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Virtual Reality beeldvorming ten behoeve van onderzoek naar embryonale en placentaire gezondheid

Naam: Annemarie Mulders

Organisatie: Erasmus MC

Voordracht: Virtual Reality beeldvorming ten behoeve van onderzoek naar embryonale en placentaire gezondheid

Disclosure belangen spreker

Geen (potentiële) belangenverstrengeling	
Voor bijeenkomst mogelijk relevante relaties	**Bedrijfsnamen**
• Sponsoring of onderzoeksgeld • Honorarium of andere (financiële) vergoeding • Aandeelhouder • Andere relatie, namelijk …	• Geen • Geen • Geen • Geen

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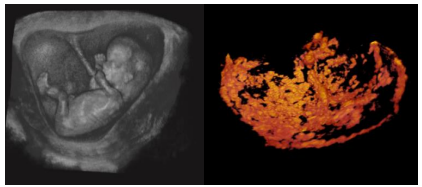
Dr. Annemarie G.M. Mulders
gynaecoloog-perinatoloog

Afdeling Verloskunde & Gynaecologie
Erasmus MC, Universitair Medisch Centrum
Rotterdam

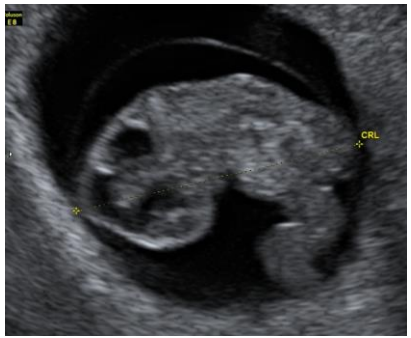
3 april 2019

Doelencongres IGO



Ultrasound in Pregnancy

- Since 1980's commonly used: 2D ultrasound
- 2007: nationwide screening program for congenital malformations
- Around 1990: introduction of 3D ultrasound



8 weeks GA

20 weeks GA

9 weeks GA

33 weeks GA

Advantages of 3D ultrasound

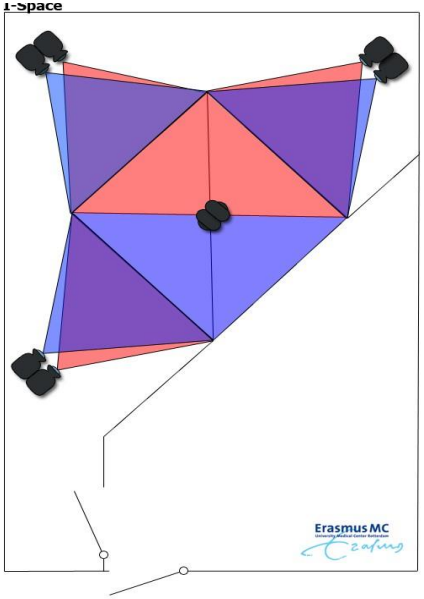
- Extra information, in particular details of external structures
- Additional value: abnormalities of external structures
- Post processing and offline evaluation
- Better understanding by parents: improved counseling

Problems with 3D ultrasound

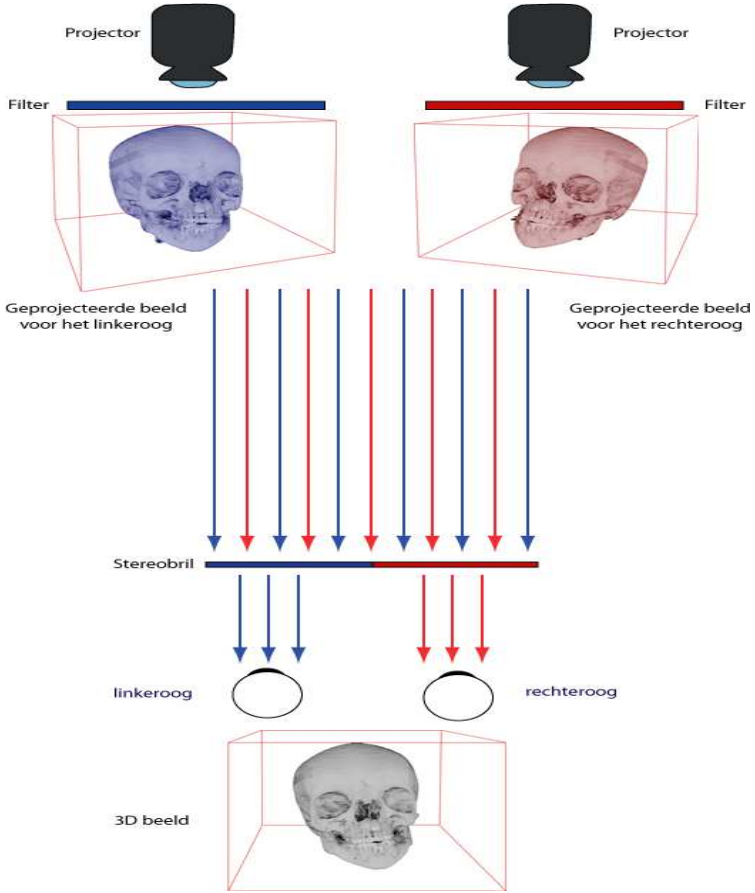
- 3D (and 4D) ultrasound: the third dimension is not used to its fullest
- Evaluation from either paper or a computer screen, i.e. a 2D medium; which does not allow depth perception
- Virtual reality system (V-scope software): is used to investigate the benefits of the third dimension in the evaluation of 3D ultrasound datasets

Virtual Reality: concept

- Virtual reality: ‘Hologram’ created by V-Scope Software
- Depth perception by stereoscopic imaging



Stereoscopic Imaging

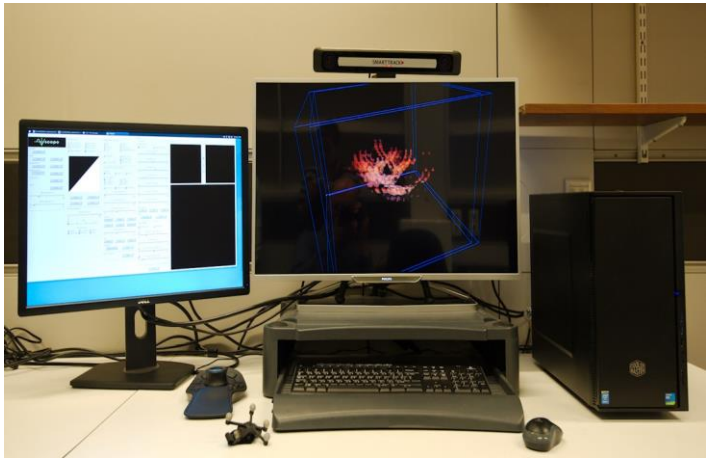


Virtual Reality: Desktop

Desktop VR system =

1. 3D Monitor
2. Smarttrack

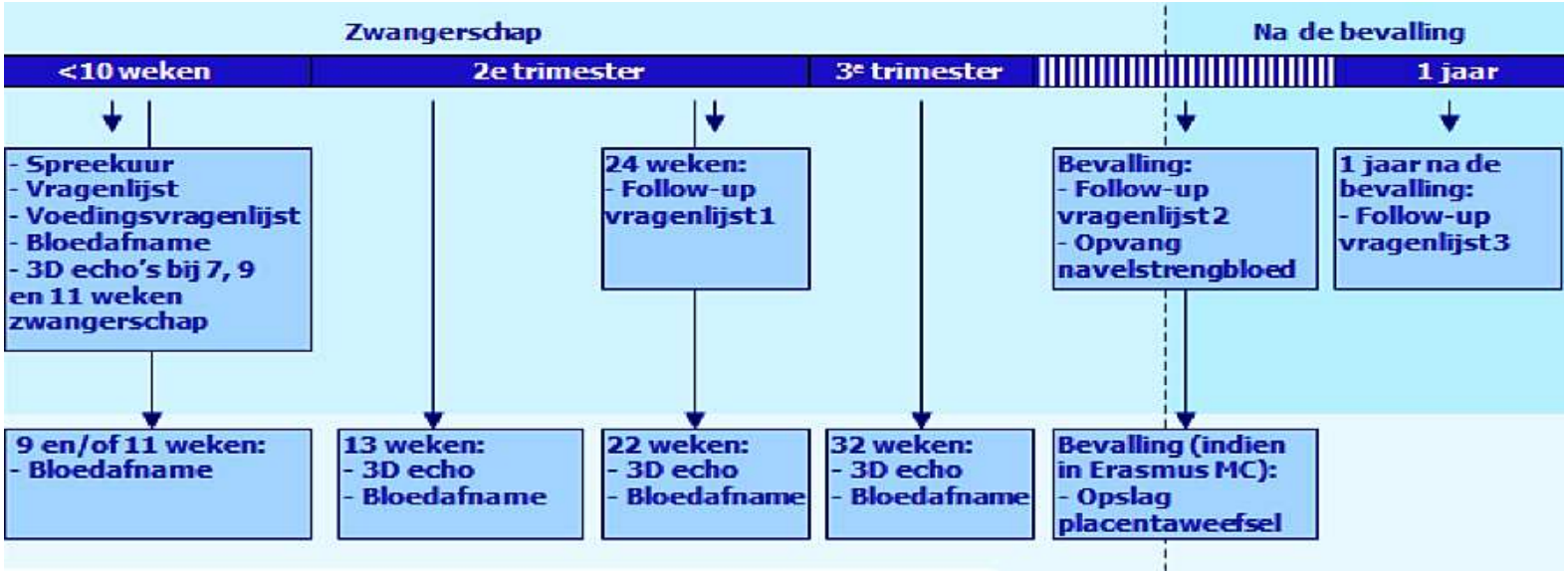
- Affordable
- Practical
- Adaptable



Baken *et al.*, J Clin Ultrasound, 2015

Virtual Reality markers: development

Research setting:
Rotterdam Periconception cohort (Predict Study)



Steegers-Theunissen et al., 2016, Int J Epidemiol

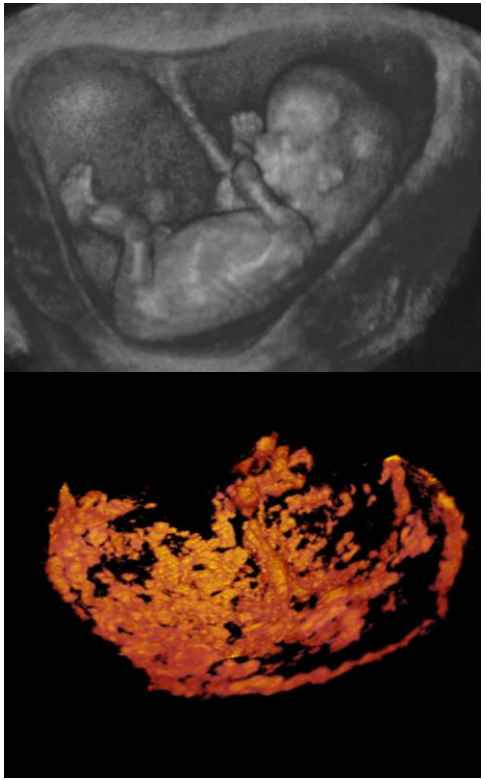
Applicablity VR Imaging

1. To asses the reproducibility and reliability of biometric and volumetric measurements performed

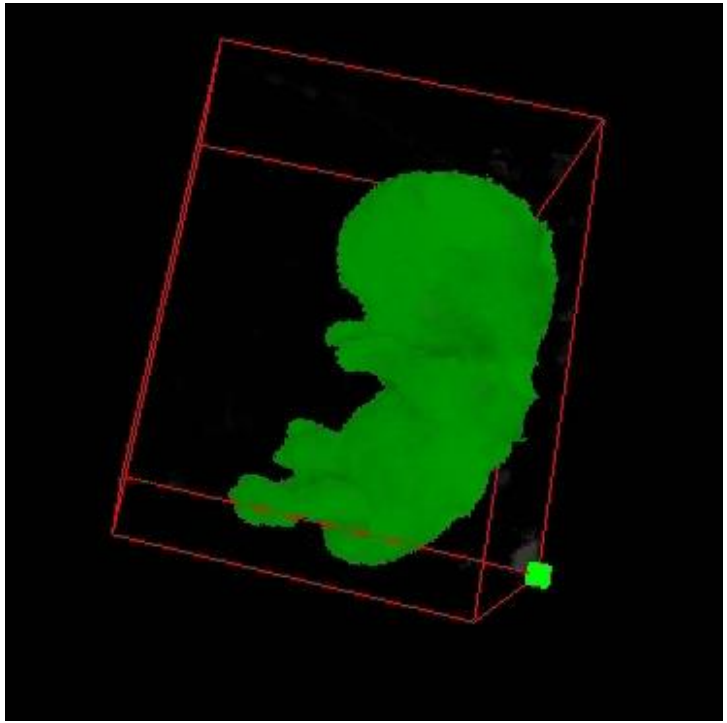
2. To study embryonic growth and development using old and newly introduced measurements

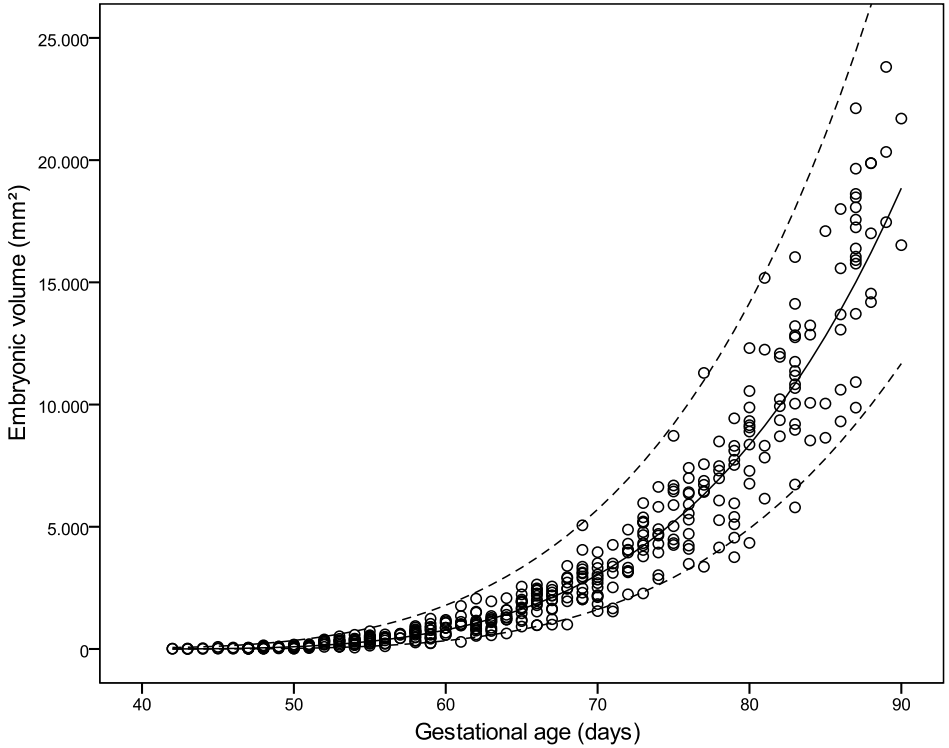
3. To study placental health throughout pregnancy

4. To study clinical applicability for diagnosing fetal abnormalities



Virtual Reality Embryonic growth



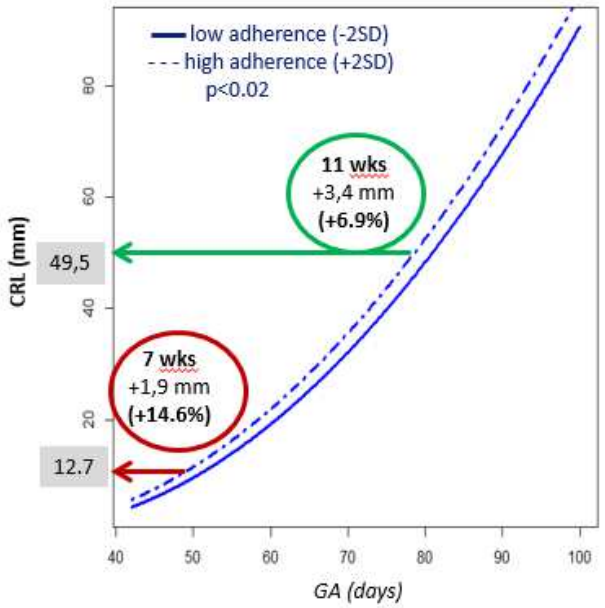


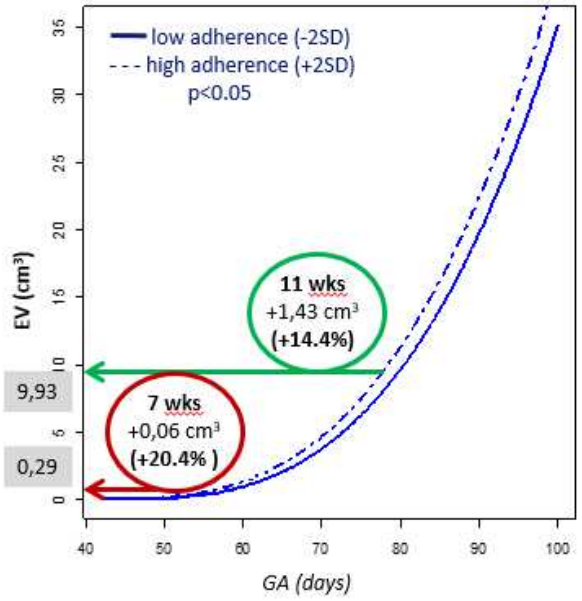
Rousian et al., Placenta, 2018

Virtual Reality: Embryonic health

Maternal periconceptional **fish and olive oil rich dietary pattern →**

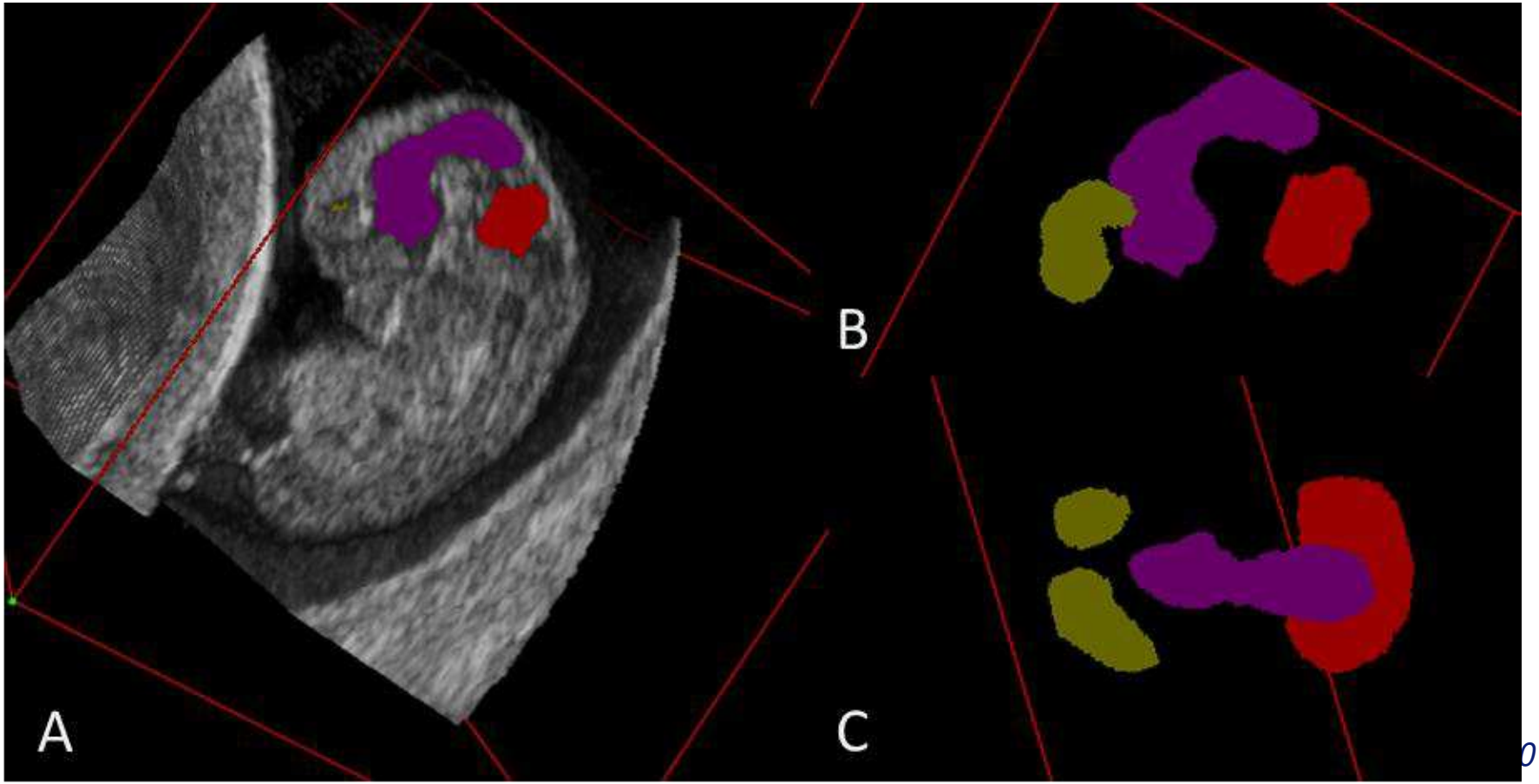
↑ ***embryonic growth trajectories***





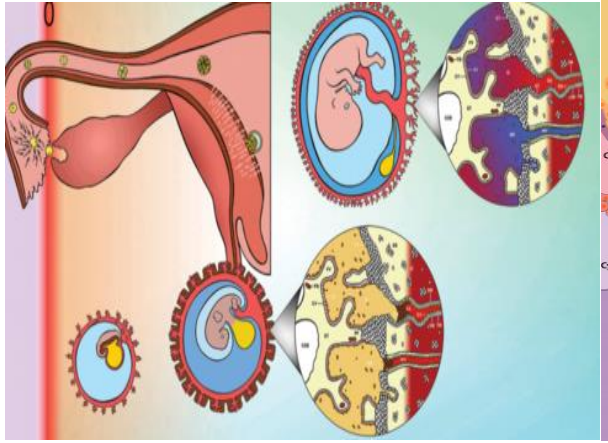
Parisi et al., Eur J Clin Nutr, 2018

VR Embryonic development: brain

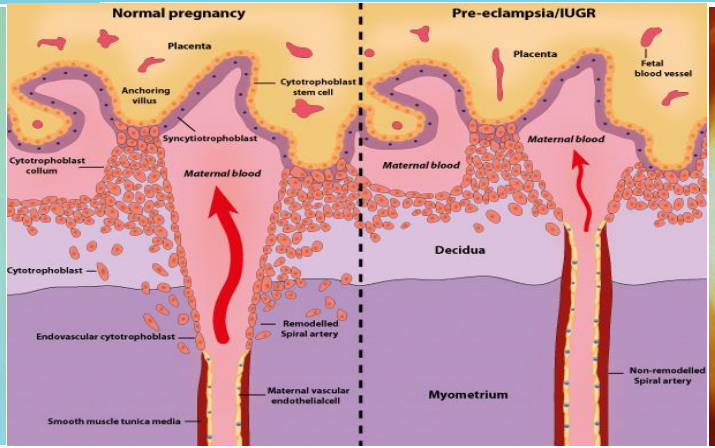


Virtual Reality: Placental health

First trimester of pregnancy



Placental development



Fetal health

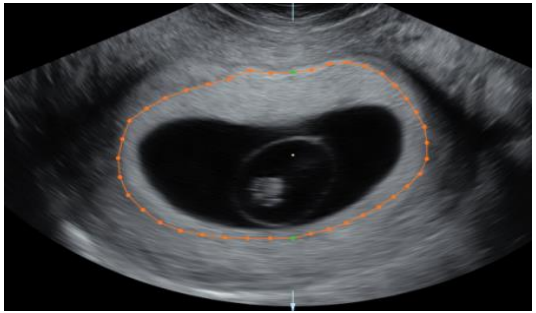
Adapted from: Steegers-Theunissen, Hum Reprod Update 2013; Burton et al, Placenta 2009

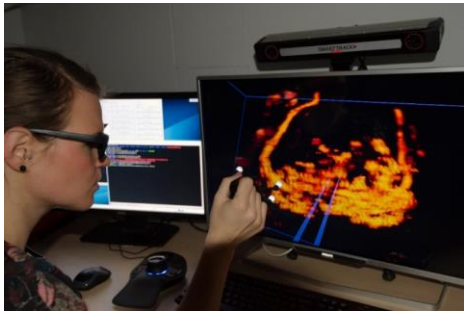
Virtual Reality: Placental health

> VIRTUAL placenta study: embedded in Predict study

<u>Placental health (growth and development):</u>

- Placental volume (PV) (VOCAL)
- Placental vasculature volume (PVV) (VR measurement)





Concept: placental vascular volume

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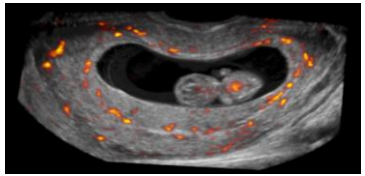
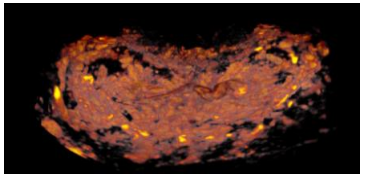
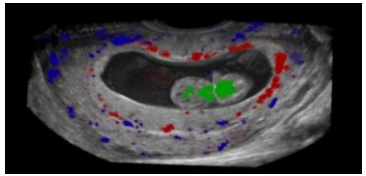
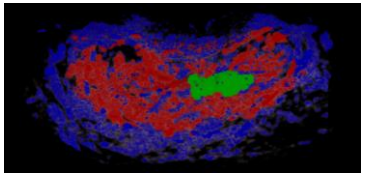
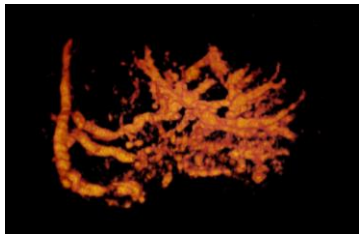
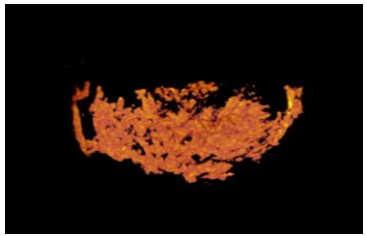
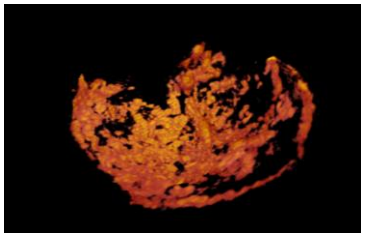
A. Slice view ***B. Volume view*** ***C. Marked slice view*** ***D. Marked volume view***

7 weeks GA (n=10) 9 weeks GA (n=10) 11 weeks GA (n=10)

0.40 cm^3 [0.08-0.99] 4.83 cm^3 [1.81-9.03] 8.04 cm^3 [2.07-20.58]

ICC > 0.8

Reijnders et al., Placenta, 2018

Placental (vascular) growth and pregnancy complications

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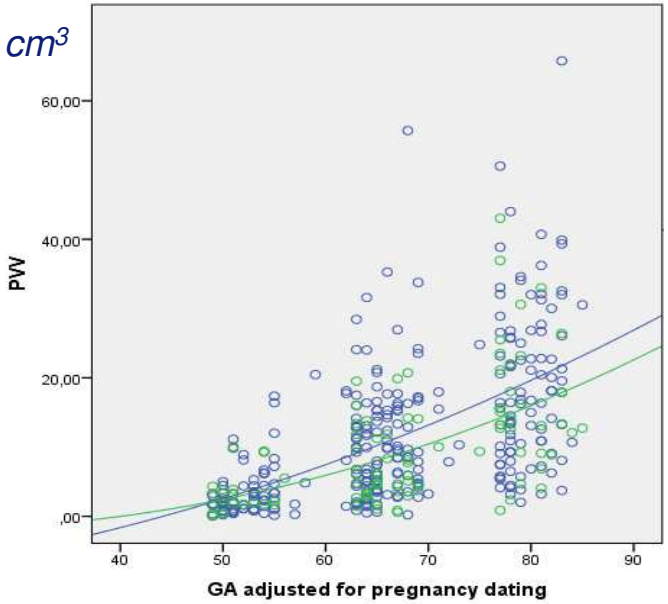
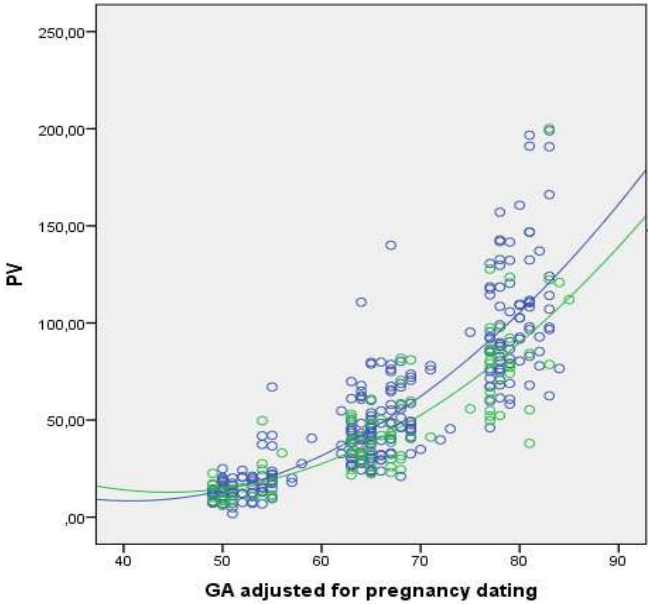
- Cases (n=41): pregnancy induced hypertension, preeclampsia, small for gestational age, fetal growth restriction and preterm birth
- Controls (n=173): uneventful pregnancy





Reijnders et al., preliminary data

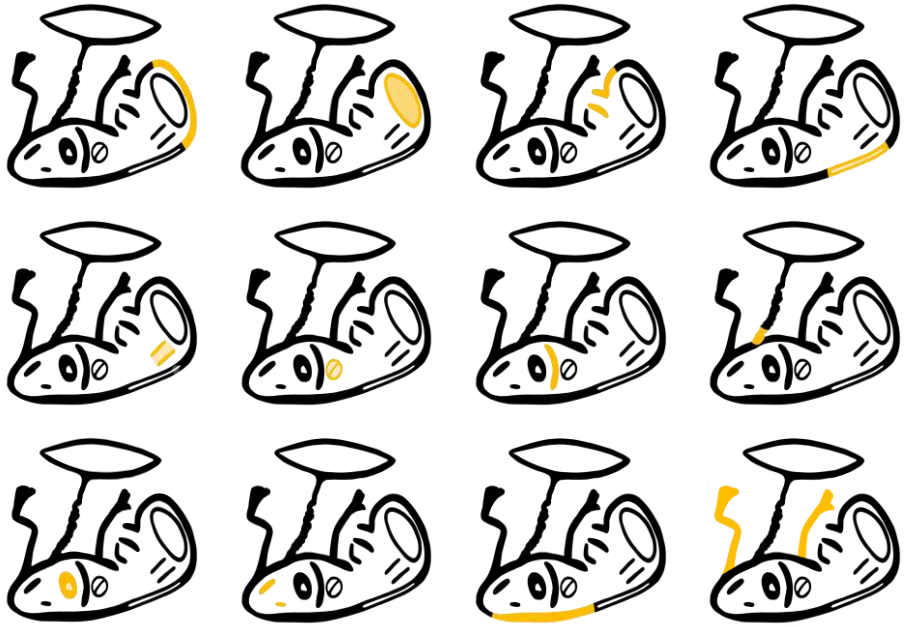
Virtual Reality: Fetal growth en development

- 12+2 weeks' GA
- Exencephalos
- Absent Radius
- Spina Bifida
- Omphalocele
- SUA
- Polydactyly

Baken et al., Biomed Res Int, 2017

First trimester ultrasound: Big 8 anomalies

- Anencefaly/Acrania
- Holoprosencephaly
- Exencephaly
- Enlarged NT/Hygroma Colli
- Omphalocele
- Megacystis
- Body stalk anomaly/
  Siamese Twins
- Lethal skeletal dysplasia



Syngelaki *et al.,* Prenat Diagn, 2011; Kenkhuis *et al.,* Ultrasound Obstet Gynecol, 2018

Virtual Reality: Fetal growth en development
Clinical practice

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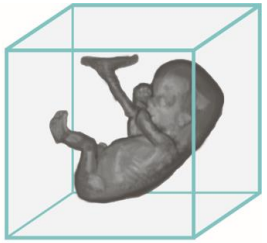
VR FETUS study



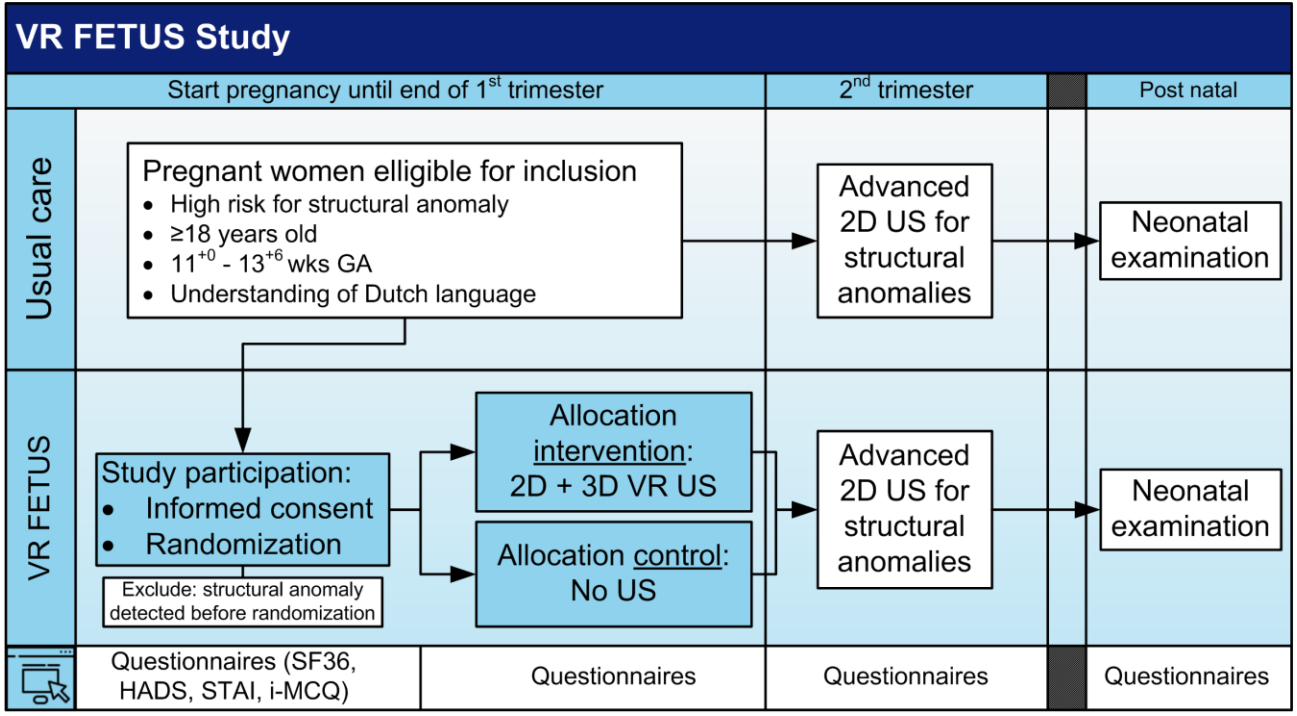
***V**irtual*
***R**eality &*
***F**easibility and*
***E**fficacy of first*
***T**rimester*
***U**ltra*
***S**ound:*
a randomized
controlled trial

VR FETUS study

- Hypothesis: Detection rate of 3D VR US at 13 wks = 2D US at 20 wks; with comparable detection rates, early diagnosis will improve quality of health
- Primary objective: To assess the detection rate of congenital anomalies using 13 wk 3D VR ultrasound
- Secondary objective: Anxiety, stress, depression
  Quality of Life (QoL)
  Cost-effectiveness
- Tertiary objective: Patient and clinician satisfaction

Study Design

Sample size: n=4000; Duration:July 2017 – July 2021



Actual inclusion:
~ 850 participants

Virtual Reality Ultrasound: Conclusions

- VR Allows *in vivo evaluation* using all three dimensions, based purely on the internal and external morphologic characteristics
- Provides knowledge on embryonic and placental growth and development
- Useful in differentiation between normal and abnormal fetal structures
- Unique basis evaluation of embryonic, fetal and placental health

Acknowledgements

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drs. M. Husen - Ebbinge

drs. S.C. Husen

drs. P.C. Schut

drs. M.C. de Wit

K. den Hollander

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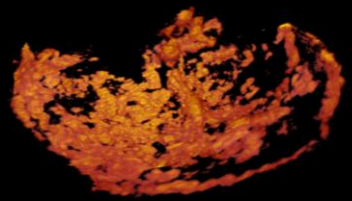
drs. A. Frudiger

drs. A. Kropman



VR Desktop demonstratie in koffiepauze