

A 3D visualization of the text 'RGL' in a blue, metallic font. The text is positioned on top of a grid of red and white squares. The grid is composed of several rows and columns of squares, with the 'RGL' text centered on top of the grid. The grid is slightly tilted and has a perspective effect.

RGL

An R-library for 3D visualization with OpenGL

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RGL: An R-library for 3D visualization with OpenGL

Outline:

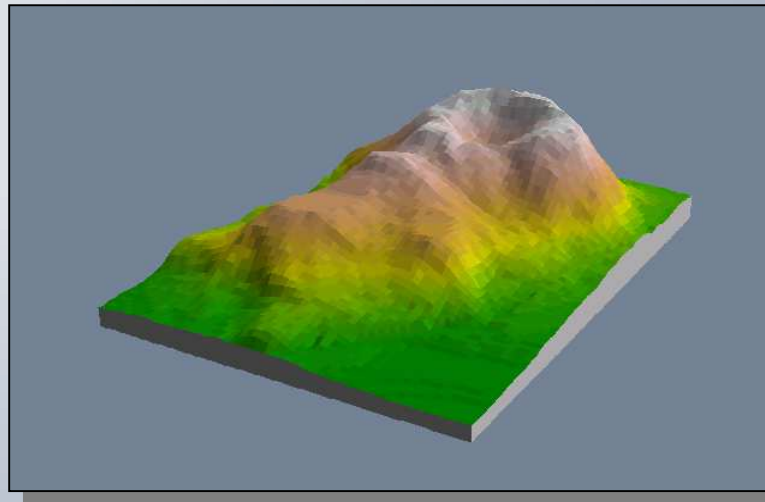
- Introduction: Motivation and goals
- The RGL-package: An overview
- Examples from applied statistics
- Summary, conclusions and outlook

I - Introduction: Motivation and goals

- Motivation behind the RGL-project:

Example: `persp()`

modified output from
`demo(persp)` :



issues:

- slow, inconvenient navigation
- adding / removing other objects not feasible
- missing "features" ...

I - Introduction: Motivation and goals

- Goals of the RGL-project:

RGL

- is an interface from R to OpenGL which acts as an "3D engine".
- allows one to navigate through the 3D scenery
- is portable across different platforms (Win32 and X11)
- is semantically similar to familiar R commands

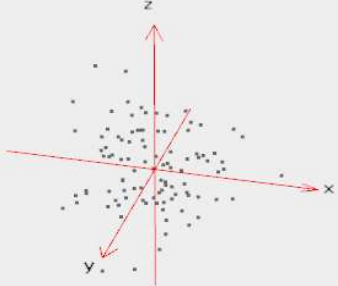
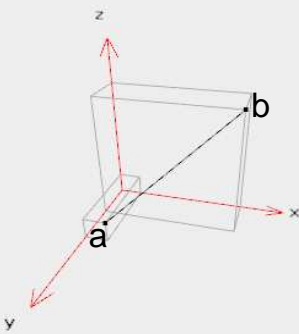
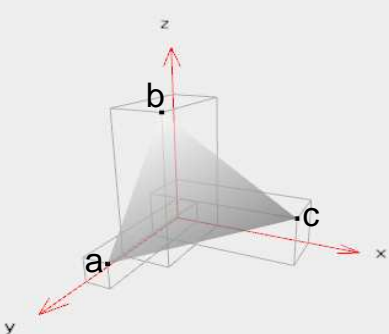
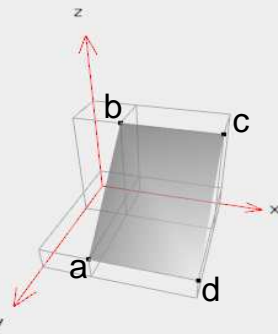
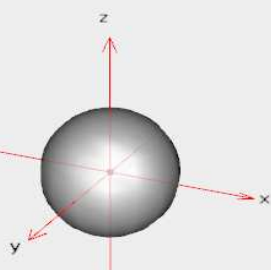
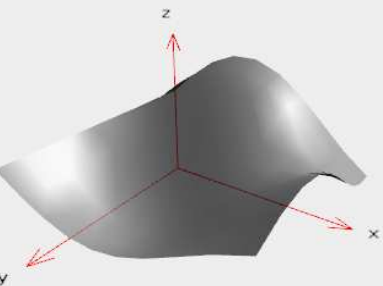
II - The RGL-package: An overview

- RGL comprises 20 functions from 6 categories:
 - **Device management** functions
 - **Scene management** functions
 - **Export** functions
 - ⇒ - **Shape** functions
 - **Environment** functions
 - ⇒ - **Appearance** functions

II - The RGL-package: An overview

- RGL: *Shape functions*

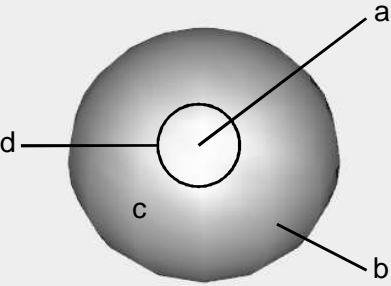
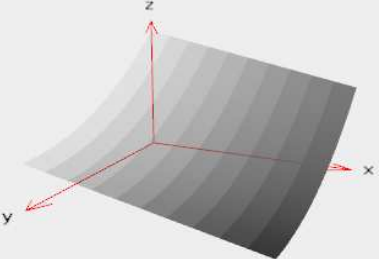
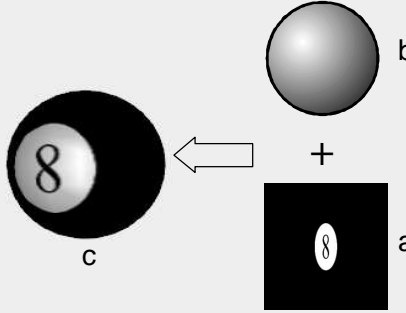
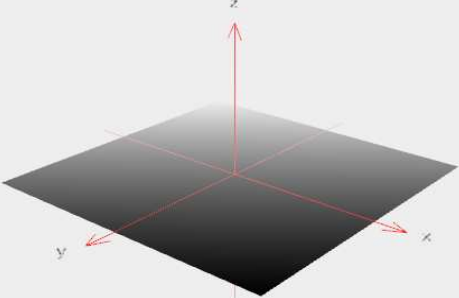
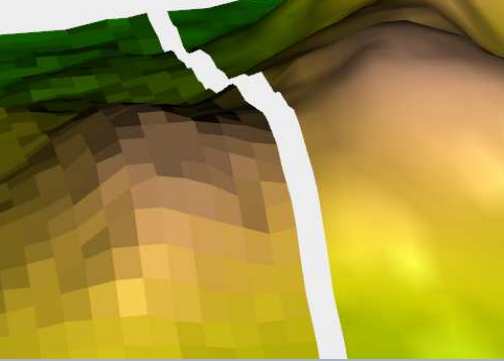
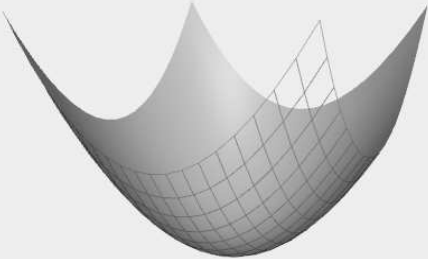
The "basic building blocks":

		
<p>Points <code>rgl.points(x,y,z,...)</code></p>	<p>Lines <code>rgl.lines(x,y,z,...)</code></p>	<p>Triangles <code>rgl.triangles(x,y,z,...)</code></p>
		
<p>Quads <code>rgl.quads(x,y,z,...)</code></p>	<p>Spheres <code>rgl.spheres(x,y,z,r,...)</code></p>	<p>Surfaces <code>rgl.surface(x,y,z,...)</code></p>

II - The RGL-package: An overview

- RGL: *Appearance features*

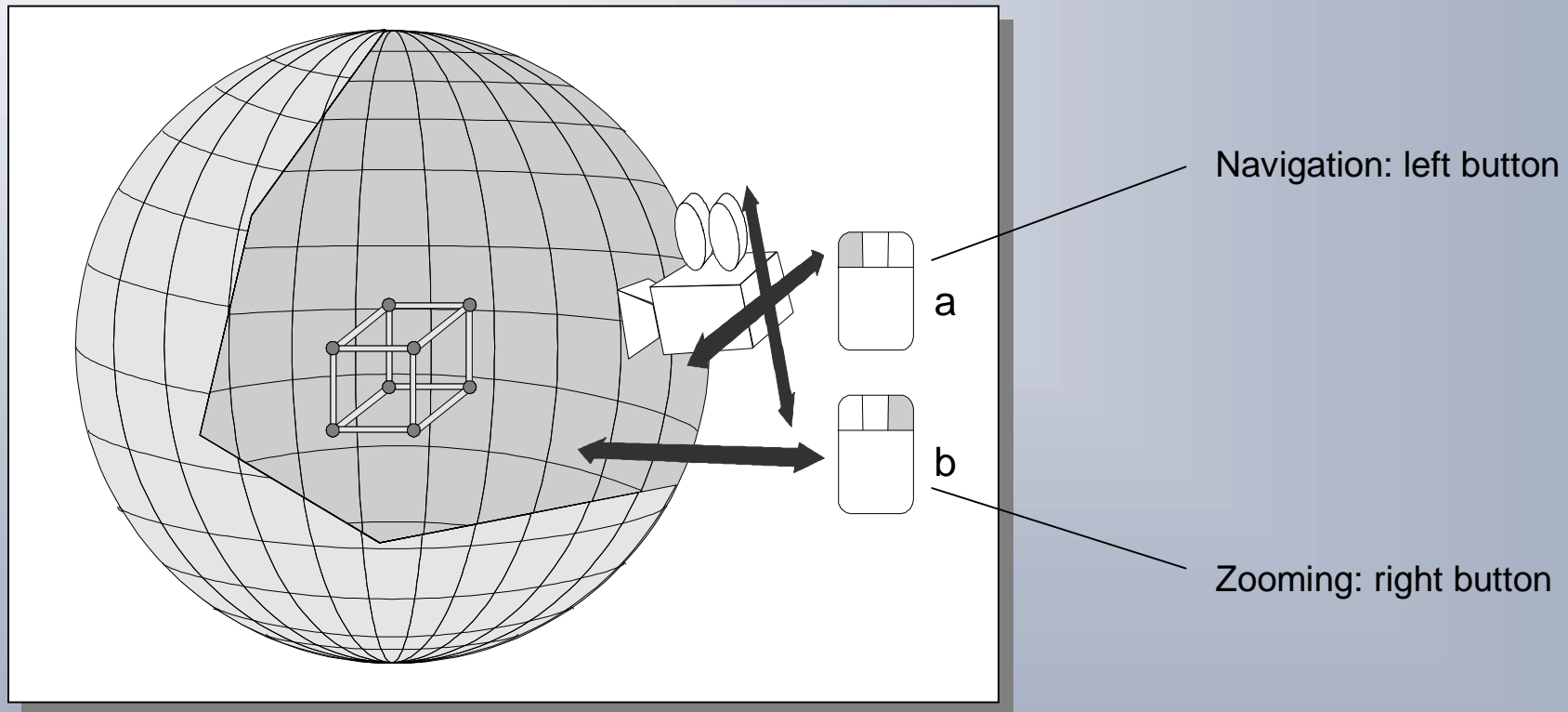
Modifying the appearance of primitives:

		
Lighting features	Alpha blending	Texture mapping
		
Fog effect	Internal smoothing	Side - dependant rendering

II - The RGL-package: An overview

- RGL: *Navigation system*

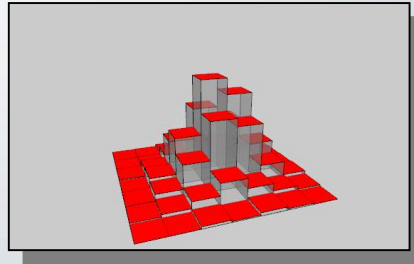
Navigation through 3D space via a pointing device:



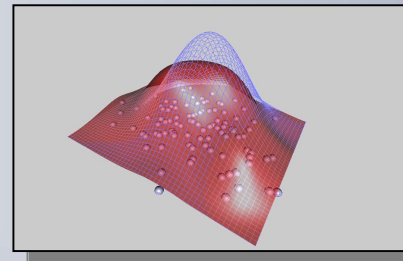
III - Examples from applied statistics

- **Examples from applied statistics:**

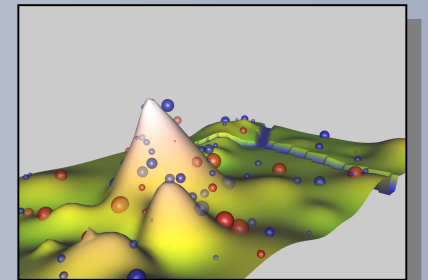
- 3D histograms



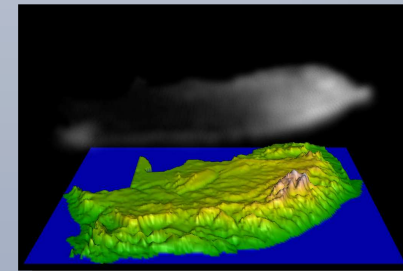
- Displaying bivariate densities



- Visualizing simulated animal populations



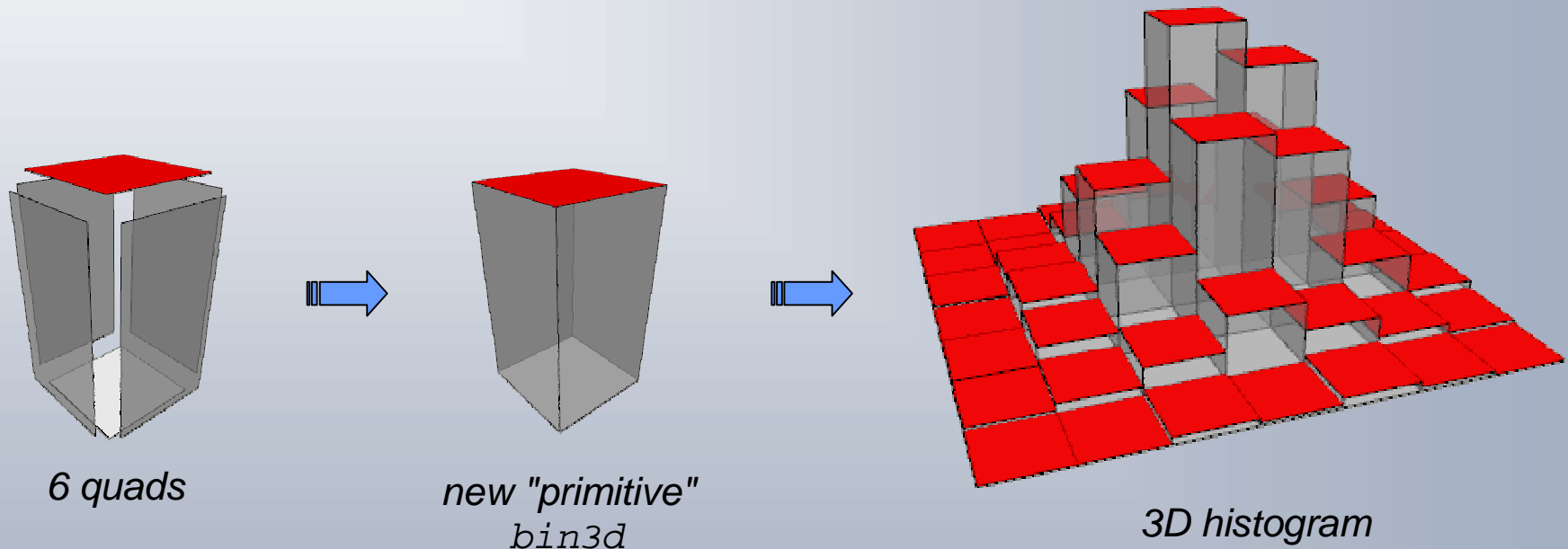
- An example from hydrology



III - Examples from applied statistics

- 3D histograms:

Construction of "complex" objects from primitives:

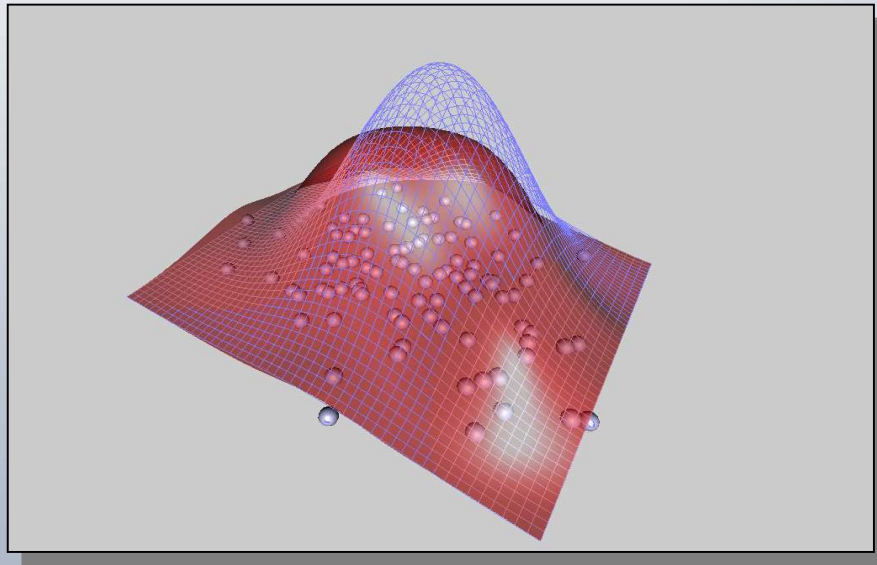


- RGL provides the basic building blocks, which can be flexibly used for constructing higher-level objects

III - Examples from applied statistics

- Visualizing bivariate densities:

E.g. comparing fit of a bivariate normal density and a kernel estimate:

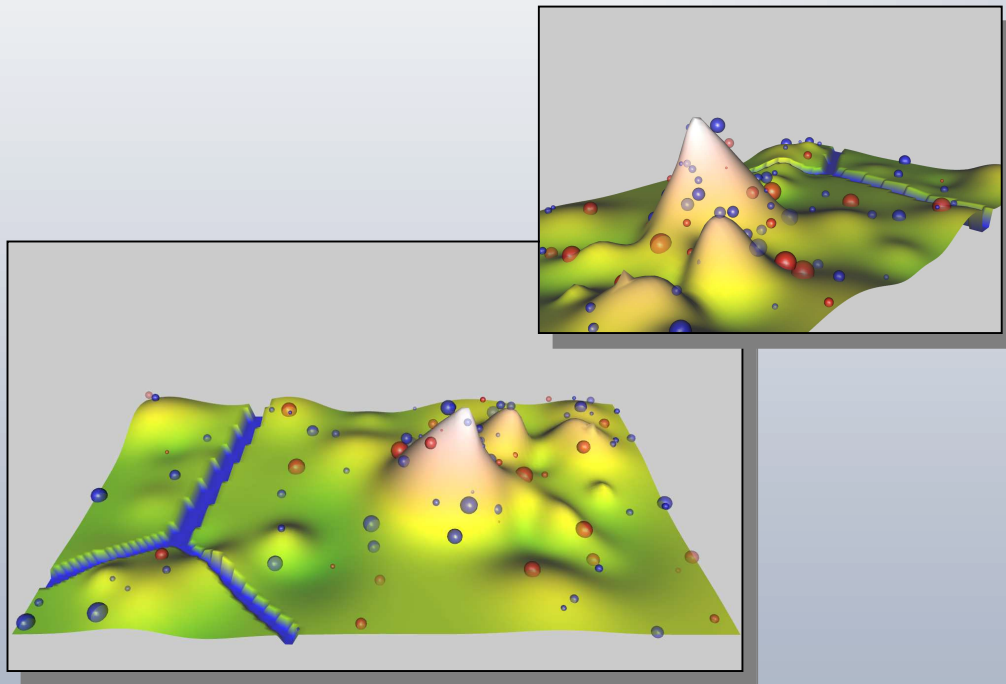


- Observations (simulated) are displayed as spheres
- A kernel estimate of the density is shown as a transparent red surface
- The fitted bivariate normal distribution is plotted as a wireframe

III - Examples from applied statistics

- Displaying simulated animal populations:

Using appearance features for representing characteristics of groups:



Characteristics of groups:

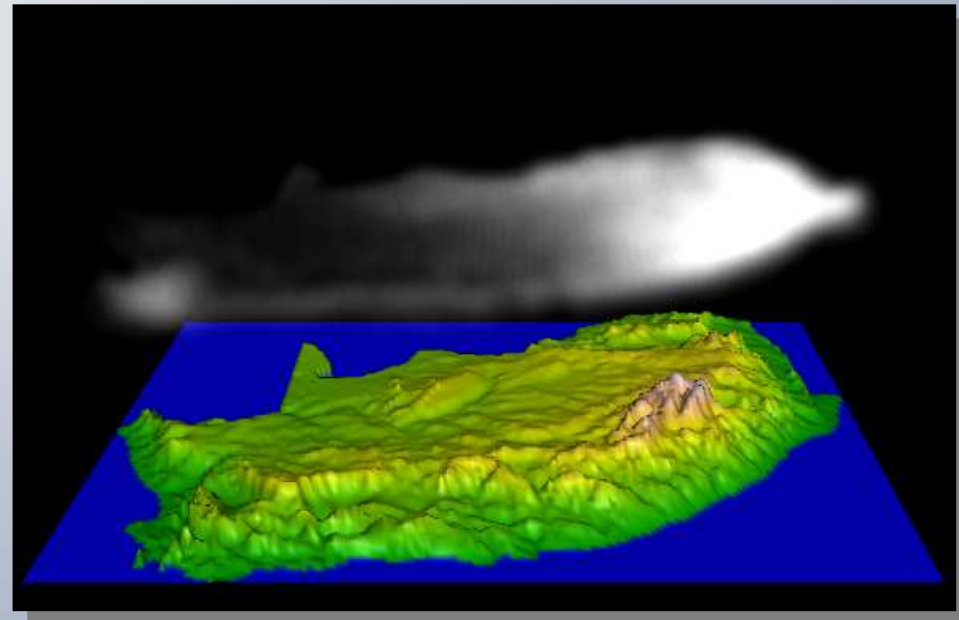
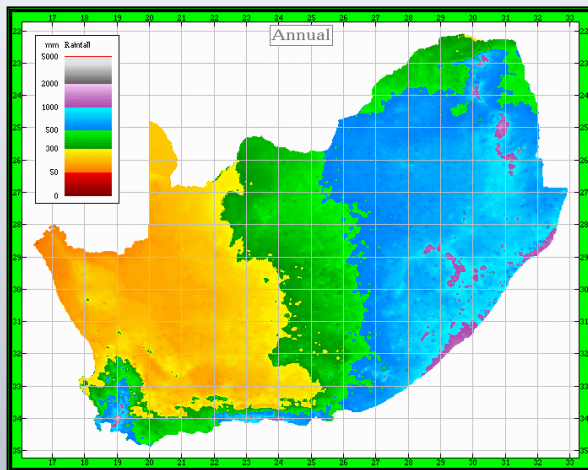
- **size**
- **type**
- **exposure**

Population density is displayed in topographic terms

III - Examples from applied statistics

- An example from hydrology:

E.g. displaying mean annual rainfall in form of clouds:



details: Nenadić, O.; Kratz, G. and Zucchini, W. (2002), The Development of a Web-based Rainfall Atlas for Southern Africa, Short Communication, *Compstat2002*, Berlin.

IV - Summary, conclusions and outlook

RGL

- contains the basic building blocks for 3D graphics
- provides a variety of appearance features
- offers navigation capabilities
- is portable across platforms

Further work focuses on

- enhancing portability (and fixing bugs)
- enabling VRML/X3D support
- adding further primitives (meshes etc.)

Preliminary RGL-site: <http://134.76.173.220/~dadler/rgl>