

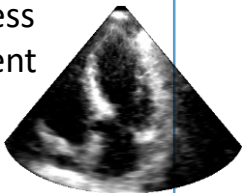
Development of mixed reality interactive visualization for three-dimensional echocardiography

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Purpose


- State-of-the art cardiac imaging is based on three-dimensional (3D) datasets
- Displaying 3D information on standard monitors naturally limit access to important content



We want to show that innovative *mixed reality* technology can significantly improve navigating 3D datasets



Methods

- Clinical collection of echocardiographic 3D scans was used to test the feasibility
- We utilize Microsoft **HoloLens** head-mounted device, and
- develop **holographic visualization** overlying holographic image of cardiac data onto real-world viewed by operator
- The option of **live streaming** of 3D echo data was explored.
- Tested also for other 3D cardiac imaging methods (CT, 3DRA, MR)



Results: 3D echo data live stream

- Raw 3D echo data stream in native resolution allowed successful holographic imaging with only 80 ms delay in interpretation of stream
- This culminated in first-in-man test of real-time augmented reality display (during percutaneous balloon commissurotomy)
- Navigation in dataset was accessible via hand gestures and voice commands

- Touchless user interface holds promise for use in interventional theatres without compromising sterility
- Direct operator control of image

Results: 3D datasets collection

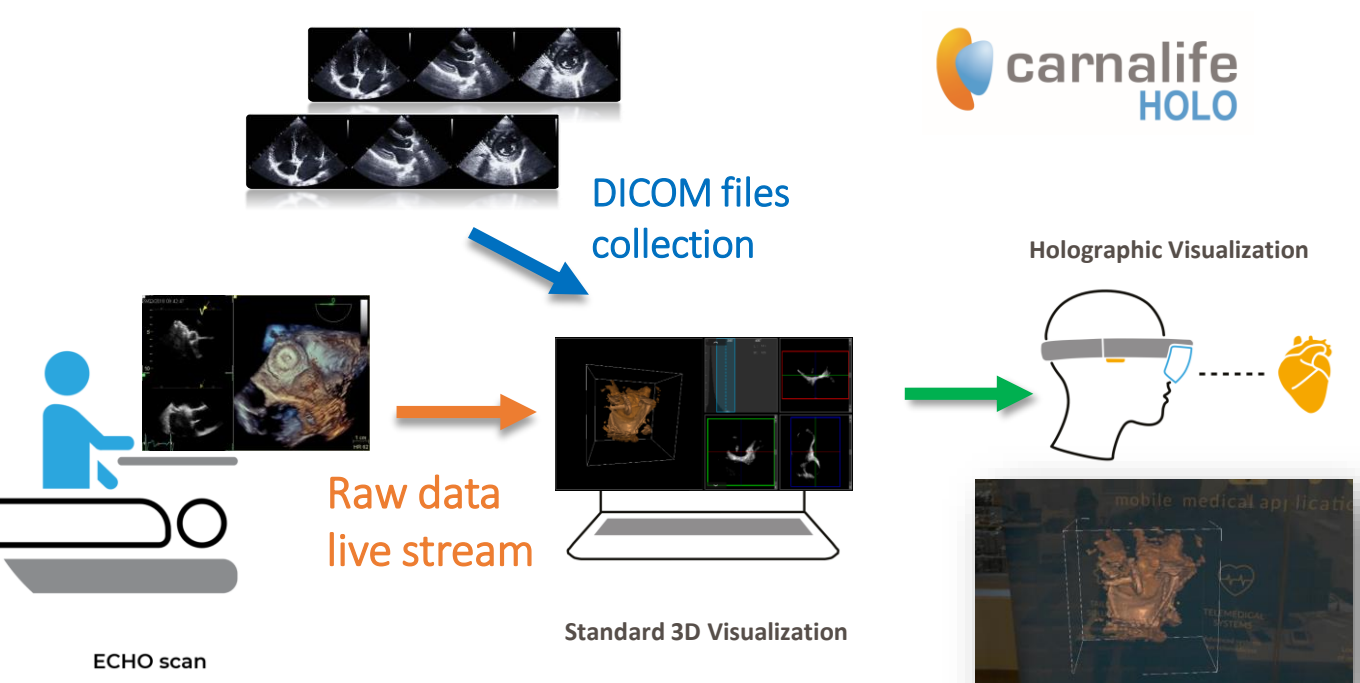
All 3D echo datasets were successfully displayed in mixed reality as a holographic image. The quality of visualization was diagnostic without content loss in >90 % of datasets (as judged by operator)

Conclusions

- Mixed reality display using head-mounted device shows promise for fully volumetric, intuitive imaging and navigation in spatial datasets obtained with routine three-dimensional echocardiography.
- Hands-free touchless control seems promising for interventional applications.
- First-in-man experience with mixed reality display of real-time 3D echo data proved feasibility in interventional scenario.

Software Pathway

We implement software pathway:
 Raw data live streaming or DICOM files conversion • 3D data reconstruction • real-time streaming of 3D object from PC to device • manipulation of hologram



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