

INVESTIGATING THE FEASIBILITY OF MIXED REALITY FOR TRAINING IN OBSTETRIC SONOGRAPHY

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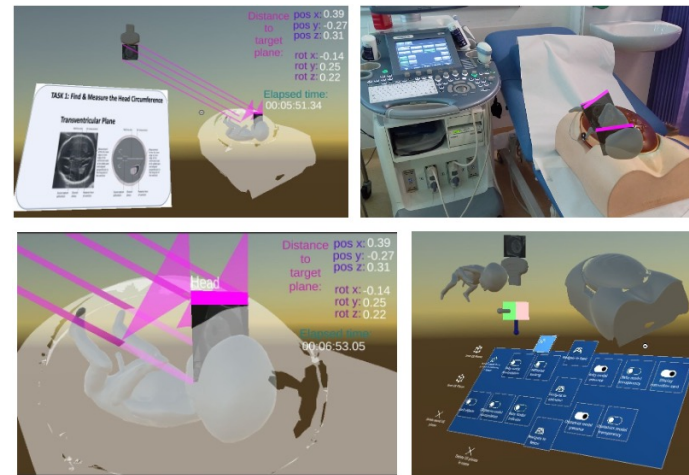
Objective: To examine the feasibility of Mixed-Reality (MR) methods in training of fetal biometry.

Design: Mixed Reality allows the user to experience the virtual and physical worlds simultaneously.

- We developed an MR training environment to allow trainees to visualise the US probe in relation to the fetus.
- Fetal biometry planes are not related to external landmarks on the maternal abdomen.
- Mixed reality can present a complex scene to the user, allowing them to 'see through' the maternal abdomen.

Method: The user performs fetal biometry using a clinical ultrasound system and a training phantom while wearing the MR headset.

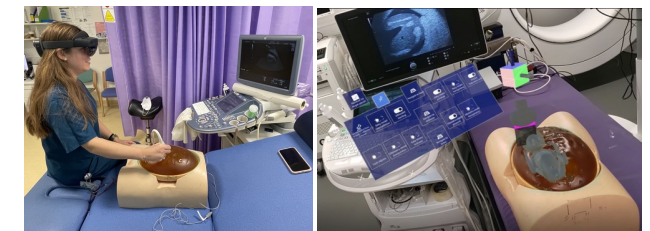
- The user is presented with arrows which are intended to guide them towards the standard planes for the estimation of fetal weight.
- The US machine, buttons and controls behave exactly as they would when scanning a real patient.
- They are provided real-time feedback on whether each of these steps is being performed correctly by the head mounted display.



Unity scene showing the various components of the holographic setup:

- (a) Navigation to target ultrasound plane incl. navigation instruction card, navigation arrows, position and rotation offset between probe and target plane and elapsed time for the navigation task.
(b) User view through the Head Mounted Display, (c) close-up of directional arrows (d) user interface.

Results: 85% of respondents felt that mixed reality helped them to understand the relationship between the US probe and fetal anatomy. 78% felt that using the system would increase their confidence when performing fetal biometry. All participants agreed that mixed reality represented a useful training tool and that mixed reality training was a viable training tool in clinical practice.



User view of the clinical training environment when they are wearing Hololens with CAL-Tutor software running. To the left is the clinical US system manufactured by GE Voluson and to the right is the training phantom with the fetus overlaid and the standard planes highlighted.

Conclusions: This work represents an initial feasibility study. We show that mixed reality can offer new ways of learning relevant clinical skills. There is potential to provide, consistent direction and logic for the trainee instructions throughout the examination.

Strongly Disagree Disagree Neutral Agree Strongly Agree Option 6

I enjoyed using CAL-Tutor

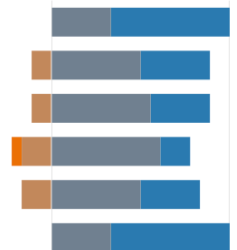
CAL-Tutor helped me understand the relationship between the US probe and fetal anatomy.

CAL-Tutor was comfortable to wear

The probe navigation was clear

I expect CAL-Tutor will increase my confidence when performing ultrasound

CAL-Tutor could be a useful tool as a mixed reality trainer.



Post-usage questionnaire results as completed by 18 clinical trainees. Each question was graded on a Likert scale where 0 represented "Strongly Disagree" and 5 represented "Strongly Agree".