A new haptic interface for VR medical training.

Abstract:
Successful applications of haptic displays are limited to tool-based interfaces that simulate haptic effects on surgical and other medical instruments. However, no satisfactory haptic display exist so far, that enable the simulation of high fidelity palpation of human tissue or body segments. Existing approaches developed for medical training fail due to unrealistic haptic effects, time-consuming donning and doffing, and inconvenient use (e.g., mechatronic tactile and kinesthetic displays) or due to restricted function and adjustability (e.g., passive mannequins). The key idea of the new haptic interface is to attach artificial organs or segments (e.g. a plastic leg) to a force actuating mechatronic unit (e.g. robot). A set of different materials combined in certain layers yield components that look and feel like real objects. When the user touches the artificial object the contact forces and position changes are measured and fed into a model-based controller. Thus, the actuator moves the object so that the user gets the impression that he had induced the movement. The new haptic display has been verified with a setup developed for the training of functional joint evaluation after knee injuries. Compared to classical approaches, this display is convenient to use, provides realistic tactile properties and can be partly adjusted to different system properties (e.g. pathological joint properties). This kind of new interface can be applied to many different medical applications, where the clinician directly touches human limbs or tissue, such as in obstetrics,
reanimation, organ palpation, etc.

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