to its properties as well. For example:

- The **Image** category can include: photo ID number, name, url, image size, date taken and author.
- The **Place** category can include: region ID number, place name, geospatial coordinates, state, and country.
To create a mapping:

1. Open the CSV tab in the Query panel.

   **NOTE** These steps apply to querying CSVs; the same basic process applies to querying a SQL table.

2. Click the Load CSV button, navigate to your CSV file, and click Open.

   The file name and number of rows and columns are displayed next to the Load CSV button, and the contents of the file are displayed in a data table, 10 records at a time. Column headings in the CSV file can be mapped to properties of the categories or relationships defined in the Mapping Editor.

3. Click New to create a new mapping.

   The Mapping Editor window displays.

  ◦ To the left is an interface for adding categories and relationships.

  ◦ To the right is a window to enter a Category (or Relationship) Name, a list of Sample Data from the currently loaded CSV, and the Properties area for mapping a ColumnName from the CSV to a PropertyName for the selected category.

4. To create a category, click the + icon on the upper left. A circular category icon appears, named Category 1. Next you’ll rename it, and map CSV data to the new category’s properties.

5. Click the category icon to select it, and enter a new name in the Category Name field (e.g. Image).

6. In the Sample Data area, click the the + icon next to data columns to be mapped as properties of the category. Each column name appears in the Properties list as you add it. By default the property will be given the same names as the CSV data, but you can enter a different name. If you add a property by mistake, simply click its trash can icon in the Remove column.

7. Click the AsKey checkbox to set one or more properties as key values.

8. You need at least two categories defined before you can add a relationship, so add another category, rename it (e.g. Place), and add its properties.

9. Click the Add Edge icon and click the source category. Then click the second category to create the directed relationship.
The relationship appears as a line connecting the two category icons, with an arrow showing the direction. The default name is the combined names of the two categories.

10. Click the line to select it, rename the relationship (e.g. `taken_at`), and optionally, add one or more properties and choose a key property.

   **TIP**
   A standard naming convention for categories and relationships will make your mapping more readable. For example, capitalize category names (Image), and use lower case with words separated by underscore characters for relationship names (taken_at).

You can now save the mapping.

11. Click the Save As icon at the top left.

12. In the dialog box, enter a short descriptive name in the dialog that helps you identify the mapping (e.g. `SW_Image_Place`), and click OK.

   The mapping name appears in the dropdown Mapping menu.

13. Select the mapping you want from the Mapping menu and click the Load button.

GraphXR queries the CSV data, maps it to your graph model, and loads the resulting graph data to the graph space.
5.3.2. Editing a mapping

You can edit the mapping and save it, or save it with a different name as a new mapping.

To edit a mapping:

1. Open the CSV tab in the Query panel.
2. Click the Load CSV button, navigate to the CSV file associated with the mapping, and click Open.
3. Select the mapping you want to edit from the Mapping menu.
4. Click Edit.
5. Edit, add or delete categories, relationships, and their properties.
6. Click either the Save As icon to save your work as a new mapping, or the Save and Exit icon to save to the existing mapping.

NOTE: To exit the editor without saving any changes, click the close box (the X at the upper right of the Mapping Editor window.

5.3.3. Exporting or Importing a mapping

You can export a mapping as a JSON file, and then re-import it whenever you want.

To export a mapping as a JSON file:

1. Open the CSV tab in the Query panel.
2. Click the Load CSV button, navigate to the CSV file associated with the mapping, and click Open.
3. Select the mapping in the dropdown menu, and click Edit to open the Mapping Editor.
4. Click the Export Schema icon at the top left.

A JSON file for the mapping is written to your local machine.
To import a mapping saved as a JSON file:

1. Open the CSV tab in the Query panel.
2. Click the Load CSV button, navigate to the CSV file associated with the mapping, and click Open.
3. Click Import, navigate to the JSON file, and click Open.

The mapping appears in the Mapping menu.

NOTE: If you choose a mapping that was not defined on the CSV file you loaded, the following message displays: "Mapping not compatible with the data."

5.3.4. Deleting a mapping

You can delete any or all of the mappings for a given CSV.

To delete a mapping:

1. Open the CSV tab in the Query panel.
2. Click the Load CSV button, navigate to the CSV file associated with the mapping, and click Open.
3. Select the mapping you want to delete from the Mapping menu.
4. Click Delete.

5.4. Loading saved Snapshots or data views

In GraphXR you can use either the SnapShots feature, or data Views to save data views periodically as you work. Once you have a saved snapshot or view, you can load it again when you want to return to a specific state of your graph.

NOTE: Because Snapshots only exist in-memory, if you don't save them they'll be lost when you close or refresh the browser window.
5.4.1. Loading a Snapshot archive

A snapshot archive can contain any number of snapshot views, which lets you drag and drop a single file, and then select among many different saved graph states. For example, the following archive includes snapshots of force-directed, geometric, and tree layouts of the same data.

To load a Snapshot archive:

1. Open your GraphXR project, which will display the empty graph space.
2. On your local system, locate the snapshot archive file. It has a default name of the form:

   kineviz-graphxr-snapshots YYYY-MM-DD HH-MM-SS.graphxrsnapshots.
3. Drag and drop the archive onto the project graph space.

The snapshots appear in the **SnapShots** window, and the most recent snapshot is loaded to the graph space.

You can now select any of the views in the archive as your new starting point.

**NOTE**

An alert message will display if the snapshot archive fails to load. Check that the project is connected to the appropriate database, or is otherwise set up to be compatible with the snapshot archive.
5.4.2. Loading a data View

Data Views are similar to snapshots, but are saved individually in the cloud to the GraphXR server. An advantage of a data view is that it can be shared with other logged in users, and you can make changes and update a view.

For a project not connected to a database, a data view can be exported as a CSV or GXRF file that you can then import locally.

**To load a saved view:**

1. In the **Project** panel, click the **Data** tab.
2. You can either:
   - Locate the view in the **View Name** list and click its **Load** icon.
   - Navigate to a view file provided as a .GXRF or as a CSV archive, and drag and drop it onto the graph space.

The view appears on the list of data views for the project, and the data displays in the graph space as it was last saved.
Chapter 6. Saving Data

Once loaded to the graph space, data can be saved at any point in the process of exploration and data transformation. You can:

- Save **SnapShots** as you work, which creates a set of data views in memory. You can export the set to an external .zip archive whenever you want.
- Save data **Views** through the **Data** tab of the **Projects** panel.
- Save data in CSV and GXRF files or to a Neo4j database.

**IMPORTANT**

Develop the habit of saving your graph data whenever you come to a point you may want to re-visit. When you **Clear** data, exit a project or log out of GraphXR, all the data is deleted from the graph space. A saved snapshot archive or data view lets you quickly recover previous graph states for further exploration, or to correct a mistake.

6.1. Saving Snapshots

Snapshots let you save a library and history of your work in memory, and re-load the data whenever you want. The **SnapShots** window floats conveniently in the graph space. You can move it anywhere in the space, and take an snapshot at any time without opening a special panel. A new snapshot is added to the top of the snapshot list. Each snapshot includes a number, a timestamp, and a **Note** field where you can add descriptive text.
To save space, you can collapse the full list, and use controls on the SnapShots title bar to take more snapshots or save your archive.

Saving your current snapshots exports a compressed archive (.ZIP) file that contains each snapshot. You can re-load the entire archived set simply by drag and drop.

To take a snapshot:

1. Go to the Settings tab in the Project pane, and click the Show Snapshot checkbox.

   The SnapShot window appears at the top right, near the legend menu. Only the title bar appears.

2. Click the + icon in the title bar, then click the arrows next to the SnapShot title to display your snapshot.

3. With the snapshots showing, you can:
   - Click Create Snapshot to add to your set.
   - Click Save Snapshots to save the entire set.

   GraphXR saves the set of snapshots to a file of the form:

   kineviz-graphxr-snapshots YYYY-MM-DD HH-MM-SS.graphxrsnapshots

To load a snapshot archive:

1. Open a GraphXR project.

2. Navigate to a snapshot archive file, and drag and drop it on your project’s graph space.

   The set of snapshots appear in the SnapShots window, and the most recent snapshot is loaded to the graph space. You can now select any of the snapshots in the set as your new starting point.
6.2. Using Data Views

Data Views are similar to snapshots, but are saved only in the cloud as GXRF files. For example, you can save and return to scatter plot, tree hierarchies, or other useful views you create during exploration and analysis.

If your project is connected to a Neo4j database, a saved view can be shared with other users. Before you enter the graph space, on the Projects page, click the project’s Lock icon to enable sharing.

An invited user can then click the GotoShare menu and open the shared view.

Views from a blank project (one not connected to a Neo4j database), cannot be shared directly. You can, however, save any view as a GXRF or CSV, and another user can load it by drag and drop.

**NOTE**  
A saved GXRF is saved on the local machine, and a data view is saved on the server. Both are saved in GraphXR’s GXRF format.
6.2.1. Saving a data View

When you save a view, you must enter a descriptive name. GraphXR automatically includes a timestamp.

To save a View:

1. In the **Project** panel, click the **Data** tab.
2. Enter a descriptive view name, and click **Save View**.

   The new data view appears in the list of views, with its timestamp.

   **NOTE** If you click **Save View** without entering a view name, GraphXR will use the YY-MM-DD-HH-MM timestamp for the name. You cannot rename a view once it has been created.

6.2.2. Updating a data View

To edit a saved view, you can load it, make changes, and then update the view.

To update a View:

1. In the **Project** panel and **Data** tab, locate the view and click **Load**.
2. Edit the view as desired.
3. Click the **Update** icon for the view.

   A warning message will ask you to confirm that you want to update the view.

4. Click **OK** or **Cancel**.

6.2.3. Deleting a data View

You can delete a data **View** at any time.

To delete a View:

1. In the **Project** panel and **Data** tab, locate the view and click **Delete**.

   A warning message will ask you to confirm that you want to delete the view.

2. Click **OK** or **Cancel**.
6.3. Saving a GXRF or CSV archive

You can export any graph state as a GXRF or CSV archive. You might do this, for example, to share the state of a project with another user.

To save a GXRF or CSV archive:

1. Click the Project panel and the Data tab.

2. Click either the Save GXRF or Save CSV button.

A GXRF file (or CSV zip archive) is created, identified by the date and time of creation.

**NOTE** Once saved, to reload the saved view, you simply locate the GXRF file or CSV zip archive, and drag and drop it onto the graph space.

6.4. Saving to Neo4j

You can save your data to a Neo4j database using Save to Neo4j in the Data tab of the Projects panel.

Clicking Save to Neo4j displays a window that prompts you to:

- Review the categories and their properties and keys that exist in the graph space.
- Specify the location and user details for the database.
To save to a Neo4j database:

1. In the Projects panel and Data tab, click Save to Neo4j.
2. Review the list of categories and their properties that exist in the graph space.
3. For each category, you must set one of the properties as a Key by clicking the + icon next to the property in the list.
4. Enter the following details, then click Save to Neo4j.
   - Neo4j Hostname
   - Bolt Port
   - Username
   - Password
Chapter 7. Navigating Graph Data

By default, nodes and edges in the graph space are displayed using a force-directed layout with axes labeled x, y, and z. When rotating the view of the data, the origin is set at the center point of the data, as defined by its layout parameters.

**NOTE** For more details, please refer to Working with Layouts.

When you select one or more nodes, the origin is set to the center of the selection. This lets you explore a subset of the data in the 3D space. For example, in the following image, a few nodes have been selected.

To take a closer look, click the **Fly To** icon on the context menu.

The GraphXR view zooms in to the selected nodes, centers on the selection, and sets the axis of rotation around it.
In any of GraphXR's layouts, you can navigate the virtual 3D space using mouse and keyboard controls, the Fly To icon in the context menu, or the GUI navigation controls at the bottom right of the browser window. Navigation controls are summarized in the following table.

Table 2. Keyboard Controls for Navigation

<table>
<thead>
<tr>
<th>Action</th>
<th>Mouse and Keyboard Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pan</td>
<td>Left mouse click drag or 1+Left mouse click drag</td>
<td>Pan right, left, up or down across the entire data set.</td>
</tr>
<tr>
<td>Zoom</td>
<td>Mouse scroll or 2+left mouse click drag</td>
<td>Drag up to zoom in, down to zoom out.</td>
</tr>
<tr>
<td>Rotate</td>
<td>Right mouse click drag or 3+Left mouse click drag</td>
<td>Rotate right, left, up or down, centered on a selection, or the center of all nodes.</td>
</tr>
<tr>
<td>Stepwise Move</td>
<td>Arrow key click (right, left, up, down)</td>
<td>Move a step right, left, up, or down.</td>
</tr>
<tr>
<td>Fly to node</td>
<td>Ctrl+0 (zero)</td>
<td>Zoom in on a selection of one or more nodes.</td>
</tr>
<tr>
<td>Reset view</td>
<td>Alt+Shift+R</td>
<td>Reset entire view.</td>
</tr>
<tr>
<td>Hide menu</td>
<td>Esc</td>
<td>Hides a panel (i.e. Project, Table, etc.) or information window.</td>
</tr>
<tr>
<td>FullScreen</td>
<td>Ctrl+F</td>
<td>Enter full screen mode.</td>
</tr>
<tr>
<td>Drag selection</td>
<td>5+Left mouse click drag</td>
<td>Drag selected nodes and edges in the graph space.</td>
</tr>
</tbody>
</table>

**NOTE** To select and fly to a single node using a table or keyword search, double click a table item, or single click a search result.
The GUI navigation panel at the bottom right of the graph space also provides mouse controls for navigating the 3-dimensional graph space.

Click and drag with the mouse (or use a keyboard control) as follows:

- **Move Right, Move Left, Move Up, or Move Down** (or use arrow keys)
- **Move Reset** (the center circle) (Alt+Shift+R)
- **Rotate** (Rotate Left or Rotate Right) around a selected node, a group of nodes, or the entire data set (Right mouse click drag).
- **Zoom** (Backward or Forward arrows) in or out (2 + Left mouse click drag).
Chapter 8. Setting the display of data

Nodes and edges in the graph space can be re-sized, labeled, and colored to aid in data exploration and visualization.

8.1. Using the Settings tab to set display options

The Settings tab of the Projects panel enables you to set display options for entities in the graph space as a whole.

Controls available in the Settings tab include:

- Sliders to set node size and edge width:
  - Fog Density, to fade out the nodes and edges not currently selected.
  - Edge Width Scale, to set a scaled width for edges.
  - Node Size Scale, to set a global value for the size of all nodes. This value is applied independent of mapping a node size to one of its properties, preserving the relative scale of different sized nodes.
• Checkboxes to set a variety of display options:

- **Auto Show Image**, to show portrait images associated with nodes through a url. Note that portrait images will only be visible within a fixed distance from the user's camera.

- **Hide Node Info**, to hide nodes’ rollover information windows.

- **Quick Info**, to show the **Quick Info** window when you roll over over a node or edge.

- **Hide Arrow**, to hide the arrowheads that show the edge direction.

- **Use Curve Line**, to render edges as curved lines, rather than straight lines. This is most useful when pairs of nodes in a graph share multiple relationships.

- **Hide Pin Icon**, to hide the **Pin** icon that displays on a pinned node.

- **Show Snapshot**, to show the **SnapShots** window in the graph space. This is an important feature that lets you save graph states at any time and retrieve them easily.

• The **Icon sheet** menu, to select the set of icons available to apply to nodes:

- **Default**, general use icons.

- **Social**, social media icons (e.g. Twitter, Pinterest, etc.).

- **Character**, alphanumeric icons.
8.2. Coloring nodes and edges

You can color categories, relationships, properties and tags as follows:

- Select a color for any category or relationship in the Category or Relationship tab of the Projects panel.
- Select a color for any property or tag, using its colored dot in the Legend.

8.2.1. Coloring a category or relationship

Nodes receive the color of their category, and edges the color of their relationship. You can change this color at any time.

To set a Category or Relationship color:

1. Open the Project panel and Category (or Relationship) tab.
2. Click on a category name (or relationship name) to display the color palette.
3. Double click to select a new color.

All nodes with that category (or edges with that relationship) change to the new color.

8.2.2. Coloring a Tag or Property

When you select a Tag or Property in the Legend list, the center of nodes of that type are temporarily assigned its color.
To set a Tag or Property color:

1. In the Legend, click Tag or Property to display the list.
2. Click the colored dot next to a tag or property name, and select a color from the palette.

8.2.3. Applying icons to nodes of a Category

You can apply many kinds of icons to a category (such as logos, portraits, social media icons, etc), either from default or custom icon sets.

NOTE

For information about creating sets of custom images, logos, or videos, please contact Kineviz.

To apply an icon to nodes in a Category:

1. Open the Project panel and the Settings tab.
2. Select the icon sheet to be applied from the dropdown menu (e.g. Social).
3. Go to the Legend and select Category to display the list of categories.
4. Click the colored dot next to a category in the list to display the icon sheet.
5. Click to select an icon.

The nodes of that category now display the icon, overlaid on the basic color. To clear an icon and display only the color assigned to the category, select the blank (white) icon.

### 8.2.4. Apply images or videos to nodes

When you include a web address (url) for images or videos as a property of a category, GraphXR can render the image on its node.

**NOTE**

You can open an information window to see if a node has a link to an image or video. Use the **Info** icon (or ctrl+i, or right-click and select **Info** from the floating pop-up menu).

To display images associated with nodes:

- Click **Auto Show Image** to display the image associated with each node.
- The image (or video) appears when you are close enough to the node.

- If an image or a video is available, the **Image** and **WebLink** icons appear in the context menu.

**NOTE**

To speed up navigation in the graph space, you can hide images at any time. Simply click to deselect the **Auto Show Image** checkbox. Icons (if any) will still be displayed.
Chapter 9. Selecting Graph Data

GraphXR provides a variety of methods to select data in the graph space. You can:

- Use the mouse or keyboard shortcuts to select nodes or groups of nodes.
- Select using full-text keyword search on the graph data.
- Select all the nodes of any category, relationship, tag or property by clicking its name in the Legend.
- Use Select Visible to select all currently visible nodes in the graph space.
- Use Inverse to select all the nodes not in the current selection. (Ctrl + R)
- Use Trace Neighbor to select all the nodes with a specific number of connections to a selected node.
- Hide selected nodes temporarily with the Hide Selection icon in the context menu, and restore hidden nodes using Un-Hide Selection.
- Filter data by any numerical property, including Date and Time, using multiple composable filters.
- Use an Enhanced Table to select and edit a selection. For details, please see Using an Enhanced Table.

9.1. Selecting using the mouse and keyboard

You can select nodes directly in the graph space using combinations of the left mouse click (LMC) and other keyboard combinations, as follows:

- Select a node (LMC)
- Select a group of nodes (LMC drag)
- Add a node to a selection (shift+LMC)
- Add a group of nodes to a selection (shift+LMC drag)
- Subtract a node from a selection (alt+LMC)
- Subtract a group of nodes from a selection (alt+LMC drag)
- Clear a selection (LMC drag on empty space)
- Select all nodes (shift + a)
9.2. Selecting through a keyword search

You can search all properties of nodes in the graph space using full-text keyword search.

To select through a keyword search:

1. If you are connected to a database, the search bar may read **Search From Database**. If so, click the icon to the right of the search bar.

   ![Screen with search bar](image)

   The search bar now reads **Search from Graph**.

2. Enter a keyword. As you enter, nodes with property values matching that text are selected in the graph space, listed by Category.

   ![Graph space with selected nodes](image)

   You can do one or more of the following:

   - **Tag** the selection for further inspection.
   - Click the arrow to the left of the category name to display a list of nodes.
   - Roll over any node in the list to see its property information.
   - Click the airplane icon at the left of each item to fly to the node.

3. Click the **x** icon in the search bar to clear the keyword search.
9.3. Selecting by Category, Relationship, Tag, or Property.

The **Legend** displays a list of **Categories**, **Tags**, **Relationships**, and **Properties** in the graph space. Each list item shows:

- The total number of associated nodes or edges in the graph space.
- The number of nodes in the current selection.

When you add, delete or hide nodes, the totals are updated.

**To select nodes using lists in the Legend:**

- Click on any list item to select all its associated nodes or edges.

  The label changes to show that all the associated nodes (or edges) are now selected (e.g, **Pets 3/3**).

![Legend Example](image)

9.4. Using Select Visible Nodes

The **Select Visible** icon in the context menu selects all currently visible nodes in the graph space. You might use it along with **Hide Selection**, for example, to hide nodes, select the remaining nodes for tagging, then un-hide the hidden nodes.

**To select visible nodes:**

- Click the **Select Visible Nodes** icon in the context menu.
9.5. Using Inverse

The Inverse icon in the context menu selects all the nodes not in your current selection. You can toggle between a selection and its inverse.

To invert a selection:

- Click the Inverse icon in the context menu or (Ctrl + R).

**NOTE** You can use Trace Neighbor and Inverse together to select subsets of data organized by their degree of connection.

9.6. Using Trace Neighbor

You can use the Trace Neighbor icon to show successive connections from one or more nodes to all the other nodes in the displayed data. This can help you understand the complexity of the relationships in your data.

To trace neighbors:

1. Select one or more nodes using any selection method.
2. In the context menu, click the Trace Neighbor icon.
   
   The connections of the selected nodes to one other node appear.

3. Click again to see the connections of the first-order neighbors, and continue clicking until all the data have been connected.
9.7. Hiding nodes and edges

To focus on specific subsets of your data in the graph space, you can hide nodes and edges temporarily and work with the remaining visible data.

9.7.1. Hiding data by Category or Relationship

You can temporarily hide all the nodes and/or edges associated with any category or relationship by unchecking its Visible checkbox in the Projects panel.

- For a **Category**, all its nodes as well as the connected edges disappear from the view, and both the category name and the name of its hidden relationships disappear from the list in the legend.
- For a **Relationship**, all its edges disappear from the graph space, and the relationship name disappears from the list in the legend. Nodes connected to the edges remain in the graph space.

**To hide data for categories and relationships:**

1. Open the **Project** panel.
2. Click either the **Category** tab (for nodes) or the **Relationship** tab (for edges).
3. Click on a category name or relationship to select it.
4. Click to de-select its **Visible** checkbox.

The nodes and/or edges are now hidden.

5. Click the **Visible** checkbox to display the nodes or edges of that type again.
9.7.2. Hiding selected nodes

You can use the **Hide Selection** icon in the context menu to temporarily hide any set of nodes (and their associated edges) that you select in the graph space, even when they do not all belong to a particular category, relationship, property, or tag.

Once you hide nodes, the **Un-hide Selection** icon appears. Click on this icon to display all the hidden nodes and edges again, update the total counts in the legend lists, and de-select the data in the graph space.
To temporarily hide selected nodes and edges:

1. Select nodes in the graph using any selection method.
2. Click the **Hide Selection** icon in the context menu.

The nodes and associated edges are hidden. The number of hidden nodes is subtracted from the totals listed in the Legend.

3. You can keep adding to a selection of hidden nodes by continuing to select more nodes, and clicking **Hide Selection**.

**NOTE**  
As you select more nodes, **Hide Selection** re-appears in the context menu next to the **Un-hide Selection** icon.

### 9.8. Filtering Data

GraphXR enables you to filter data (nodes or edges) on the fly using any combination of numerical properties (such as date, time, etc.).

The following example uses a set of tweets from the Russian Twitter Troll demo dataset (courtesy of Neo4j) to explore communications created between May and Election Day 2016, by trolls with more than 1000 followers.
To filter data with multiple composable filters:

1. Open the Filter panel. We'll start by filtering by date, then add a second filter for the number of troll followers.
2. De-select the Force Layout with Filter checkbox.
3. From the Node Properties menu, choose the date-time property (e.g. created_str).

   **NOTE** Date-time information should be formatted as YYYY-MM-DD hh:mm:ss. Data not in this format can be converted using f(x) in the Transform panel.

The filter by date is created, labeled with the property (created_str) and category (Tweets). A slider shows the range of the property's date-time values.

4. Set a range of dates using the Min and Max selectors under the slider. For filtering by date, you can click the value to display a calendar and select dates you want.

   As you select values, the filter operates on the data in the graph space.

5. Now add a second filter. In this example, followers_count, from the Node Properties menu.
6. In the Min textbox, enter the minimum value (e.g. 1000).
The view in the graph space now includes only the filtered data.

**NOTE**
You can set a fixed range of values (for example, for a date or time series). Enter a value in Min and Max text boxes, and click the Fixed Range checkbox. Once you set a fixed range, you can use the slider to scrub through a filter by a range of values of the property (for example, by day, hour, or minute).

With data filtered in the graph space, you can save one or more Snapshot views; these will include only the filtered data.

7. You can add another filter at any time, or clear a filter by clicking the Del button to the right of the slider.

**NOTE**
Filters persist throughout a project session, that is, you can close the Filter panel and continue working with the filtered data. To see all the data again, you must clear (i.e., delete) all your filters. Filters do not persist when you exit the project.
Chapter 10. Tagging nodes

A tag is one way to group nodes that you consider related in some way, even if they belong to different categories. Once you tag a group of nodes, you can use the tag to select them again, or to update your selection.

To create a tag, you select nodes, then use the Tag icon in the context menu to show the Create Tags dialog. You can then:

- Create a tag, i.e. tag selected nodes.
- Update a tag with additional selected nodes.
- Delete all the tags on selected nodes using Clean Nodes Tags.

Tags appear in the legend under Tag, labeled with name you chose for the tag, the number of nodes you tagged, and a color. Click on a tag name to select all its nodes.

10.1. Creating a New Tag

To create a tag:

1. Select one or more nodes using any selection method.

2. In the context menu, click Tag to display the Create Tags dialog.
3. Enter a name for the tag and click **Save**.

4. Click **Tag** in the legend to see the new tag.

The tag name is displayed, along with its number of nodes. Check this to see that you've tagged the expected number of nodes. In the graph, the nodes will still be selected. GraphXR assigns a color that's not already in use. You can change the color at any time.

### 10.2. Changing a tag color

**To change a Tag color:**

1. Click **Tag** in the legend to display your tags.
2. Locate the tag in the list, and click on the color spot next to its label.
3. In the color palette, click to select the new color.

### 10.3. Adding nodes to a tag

**To add nodes to a tag:**

1. Select a group of nodes using any selection method.
2. In the context menu, click **Tag** to display the **Create Tags** dialog.
3. Locate the tag you want to apply and click the + icon on its label.

4. Click Tag in the legend, to see that the additional number of nodes have been added.

   To see that you tagged the correct nodes, you can also click the tag to select all its nodes.

### 10.4. Cleaning all tags from selected nodes

To clean all existing tags from nodes:

1. Select a group of nodes using any selection method.
2. In the context menu, click Tag to display the Create Tags dialog.
3. Click Clean Nodes Tags.

   The color coding disappears from the nodes you’ve selected. All of the tags applied to those nodes will be removed from the Tag list in the legend.
Chapter 11. Adding or Deleting data

You can now add a new node or edge to the graph space, one at a time. However, most data will be imported from an external source or generated through a data transformation.

NOTE
For details about data transformation, please refer to Transforming Graph Data.

To remove data from the graph space you can:

• Delete any data selection using the Delete icon (del or backspace).
• Delete data with few connections using the Leaf Trimming icon (Ctrl + L).
• Delete all the data in the graph space using the Clear icon (or Ctrl + Shift + C).

11.1. Adding a node or edge

You can add a new node or edge directly in GraphXR, one at a time, using the Add Node or Add Edge icons in the context menu.

You can add a node or edge of an existing type, or create a node (or edge) with a new category (or relationship).

NOTE
For a scalable process to import data and define its categories, relationships, and properties, use a query and the Mapping Editor.

For example, suppose that we notice that a Game of Thrones character has dogs, called, for example, Harry and Rufus. So far, the data set doesn't include animals appearing in the show. For each pet, we can quickly:

1. Add a node (and, for the first one, create a new Pets category with properties such as the name, owner, age, url image, breed, and color of the pet).
2. Add a new edge (and, for the first one, create a new owned_by relationship, with optional properties), to connect the pet to its owner.
11.1.1. Adding a node

First, we need to add a node (e.g. for Harry) in a new category (e.g. Pets), then add further nodes to the existing category.

To add a node:

1. In the context menu, click the Add Node icon.

2. In the AddNode dialog, you can use the dropdown menu to do one of the following:
   - Add a new Category:
     - Enter a new Category name (e.g. Pets)
     - Enter one or more Property Names for the category (e.g. petName), and enter its corresponding Property Value (e.g. Harry).
   - Click Create to create the node.
The new node appears in the graph space, and the new **Pets** category appears in the **Category** list in the legend.

OR

- Select an existing **Category**:
  - In the list of existing properties for the category, enter the **Property Value**, add more properties, or enter just the values you have and click the minus (-) icon for properties with no value.
  - Click **Create** to create the node.

The new node appears in the graph space, and the total number of nodes in the category is updated in the **Category** list in the legend.

**NOTE**

Other nodes of this category will be updated with any new properties you add, but the new property values will be empty. You can inspect a **Table** for missing values, and add a property value to a node using its **Information** window (**Ctrl + I**). To calculate values for multiple nodes at once, use the **f(x)** or **Aggregate** transforms.
11.1.2. Adding an Edge

Now we will connect the new node (Harry) with the correct character node (Jon Snow) through a new owned_by relationship.

To add an edge:

1. Select a source node. (e.g., the unconnected node in the Pets category).
2. Click the Add Edge icon.
3. The Add Edge window displays, showing the category and identity of the selected node.
4. Click Set as Source to set the selected node as the source.
5. Enter a new relationship name, or select an existing one. (e.g. enter owned_by).
6. Optionally, enter property names and their values for the relationship.
7. Now select the node you want connected (e.g. for the character Jon Snow), and click Set as Target.
If you've set the source and target backwards, click the **Switch** button to reverse the two.

8. Click **Create** to create the edge and connect the two nodes.

The new edge appears between the two nodes in the graph space, with an arrow showing the direction of the relationship. The total number of edges of that relationship is updated in the **Relationship** list in the legend.
11.2. Deleting data from the graph space

Deleting data from the graph space is easily done. You can:

- Delete any data selection using the **Delete** icon (del or backspace).
- Delete data with few connections using the **Leaf Trimming** icon (Ctrl + L)
- Delete all the data in the graph space using the **Clear** icon (or Ctrl + Shift + C).

**TIP**

You can use Ctrl + Z to immediately undo a Delete, Leaf Trimming or Clear action.

11.2.1. Deleting selected data

Use the **Delete** icon in the context menu to remove selected nodes and their edges from the graph space.

**NOTE**

Deleting data in the graph space does not affect the source data.

To delete a selection:

1. Select nodes in the graph space using any selection method.
2. Click the **Delete** icon (or press backspace).

11.2.2. Leaf Trimming

Leaf trimming deletes nodes that have only one (or no) relationships from the graph space. This lets you simplify a graph by quickly clearing out unconnected nodes.

To trim nodes:

1. Select one or more nodes (or deselect all nodes to trim all the data).
2. In the context menu, click the **Leaf Trimming** icon (Ctrl + L).

The nodes with zero or one connection disappear and the counts are updated.
in the lists in the Legend.

3. Click again to trim nodes in the remaining graph that now have zero or one connection. You can trim until the only nodes remaining are those with at least two connections.

### 11.2.3. Deleting all data using Clear

Clicking the **Clear** icon in the context menu removes all data from the graph space.

To clear the graph space:

- Click the **Clear** icon in the context menu (Ctrl + C).

All nodes and edges disappear from the graph space.

**NOTE** The data model persists, and the **Categories** and **Relationships** tabs in the **Project** panel still list defined data entities.
Chapter 12. Using Tables

The **Table** panel displays nodes and edges and their properties as rows and columns. Using basic tables, you can skim and search selected data and review its properties, but not edit the values or reformat the table. To do that, you must use the **Enhanced Table**.

Separate **Category** and **Relationship** tabs display all the categories and relationships in the data, which you use to display a table with those nodes (or edges).

With nothing selected in the graph space, the tables include all the data. With nodes selected, the basic tables include only the selected nodes.
12.1. Using a basic table in the Table panel

To display a basic table:

1. Either select data of interest, or deselect all data to display tables for all the data in the graph space.
2. Open the Table panel.

In the basic table you can:

- Click a category (or relationship) name to display the table of its nodes (or edges).
- Scroll through the table using scroll bars and Next or Previous page controls.
- Enter a search term to display only nodes (or edges) with matching properties.
- With all nodes de-selected, double-click a single table entry to select that node and fly to it, to display its information, add an annotation, or delete it.
- Export the entire table as a CSV.

12.2. Using an Enhanced Table

The Enhanced Table includes extended editing and selection capabilities for data tables. It displays all the data currently visible in the graph space (i.e., not hidden), whether currently selected or not.
To display an Enhanced Table:

1. Open the Table panel.
2. Click the Enhanced Table button at the bottom of the table.

The table that displays is initially tethered to the graph space, but you can click the airplane icon at the upper right corner to display it in a separate browser window.
In the Enhanced Table you can:

- Show the data for any Category or Relationship by clicking its label.
- Show only nodes that are currently selected in the graph space, by clicking the Show selection only checkbox.
- Add or remove properties from the table headings using the dropdown menu and property labels.
- Sort the table by clicking a property name in the table heading.
- Edit the property data in a table by clicking on it.
- Add a row to the table.
- Select table entries using the checkbox in the first table column.
- Filter Rows, either by selecting 20 or more rows using the checkbox, or by entering a keyword search in the search field for the column.
- Display the More Actions menu, which includes:
  
  - Export CSV (number of rows). A CSV containing the listed number of rows will be exported. You can export the entire table, or just the rows you’ve filtered or selected.
  
  - Mark Selected in Graph (number of rows), which selects data in the graph space that you’ve selected in the table. You can then go to the graph space to work with the selection, for example to add a tag.
  
  - Remove (number of rows), which removes marked nodes from the graph space.

**WARNING** Before using Remove to delete selected data, take a Snapshot. Then, if you’ve removed data by mistake, you can revert the action by loading your most recent snapshot.
Chapter 13. Transforming Graph Data

The **Transform** panel provides a suite of graph-based data operators to transform data from a variety of sources into connected graph data. The ability to view data as a collection of objects makes the operations both visual and more intuitive.

With these **Transform** operators, GraphXR delivers essential data operations within the graph space that have traditionally been performed in Excel (Pivot Table, Formula), a Relational database (Join, Where, Group By, Formula), or a big data environment such as MapReduce, or Spark (Map, Reduce, Filter, Group By, Function)

The graph-based operators in the **Transform** panel include:

- **f(x)** (i.e. function), to calculate values based on one or more existing properties and write the results back to the source nodes or edges.

- **Extract**, to generate nodes and edges belonging to new or existing categories and relationships, based on one or more source properties.

- **Aggregate**, gather properties from a node’s neighboring nodes or edges, optionally perform a function on those values, and write the result back to the origin node.

- **Merge**, to merge nodes sharing matched properties into a single node.

- **Link**, to connect nodes that share matched property values.

- **Shortcut**, to create a new relationship between nodes that share a common neighbor.

- **Connector**, to access 3rd party APIs. These can inject additional data or transform existing data.

**NOTE** The **Connector** is only available in GraphXR Analyst and Enterprise editions.
13.1. Using (f(x)

The f(x) transform is similar to formulas in Excel and SQL, and functions in a MapReduce framework. It lets you run javascript formulas on a single category or relationship. You select existing properties in the data to create new properties according to pre-defined or custom formulas. The following table lists the available preset formulas.

Table 3. f(x) Preset Formulas

<table>
<thead>
<tr>
<th>Preset</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>toNumber</td>
<td>String or Number ⇒ a Number</td>
</tr>
<tr>
<td>toString</td>
<td>String, Number, or Date ⇒ a String</td>
</tr>
<tr>
<td>toDate</td>
<td>Valid date-time ⇒ a YYYY-MM-DD HH:mm:ss timestamp.</td>
</tr>
<tr>
<td>toWeek</td>
<td>Valid date-time ⇒ a weekday (e.g. Monday).</td>
</tr>
<tr>
<td>convertCustomDate</td>
<td>The custom date format MM,DD,YYYY ⇒ a YYYY-MM-DD HH:mm:ss timestamp.</td>
</tr>
<tr>
<td>fullName</td>
<td>Combine firstName and lastName property values ⇒ the new property, as a full name.</td>
</tr>
<tr>
<td>toCustom</td>
<td>Editable format</td>
</tr>
</tbody>
</table>

NOTE Editing a preset moves it to the toCustom item, where you can test or run the edited formula.

13.1.1. Running preset f(x) formulas

Formulas apply to a single category or relationship at a time. You can run more than one formula at a time on a selection of data.

To use preset formulas to create and populate new properties:

1. Select data in the graph by using selection tools or the legend.

   TIP This is a good time to save a snapshot of your data.

2. Open the Transform panel and f(x) tab.
3. Select a **Category** or **Relationship** for the data you want to operate on. In this case, `csvImport_sample`.

4. In the **Apply Formula to Properties** area, select the property to transform, in this case `duration`, and click its + icon to add it to the list of formulas.

   The review list below the properties shows a sample of existing values and their data formats.

5. You can enter a new property name to save the result, or use the default. By default, `_new` is added to the **selected Property** name.

   **NOTE**
   Entering the source property name overwrites the existing data. This might be appropriate for simply transforming data to a different format. In many cases you will want to create a new property and give it a descriptive name.

6. Choose a preset formula from the dropdown menu. In this case, we choose `toNumber` which will attempt to convert the `duration` string to a number.
Sample values beneath the **Selected Property** and **New Property Name** show the input and the output property values of the selected formula, respectively.

**NOTE** If the input property value is invalid for a selected formula, or there is a mistake in the formula, the area below the new property name displays a short description of the problem.

7. Check to see that the formula returns a reasonable value, formatted as you expect.

8. You can repeat steps 2 to 4 to add more properties for transformation.

9. Once you have added the formulas you want you can either:
   - Click **Test** to run a test and review the results.
   - **OR**
   - Click **Run** to run the formula(s) and create the new properties for the category or relationship.

   A new property will be added to the selected category or relationship and the new calculated value will be added to each node (or edge).

### 13.1.2. Running a custom f(x) formula

Custom formulas enable you to use javascript functions to handle complex conversions, and also to bring multiple properties into a single property. The libraries **Lodash.js** and **Moment.js** are supported.

**NOTE** For additional information on Lodash, visit [https://lodash.com/docs](https://lodash.com/docs). For additional information on Moment, visit [https://momentjs.com/docs/](https://momentjs.com/docs/)

Data from the HBO series Game of Thrones illustrates the process. It includes a file with details about the dialog spoken in the show (Lines.csv), and another file with details about the show’s episodes (Episodes.csv). Importing these into the graph space by drag and drop creates nodes with the default categories **csvImport_Lines** and **csvImport_Episodes**.

**NOTE** This data is available at [https://kineviz.com/s/GXR_QSG.zip](https://kineviz.com/s/GXR_QSG.zip).
We want to link lines of dialog with the corresponding episodes, but the season and episode properties are defined differently in the two files:

- In `csvImport_Lines`, season and episode number are combined into a single `seasonEpisode` property as a text string (e.g. 'S1E3').
- In `csvImport_Episodes`, `seasonNumber` and `episodeNumber` are separate properties with a numerical value (e.g. '1').

You can use a custom formula to add a new, correctly formatted `seasonEpisode` property to `csvImport_Episodes` nodes.

To create a new property from existing properties using a custom formula:

1. Deselect all the data in the graph space. This applies your transformation to all nodes, rather than a selected set.
2. Open the Transform panel and f(x) tab.
3. Click Category and select the `csvImport_Episodes` category from the dropdown menu.
4. Click `episodeNumber` in the list of properties to add it to the Selected Property list.

   **NOTE** You only need to add one of the properties, so as to display your Input Formula options.

5. In the New Property Name textbox, enter `seasonEpisode`.
6. Select `toCustom` from the Input Formula menu, and enter the following javascript:

   ```javascript
   (propVal,props) =>
   'S'+props.seasonNumber+'E'+props.episodeNumber
   ```
As you enter a formula, a sample result appears beneath the new property name. This helps you verify that the formula returns the values you expect. If there is a problem with the formula or the source data, a brief message indicates the likely issue (for example, "Invalid input").

7. Click **Test** to test the script, or **Run** to run it.

In either case a message shows the result of the transformation, including the number of nodes with the new property.

To inspect the new `seasonEpisode` property and its values, you can open the **Table** panel and select `csvImport_Episodes`. 
13.2. Using Extract

The Extract transform converts properties into new nodes. For example, we have a CSV file (Characters.csv) with data on all the characters in the HBO series Game of Thrones, including the house (or family) each belongs to. When you drag and drop the CSV onto the graph space, the data are assigned a single default category, csvImport_GoT_Characters, which includes a houseName property. To create a separate new House category, you can extract it from the houseName property. In the process, you create a new belongs_to relationship which links House nodes to csvImport_GoT_Characters nodes.

NOTE

A standard naming convention will make category, relationship, and property names easier to work with. Here, a category name is capitalized (House), a relationship name is all lower case with words separated by underscores (belongs_to), and property names are alphabetic and lower case except for an upper case character starting a new word (houseName; seasonEpisodeId).

To use Extract to create a new category:

1. In the graph space, de-select the data to extract from the entire data set. With nothing selected, transformations affect the whole graph. If you select nodes, Extract operates on only those elements.
2. Open the the Extract tab of the Transform panel.
3. Enter the following details:
   - In the Extract From Category menu, select csvImport_GoT_characters.
   - In the Create Relationship textbox, enter belongs_to.
   - In the Create Category textbox, enter House.
   - In the Create Category From Properties area, click the houseName property to add it to the Selected Property list.

NOTE

Properties in the source data are listed alphabetically in the scrollable list of properties. A sample of data displays below the property names, showing property values and data formats.

The property name appears in the New Property Name text box. Leave it unchanged for this example.
4. Click the **Key** checkbox to set *houseName* as a key. This means that a single node will be created for each unique value of *houseName*, rather than a separate one for every source node.

5. Click **Run**.

- The legend displays the new **House** category, and its nodes appear in the graph space.
- The new **belongs_to** relationship links each of the character nodes to their respective **House** node.
### 13.3. Using Aggregate

The **Aggregate** transform starts from a node, collects neighbors of a specific relationship, and calculates new aggregate property values as follows:

1. Collects a property along either the connected edges or neighbor nodes of a selection of nodes.
2. Calculates an aggregate property (such as sum, average, range of values, etc.).
3. Writes the results back to a new property of the origin nodes.

You can use **Aggregate** to generate quantitative data relating to how graph data are connected. For example, in a telephone call log, you can aggregate the number of incoming and outgoing calls for a given caller, and write that aggregate value as a property on each caller node.

**NOTE** You can aggregate along either a property of neighbor nodes or a property of connecting edges.

Preset formulas are available for often-used calculations, as shown in the following table. You can also enter a **custom** javascript formula.

<table>
<thead>
<tr>
<th>Preset</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>custom</td>
<td>Editable format</td>
</tr>
<tr>
<td>take first</td>
<td>Copies the value of another property.</td>
</tr>
<tr>
<td>count</td>
<td>Calculates a value based on number of connections.</td>
</tr>
<tr>
<td>sum</td>
<td>Sums the values of the selected property.</td>
</tr>
<tr>
<td>average</td>
<td>Averages the values of the selected property.</td>
</tr>
<tr>
<td>range</td>
<td>Finds the lowest and highest value of the selected property.</td>
</tr>
<tr>
<td>max</td>
<td>Finds the maximum value of the selected property.</td>
</tr>
<tr>
<td>min</td>
<td>Finds the minimum value of the selected property.</td>
</tr>
</tbody>
</table>

**NOTE** Editing a preset moves it to the **custom** item, where you can test or run the modified formula.
We can use **Aggregate** to find the total number of lines spoken per Game of Thrones episode. Importing Lines.csv, with its data about the dialog in the show, and Episodes.csv, with details about each season and episode, we first transform the imported data as follows:

- Use the **f(x)** transform to calculate `seasonEpisode` property values for the **csv_Import_Episodes** category, to match the `seasonEpisode` property in **csv_Import_Lines**.

  NOTE For details, please refer to **Running a custom f(x) formula**.

- Use the **Link** transform to link lines to their respective episodes through a new `spoken_on` relationship.

  NOTE For details, please refer to **Using Link**

To aggregate connections between nodes:

1. Select one or more nodes. For example, click the **csvImportEpisodes** category to select its nodes.

2. Open the **Transform** panel and **Aggregate** tab, and enter the following:
   - In **Aggregate To Category**, select **csvImport_Episodes**.
   - In **Aggregate Along** select the **spoken_on** relationship.
   - Click **Property from neighbor nodes** and select the **lineCount** property.
In the New Prop textbox, enter `totalLines`. This is the new aggregate property that will contain the total number of lines of dialog in an episode.

In the Formula Name Here menu, select the `sum` preset.

3. Click Run.

To review the new `totalLines` property, you can open the Table panel and select `csvImportEpisodes`. You can Export the entire table as a CSV, or open an Enhanced Table to edit and export the edited table.
13.4. Using Merge

**Merge** combines nodes of a single category or edges of a single relationship, based on a property value. This enables you to simplify your graph data easily.

Using the Game of Thrones data as an example, we can combine all of the lines spoken on a single episode into a single node based on the `seasonEpisode` property in the `csvImport_Lines` category. There would then be only as many nodes in that category as there are in the `csvImport_Episodes` category.

**To use Merge to combine nodes:**

1. Deselect all the data to operate on all the data.
2. Open the **Transform** panel and the **Merge** tab.
3. Click **Category** and select the `csvImport_Lines` category from the dropdown menu.
4. In the **Select key properties** list, click to select the `seasonEpisode` property.
5. Click **Run**
The graph is now far simpler. Instead of a few thousand nodes, the `csvImport_Lines` category now includes only 73 nodes, which is the number of episodes in the series.

**NOTE**
The merged node will only preserve a single value for each property from its source nodes. In most cases, these properties should be cleared by checking the **Clear Unselected Properties** checkbox before running the merge.

### 13.5. Using Link

The **Link** transform connects nodes with matched property values with new edges belonging to a new or existing relationship. You can use it to bring two different data sets together, and also to explicitly draw the connection among nodes within a data set.

You can link properties even if the property names differ. For example, when imported into GraphXR, the Game of Thrones Characters.csv file includes the `characterName` property, and the Lines.csv file includes the `speaker` property. Although named differently, the two properties have matching values, that is, the name of the character in the show.

**To Link nodes by property value:**

1. To operate on the entire data set, deselect all the data.

2. In the **Transform** panel, open the **Link** tab.
3. Select or enter the following details:

- **Source Category**: select `csvImport_GoT_Characters`
- **Create Relationship**: enter `spoke`
- **Target Category**: select `csvImport_Lines`
- **Source Property**: select `characterName`
- **Target Property**: select `speaker`

4. Click **Run**.

The character nodes now have new directional edges showing the lines of dialog each one spoke.

**NOTE**

In the example data, you'll see that many of the `csvImport_Lines` nodes have no connection. These correspond to lines with a `speaker` that's not in the Characters.csv source data (a character may be missing, or its value could vary in the target file). You can use **Filter** to filter and select unconnected nodes and delete them, or to tag them for further evaluation.
13.6. Using Shortcut

The **Shortcut** transform connects two nodes that share a common neighbor with a new edge, and in the process creates a new relationship. The source pattern remains, but it can be hidden or deleted.

This enables you to simplify a graph without merging nodes, such that for the pattern:

\[(\text{CategoryA}) \rightarrow [\text{Relationship1}] \rightarrow (\text{CategoryB}) \rightarrow [\text{Relationship2}] \rightarrow (\text{CategoryC})\]

a new shortcut pattern is created:

\[(\text{CategoryA}) \rightarrow [\text{Relationship3}] \rightarrow (\text{CategoryC})\]

where categories A, B, and C contain nodes that share a common neighbor. [Relationship1] and [Relationship2] contain edges of the two relationships, and [Relationship3] contains edges of the new shortcut relationship.

Optionally, you can add new properties to the new [Relationship3], selected from properties of the category of the center (Category B) node as follows:

- Enter a new property name for the [Relationship3] property.
- Select a preset Input Formula from the list shown in the following table, or enter a custom formula.

<table>
<thead>
<tr>
<th>Preset</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>custom</td>
<td>Editable format</td>
</tr>
<tr>
<td>take first</td>
<td>Copies the value of another property.</td>
</tr>
<tr>
<td>count</td>
<td>Calculates a value based on number of connections.</td>
</tr>
<tr>
<td>sum</td>
<td>Sums the values of the selected property.</td>
</tr>
<tr>
<td>average</td>
<td>Averages the values of the selected property.</td>
</tr>
<tr>
<td>range</td>
<td>Finds the lowest and highest value of the selected property.</td>
</tr>
<tr>
<td>max</td>
<td>Finds the maximum value of the selected property.</td>
</tr>
<tr>
<td>min</td>
<td>Finds the minimum value of the selected property.</td>
</tr>
</tbody>
</table>
Editing a preset moves it to the custom item, where you can test or run the edited formula.

Using Game of Thrones data as an example, we can connect characters directly to episodes through a shortcut in which the spoke → csvImport_Lines → spoken_on pattern is used to create a new appeared_on relationship.

To create a shortcut:

1. Open the Transform panel and Shortcut tab. To create a shortcut, you must first select the center node of an edge-node-edge pattern, so the message in the Shortcut tab prompts you to select at least one node.

2. Click csvImport_Lines in the legend menu to select all the nodes in the category.

3. Enter the following details:
   - In Center Category(B), select csvImport_Lines.
   - In Relationship(R1) select spoke.
   - In Relationship(R2) select spoken_on.
   - In New Relationship(R3) enter appeared_on.

   Optionally, you can copy properties from csvImport_Lines to appeared_on, and transform property values using an Input Formula.

4. Leave the Directional Edge and Count Links checkboxes as they are.
5. Click **Run**.

At this point the source nodes are still present in the graph space.

6. To view the simplified graph, click the `csvImport_Lines` category on the legend to select its nodes (if they are not still selected). Then either **Delete** the `csvImport_Lines` category, or **Hide** your selection.
13.7. Using the Connector

The Connector provides access to 3rd party services. These can be useful for injecting data from external sources, or modifying existing data in your graph.

**NOTE** The Connector is only available in the Analyst and Enterprise editions of GraphXR.

The following connectors are available by default:

- **Address ⇒ Geo**, to transform a physical address to geospatial (latitude and longitude) coordinates.
- **IP ⇒ Geo** to transform an IP address to geospatial coordinates either through:
  - `ipgeolocation.io`, or
  - `iplocation.com`
- **ShortURL to FullURL**, to complete a short URL address.

To run an application in the Connector:

1. Deselect all data, to operate on all your data, or make a selection, for example, by clicking a category name on the Legend.
2. Open the Transform panel and Connector tab and select one of the applications from the drop down menu.
3. Select a **Proxy Setting**. This will be either **No Proxy**, or **HTTP Proxy**, where you enter details for the **Host**, **Port**, **Username**, and **Password**.

4. Open the **API Setting** window to enter an API token or key.

5. Select a **Category** and the property (**prop**) that will supply the input.

6. For a geospatial transform, enter the name of the new longitude and latitude properties that will be created. The default names are **lng** and **lat**, respectively.

7. Click the **Create New Node** checkbox if you want a new node category to be created. In that case, you must also enter a **New Node Prefix** and a **New Rel Prefix** (for the new relationship that will be created). You can use the default entries, or enter your own prefixes.

8. Click **Run**, or **Stop** to stop an already running process.
Chapter 14. Running Graph Algorithms

The Algorithm panel enables you to run one or more of the computational graph algorithms widely used in graph analytics.

NOTE
For an e-book introduction to graph algorithms and their use, please see Graph Algorithms: Practical Examples in Apache Spark and Neo4j.

When you run an algorithm on selected data, the computational result is added as a property to each node in the selection. These data can be displayed (for example, in a scatter plot), accessed for other processes within GraphXR, or exported for use in other statistical or graph analytics software.

In the Algorithm panel, graph algorithms are organized in Path Finding, Centrality and Community Detection tabs.

- The Path Finding algorithm traces the path between a selected start and end node and applies an optional weight.

- Centrality and Community Detection algorithms each add their resulting values to a new property for a single node or set of nodes.
The following table lists the available algorithms and their GraphXR property names.

<table>
<thead>
<tr>
<th>Algorithm tab</th>
<th>Algorithm</th>
<th>Property Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path Finding</td>
<td>Path Finding</td>
<td>gxrPathIndex</td>
</tr>
<tr>
<td>Centrality</td>
<td>PageRank</td>
<td>pageRank</td>
</tr>
<tr>
<td></td>
<td>Betweenness</td>
<td>betweenness</td>
</tr>
<tr>
<td></td>
<td>Closeness</td>
<td>closeness</td>
</tr>
<tr>
<td></td>
<td>Eigenvector</td>
<td>eigenvector</td>
</tr>
<tr>
<td>Community Detection</td>
<td>Connected Component</td>
<td>componentId</td>
</tr>
<tr>
<td></td>
<td>Strong Connected Component</td>
<td>strongComponentId</td>
</tr>
<tr>
<td></td>
<td>Louvain</td>
<td>louvainComponentId</td>
</tr>
<tr>
<td></td>
<td>Label Propagation</td>
<td>labelPropagationId</td>
</tr>
</tbody>
</table>
Chapter 15. Working with Layouts

GraphXR provides the following layout options for displaying data in the graph space:

- Force
- Parametric
- Geometric
- Tree
- Category

These layouts, as well as GraphXR's geospatial mapping function rely on the ability to fix, or Pin nodes in 3D space in various specific ways, and to Release the pinned nodes when desired.

15.1. Pinning Nodes

Pinning locks pinned nodes to their current relative positions in the graph space. It is designed for use with the Force layout, to re-distribute nodes for a better view or grouping and give you finer control of the layout. In addition, GraphXR automatically pins nodes in the following situations:

- A single selected node is automatically pinned.
- When selecting and arranging nodes geometrically using the geometric Line, Grid, Circle, or Cube layouts, the selected nodes become pinned to their new geometric layout. Geometrically locked nodes remain pinned until you explicitly release (un-pin) them, or select the explicit Force geometry, which releases all pinned nodes.
- Nodes with geospatial coordinates that you drop onto a map using the Map panel are pinned according to their latitude/longitude coordinates and the 3D perspective that you choose. Mapped nodes remain pinned until you explicitly release (un-pin) them.

To pin and release one or more nodes:

1. Select one or more nodes and click the Pin icon on the context menu.

   The selected nodes will be pinned (in addition to any already pinned nodes).
2. To release, select only the pinned nodes.

The Pin icon changes to Release.

3. Click the Release icon to release the nodes and return them to the default force-directed layout.

### 15.2. Force Directed Layout

A Force directed layout is a physics simulation in which each node pushes away from other nodes while edges pull them together. There is no intrinsic meaning to node position or edge length in the Force layout.

**NOTE** For details about the algorithms behind a force-directed layout, please visit Force-directed graph drawing.
The **Force** tab of the **Layout** panel provides sliders to adjust the following parameters:

- **Link Strength.** Adjusts how strongly the links pull the nodes together.
- **Link Distance.** Controls the edge length.
- **Gravity.** Pulls the nodes toward the center of the graph space. This is the point the camera rotates around when nothing is selected.
- **Charge.** Adjusts how strongly the nodes push away from one another.
- **3D.** Compresses nodes on the Z axis to approach a flat 2D distribution.

### 15.3. Parametric Layouts

A **Parametric** layout enables you to create scatter plots by displaying any numerical property value encoded in your data on X-, Y-, or Z- axes.

To display a parametric layout:

1. Click to open the **Layout** panel and choose the **Parametric** tab.
2. Choose a property name for the X-, Y-, and Z-axes.
3. Use the **Axis** slider to adjust the size of the scatterplot space.
4. Click **Apply**.

   The plot displays with axes labeled with the property names you entered.

Your choice of variables for the three axes is saved in the panel, and you can:

- Click **Apply** to re-apply any of the parametric layouts you’ve saved.
Click **Delete** to delete a parametric layout.

Click **Reset** to return to the layout you started with.

Once you are done designing your scatter plots, you can save a **Snapshot** or data **View**, and then **Reset** the data to the layout you started with. For example, if you started with geospatial data pinned to a map, but crafted another view of it in a parametric layout, you can reset it to the map layout.

**NOTE**

If desired, you can flatten the layout to a 2D projection by choosing **none** as the Z axis.

### 15.4. Geometric Layouts

Geometric layouts let you display selected nodes in a **Line**, **Circle**, **Square**, or **Cube**. The edges between nodes are displayed as well, so that the connections in the graph data can still be seen.

Additional controls to scale and rotate selected data enable powerful data visualization in the 3D graph space. Nodes can be arranged in sequence according to numeric properties as well.

Within the same view, you can:

- Apply different geometries to subsets of selected data. For example, one selection of data can be displayed in a line, and another in a circle, grid, or cube.

- Scale each selection separately in the layout space. You can enter a **Scale** factor, then click **Expand** or **Contract** to increase or decrease the display scale of the selected data. For example, you can expand the scale for data displayed in a line, and contract the scale for other data displayed in circles.
• Rotate a selection separately along the x-, y-, and z- axes. You enter a number of degrees to rotate the layout, then use Rotate X, Rotate Y, or Rotate Z buttons for fine-tuned control the 3D orientation of your selection.

When you have crafted a layout you like, you can save it as a Snapshot or data View.

15.5. Tree Layout

A tree layout displays nodes and edges as a hierarchy branching from one or more nodes that you select.

To display a Tree hierarchy:

1. Click the Layout icon, and select the Tree tab.
2. Select one or more nodes to be the first level of the branching hierarchy.
3. Click Apply to show the tree hierarchy.

You can use the Axis slider to increase or decrease the apparent size of the tree view.

To change the hierarchy of nodes in a tree view:

1. Add (shift+LMC) or subtract (alt+LMC) nodes.
2. Click Apply.

The new set of nodes you have selected are now used as the first level in the tree hierarchy.
To revert to the default Force layout:

- Click Reset in the Tree tab.

**NOTE** If you close the Layout Panel without resetting the view, a green Reset flag appears next to the Layout panel icon. You can click this Reset flag to revert to the default Force layout.

### 15.6. Category Layout

The Category layout enables you to separate nodes by category in the 3D graph space. Nodes are grouped by category displayed along x-, y-, and z-axes. This looks similar to the tree hierarchy, but the focus is on groups of categories, rather than branching hierarchy.

In the Layout panel and Category tab, you can use the Axis slider to set a virtual viewpoint closer or further away.
Chapter 16. Using Geospatial Maps

The Map panel lets you work with data positioned on a world map (powered by Mapbox, https://www.mapbox.com). Both the nodes and their associated edges appear on the map.

When you open the Map panel to display the world map, nodes with latitude and longitude properties are automatically dropped onto the map, and a map boundary is set based on the area covered in the graph data. Nodes without geospatial data which are connected to those on the map also appear, with their connecting edges, positioned above the map.
Geospatial data must be encoded in the data in separate latitude and longitude coordinates. The .KML and .KMZ (Keyhole Markup Language/Keyhole Markup Zip) files used by mapping applications such as Google Earth contain appropriately encoded coordinates, and you can map these files directly in GraphXR.

With the Map panel open, you can:

- **Show** or **Hide** the map.
- Fly to a general location by searching place names in the **Search Location** bar.
- Use **Map Control** to reposition the map.

Nodes remain pinned to the map until you release them, which means that you can close the Map panel and continue to work with mapped nodes in the graph space, whether a map is shown or hidden. You can:

- Navigate the mapped nodes using any GraphXR navigation method (i.e. pan, zoom, change 3D perspective, or fly to a single node or selection of nodes).
- Select nodes using any selection method, and perform any of the data transformations, editing, or tagging available in the graph space.
- Save snapshot views for use in data visualization.

For example, in the map below, we've created tags to assign regions to sets of nodes.
We can use a tag to select nodes then click the **Fly To** icon (or **Ctrl** + 0 (zero)) to fly to the center point of the selection on the map.

### 16.1. Using Show Map

Opening the **Map** panel automatically shows a map with suitable boundaries, and drops your graph data onto it.

You use **Show Map** to:

- Show the map that was hidden using **Hide Map**.
- Reset nodes on the map after using **Search Location** or **Map Control**.
16.2. Flying to a Search Location

To fly to a general location:

1. Open the Map panel and click Show Map.

2. In the Search Location bar, enter the name of a location (e.g. United Kingdom) and click it on the search list.

   The map zooms to a position centered on the named location.

   ![Map panel showing search location]

   **NOTE**

   To reset the map, clear the search by clicking the x icon in the search bar, and click Show Map again.
16.3. Hiding the Map

You can click **Hide Map** to hide the underlying map, showing only its nodes. This may make it easier to work with just the nodes on the map.

The nodes remain pinned to the hidden map, and 3D navigation controls apply whether the map is shown or hidden. For example, if you zoom in on a selection of data and then show the hidden map, it will be zoomed in and centered on your selection.

**NOTE**

To return data to a force-directed layout, you must click the **Pin /Release** icon in the context menu. (You can immediately click the icon again to toggle to the previous pinned state and re-pin the nodes to the map.)

16.4. Using Map Control

**Map Control** mode lets you reposition the map itself temporarily.

**NOTE**

When you click **Map Control**, the button is outlined in red, and 3D navigation is de-activated.

**To reposition the map using mouse controls:**

1. Open the **Map** panel and click **Map Control**.
2. Set the map display with mouse controls or their equivalent keyboard shortcuts:
   - Pan (**left mouse click** drag)
   - Zoom (**mouse scroll** or **2 + left mouse click** drag)
3. Click **Map Control** to exit and resume 3D navigation in the graph space.
Appendix A: Setting up WebVR for GraphXR (BETA)

This section outlines setting up an environment for using GraphXR with WebVR, in this case, using the Oculus Rift (or Oculus Rift S) headset with Chrome WebVR. The steps are:

1. Prepare the VR Device, Hardware, and Software
2. Configure the Chrome browser.
3. Run GraphXR.

**NOTE** Because WebXR is a rapidly evolving standard, GraphXR only provides beta support for VR viewing at this time.

A.1. Prepare the VR Device, Hardware, and Software

A.1.1. Oculus Device

For setup refer to https://www.oculus.com/rift/setup/

A.1.2. Hardware Requirements

2D use

- Minimum RAM: 8GB
- Processor: Intel Gen 6 i5
- GPU: Nvidia GTX-1050 or equivalent

VR/XR use

- Minimum RAM: 16GB
- Processor: Intel Gen 6 i7
- GPU: Nvidia GTX-1070 or be

A.1.3. Software Requirements

- Windows 10
• Chrome version (v.70.xxx or greater)
• Oculus Client

A.2. Configure Chrome

1. Configure NVIDIA GPU.

Open NVIDIA Control Panel ⇒ Manager 3D settings ⇒ Program Settings ⇒ Select Google Chrome ⇒ Select NVIDIA Processor

2. Enable Chrome Hardware acceleration

Open Chrome ⇒ Go to chrome://settings ⇒ Scroll to the bottom ⇒ Click Advanced ⇒ Scroll to System ⇒ Enable Use hardware acceleration when available.

3. Configure WebVR flags in Chrome

Open Chrome ⇒ Go to chrome://flags/ ⇒ Search with vr ⇒ Enable WebVR and Oculus hardware support.

**NOTE** Please make sure that OpenVR hardware support is set to Default or Disable.

4. Configure Gamepad flags in Chrome

Open Chrome ⇒ Go to chrome://flags ⇒ Search with gamepad ⇒ Enable Gamepad Extensions

5. Relaunch Chrome.

A.3. Run GraphXR

1. Open the Oculus client.

**IMPORTANT** You must keep the Oculus client running continuously.

Open Oculus client ⇒ Click Devices menu ⇒ Please make sure of the devices status.
If you can't start the Oculus client, please go to:

C:\Program Files\Oculus\Support\oculus-runtime. start OVRServer_x64.exe.

Once this is running continuously (this is the terminal GUI, and you will be able to see the logs), OVRServer will automatically open the Oculus client again.

2. Open GraphXR.

Open Chrome ⇒ Go to https://graphxr.kineviz.com ⇒ Create VC Demo ⇒ Start.

3. Load Data in to GraphXR, for example using a Cypher query as follows:
   a. Click the Query icon.
   b. Enter MATCH (n)-[r]-(m) RETURN * LIMIT 100
   c. Click the play icon.

4. Click the Enter VR icon to enter the VR space.

   **NOTE** When VR has been set up, the Enter VR icon appears at the left side of the graph space.
TYPOGRAPHY

Text in this document is set in the following freely available or licensed fonts:

**Lato**, copyright (c) 2010-2015, Łukasz Dziedzic (dziedzic@typoland.com), with Reserved Font Name Lato. Licensed under the SIL Open Font License, Version 1.1. This license is available with a FAQ at:

http://scripts.sil.org/OFL

**M+ Fonts**, copyright © 2002-2014 M+ Fonts Project. These fonts are free software. Unlimited permission is granted to use, copy, and distribute them, with or without modification, either commercially or non-commercially.