

Rapid Prototyping models of fetuses built from Ultrasound 3D and Magnetic Resonance files

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Abstract

Advances in imaging technology have allowed vast improvements in the diagnosis of foetal anomalies. The Foetus 3D project was made through the capture, segmentation and the conversion of Ultrasound 3D and Magnetic Resonance exams into virtual 3D models that at the end of the process gained physical volume through the use of rapid prototyping technologies.

The Medical Doctors who accompanied the project were the Foetal Medicine specialist Dr. Heron Werner from the Clinica de Diagnostico por Imagem in Rio, Brazil and the renowned Medical Doctor Professor Stuart Campbell , pioneer on the use of Ultrasound 3D in UK. The exams conducted, performed a total of fifty cases studies developed on both countries. The Prototypes were made in two Institutions, the Royal College of Art - Rapid Form 3D Laboratory in London, UK and the Laboratorio de Modelos 3D at the Instituto Nacional de Tecnologia in Rio de Janeiro, Brazil.

The experiment proved itself as an innovative contribution to science and specifically for the educational study of fetuses, as the methodology may be applied at different stages of pregnancy (first, second and third trimesters) . It is suggested that the use of USG 3D exams and Magnetic resonance when segmented and applied separately or combined in the construction of 3D virtual and physical models, may improve our understanding and demonstration of foetal characteristics for medical educational purposes and also for parents visualization.

A new modelling path has been opened in foetal medicine, especially for the possibility of materializing images of internal areas of the bodies of pregnant women in order to obtain a greater interaction with the real forms and dimensions of fetuses.

For medical doctors, this is an opportunity to have a physical contact with tactile models of fetuses in different stages of pregnancy, having also the possibility to study and visualize malformations, and being possible to physically demonstrate different pathologies either for parents to be or medicine students.

Thus, regarding the Foetus 3D experiment as an ongoing project, the author believes that the use of Ultrasound 3D and magnetic resonance exams combined or not, transformed in Rapid Prototyping physical models can expand the possibilities of demonstration of foetal characteristics related to didactic medical and even diagnostic purposes.

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Virtual and Physical model of foetus with Dwarfism – Images from the top left : 3D USD image, detail of the Rapid Prototyping model built on Z Corp, virtual 3D mathematical model, and the RP physical model of the whole body from USD 3D files and resonance magnetic exams. Exam conducted by Dr. Heron Werner.