When you enter Operating Theatre 3 of the new central operating department at Pius Hospital Oldenburg, the first thing you notice is the large, three-part mural on the back wall: a dream-like landscape of white dunes, a tranquil sea and blue sky. “We believe that an attractive environment significantly improves the workplace atmosphere,” says Dirk Weyhe, Professor of Visceral Surgery at the University and director of the University Clinic for Visceral Surgery at Pius Hospital Oldenburg. And that, he stresses, is indispensable for the success of the operations that are performed here on a daily basis.

However, the atmosphere in the operating theatre is just one aspect of a comprehensive plan to make internal organ surgery safer for patients. Weyhe and his team are integrating various new technologies – from intelligent lighting and voice assistance systems to augmented and virtual reality (AR and VR) – to achieve this goal. Several computers and data cables as thick as arms are embedded in the walls of the new operating theatre, which also features no less than seven strategically positioned monitors and several cameras, as well as a powerful Wi-Fi connection. “Complex human-machine interactions will be integral to the operating theatres of the future,” the surgeon explains. Rather than replacing humans, Weyhe believes, technology should complement and optimize their capabilities. He sees potential for new technologies in both the planning and implementation of surgical procedures, as well as numerous applications in medical training and continuing education, including anatomy courses using VR headsets and realistic organ models for practising surgical procedures.

The special lamps in the new operating room at the Pius Hospital feature all the colours of the spectrum, making contrasts such as those between blood and liver tissue easier to see. The surgeons today still have to manually adjust the lighting in the operating theatre while they perform surgery. The partners involved in the SmartOT project are developing an intelligent lighting system that automatically compensates for any shadows.
Deutsche Welle 

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Weyhe is working with his colleagues Dr. Verena Uslar, Dr. Daniela Salzmann, and Dr. Timur Cetin to turn these plans into reality. The research team at the University Clinic for Visceral Surgery is a partner in various projects for developing and testing new technologies. In addition, the researchers are examining the impact of the innovations on workload and stress levels in operating room personnel – a question that has been little re-searched. “The overarching research topic in our group is patient safety,” Weyhe emphasizes. Because for all the top-level expertise, consciousness and constant advances in medicine, operating rooms don’t always go according to plan – with potentially negative conse- quences for the patient. Reducing the frequency of such adverse events is the department’s declared mission.

Another factor that has received little attention is the lighting in oper-at ing theatres. “It’s clear that poor illumination of the surgical field can lead to errors, but there are hardly any studies on this,” says Weyhe. A typical problem is that doctors and nurses have to move around during an operation, meaning that the lighting conditions are constantly changing. Weyhe and his team are involved in developing a new system (Smart Lighting in Operating Thea-tres) project led by the University of Bremen, which is working to find spe-cialized solutions.

With funding from the German Federal Ministry of Education and Re-search (BMBF), the project team is jointly developing a lighting system that eliminates shadows automatically. Conventional surgical lamps are replaced with light arrays of a type that is controlled via gestures and voice commands. For fine-tuning, individual sections switch on and off automatically. “This allows the sys-tem to be operated in a completely sterile manner,” explains Timur Cetin, who leads the Oldenburg subproject. A prototype of the system, which is control-led by sensors, depth cameras and artificial intelligence (AI), will be used in the Pius Hospital’s new operating theatre for surgical training, which is due to open its doors by the end of the year. “We have been tasked with cre-ating solutions that can adapt to the medical staff’s changing working conditions,” Cetin says. The research team at the University of Oldenburg is developing a computer surg-ical lighting system at the start of the pro-ject and is currently evaluating the usability of the prototypes.

The team also plans to use realistic organ models as training objects for res-idents to practise surgical procedures such as electrocautery or high-fre- quency surgery later on.

Improving understanding of anatomical relationships

VR technologies could also be useful for improving medical students’ under-standing of anatomical relationships. “It’s a little bit of a ‘huge topic’,“ Weyhe emphasizes. He considers it a happy coincidence that the Oldenburg neuro-psychologists are already studying exposure to noise pollution in daily life, which means that thanks to the port-able EEG device they will be perfectly equipped to carry out the study in the operating room, too.

The researchers first realized that new technologies can increase the stu-dies in operating room personnel in a study investigating minimally invasive pro-cedures in which camera images from inside the body are transferred to a screen and converted into 3D images via 3D glasses. They found that the pro-cedure causes eye strain because the 3D image appears to jump in front of the user, and the eyes are forced to constantly adjust to different distances, which is very tiring. “The problem can be easily solved by placing the monitor at least two metres away from nursing staff,” Weyhe explains.

This insight was immediately put into practice in the new operating the-a tre at Pius Hospital – another building block in the quest to create an optimal working environment. “UK

Dirk Weyhe and his team are working to bring new technologies to medicine.

Physicians can use AR headsets to study ho-lograms of organs from all angles, rotate them manually, or move them about. The images can also be viewed on a large screen by medi-cal staff not wearing data headsets.

Assistant doctors can train to perform a va-riety of surgical procedures using half-organ models produced with 3D printing.

Dr. Verena Uslar, Dr. Daniela Salzmann, and Dr. Timur Cetin in a study investigating minimally invasive procedures in which camera images from inside the body are transferred to a screen and converted into 3D images via 3D glasses. They found that the procedure causes eye strain because the 3D image appears to jump in front of the user, and the eyes are forced to constantly adjust to different distances, which is very tiring. “The problem can be easily solved by placing the monitor at least two metres away from nursing staff,” Weyhe explains.

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