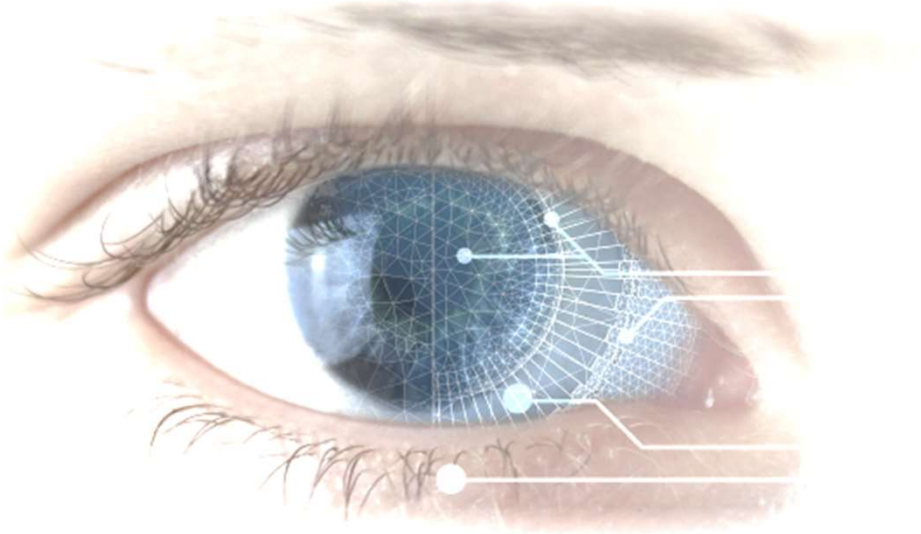
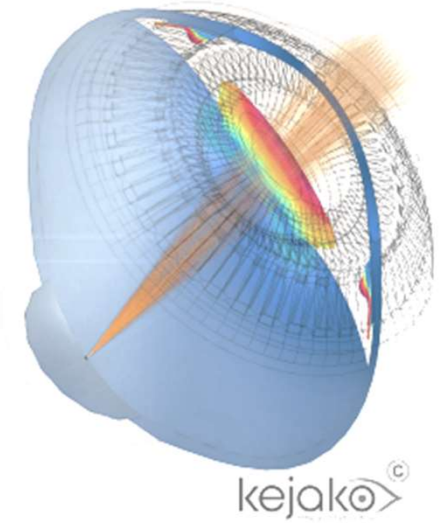
SIMULATION
TO CURE
VISION





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Your eyes are amazing…

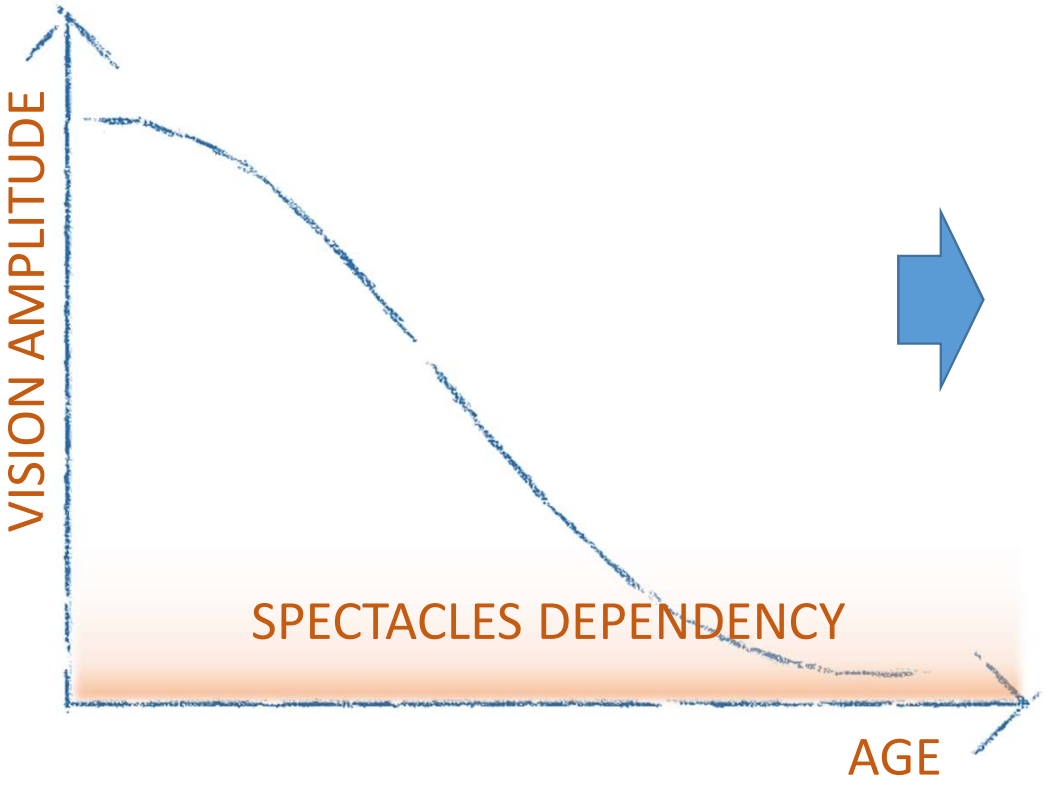
ACCOMMODATION : FOCUS FROM INFINITE OBJECT TO CLOSE OBJECTS

… but they are getting old…

… until your arms are too short.

This is
Presbyopia

Presbyopia

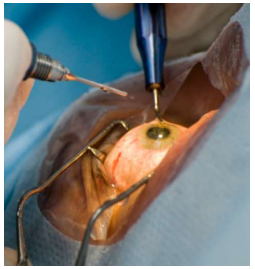


2 BILLION presbyopes in the world by 2020

… A progressive loss of your accommodation amplitude

Clear unmet medical need

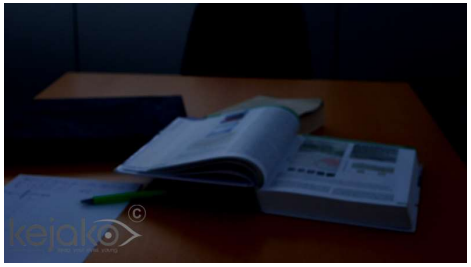
or



Invasive surgery and still visual compromises:

Halos

Glare



Poor acuity in dim light

Is there *another option* ?

Kejako's Quest

A lot of accommodation theories from Descartes to now

=

A lot of claims about the causes of presbyopia

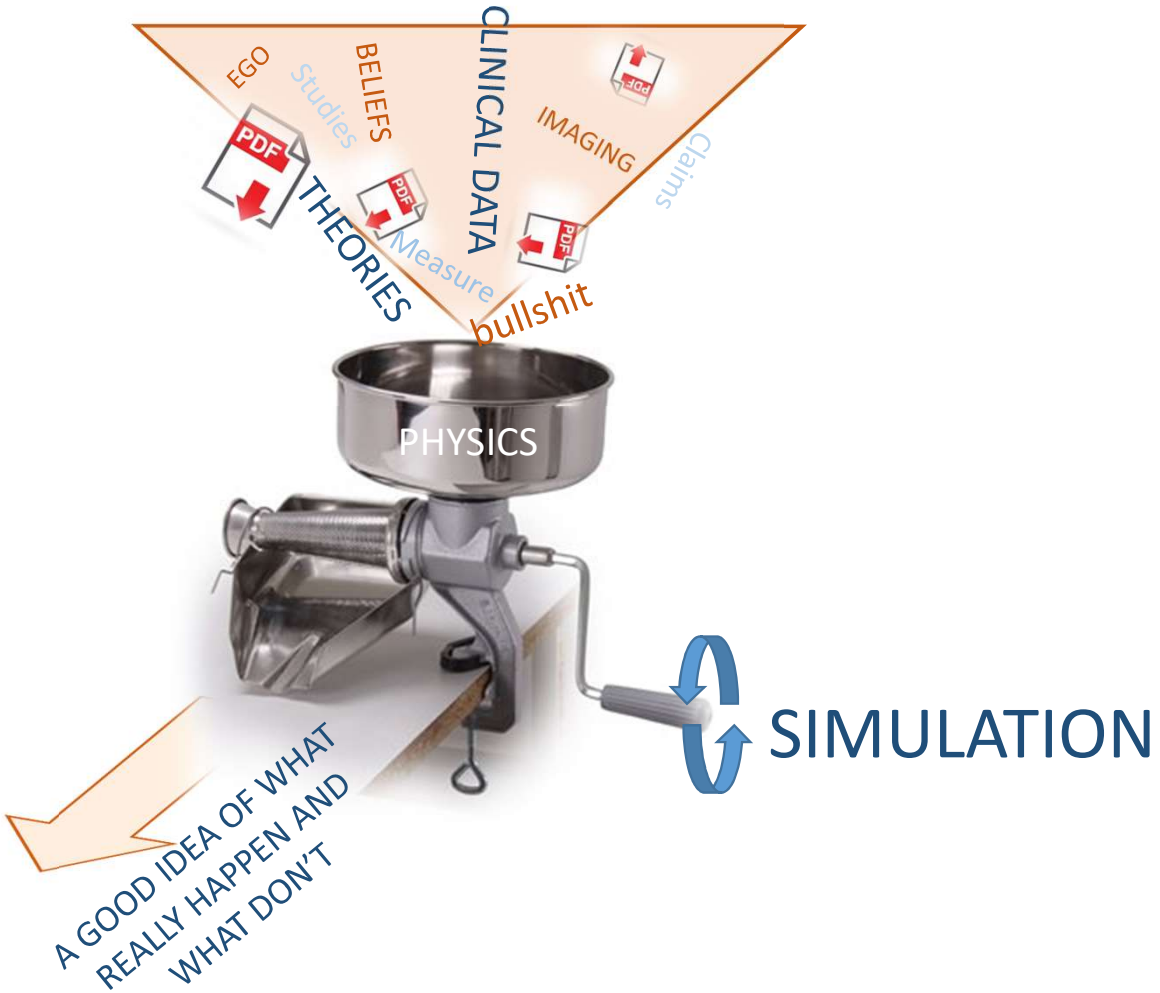
→ Still not everyone agrees ☹

RATIONALISM

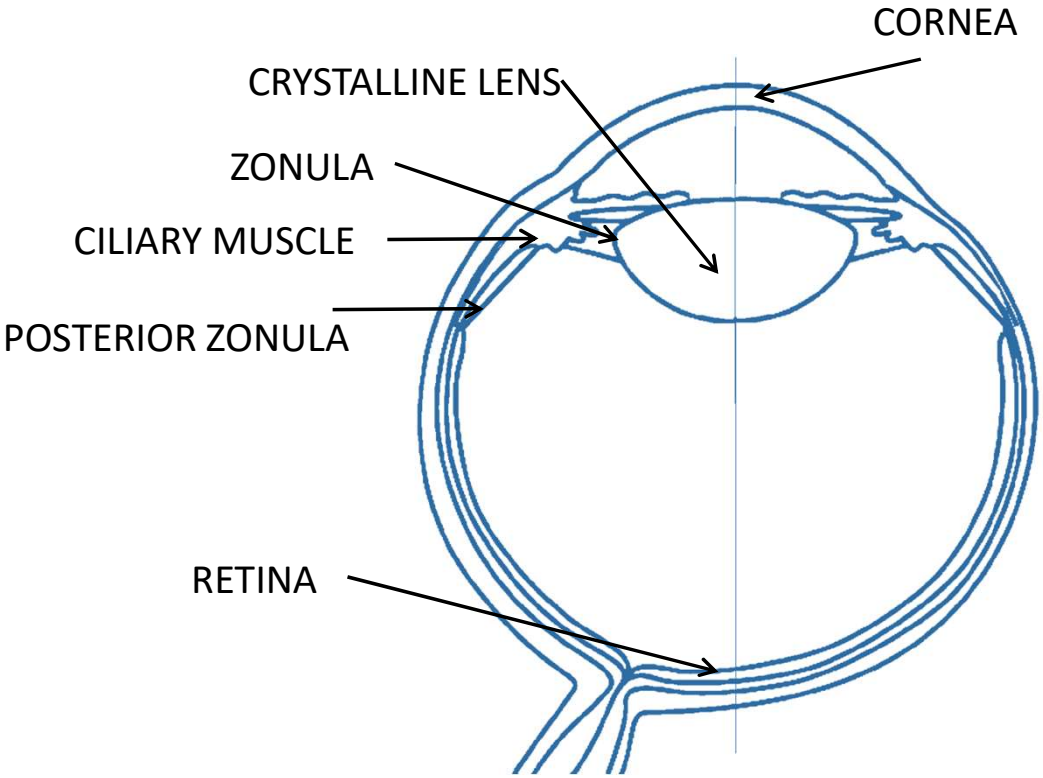
VS

BELIEFS

Kejako's quest

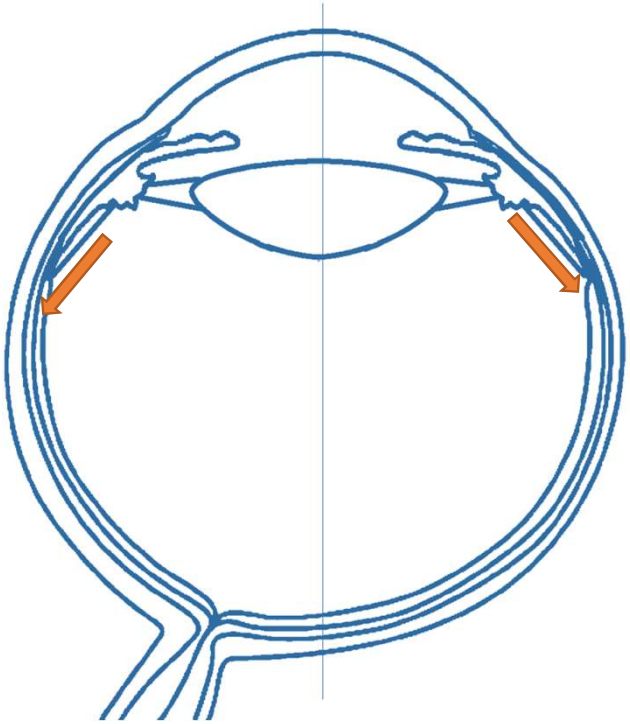


Why simulation ?



- **Multi-components & interactions**

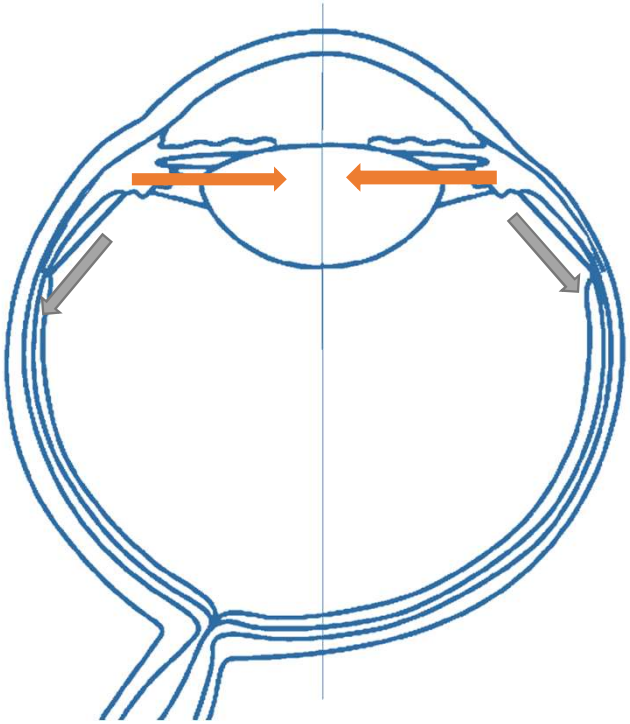
Why simulation ?



FAR VISION

- Multi-components & interactions
- **A biomechanical process**

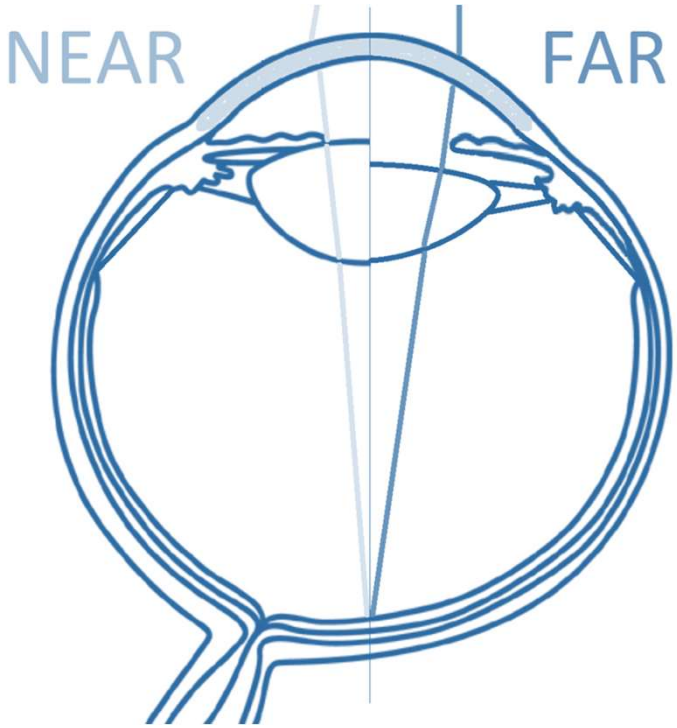
Why simulation ?



NEAR VISION

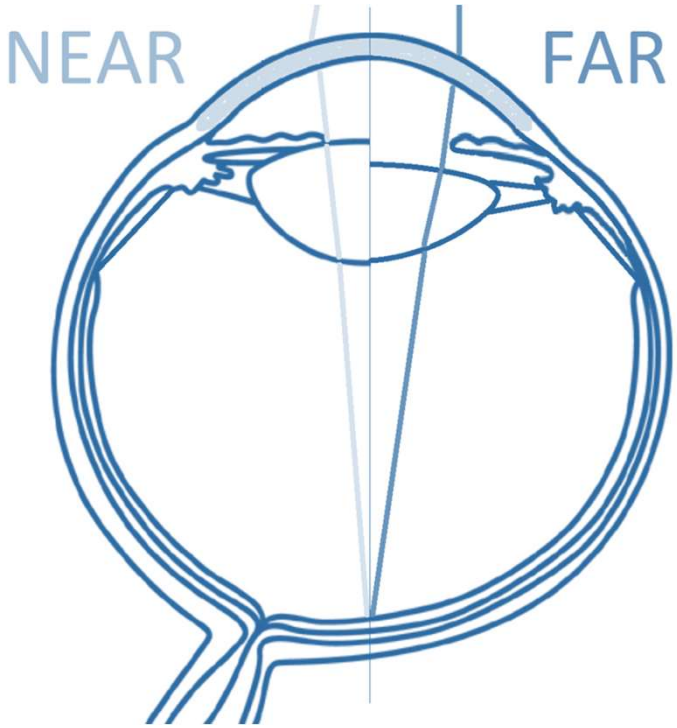
- Multi-components & interactions
- A biomechanical process
- **Fluid interaction**

Why simulation ?



- Multi-components & interactions
- A biomechanical process
- Fluid interaction
- **Optical consequences**

Why simulation ?

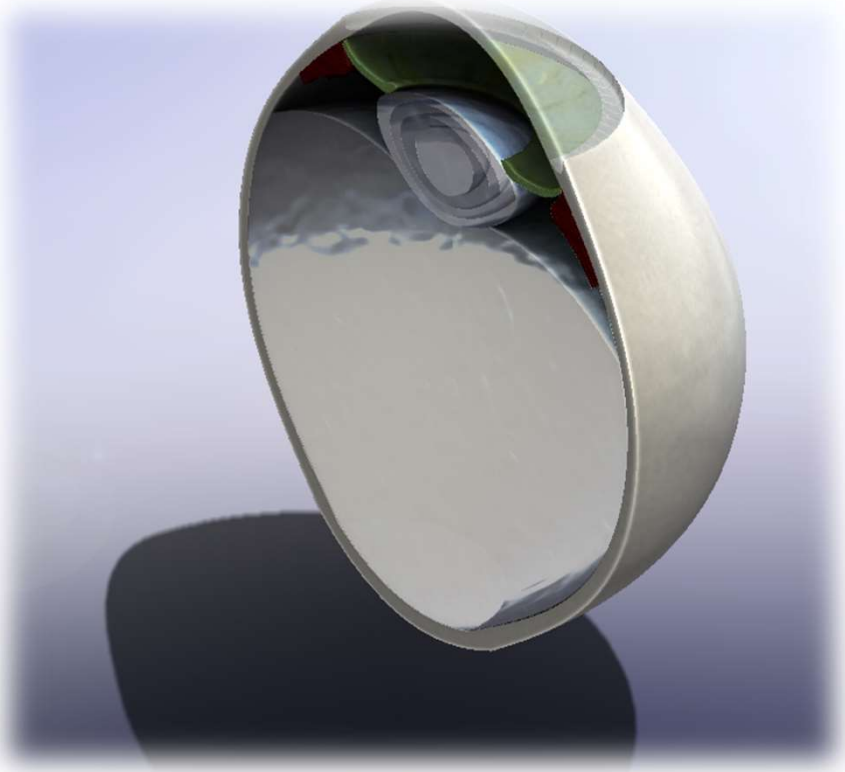


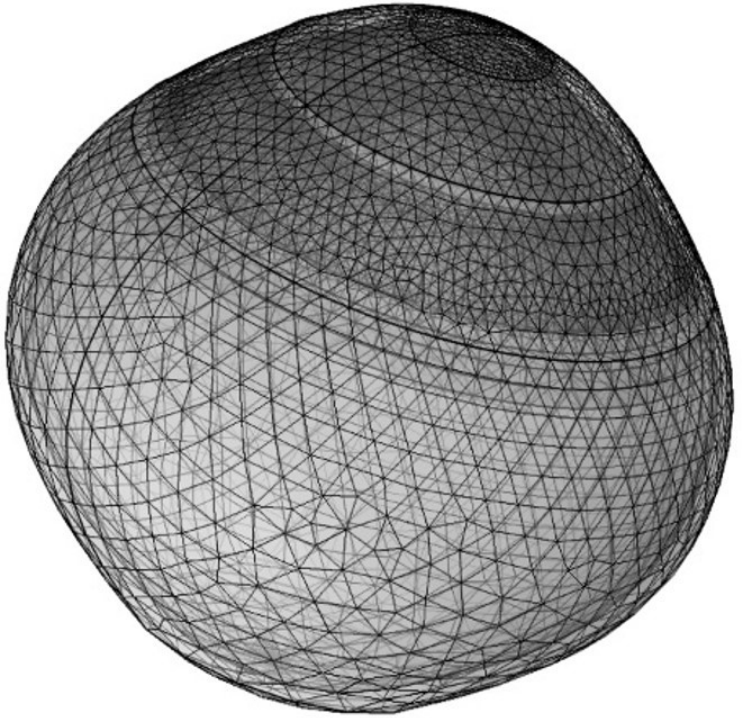
- A lot of components & interactions
- A biomechanical process
- Fluid interaction
- Optical consequences

A COMPLEX MULTIPHYSICS PROBLEM

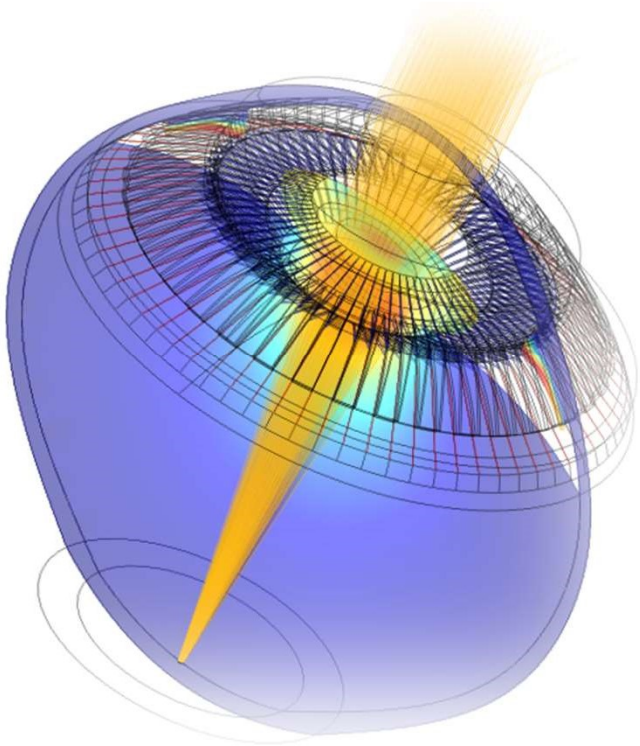
COMSOL MULTIPHYSICS®

3D parametric full eye model





3D parametric full eye model

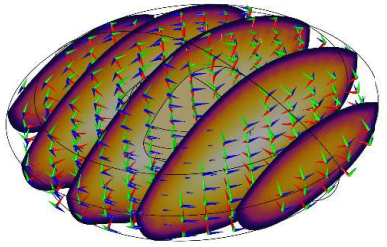


NON EXHAUSTIVE LIST:

Structural Mechanics
-> Shell/Membrane/Solid/Truss coupling
-> Contact modelling
-> Fluid structure interaction

Nonlinear Structural Materials
-> Anisotropic fibrous biological tissues

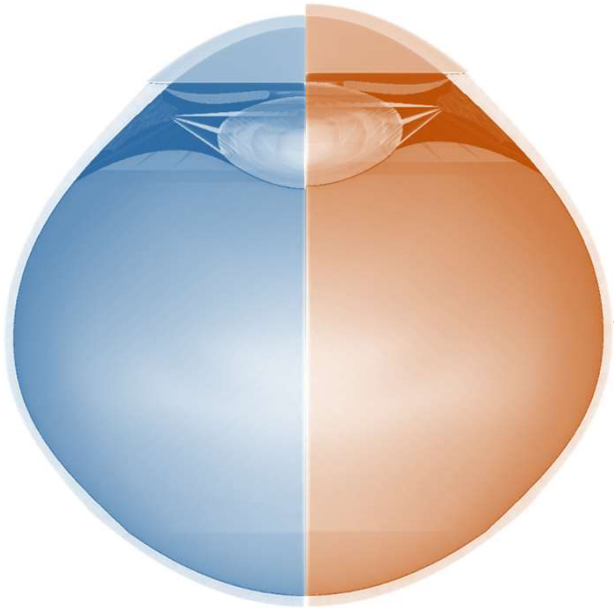
Ray Optics
-> Gradient of refractive index
-> Tissue absorption
-> **Objective optical evaluation**



& More

COMSOL MULTIPHYSICS®

Model of aging and presbyopia



Aging of the geometry

+

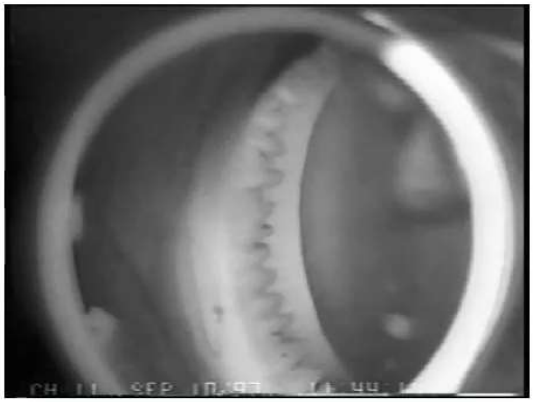
Aging of material properties

↓

Accurate prediction of presbyopia
from modelling ?

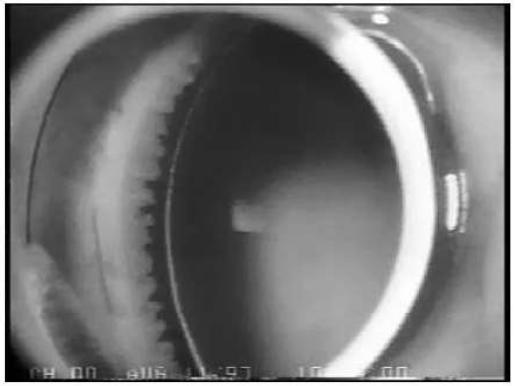
Simulation vs Reality

Young



Courtesy: Adrian Glasser

Old



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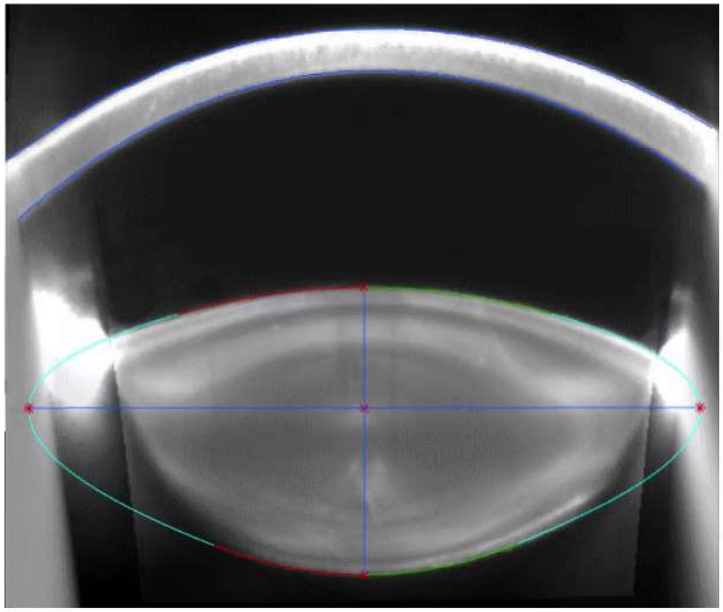
Scheimpflug Imaging,
Accommodating Human Eye (20y, 5D stimulus)

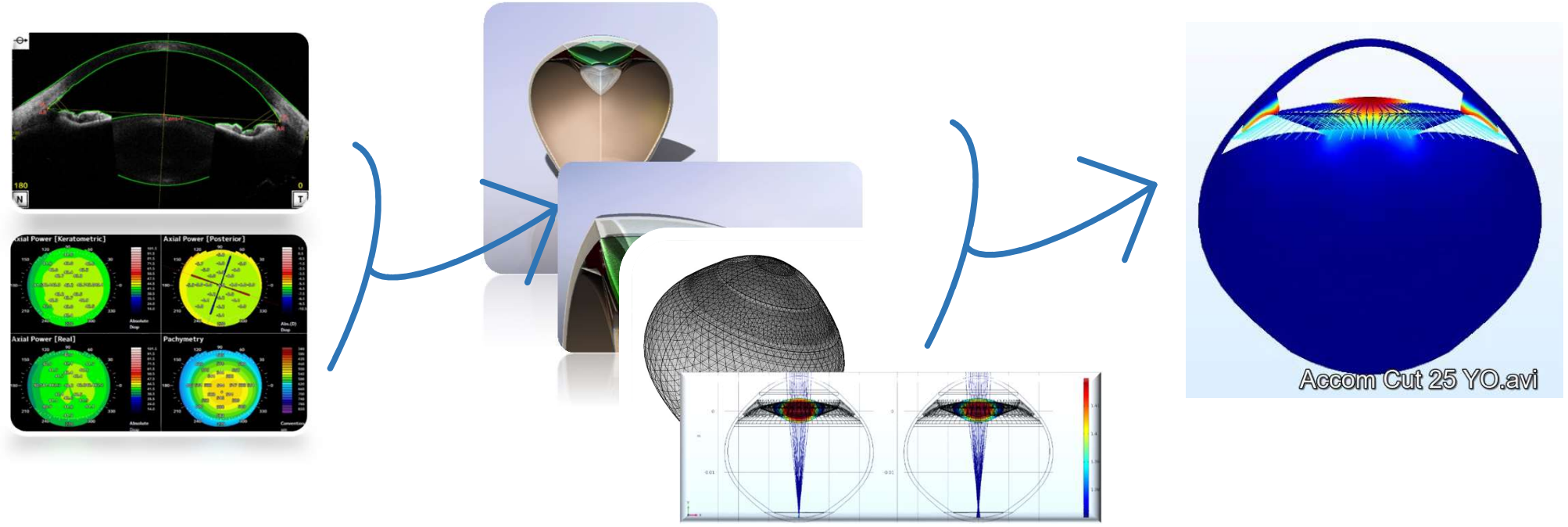


Courtesy:

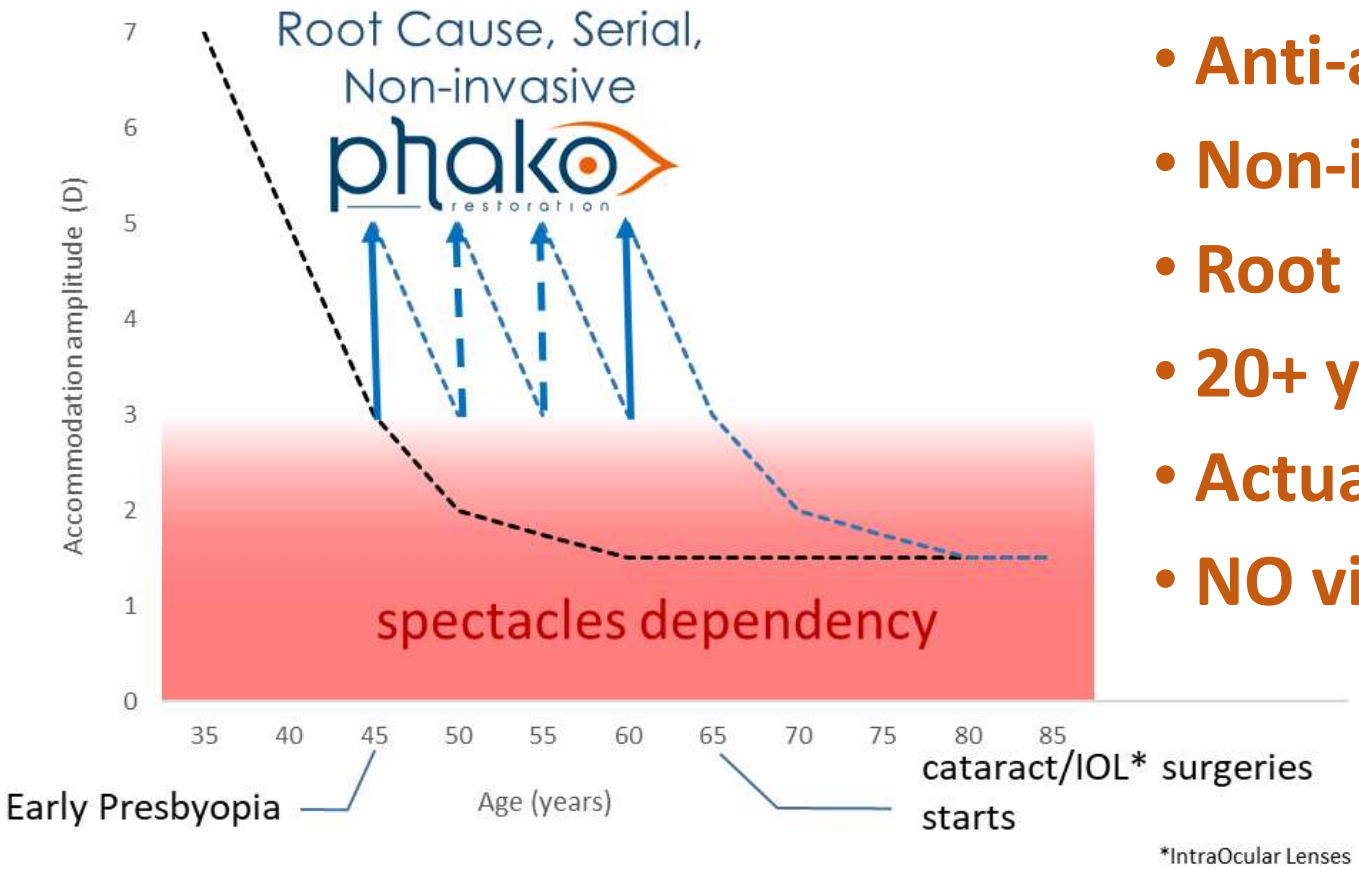
M. Dubbelman

Model of aging and presbyopia

From patient imaging to simulation

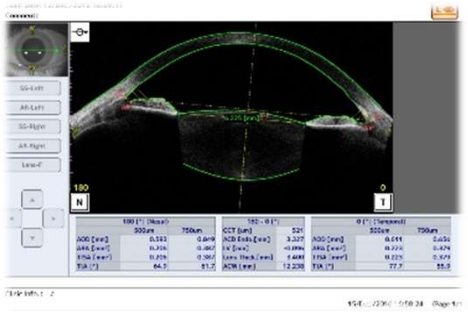


Kejako's mission



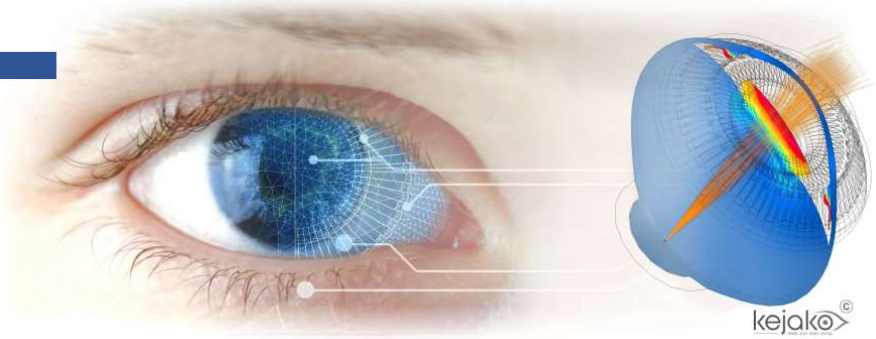
- **Anti-aging**
- **Non-invasive**
- **Root cause treatment**
- **20+ years glasses-free**
- **Actual visual accommodation**
- **NO visual compromises**

Engineering + Medtech+ COMSOL MULTIPHYSICS®



Standard imaging

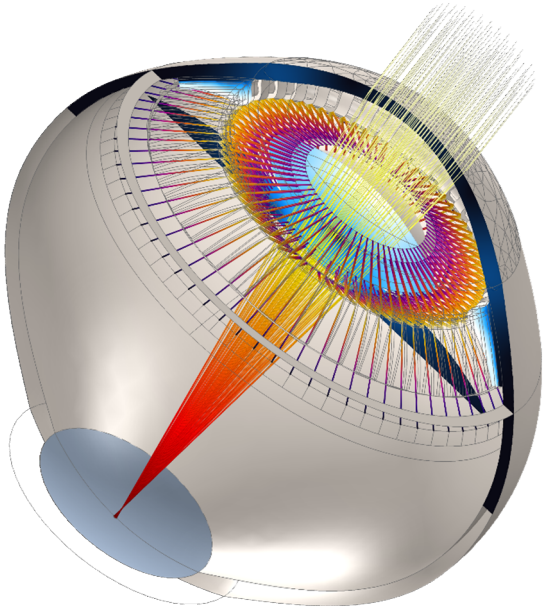
+



Customization by 3D parametric eye model

= Personalized phako restoration procedure

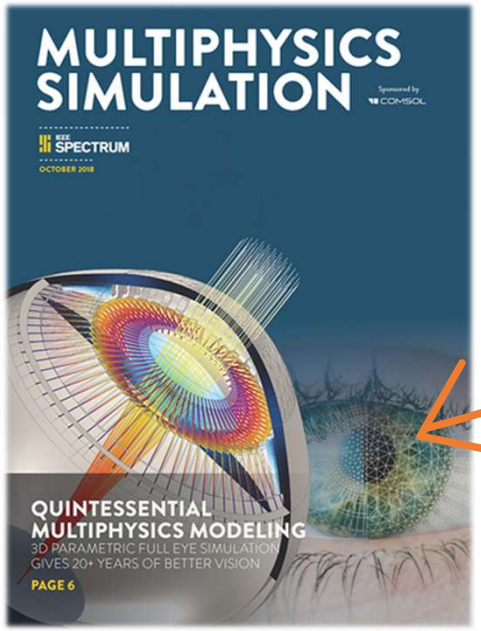
Simulation as core competence
(now)



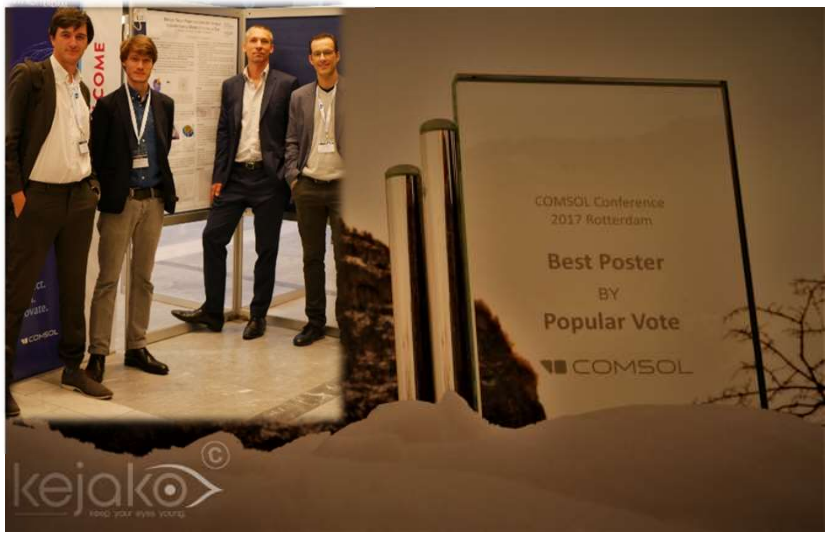
- Accommodation understanding tool
- Identify & weight root causes of presbyopia
- Evaluation & design of solutions (4 patents now)
- Numerical POC
- Personalized ophthalmology
- Internal sub-app for productivity/research (Check poster n° 112 !)
- Base for simulation services in ophthalmology
- Other eye diseases solution design & more !

kejako
keep your eyes young

Thank you
for your attention !
(And special thanks to COMSOL support!)



Find out more
In this October release !



Last year best poster award (public vote)
COMSOL Conference 2017 Rotterdam

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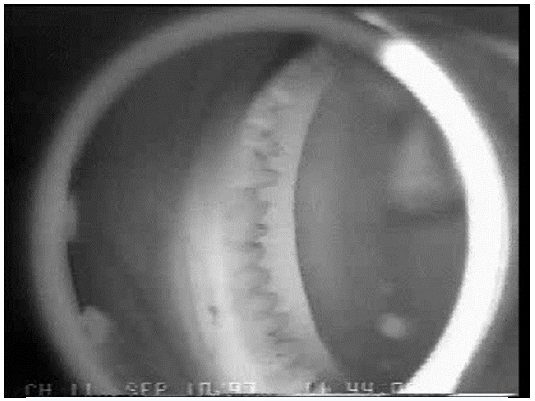
Questions ?

Simulation vs Reality

Young



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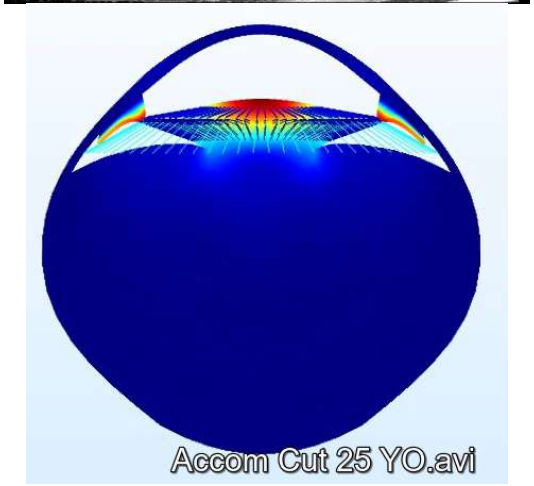

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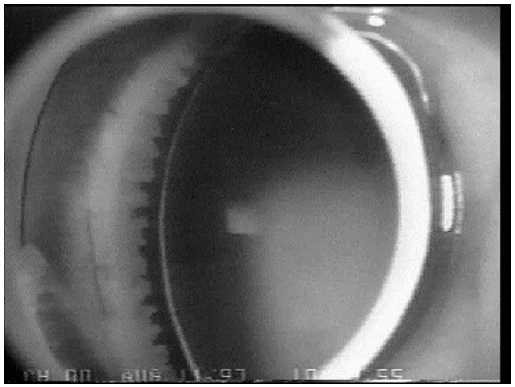

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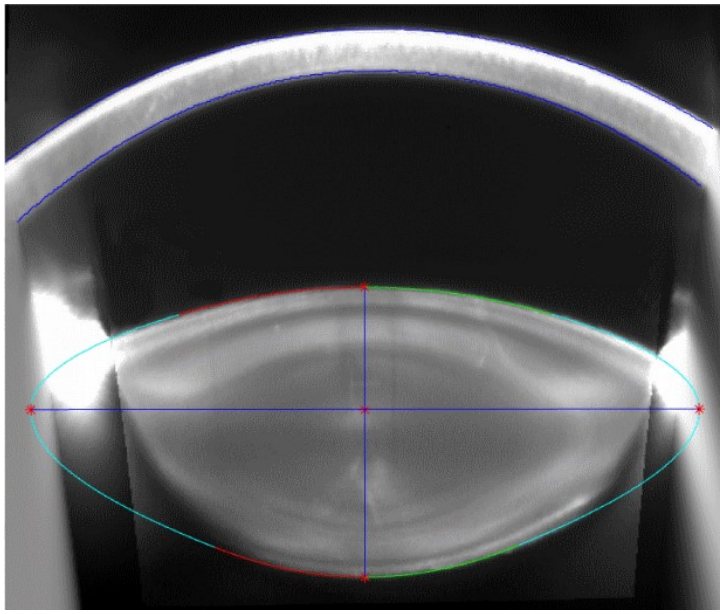

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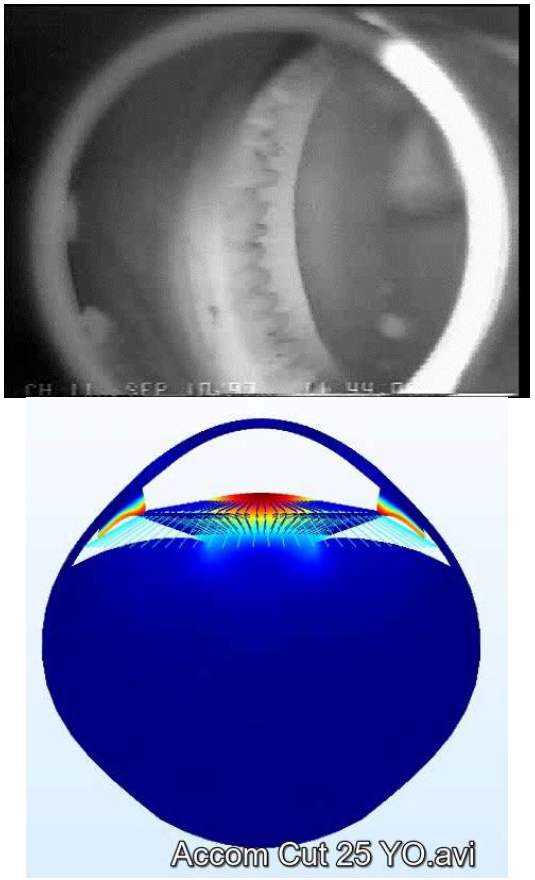
M. Dubbelman

Simulation vs Reality

Young



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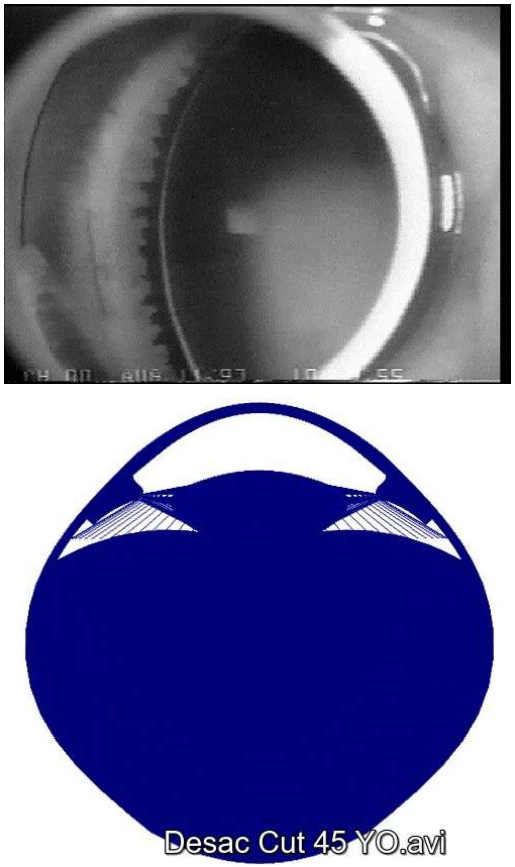

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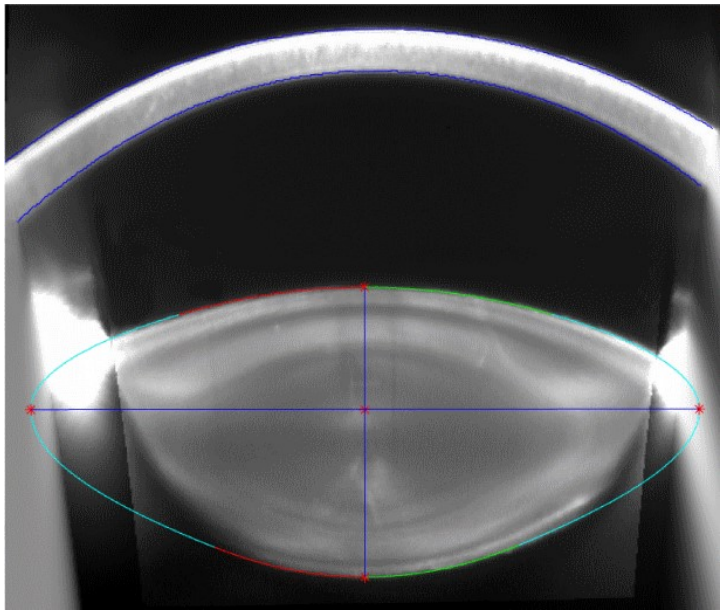

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