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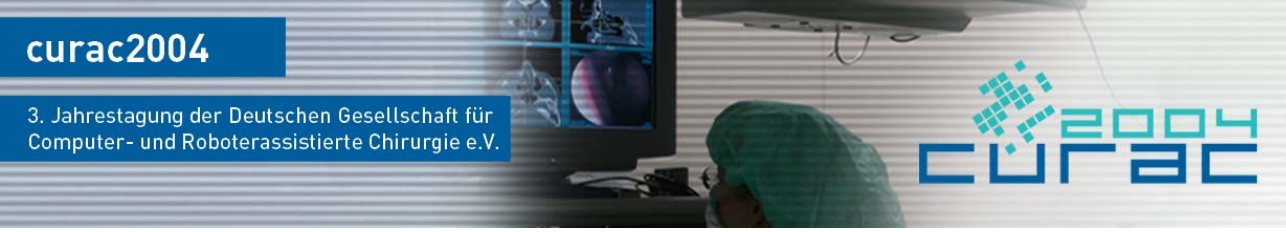
3. Jahrestagung der Deutschen Gesellschaft für Computer- und Roboterassistierte Chirurgie e.V.



# Ein kombiniertes medizinisches Visualisierungssystem für Mund-, Kiefer- und Gesichtschirurgie

## A Combined Medical Visualization System for Oral and Maxillofacial Surgery

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### Purpose

Over the past decades the computer-based patient model visualization has evolved into a promising tool in preoperative diagnostics and surgical education. There are a variety of visualization methods based on 2D and 3D representations, and each has its own advantages as well as drawbacks. In this contribution, we present a medical visualization system, which integrates various visualization techniques and allows for high-quality and interactive patient model representation.

### Material and Methods

The visualization system is based on a standard PC. The developed software supports the following visualization techniques: 2D orthogonal and arbitrary sections, 3D surface-rendering and 3D volume-rendering.

A patient model is fed into the visualization system as a series of axial DICOM-files. The 2D visualization module is able to visualize the patient model directly. This cannot deliver a general view of the model, but provides an easy way to define the specific points in the patient model. The axial, coronal, sagittal and arbitrary section projections are provided.

The 3D surface-rendering visualization module requires a time-consuming preprocessing stage to extract an isosurface. Despite the widespread using of this method it has intrinsic limitations, caused by inability to depict the soft tissues covered by harder ones and by the losing of model details.

The volume-rendering visualization method was implemented to reveal the internal structure of the patient model (Fig. 1).

Since volume rendering is extremely computationally-intensive, we equipped the PC with the VolumePro 1000 board with 1GB volume memory onboard by TeraRecon Inc. This hardware acceleration provides high-quality volume rendering in near-real-time mode. The appearance of the volume visualization is controlled by the color and transparency transfer functions. The system provides user interface tools for the interactive editing of transfer functions (Fig. 2).

Each of the visualization methods described above is interactive and all the views affect each other. Due to the close interaction between different visualization representations it is possible to examine internal tissue and bone structures.

## Results and Conclusions

The integration of various methods in one visualization system allows fast and comprehensive in-depth study of the patient model, which is important for the diagnosis and treatment planning. The 2D section visualization allows to select the region of interest quickly and to define the orientation of additional cut planes. The surface rendering representation is suitable for the cursory inspection of bone structure. The visualization in the 3D volume-rendering mode allows for an insight view of complex skeletal structures which might imply a potential benefit, when vulnerable intraosseous structures, e.g. the inferior alveolar nerve, have to be preserved during surgery.

## Acknowledgements

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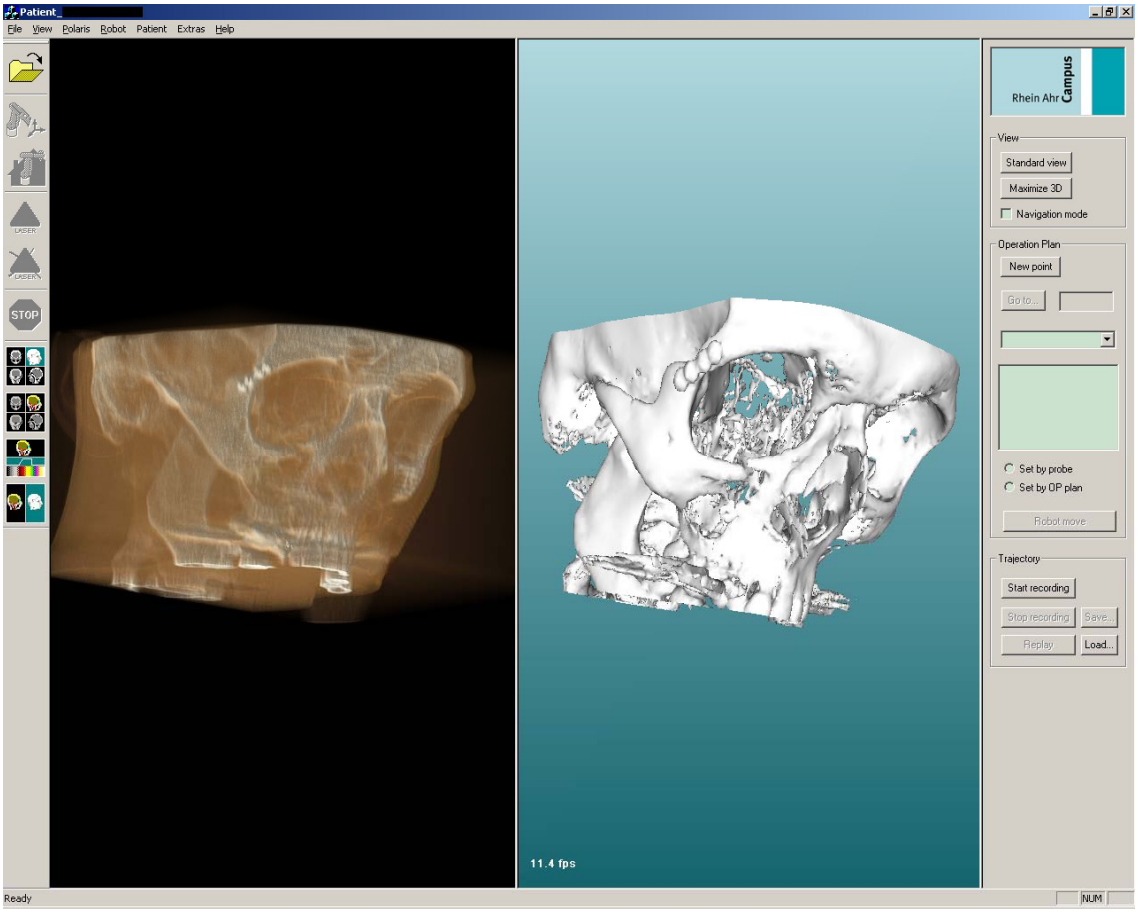
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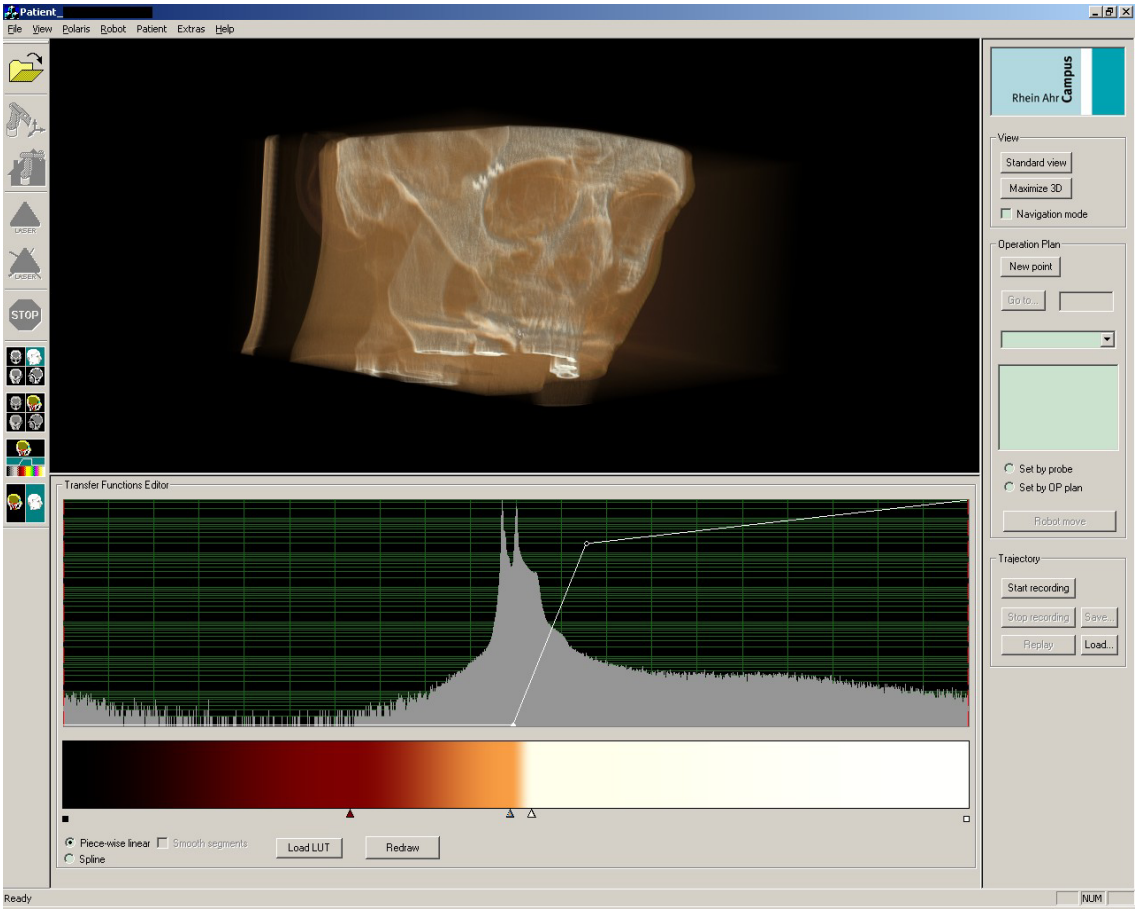
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