

**CURRENT
APPLICATIONS OF
VIRTUAL AND
AUGMENTED REALITY
IN RADIOLOGY**



AUTHORS

Sherley Demetrius, MD

Nassier Harfouch, MD

Emmanuel Amoateng, BS

David Sarkany, MD

Department of Radiology,
Staten Island University
Hospital/Northwell Health
Staten Island NY

INTRODUCTION

Virtual reality (VR) is a computer-generated simulation of a three-dimensional (3D) environment where users can interact with virtual objects via a head mount or eyewear device

Augmented reality (AR) enhances the 3D world by fine-tuning a user's visual, tactical, and auditory senses

VR/AR simulations allow residents to repeatedly practice, hone, and perfects their skills by making mistakes that they can learn from without causing harm to patients



OBJECTIVES

- Present applicability and educational value of VR/AR simulations that is widely used in various aspects of medicine and medical education to facilitate:
 - Meetings
 - Workflow
 - Surgical/procedural planning
 - Resident education
 - Radiologist workstations

METHODS

Broad literature search
investigating current common
uses and applications of VR/AR in
the general medical community

Focused literature review
specifically looking at VR/AR use
in medical school and residency

Focused literature review looking
at VR/AR use in all aspects of
radiology

Results: Applications in Meetings

- The applicability and educational value of VR/AR simulations allows its wide use in various aspects of medicine and medical education such as:
 - Education of individual or small groups in anatomy labs¹⁻²
 - Surgical laparoscopic skill practice through simulation³⁻⁵
 - Residency applicant hospital tours⁵



Results: Applications in Workflow



- VR/AR impact in radiology workflow includes assisting in multiple levels of patient care, scheduling, and medical education
- VR/AR technology use to improve workflow operations includes:
 - Assisting in obtaining patient consent by creating a simulation of the planned procedure for the patient to better clarify the procedure to be done⁶
 - Improving the patient experience for imaging exams (for e.g. MRI), by using relaxation and “distraction therapy” through simulation⁶⁻⁷

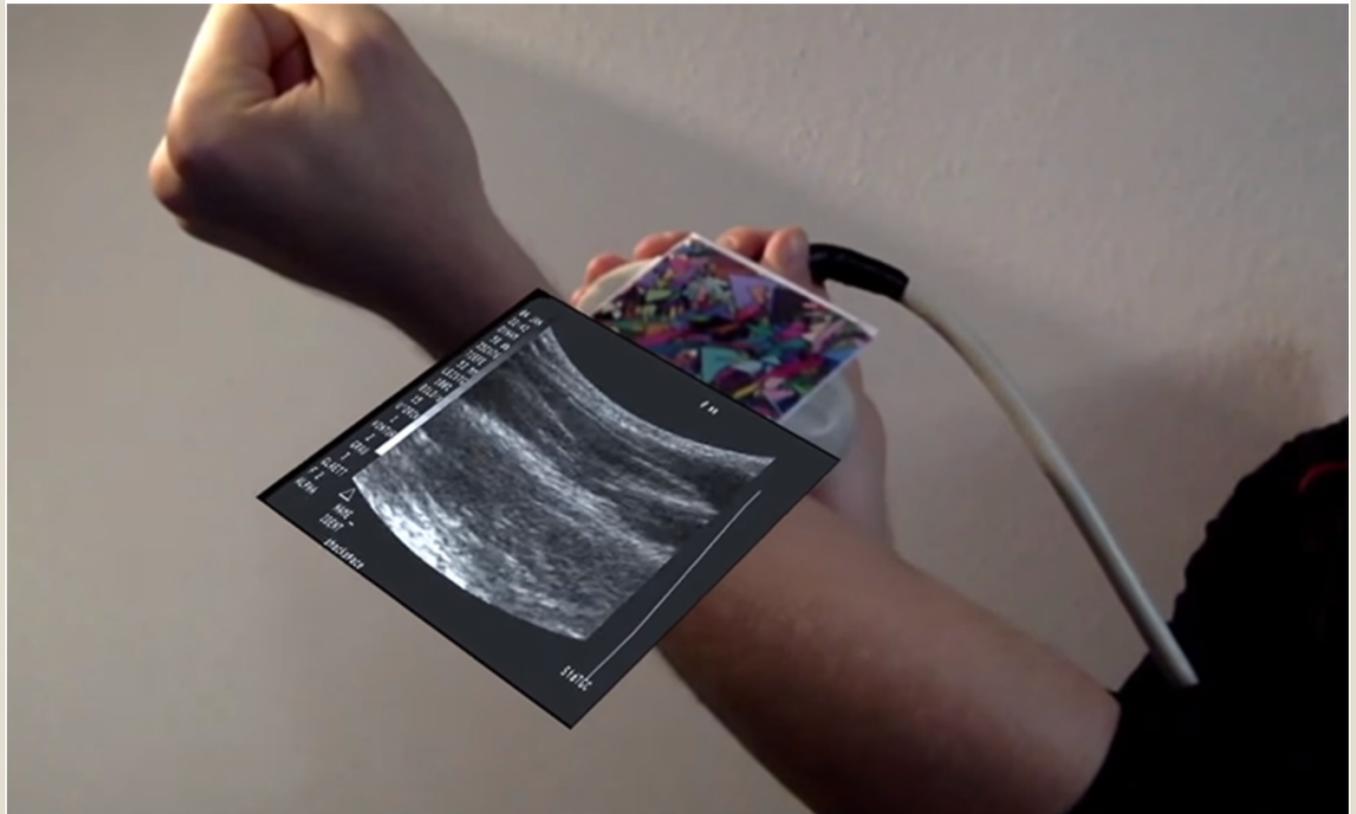
Results: Applications in Surgical/Procedural Planning



- Pre-operative vascular mapping for Interventional Radiology procedures has benefited from VR/AR by creating simulations/reconstructions of a patient's specific anatomy
- This allows the interventionalist to be better prepared to handle variant anatomy and possibly reduce fluoroscopic exposure time to the patient⁸⁻⁹

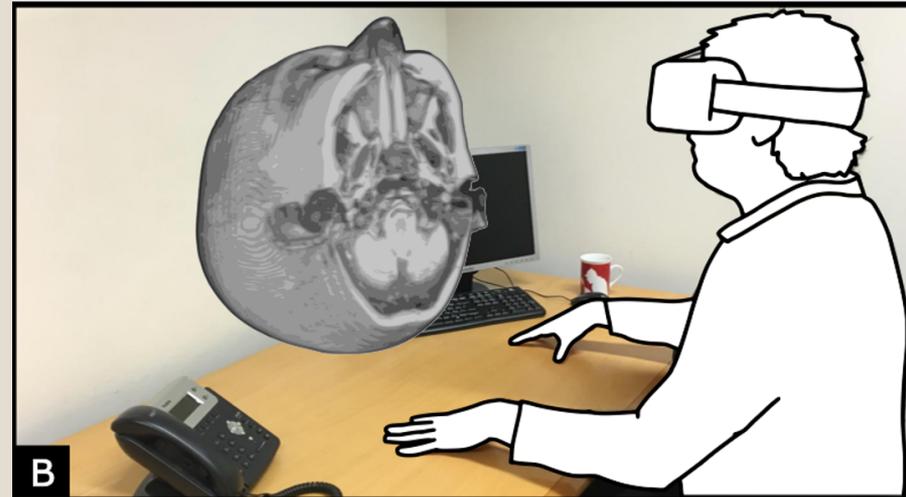
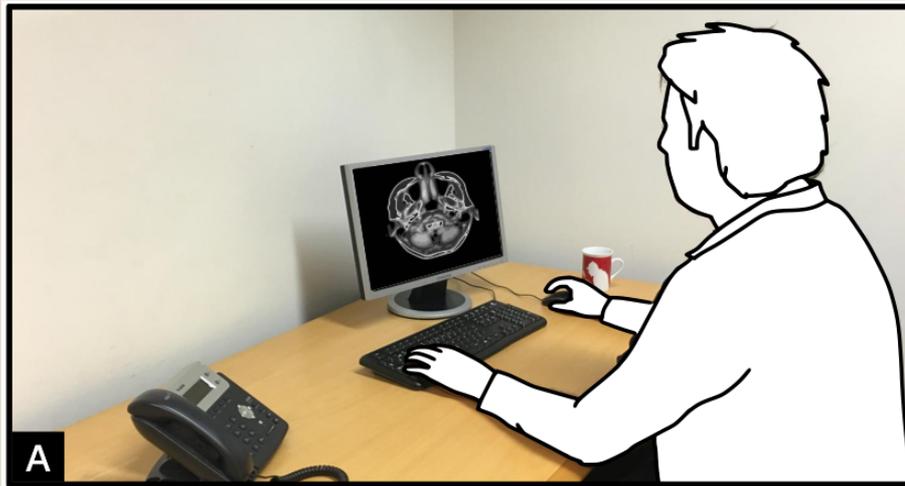
Results: Applications in Resident Education

- Regarding medical education, radiology residents have already begun experimenting with simulations that allow the use of virtual sonographic equipment¹⁰⁻¹¹
- This includes exchanging different probes and learning about various sonographic settings (for e.g. adjusting gain and brightness)



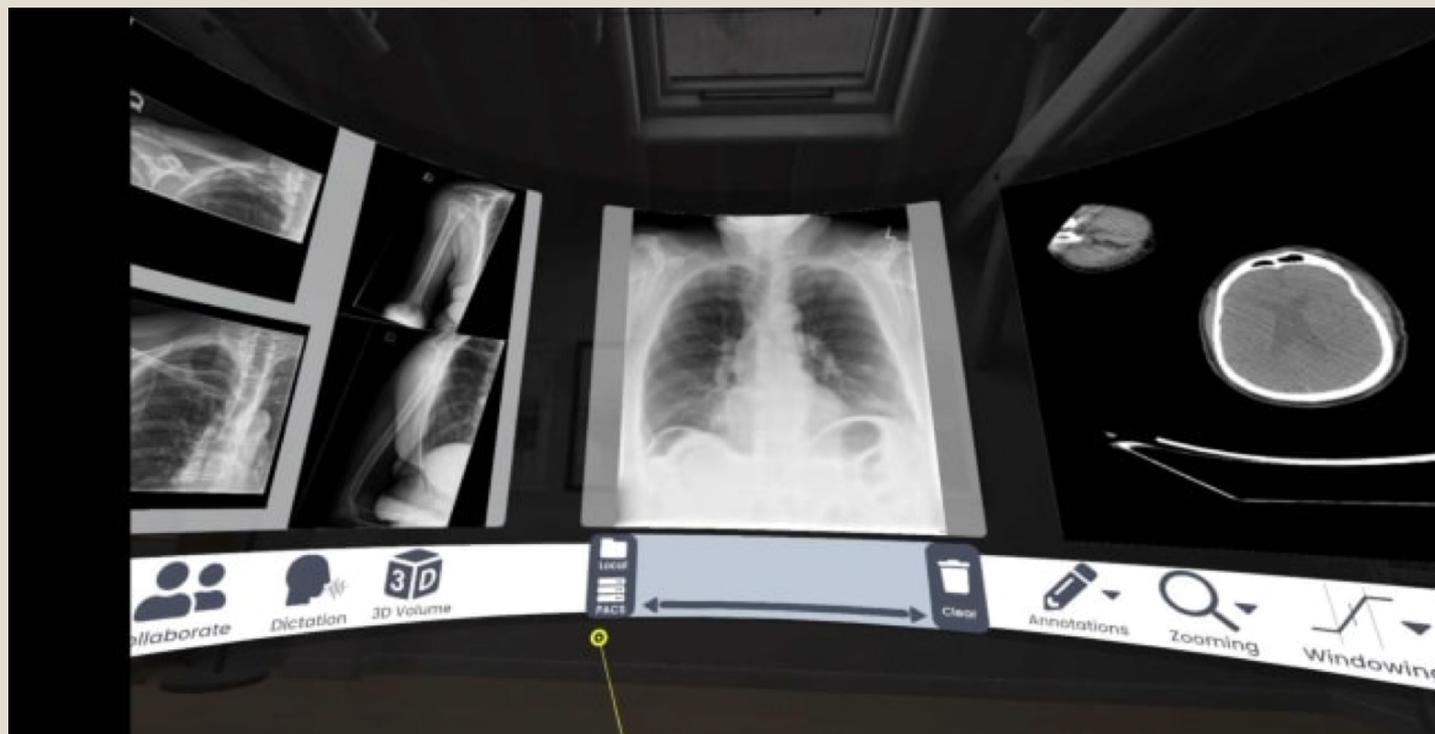
Results: Applications in Radiology Workstations

- VR/AR for reading diagnostic images is an exciting and upcoming application
- Using a headset, users are transformed from the physical reading room into a virtual reading room¹²
- This allows one to decrease physical equipment requirements, including:
 - Monitors
 - Dictaphones
 - Mouse and keyboard
- The user is transported to a virtual world, immersing the user into the imaging study to be read¹²



Results: Applications in Radiology Workstations (continued)

- A virtual radiology reading room not only reduces space needed and cost of equipment, but corrects and accounts for:
 - Poor lighting
 - Screen reflections
 - Ergonomics
- Reduced glare may improve users' attention spans, likely due to minimization of distractions inherent to the physical reading room¹³



CONCLUSIONS

- Contrary to William Halsted's surgical adage of see one, do one, teach one, VR/AR simulation allow residents to practice their skills until the correct patterns become habits
- While VR/AR technology continues to improve, the use of simulation technology can greatly benefit the radiologist, department workflow, and the patient experience
- More studies are needed to further highlight these possible benefits, but the paradigm shift of simulation technology in radiology has arrived

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THANK YOU
CONTACT: SHERLEY DEMETRIUS, MD
EMAIL: SDEMETRIUS1@NORTHWELL.EDU
TWITTER: SHERLEYDEMETRI