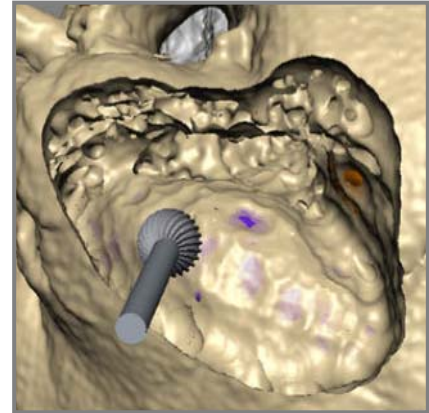


VOXEL-MAN *Tempo* is a unique virtual reality simulator for *training* and *planning* surgical access to the middle ear. The system is based on virtual 3D models of the skull base, derived from high-resolution CT data. Using force-feedback techniques, it provides a look and feel close to the real procedure. Following its predecessor *TempoSurg* - installed in more than 50 institutions worldwide - the **new version *Tempo*** exhibits striking new features: All functions in *real time*, automatic *skills assessment*, *bleeding and suction device (second instrument)*, and a new compact setup with a *3D flat panel display*.

See and Feel the Difference

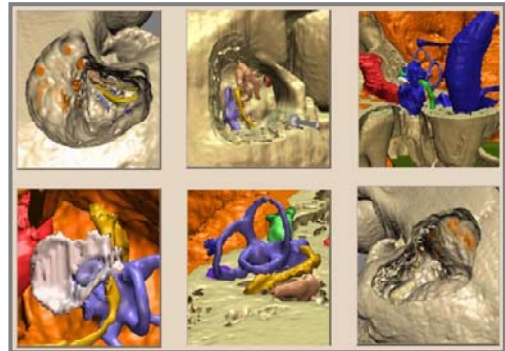
In *VOXEL-MAN Tempo*, skull and instruments are modeled in high resolution inside a computer and visualized on a 3D screen. The drill is controlled by a force-feedback device which can be moved in three dimensions and provides a very life-like sense of touch. With *VOXEL-MAN Tempo*, you can actually feel the subtle differences between the different bony structures of the mastoid.

Instruments provided include a selection of metal and diamond burs, with the drill speed controlled by a foot pedal, as well as a suction device. At any time, the surgical site may be inspected from all sides, magnified as desired, and even shown as cross-sectional images.



Problem-Based Training

VOXEL-MAN Tempo offers seven pre-defined training cases (left and right side each) of the middle ear with different anatomy and pathology. Organs at risk, such as facial nerve, tympanic chord, vestibular labyrinth, cochlea, auditory ossicles, carotid artery, sigmoid sinus, and dura are marked. When in training mode, the distances to the organs at risk are constantly monitored and navigation is supported by cross-sectional views at the position of the drill's head. All procedures can be practiced as often as needed, with no costs for disposable parts.



Skills Assessment

As a step further, *VOXEL-MAN Tempo* also includes an automatic skills assessment. Both process and result of a trainee's preparation can be evaluated objectively, based on predefined master preparations. Hence, trainees get immediate feedback on their work, progress over time can be monitored, and instructors are substantially relieved from supervision work. Likewise, the automatic skills assessment provides the base for a great deal of additional self study.

Task Fulfillment	Score	
463 mm ³ correctly removed (expert reference: 536 mm ³ ;	86	✓
Injuries		
2 injuries of the dura	-2	✗
Force		
somewhat excessive force (0.1 N) near the dura	-1	✗
Instrument Handling		
Efficiency		
time used: 04:32 min (expert reference: 05:20 min)	1	✓
Passed	84	✓

Own Cases

With *VOXEL-MAN Tempo*, you can also import CT data of your patients. This feature allows you to create your own training cases, which may also be used for surgery rehearsal. Within minutes, the system provides a bone model that can be drilled on. While the organs at risk are not marked in such a model, navigation on simultaneous cross-sectional views substantially facilitates orientation.



Setup

VOXEL-MAN Tempo is a compact unit that comes as a table-top or stand-alone system.



Prototype of VOXEL-MAN Tempo

Coming up: VOXEL-MAN Sinus, the Endoscopic Sinus Surgery Simulator

Based on the same mechanical setup, the endoscopic sinus surgery simulator *VOXEL-MAN Sinus* is under development. The input devices serve as cutting instrument and endoscope respectively. It will be available in September 2011 as a separate system or an add-on to *VOXEL-MAN Tempo*.



Benefits

- Training of both manual dexterity and problem solving skills
- Immediate feedback
- Objective evaluation of performance (skills assessment)
- Problem-based training
- Self-study facilities
- Reduced need for supervision
- Reduced laboratory and material cost
- Training with own patient cases

Features

- 3D display with 3D glasses
- Industry-leading image quality
- Simultaneous handling of drill and suction device
- Drilling with realistic force feedback (patent pending)
- Additional cross-sectional images
- Complete set of burs with matching haptics and sound
- Foot pedal
- Compact unit
- Comes as table-top or stand-alone system

Availability

VOXEL-MAN *Tempo* will be available in April 2011.

About VOXEL-MAN

VOXEL-MAN is a pioneer in medical simulation technology. VOXEL-MAN *Tempo* is the market leader in ENT surgery simulation. Besides ENT, VOXEL-MAN is developing simulators for dental education. VOXEL-MAN received an *EXIST-Transfer of Research* grant of the Federal Ministry of Economics and Technology of Germany (BMWi).

VOXEL-MAN

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