3D widgets for vtk Status Report 06

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Widgets

What I have found from looking at 3D design software is a large mixture of tools. There seems to be a kernel of similar tools or widgets common to all software studied, with each having a more specific way of dealing with widgets depending on the desired use of the software.

On the whole, it seems that the vtk 3D Widgets include the type of widgets common to most 3D software (according to limits of this study) and even provide interaction that do not seem to be covered in other software. My studies show that the widgets included in a software application depend greatly on the desired use of the software. For instance, CATIA has no tools for performing animations or for simulating physical conditions as in 3DS Max and Maya – which are designed for animation and dynamics.

From this, it would seem that the course to follow for new/improved widgets would depend on the desired market segment. From a personal point of view, I like the idea of including more 3D shapes (boxes, cones etc) and camera functions, also to improve the capabilities of the distance and angle measurement widgets.

Similar yet different

Scale, translate, rotate. All 3D software looked at provided the user with the basic ability to perform such actions – comparable to the vtkBoxWidget. Some software (notably 3DS Max and Maya) have these as separate tools and with another tool that combines these three functions.

Personally, I liked the representation of this tool in CATIA. The main screen in CATIA has a representation permanently in the top-right of the design screen. This permits rotation and translation of the entire scene. Dragging and dropping the widget onto an object links the widget to the object – thus further rotations and translations are performed solely on said object. This representation is intuitive to use, although has some setbacks – namely, when a rotation approached 180° the widget's interface was hidden and thus difficult to use, also, as the lines indicating interactivity are rather thin, it can be tiresome to find the correct line to interact with.

Measuring tools. It seems that all the software studied also included functionalities permitting the measuring of distances and angles. In this regard, CATIA's tools are the most powerful. Other software permitted measurements between points and angles between lines, but CATIA takes these ideas much further, permitting measurements between points, lines, curves, arcs, arc centres, planes and surfaces. Also, simple measurements, shortest and furthest distances, chaining measurements for a total, comparative measurements between separate distances and more.

Development possibilities

A number of the tools from other software permit the creation of object that derive from vtkImplicitFunction in the vtk library – such as boxes, cones, cylinders, planes and spheres. The difference seems to be that other software tends to view them as polygonal constructs represented as wireframes and not implicit functions as used in vtk. It is therefore possible to include such objects to be added as widgets – possibly using their implicit functions as part of their representation.

Animation and cameras; there is the vtkCameraWidget (derived from the vtkBorderWidget) in vtk. Most of the other software looked at did not include much in the way of camera interactivity, except for 3DS Max and Maya. These products of Autodesk centre greatly on animation and thus have a mush more flexible camera interaction system that provides timelines, keyframes, motion linking, camera pathing, blending, motion capture, dynamic (physics based) animation and even formulaic animation. Other tools allow direct control of the camera to perform film-style effects.

Overall it seems that vtk's widgets are not greatly lacking, indeed there are functions provided for which I was not able to find reasonable equivalents of in other software – such as vtkAffineWidget, vtkBorderWidget, vtkHoverWidget etc. As an example, tool tips (eg. vtkBalloonWidget) may be triggered by events in the software, but there was no way of creating a tool to provide a popup balloon for a specific object. In such cases, it is likely that these functions are provided as a different part of the software architecture itself and not tools or widgets that can be added and interacted with in the manner of a widget.

With all said and done, it is not easy to see the reality of what ought to be added or changed without a specific goal in mind – a general idea of improvement leaves too many possibilities. As stated above, my personal view would be to add shapes and camera widgets, with possible improvements to measurement widgets as these would fill the "general" gap and permit future improvements based on specific goals.