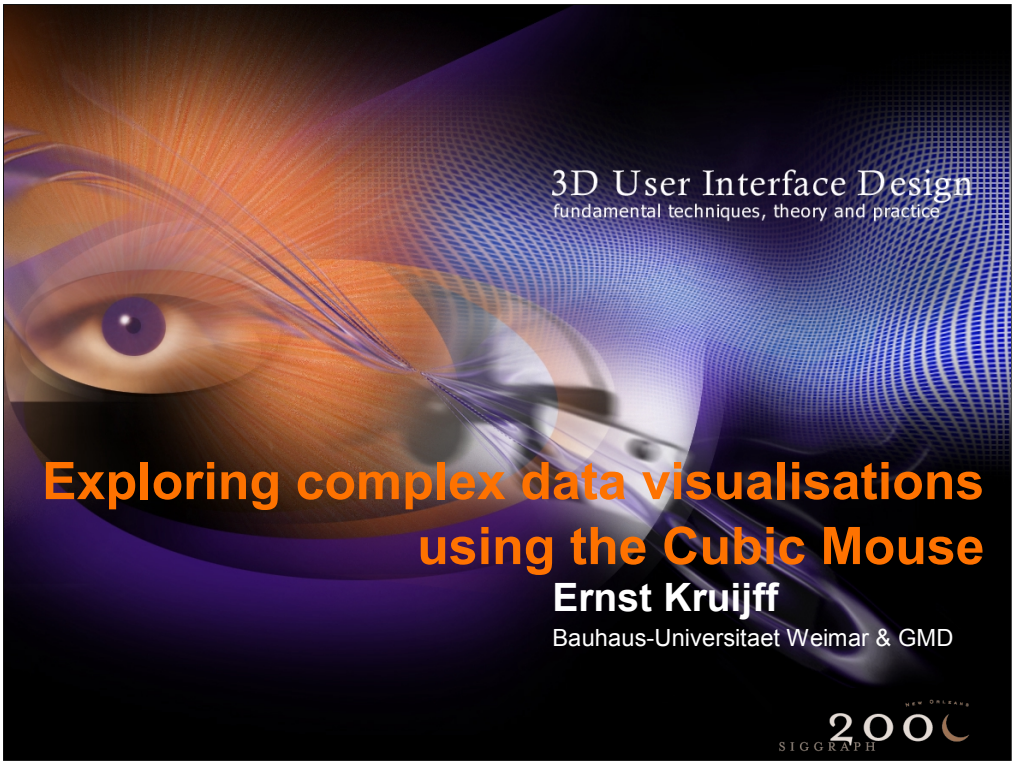


Exploring complex data visualisations using the Cubic Mouse

Ernst Kruijff

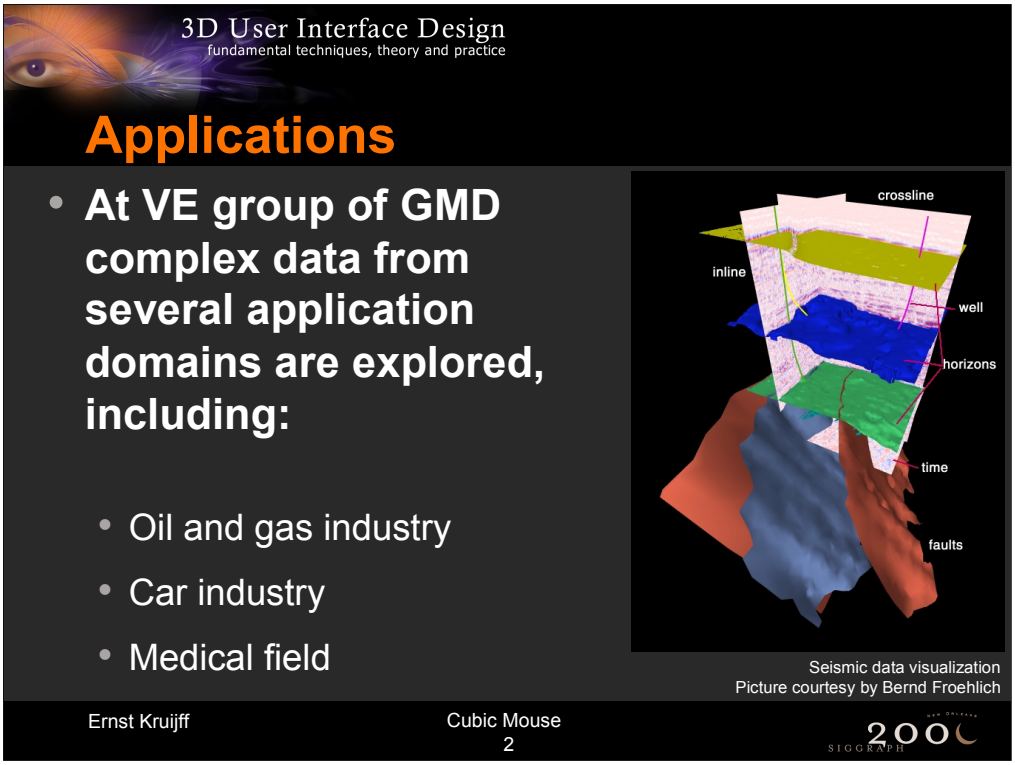
Chair for CAAD & Architecture (Prof. Donath), Faculty of Architecture
Bauhaus-Universitaet Weimar, Germany

Virtual Environments group (IMK.VE)

German National Research Center for Information Technology

http: http://www.uni-weimar.de/~kruijff

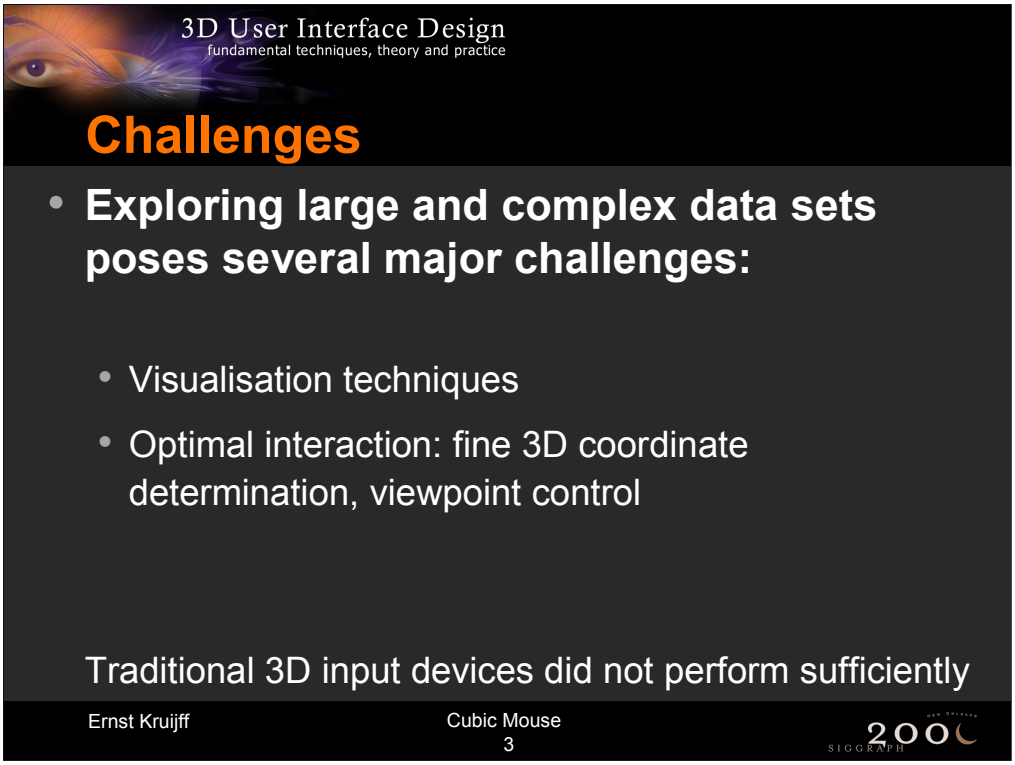
email: ernst.kruijff@archit.uni-weimar.de



At the VE group of the German National Research Center for Information Technology (GMD), complex data from several application domains are explored. In the applications from the oil and gas industry, experts explore data obtained from seismic surveys and well logs. A typical oil exploration data set is built up of subsurface structures, wells and seismic slices. The subsurface model contains two major structures, namely horizons (the separation between two earth layers) and faults (breaks in the rocks, where one side is moved relative to the other). In the application, three orthogonal slicing planes are used to visualise the seismic volume. Horizons can be transformed.

In the applications from the auto industry, engineers explore three-dimensional models for interpreting the model. The engineers use up to three orthogonal cutting planes to visualise specific parts of a car. (Froehlich, et al 2000).

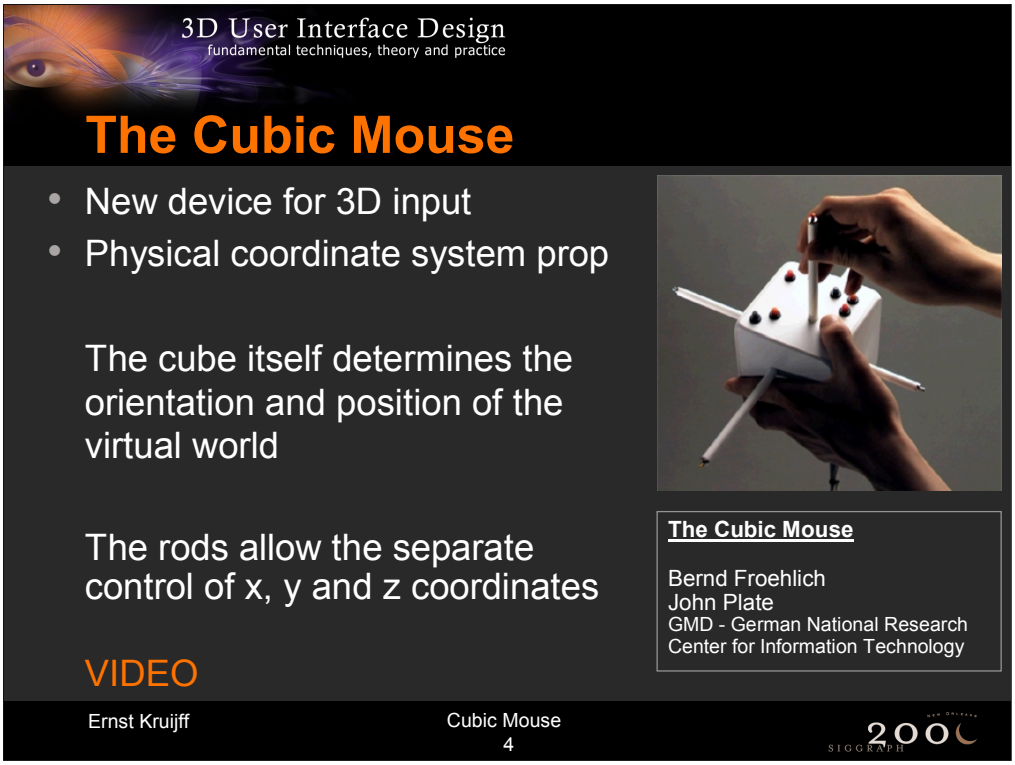
In medical applications, volumized medical data is traditionally used in combination with three orthogonal slicing planes to view human cross sections. (Froehlich, et al 2000)



Exploring large and complex data sets pose several major challenges. First of all, due to the complexity and amount of the data to be visualised, proper visualisation techniques need to be applied. For information on the visualisation techniques used in this work, see (Froehlich, et al 1999) and (Froehlich, et al 2000).

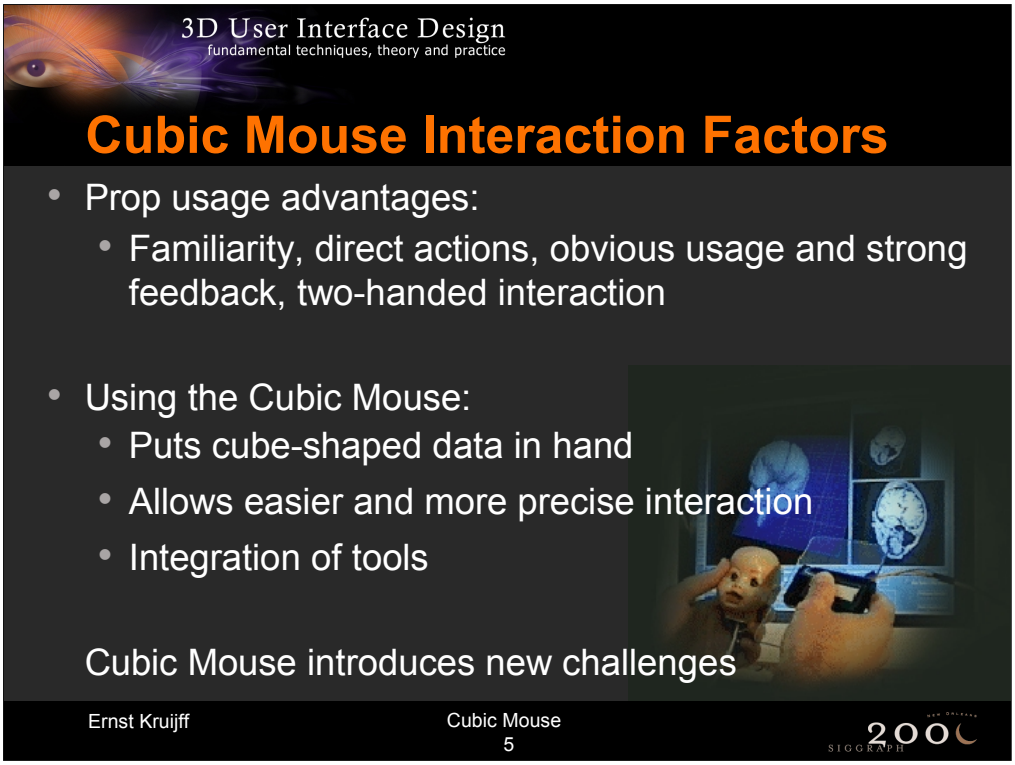
On the other hand, the applications require optimal interaction with the complex data set. 3D coordinates of objects (both cutting planes or slices and other objects) need to be defined, often with precision. Furthermore, viewpoint control has to be highly intuitive to understand the data set.

As identified in several user tests (described in Froehlich, et al 1999), the input devices traditionally used (mouse and stylus) did not perform well enough in cases where precise interactions were performed. Precise interactions were required in the applications (especially the oil and gas applications). Additionally, users often had to change tools which cost quite a bit of time.



The Cubic Mouse is a recently developed input device by Bernd Froehlich and John Plate at the German National Research Center for Information Technology. The cube shaped box with three rods represents a physical coordinate system prop. In the current applications, the cube (with its 6DOF tracker inside) allows position and orientation control of a virtual world, whereas the rods are used to manipulate the (x,y,z) coordinates of an object (for example a cutting plane) in the virtual world. Both 3DOF and 6DOF versions of the Cubic Mouse exist - with the 3DOF version, one can only control translation of objects via the rods, whereas with the 6DOF version, one can additionally rotate the rods for rotating objects.

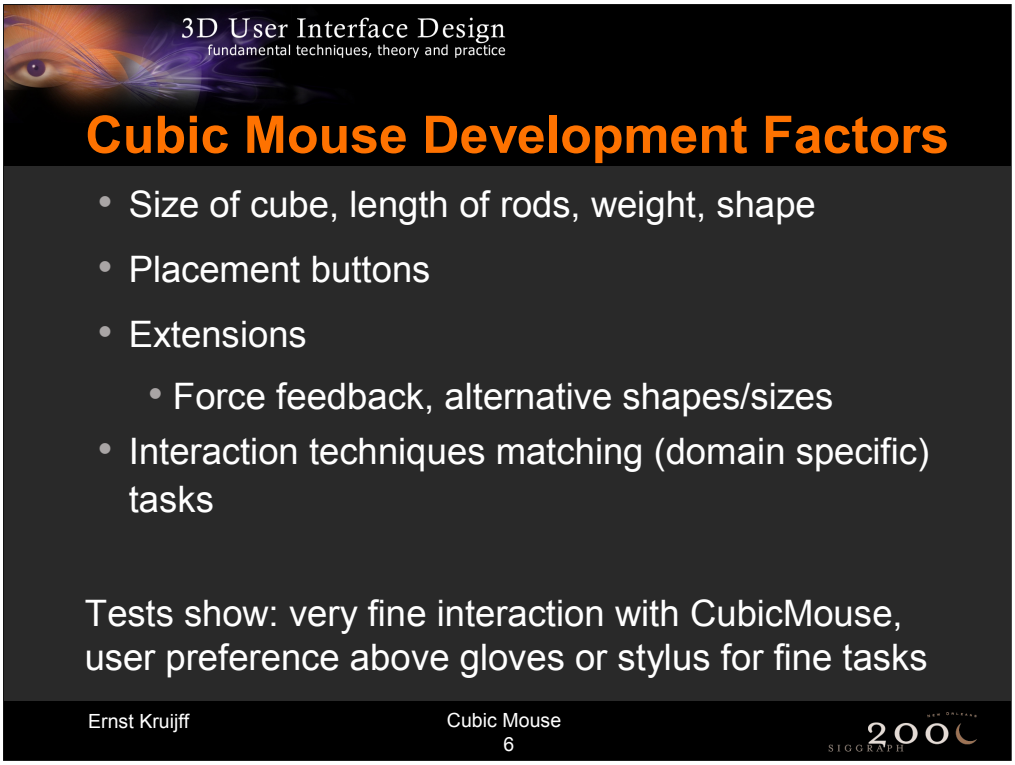
The Cubic Mouse will be sold by Fakespace|Pyramid systems.



In (Hinckley et al 1994) several advantages of using props are stated. Because of their familiar form, new users of an application often do not need to learn how to use the prop due to previous (domain) experience. This often results in very short introduction times to an application. With respect to the characteristics of the prop, usage is often very direct, and actions easily match the users task. The form of a prop gives strong cues to its use, besides valuable feedback. The physical characteristics of the prop naturally constrain the amount of possible (logical) actions.

The Cubic Mouse has proven itself in the described applications to be easy and efficient to use. The cube shaped data sets literally are put in the hand of the user, allowing easy viewpoint control, and the rods allow precise translations on the objects. Additionally, several tools are combined into one device, reducing time to change interaction mode.

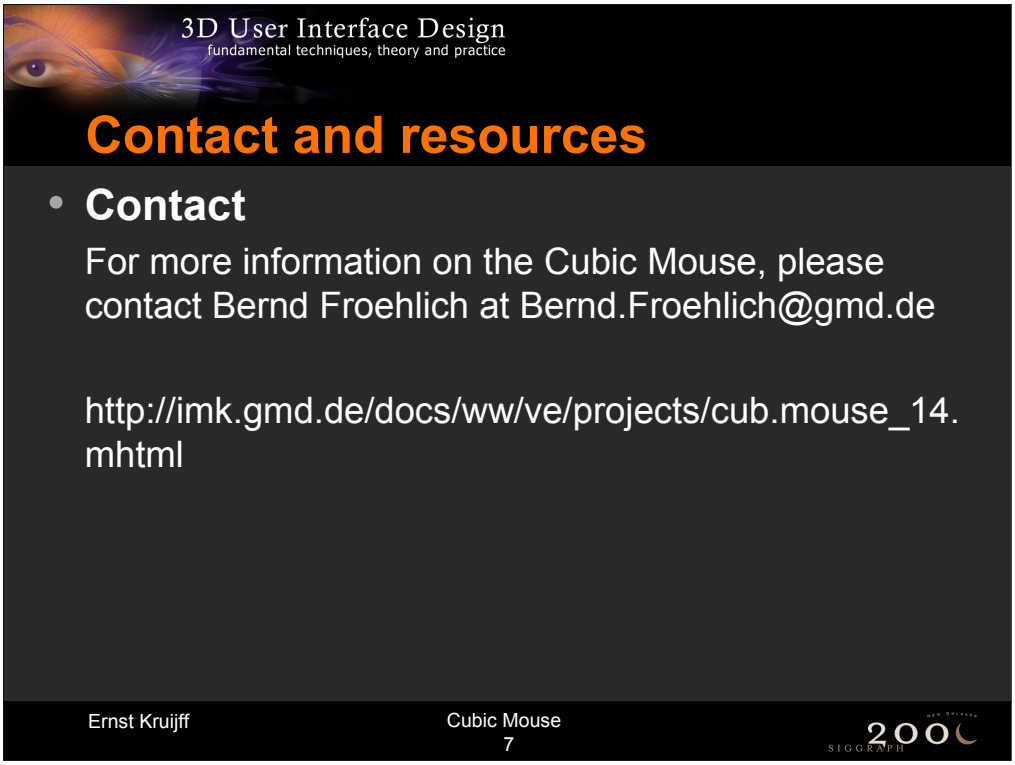
However, using the Cubic Mouse also introduces new challenges. Interaction techniques need to be carefully chosen (or developed), and one might even need (as in our case) to add an extra input device for a specific task. This can easily be explained by pointing at the context sensitive characteristics of a prop. For example, the Cubic Mouse is excellent for (precisely) controlling the translation of an object, but the selection of this object before one can manipulate it is often hard.



The Cubic Mouse is still in its initial stage of development and several improvements and extensions can be envisioned. These developments represent current work by Froehlich, Kruijff, Beetz, Seichter and Plate.

Shape and size for the Cubic Mouse can be altered, and so can the buttons and the rods. Especially the button layout forms a challenge for “eyes-off” interaction. Extensions which are foreseen are the implementation of force feedback, and experimentation with radically different forms of mice.

With respect to interaction, domain specific and unspecific interaction techniques are being explored to widen the applicability of the Cubic Mouse. For example, current explorations include a new system control technique, and the addition of another input device (glove) for easier selection of objects.



Bibliography

For most references, refer to the “20th century 3DUI Bib”. Below is the reference that is not in the main bibliography.

Froehlich, B., Barrass, S., Zehner, B., Plate, J., Goebel, M. Exploring Geo-Scientific Data in Virtual Environments. In proceedings of IEEE Visualization’99, San Francisco, 1999.

Acknowledgements

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