

An Interactive 3D Web-based Learning Platform for Visualising Ovarian Anatomical Transformations in Long-Finned Pilot Whales (*Globicephala melas*)

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A Pilot's Journey

Understanding ovarian anatomy and transitions between reproductive states is essential for interpreting female life history in cetaceans. Yet, research is constrained by limited specimen access and reliance on conventional methods such as histology and static images, which reduce 3D complexity to 2D representations. This study presents and evaluates an interactive web-based 3D learning platform which allows users to visualise ovarian structural transformations in female long-finned pilot whales (LFPW) (*Globicephala melas*). The goal is to improve anatomical understanding among professionals and exploring MRI as a more comprehensive imaging technique for assessing female reproductive tissues and status.

MATERIALS & METHODS

Ovarian models from five stranded female LFPW specimens provided by the Scottish Marine Animal Stranding Scheme (SMASS) were digitally reconstructed from MRI data, using volumetric and 3D modelling softwares, and imported into an interactive web-based platform (Figure 1).

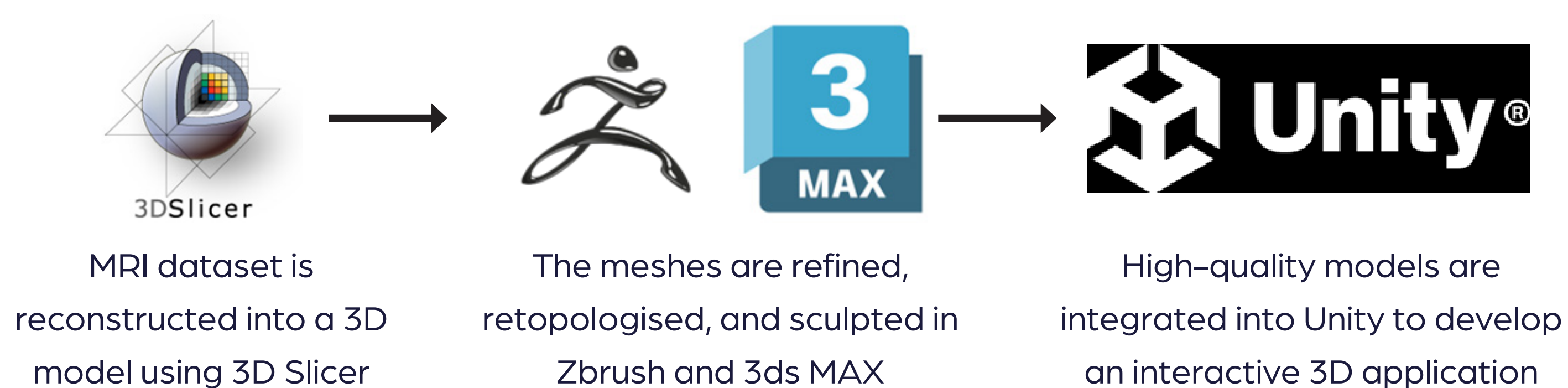


Figure 1. Workflow overview

The platform enables visualising ovarian anatomy across two main reproductive stages: sexually active adult and postpartum.

Evaluations involved veterinary professionals, marine mammal researchers, and related specialists internationally (n = 22), using five metrics: Knowledge gain, Cognitive load, Face and content validity, Usability (SUS), and User motivation (RIMMS).

RESULTS & DISCUSSION

The final application consists two sessions: 1) an overview handbook on cetacean female reproductive biology, and 2) a focus session for exploring 3D anatomical models alongside MRI data.

Evaluation summary:

1. Knowledge assessments showed significant improvement ($Z = -2.652$, $p < 0.05$) with reduced score variability, indicating greater consistency in topic understanding.
2. Cognitive load revealed correlations between extraneous and germane load linked to interface design challenges.
3. Face and content validity indicated favorable perceptions upon anatomical accuracy and educational content, though variability highlighted areas for refinement such as content clarity.
4. Usability scored above average (SUS = 75.57 vs. standard 68).
5. User motivation was moderate to high, with confidence and satisfaction rated highest.

This research presents a replicable workflow for transforming archived specimens into accessible educational and diagnostic resources, addressing current limitations in analysing cetacean reproductive states. By reducing geographical barriers, the web-based platform can advance digital visualisation methods and support global access to marine mammal science and conservation education.



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Scan QR code on the right to watch the walk-through video :)

