

# VheaRts: a single centre experience to develop, test and implement a novel virtual reality application for enhancing understanding of congenital heart diseases and non-technical skills training in paediatrics.

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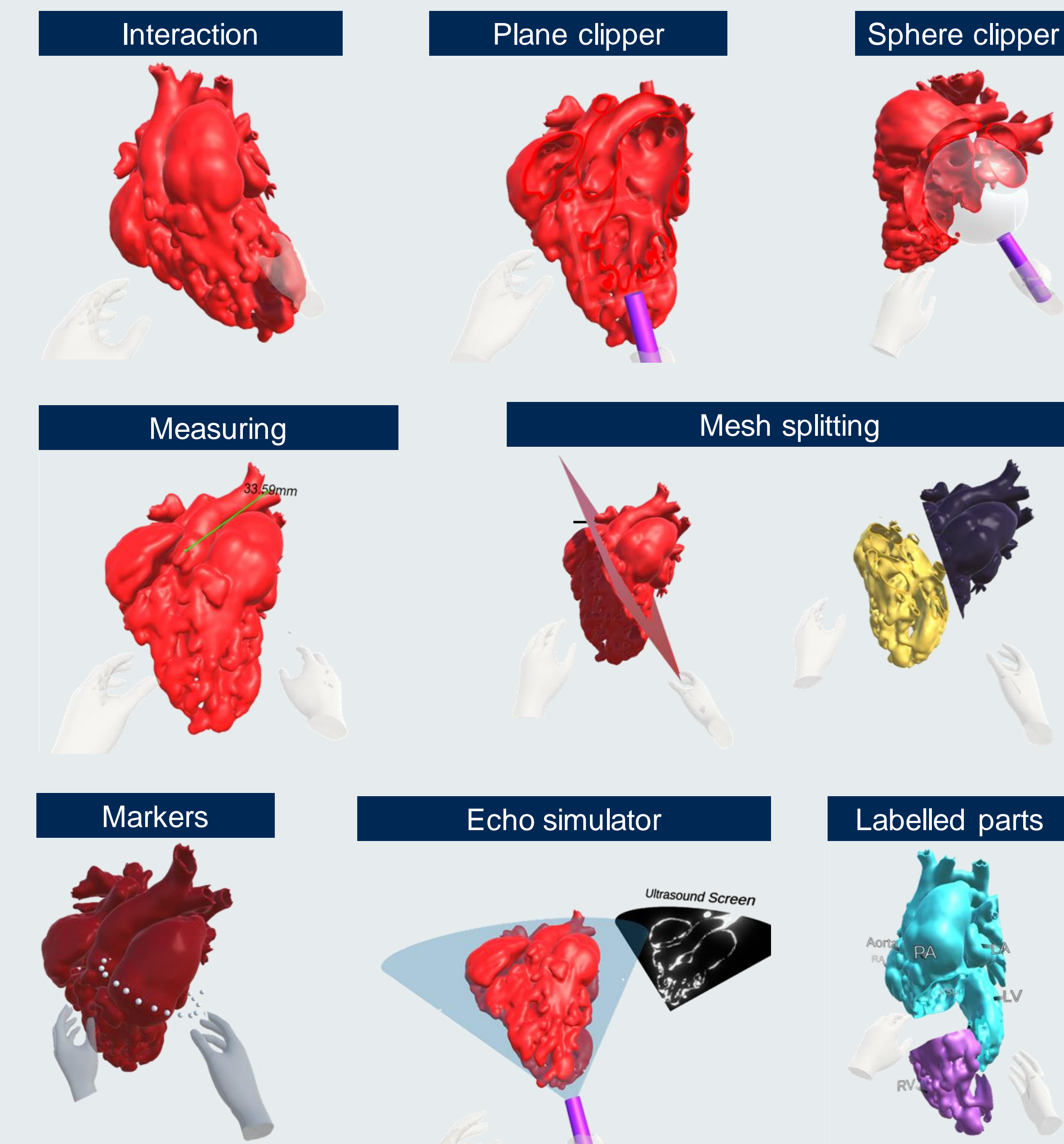


## Background

**Congenital heart diseases (CHD)** encompass a diverse array of structural variations that often require individualized treatments. Despite the increased amount of imaging data, surgical planning and training in complex cardiac morphology remains challenging.

**Virtual reality (VR)** is a rapidly growing technology allowing the user to be completely immersed within a simulated environment. However, the integration of VR with advanced cardiovascular imaging is in early stages globally.

In this study, we report our endeavours in designing, implementing and assessing a VR service for the treatment and the training in CHD. We also report a partnership with the Great Ormond Street Learning Academy which will allow further evolution of this work, and consider how the same technologies and pipelines can be used to aid non-technical and communication skills training in paediatrics.

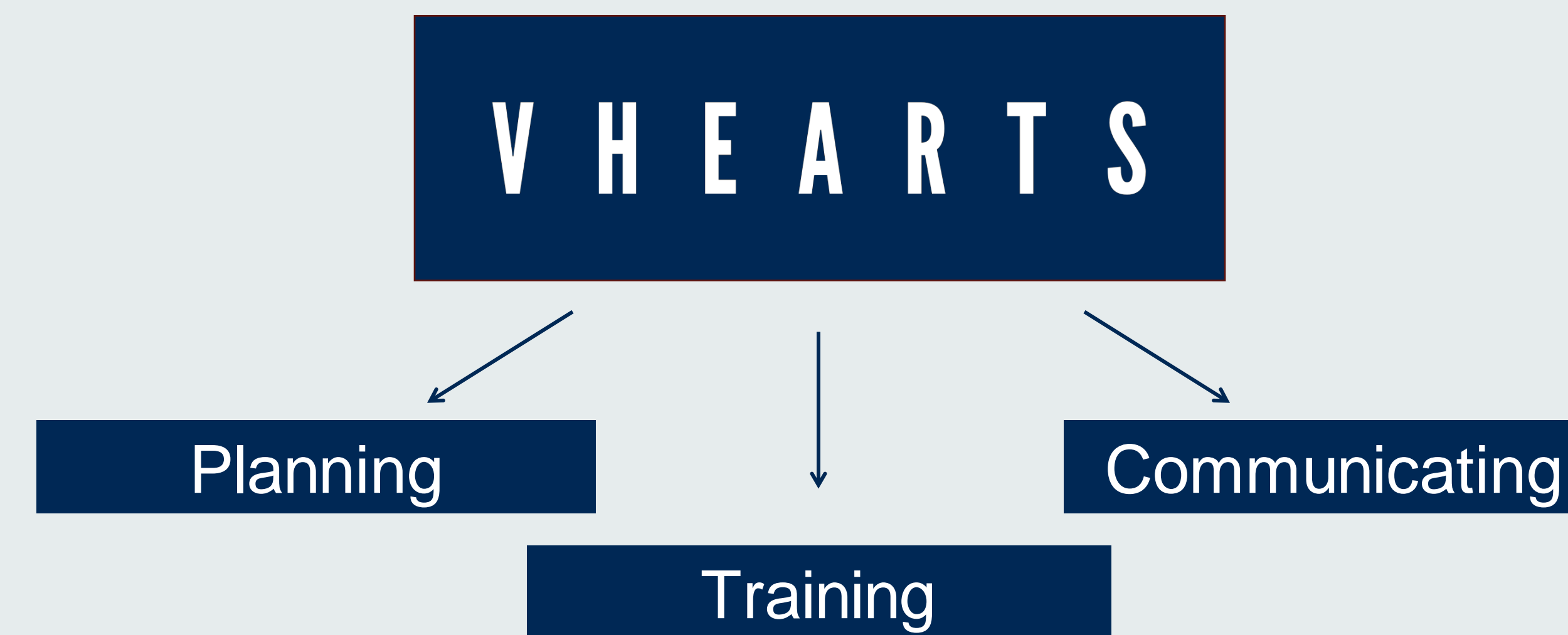


VheaRts features designed for multiple usage

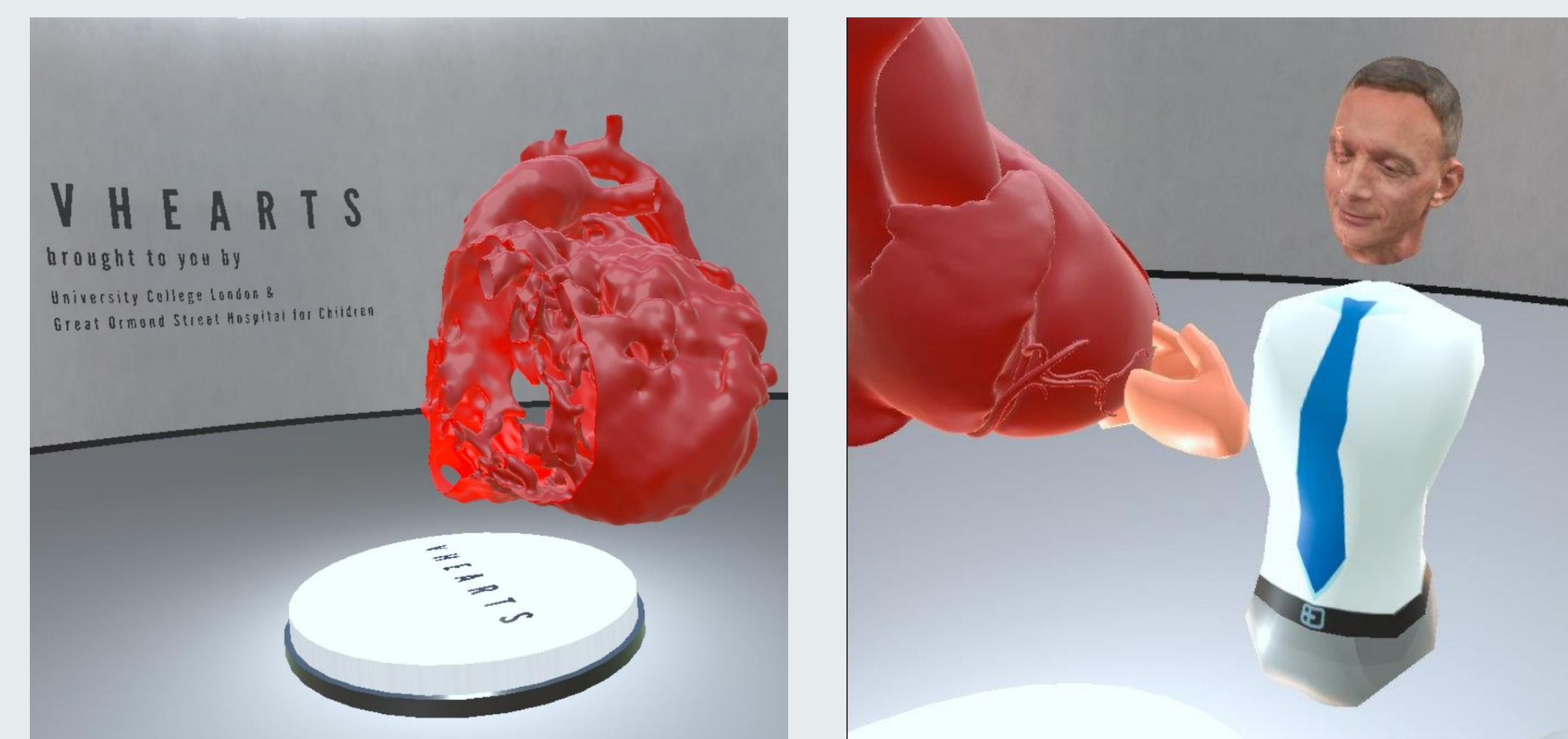
## Methods

A VR application, **VheaRts**, was designed by our group specifically to plan surgical treatments and improve education for CHDs.

**VheaRts** can import patient-specific models reconstructed from medical images along with multi-modality data. Compatible with various commercial headsets, tools were built in to facilitate the planning, improve teaching and explore new ways to communicate with patients and their families.



VheaRts has been implemented within our clinical and training Centre and data have been recorded to evaluate its effectiveness in enhancing the understanding of CHDs.

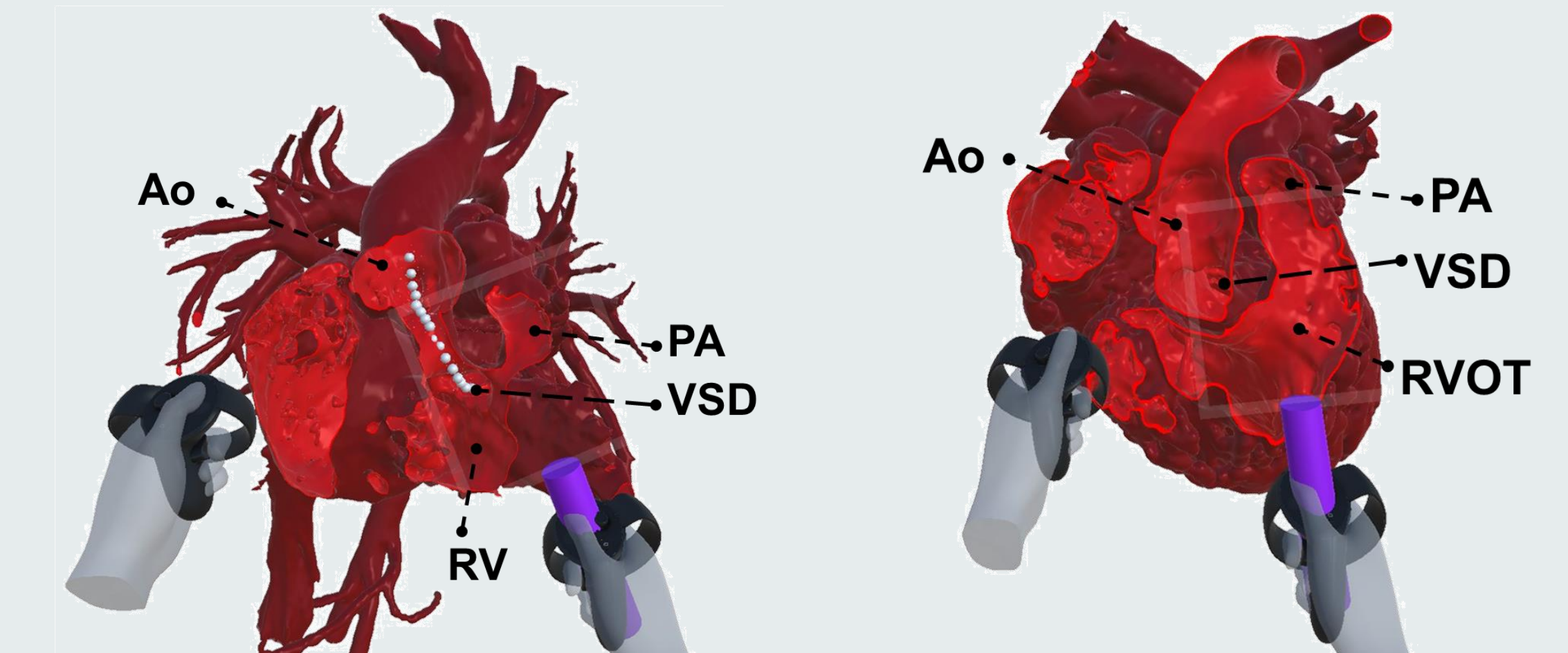


VheaRts for training

## Results

### VheaRts for Planning

During the period 2019-2023, 56 patients underwent clinical evaluation prior to surgery using VheaRts. Conotruncal lesions accounted for 39% of the cases, followed by cardiac tumour fibroma (11%) and septal defect (9%), although the latter were more commonly associated lesion in other diseases. Feedback indicated that VheaRts was easy to use in aiding pre-operative planning of CHD in 86% of the cases.



VheaRts for planning

Pre-surgery (LV/Ao baffle marked out) and post-surgery (baffle in place)

### VheaRts for Training

Over the same period, VheaRts was evaluated by over 200 trainees rating it highly useful for learning CHD (average score 4.4/5) and 'intuitive' (average score = 4.6/5), even with no prior experience with VR technologies (76% of attendees).

### VheaRts for Communicating

Pilot tests were conducted to test the use of VheaRts with patients and their families who showed a high level of curiosity and engagement.

## Conclusions

The design and adoption of VheaRts showed how this can be used in facilitating the understanding of CHD for treatment planning, education and communication. Such positive results suggest further developments facilitate its adoption as clinical service and monitor its efficacy in improving the planning of complex treatments considering still scarce diffusion of the technology. We are currently embarking upon a collaboration with the Great Ormond Street Learning Academy which will allow for this technology and these methods to reach a much wider audience. In particular, we will be expanding the scope to include training in non-technical and communication skills by creating bespoke VR scenarios according to needs identified by clinicians at Great Ormond Street Hospital.

