



2. SPECIAL CLASS ATTRIBUTE & ATTRIBUTE

GRAPHREP

Basics: Graphical Notation of Classes



Static Notation:

- ▶ Semiotic Clarity
- ▶ Perceptual Discriminability
- ▶ Semantic Transparency
- ▶ Complexity Management
- ▶ Cognitive Integration
- ▶ Visual Expressiveness
- ▶ Dual Coding
- ▶ Graphic Economy
- ▶ Cognitive Fitness

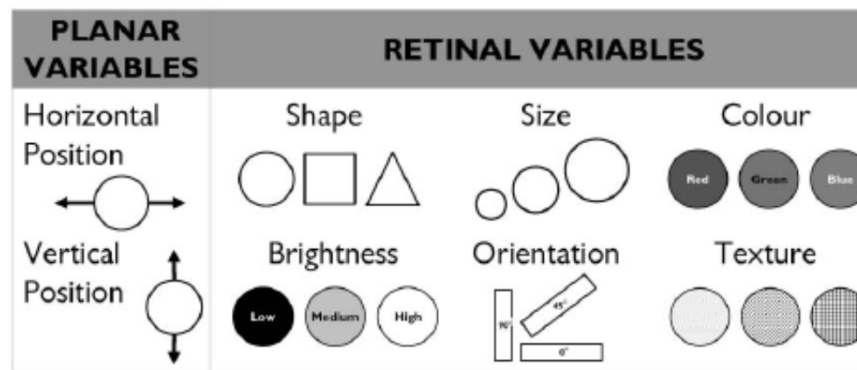


Fig. 7. Visual variables [8]: These define a set of elementary graphical techniques for constructing visual notations. A color version of this figure may be viewed at <http://doi.ieeecomputersociety.org/10.1109/TSE.2009.67>.

Dynamic Notation:

- ▶ Event based changes of notations (e.g. attribute change)

GRAPHREP I



- ▶ Class attribute GRAPHREP is of type long string, hence the attribute value is a text that is interpreted as a script by the GRAPHREP interpreter.
- ▶ The following types of elements are distinguished:
 - ▶ Style elements
 - ▶ Shape elements
 - ▶ Variable assigning elements
 - ▶ Context elements
 - ▶ Control elements
- ▶ The representation characteristic for following shape elements is modified by style elements:
 - ▶ **PEN** sets the characteristics of the outline pen for shape elements.
 - ▶ **FILL** sets the characteristics of the fill-in brush for shape elements.
 - ▶ **SHADOW** switches the additional shadow of shape elements on or off
 - ▶ **STRETCH** switches geometric stretching on or off
 - ▶ **FONT** sets the font for displayed texts and attribute values.
- ▶ **PEN** determines in which manner the lines and curves are drawn, i.e. how strong, in which color and in which style (e.g. dashed line). For shape elements which can be filled, only the outline of the shape is influenced by the current pen. The filling of shapes is controlled by the current fill-in brush, which can be set with BRUSH.
- ▶ **Shape elements** which can not be filled are **POINT**, **LINE**, **POLYLINE**, **ARC** and **CURVE**. Fillable elements are **RECTANGLE**, **POLYGON**, **ELLIPSE**, **PIE** and **COMPOUND**.
- ▶ For shape elements coordinates (positions) have to be specified. Coordinates here are relative to the position of the particular object, i.e. they are added to the object's position.

GRAPHREP II

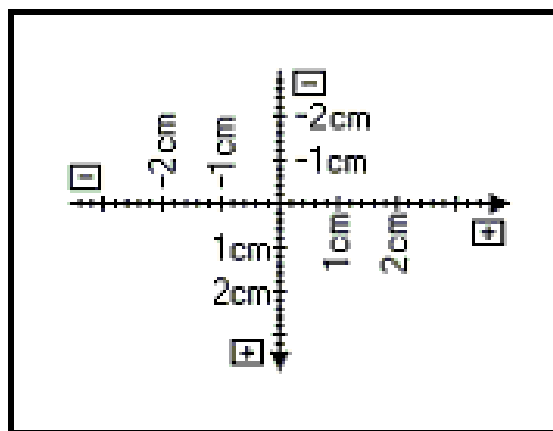


- ▶ Context elements just exist for relations. They specify whether the starting, the middle or the endpoint of the relation is being defined. Keyword "START" defines that the following description refers to the start point of the relation until the next context element START/MIDDLE/END is specified. A fourth context element (EDGE) triggers the drawing of a relation's edge. This is the line from the starting point via possible bendpoints to the end point of a relation.
- ▶ For relations the starting, the middle and the end (point) can be defined. Positions then refer to one of these three points. However, the coordinate system is rotated depending on the direction of the relation instance. On defining a relation's GraphRep, you have to regard the relation as going horizontally from the left to the right. The coordinate system's origin then is the point of the relation for which the graphical representation currently is being defined, i.e. start, middle or end point.



GRAPHREP III

- ▶ On the x-axis the coordinate values increase from the left to the right, on the y-axis they increase from top to bottom (differing from mathematics). Arcs and pies are rotated counter-clockwise.
- ▶ ATTENTION: The unit of measure for positions and proportions (cm or pt) has to be specified in every case. Pixel values cannot be used.
- ▶ On the drawing of an object, the elements are processed sequentially. However, the control elements make it possible to skip sections during the element processing depending on variables. For example, attribute values of the object to be represented may be assigned to such variables. A graphical representation depending on object attributes can thus be obtained using variable assignment elements combined with control elements. Additional possibilities are given from using variables in graphical elements.



GRAPHREP IV



Graph Elements

```
Edge | Start | Middle | End |  
Pen | Fill | Shadow | Stretch | Map | Font |  
ClipRect | ClipRoundRect | ClipPoly | ClipEllipse | ClipOff |  
Point | Line | PolyLine | Arc | Bezier | Curve |  
Rectangle | RoundRect | Polygon | Ellipse | Pie |  
BeginPath | MoveTo | LineTo | BezierTo |  
EndPath | DrawPath |  
Compound | Bitmap | GradientRect | GradientTri |  
Text | Attr | Hotspot |  
Set | Aval | Table | TextBox | AttrBox | BitmapInfo |  
IfStatement | WhileStatement |  
ForNumStatement | ForTokenStatement | Execute.
```

For detailed explanation see online support for each of the elements



Some GraphRep-Commands (1)

GRAPHREP

- The GraphRep definition must start with this command to be valid. The parameter **layer** defines whether an object will be displayed above or below other objects. The parameter **sizing** specifies if the size can be changed.

SHADOW

- Specifies if the class will have a shadow or if it should be drawn “flat”.

PEN

- Defines the pens width/color/style.

FILL

- Defines the fill color/style and transparency.

ATTR

- Shows an attribute value on the drawing area (e.g. object name).



Some GraphRep-Commands (2)

POINT

- Draws a point.

LINE / POLYLINE

- Draws a single line (**LINE**) or several lines (**POLYLINE**).

CURVE / ARC

- Draws a curve according to a mathematical function or an arc.

POLYGON

- Draws a polygon consisting of several straight lines where each corner is defined as a single point.

RECTANGLE / ROUNDRECT / ELLIPSE / PIE

- A rectangle, rectangle with rounded edges, an ellipse or a segment of an ellipse.

COMPOUND

- A composite filled Form (from **LINE**, **POLYLINE** und **CURVE**-Elements).



Some GraphRep-Commands (3)

TEXT

- Allows to show a specific text on the drawing area (Letters, Symbols ...).

FONT

- Defines the font style/color for drawn text.

BITMAP

- Allows to embed a picture (*.BMP-Format).

TABLE

- Creates a table for structuring the attribute representation of an object.

Hint:

Graphical elements can be combined for more complex drawing!



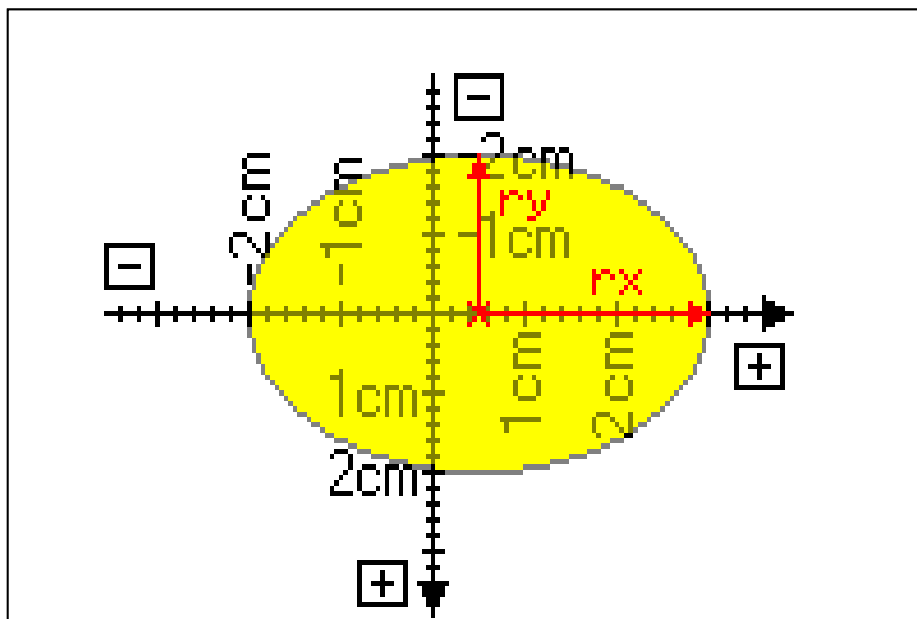
The GraphRep Coordinate Plane

A **coordinate plane** is used to provide an exact positioning of the GraphRep elements. It is composed of:

The null coordinate is in the middle

Positive values go to the right and down

Negative values go to the left and up



Hint:

- It is required to specify the **Unit** (cm or pt). Units in pixels are not possible.
- The direction of rotation progresses counter-clockwise!

GraphRep Structural Commands



SET

Sets a variable with a constant or the result of an expression, which in turn can contain variables.

AVAL

Sets variables with the values from an attribute of the instantiated object.

IF / ELSIF / ELSE / ENDIF

Allows to change the representation based on values.

BITMAPINFO

Reads the height and width of a bitmap file, allowing to properly represent it.

TEXTBOX / ATTRBOX

Similar to TEXT and ATTR. However instead of drawing the values it sets specific variables with the rectangle area they would need.