Voronoi Dilation Diagram Viewer

Quick User Guide

Note: *Even though this application has been written with help of the SwingFramework class library, this quick guide does not cover all features of this library. Full documentation on SwingFramework will follow shortly.*

User Interface overview

The main application window consists of two views:

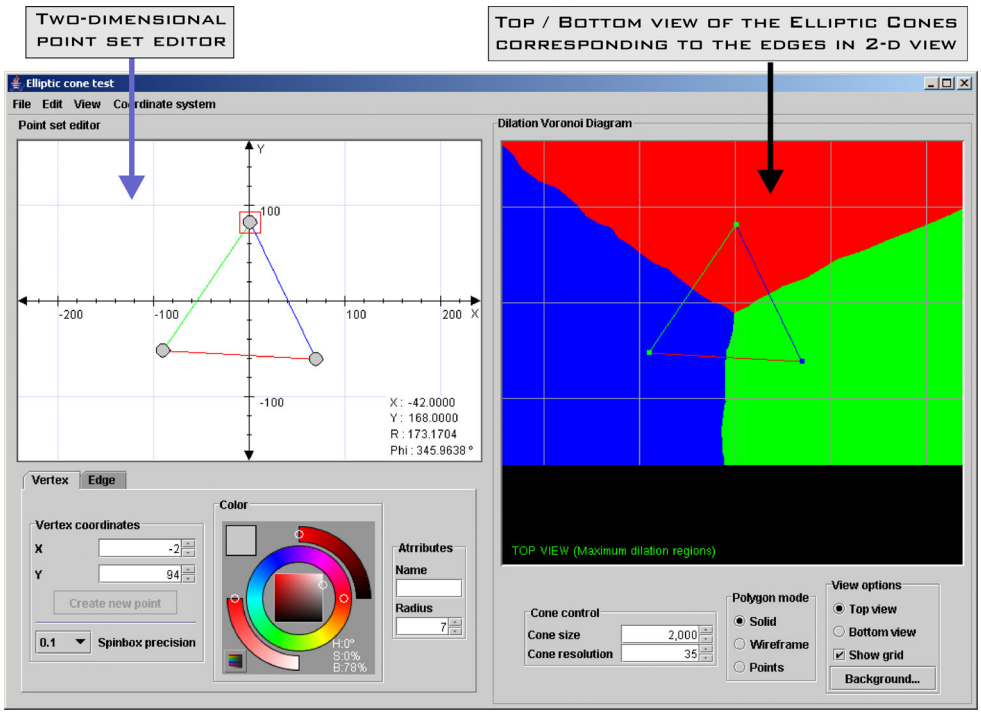


Fig.1 Overview of the main application window

Most of the work is done in the left view, which is a 2-dimensional point set editor. The right-hand view will automatically update upon any changes in the point set editor.

Note: *Admittedly, some of the UI features are a bit unintuitive yet, such as the absence of some important keyboard shortcuts etc. These will be added (or modified) as time permits.*

Following is a detailed explanation of the 2-d editor UI:

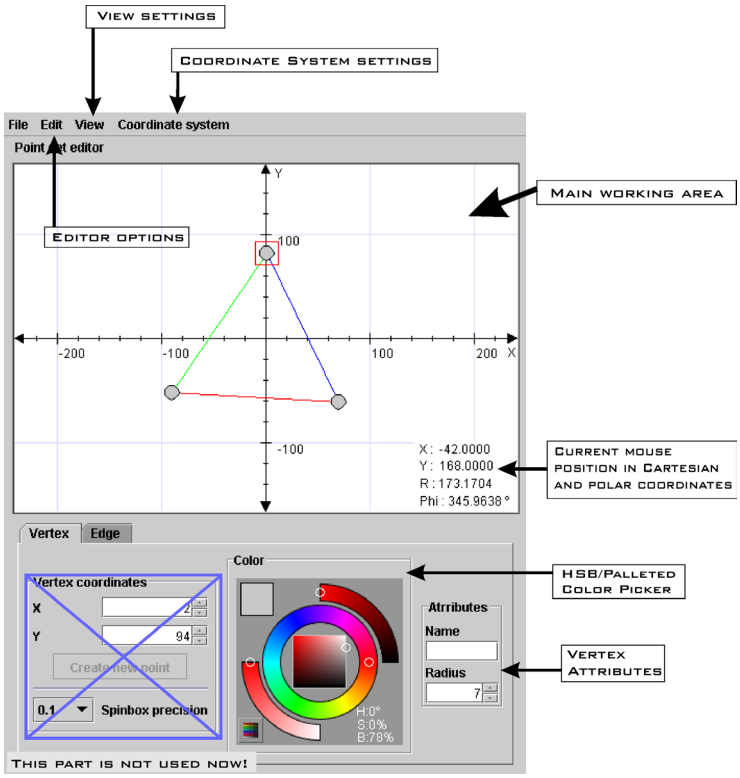


Fig.2 Principal components of the 2-d editor

Main working area:

Here the graph vertices and edges are entered and modified.

Coordinate display:

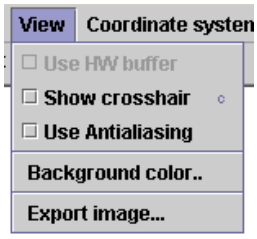
Continuously changes as you move the mouse and shows the approximate current mouse position in the world coordinate system.

Color picker:

This interface element can be used to alter colors of vertices and/or edges. [Also applies to multiple object selections.]

The Edit / View / Coordinate system menus control various aspects of editing behavior and also affect the way the geometry is displayed.

Menu descriptions



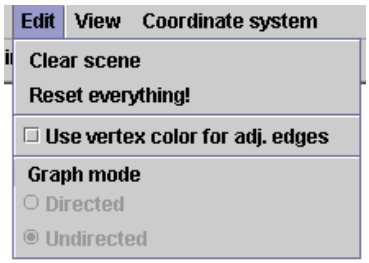
"View" Menu

"**Show crosshair**" toggles a crosshair consisting of two perpendicular lines, which follow the mouse cursor. The crosshair can be used in conjunction with the grid to perform precise coordinate input.

"**Use Antialiasing**" toggles antialiased rendering mode which smoothes the edges on all geometric elements, as well as text, and provides a "nicer-looking" view. However, keep in mind that antialiasing consumes additional CPU time – the system may be considerably slowed down when operating on complex geometric scenes.

"**Background color...**" shows a standard color-chooser dialog, which changes the background color of the entire view.

"**Export Image…**" takes a screenshot of the current view as a PNG image.

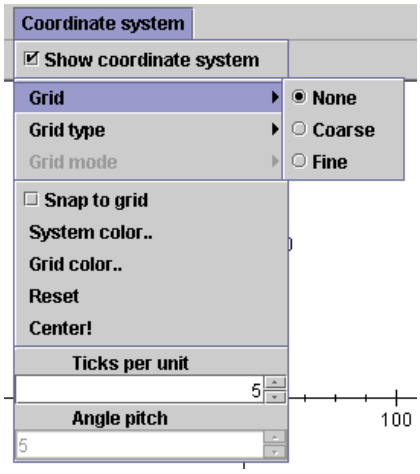


“Edit” Menu

“Clear Scene” destroys all previous scene contents. The settings of the coordinate system etc. are left unchanged.

“Reset everything!” clears the scene just as “Clear Scene”, but it also returns the coordinate system etc. to default settings.

“Use vertex color for adj. Edges” is an experimental feature. If enabled, it instructs the editor to assign colors chosen for vertex selections to the edges that are bounded by the selection’s vertices.



“Coordinate system” Menu

“Show coordinate system” turns on/off the coordinate axes and grid. Be aware that when the coordinate system is not visible, its snap-to-grid mode will be inactive.

“Grid” controls the grid visibility.

“Grid type” switches between Cartesian and Polar coordinate grids.

“Snap to grid” toggles the snap mode, in which the mouse cursor (or objects) will be snapped to the closest grid intersection. Use this for precise drawing.

“System color” and **“Grid Color”** set colors for the coordinate axes and grid, respectively.

“Reset” reverts the coordinate system to default settings, including zoom factor and position.

“Center” centers the coordinate axes in viewport.

“Ticks per unit” sets the amount of small “ticks” between adjacent values on the coordinate axes. This also affects the granularity of the grid. (For polar grid, this affects the spacing of grid circles).

“Angle pitch” Active only when polar grid is selected, this sets the angular distance between adjacent grid lines.

Additional keyboard shortcuts

ALT + C	Center the coordinate axes in view
ALT + G	Cycle through grid visibility options (Currently None, Coarse or Fine)
ALT + S	Toggle Snap-to-Grid
C	Toggle crosshair
CTRL + Z	Undo last action

Basic interaction in the point set editor

Coordinate system

Movement: Press and hold down the **ALT** key, and then **left-click and drag** the mouse to move the coordinate system around. While moving the mouse, you will notice that as the coordinate axes move out of the visible area, they will "stick" to the edges of the viewport. This way, even with the axes off-screen, you will still have the information about the coordinate ranges you're currently in.

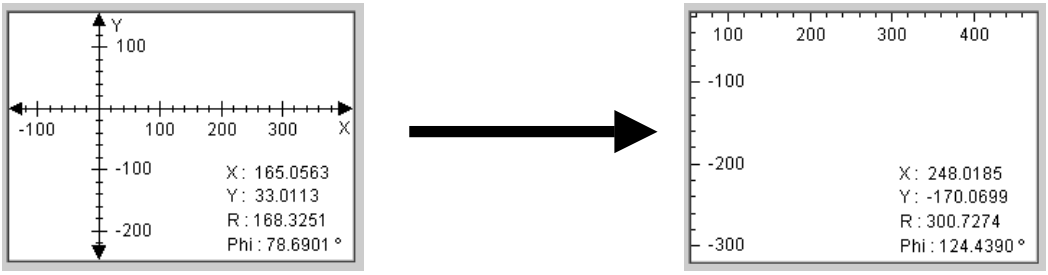


Fig.3 Coordinate system axes movement

Zooming: there are two options for this – either use the mouse wheel, or press and hold down the **ALT** key and then **right-click and drag** the mouse to zoom in/out on the current mouse cursor position.

Visual aids: You can activate the visual aids at any time with the shortcuts and menu options described above.

Note: When snap is active, keep in mind that multiple-object selections are always snapped to the grid in terms of selection's center. For unevenly spaced point sets, this may lead to undesired results.

Drawing and modification of geometry

General note: You can press **CTRL+Z** at any time to undo the most recently performed operation. The undo system remembers all operations in reverse order, beginning with the insertion of the first point into an empty graph, and can undo all stored operations.

Note*: Due to some bugs in the UI which I haven't yet been to identify, sometimes an object may appear "frozen", i.e. you may not be able to select it. The general remedy is to try to select a different object, and then try again to pick the desired one. I'm working on the solution to this problem….*

New Point: Click anywhere in the view to set a new point. It will be automatically highlighted by a thin red square. If snap is enabled, the point will be created at the closest grid intersection. The point will remain selected until you select a different one or create another one.

As soon as two or more points are created, they will be automatically connected by edges.

Movement: To move a point or an edge around, click on it to select it and then drag it with the mouse.

Deletion: Press the **DELETE** key to delete the currently selected point.
Note: *Edges cannot be deleted in this particular application.*

Color change: Select a point or an edge and then pick a color on the color picker below.

Short explanation of the color picker's operation:

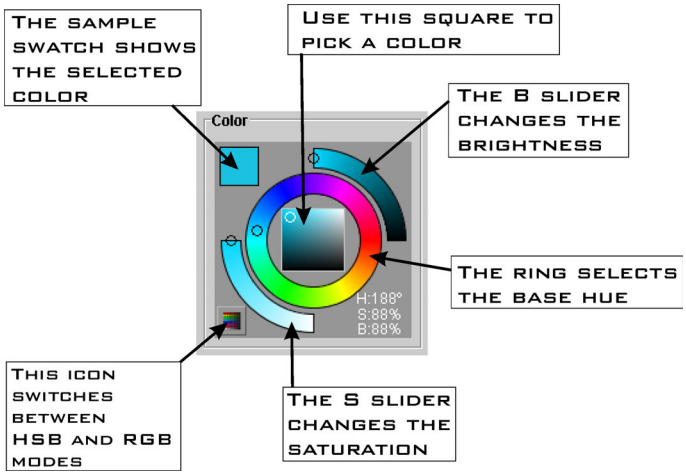


Fig.4 Color picker and its components

The **H, S and B** pickers can all be either clicked or dragged to select the desired palette of colors. **The numbers in the lower-right corner** reflect the current **HSB** values.

Then click or drag anywhere in the **central square** to select a color.

Click on the **mode icon** in the lower-left corner to switch to palletized mode or back. When in palette mode, the picker provides 64 most commonly used colors. Just click on any of the squares to select the desired color.

Manipulating multiple objects:

You can manipulate multiple points and/or edges by means of a **selection rectangle. Left-click and drag** anywhere in the view **(but not on an object!)** to specify a selection area, which will be drawn as a **thin dashed blue outline**.

Once you release the mouse button, all points falling into the selected area will be added to the selected set. Alternatively, use can press and hold the **CTRL** key and click on individual objects to add to or remove them from the selection set.

Note: *Due to certain UI considerations, the drag-to-select method as described above does not select multiple edges, only vertices. Multiple edges must be selected using the CTRL key.*

You can click anywhere outside the selection rectangle to clear the current selection.

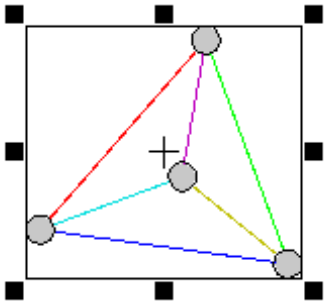


Fig.5 Selection rectangle in translate / scale mode

Initially, the selection rectangle is always in the "translate or scale" mode.

Click anywhere in the rectangle and **drag it** to move the selected objects inside the view.

Click on and drag any of the eight **black markers** to resize the selection. (When the mouse pointer changes shape to a "resize cursor", the selection rectangle is in the translate mode.)

Holding down the **SHIFT** key while resizing produces a **uniform scaling** around the selection's center.

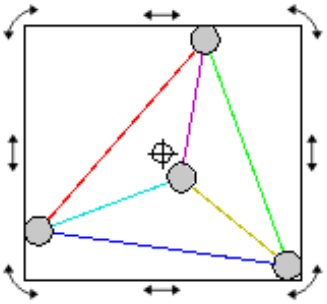


Fig.6 Selection rectangle in rotate / shear mode

If you **click once**, without dragging, inside the selection rectangle, the markers will change and the rectangle will go into **rotate / shear mode**.

When the mouse cursor hovers over any of the corner markers, it will change shape accordingly to indicate rotation or shear.

Click and drag on the desired marker to rotate or shear the selection. Holding down the **SHIFT** key when shearing produces a **uniform shear**, similar to uniform scale.

The "**gun sight**" marker in the middle of the rectangle specifies the rotation center. You can **click and drag it** to a different location, even outside the selection rectangle, to modify the center of rotation.

Deletion: Press the **DELETE** key to delete the selected points.

Color change: Select a color using the color picker to change the color on selected points or edges.

Please note that vertex colors are not relevant in this particular application, so these changes will not show up in the 3-d view.

Saving / Loading

The scenes can be saved in XML format using File -> Save menu item. When a scene is saved, almost all current application settings are saved as well, so that upon loading the editing environment will be restored to the settings used when creating that particular scene.

Basic Interaction in 3-d view

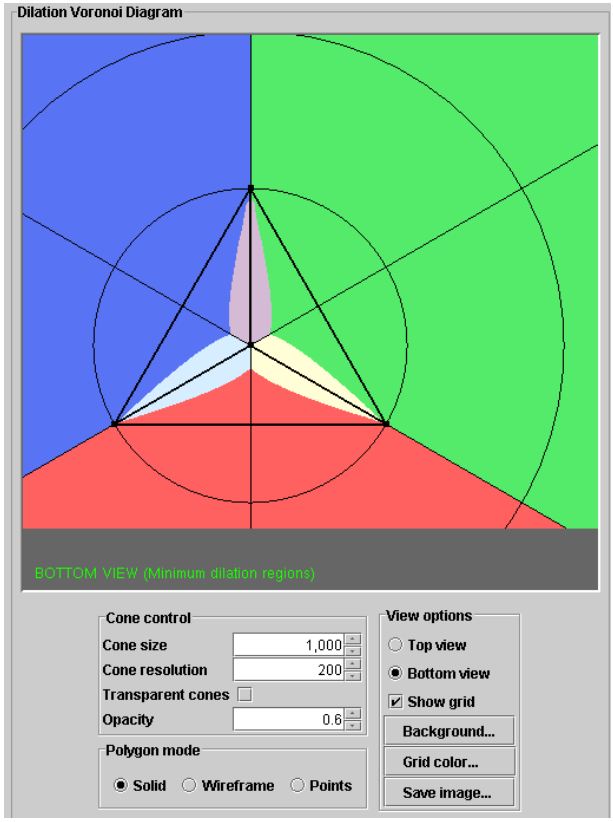


Fig.7 3-D viewer

The 3-d view possesses comparatively few controls. The most important are the cone controls, which will be explained in detail on the next page.

"Polygon mode" switches the view between solid (filled triangles), wireframe and point modes. The latter two, especially wireframe, are useful for examining the density of underlying elliptic cones etc.

"Top / Bottom View" switch between maximal / minimal dilation diagrams, respectively.

"Show grid" enables the viewport grid, which automatically tracks the grid in the 2-d view.

"Show grid" enables the grid that is drawn using the same settings as the grid in the point set editor.

"Background…" allows you to select a different background color for the 3-d view.

"Grid Color…" selects a color for the grid (independent of grid in 2-d view).

"Save Image…" saves an image of the dilation diagram.

Note: *Inside the "Cone control" panel, apart from "Cone size" and "Cone resolution", there's an option "Transparent cones". When enabled, it makes all cones partially translucent, amount of transparency being controlled by the "Opacity" field. This is an experimental option, which might or might not prove useful.*

The function of “Cone Size” and “Cone resolution”

The dilation diagram is approximated by drawing overlapping elliptic cones, and since the cones cannot be of infinite size and infinite resolution, their real size and resolution play an important role in the appearance of the diagram.

“Cone Size” controls the physical extents of a cone in the world coordinate system. Initially, all cones are created sufficiently large so that they cover the entire view and their edges cannot be seen. As you zoom out or draw points on a larger scale, it may be necessary to adjust the cone size accordingly.

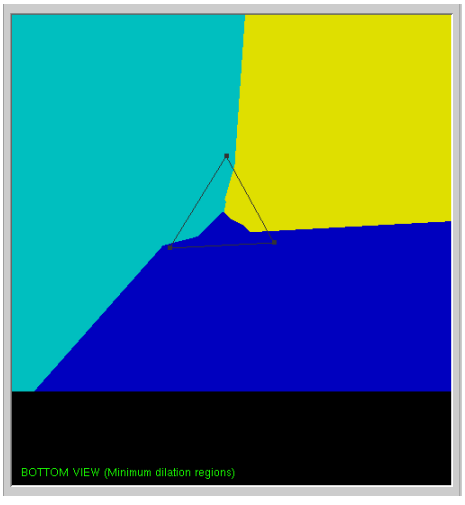
“Cone resolution” controls the number of elements in the triangle mesh used to represent a cone. As this parameter increases, the grids get denser. As a result, the intersections become more precise, which has the effect of smoothing the edges and adding more details to the diagram. However, the rendering pipeline also has to cope with the increased amount of geometry, so there’s a definite tradeoff between cone resolution and rendering performance.

Note: *For performance reasons, the maximum values of cone size and cone resolution have been limited to 10000 and 200, respectively.*

General Rule of a Thumb:
Higher cone resolution => More accurate, detailed diagrams, but slower rendering.
Lower cone resolution => coarser, more “jagged” diagrams, but faster rendering.

Cone size and cone resolution are somewhat dependent on each other and on desired accuracy of a diagram. That is, accuracy can be improved not only by increasing cone resolution, but also but decreasing cone size. Smaller cone size means smaller mesh cells and consequently, increased resolution. In other words, when the extents of a point set are small, cone size can be decreased to improve accuracy. This can be illustrated by the following example:

Cone size: 10000, resolution: 35



Cone size: 1000, resolution: 35