COLLABORATIVE VIRTUAL REALITY

for Rhinology

DEC 09, 2020 I ANDREAS FRANKEN

RHINO
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DIAGNO⌀T
funktionelle Präzisionsdiagnostik der Nase

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AGENDA

Virtual Reality

Collaboration

Hardware

Software

Collaborative VR

HPC

CollaboRhino App

Outlook

Discussion

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Definition

Motivation & Result

Outcome

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VIRTUAL REALITY
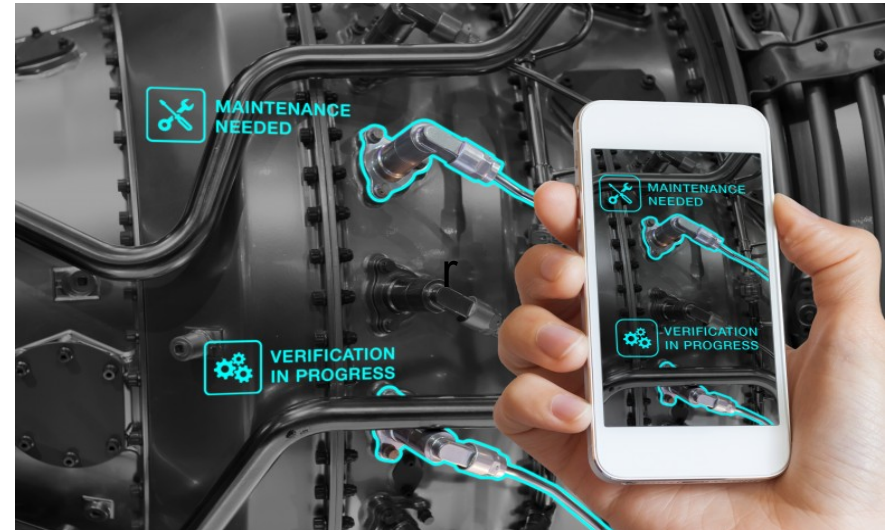
is not just for gaming

Gaming

- Huge investments
- Powerful 3D Engines

Industry

- Architecture Design
- Industry Design
- Training

Science

- Visualization
- Simulation

VIRTUAL REALITY

feels quite natural

Intuitive usage

- Look around

- Walk through geometry

COLLABORATIVE WORK

growing importance especially since Corona

Studies

- Improved learning outcome related to cognitive processes

- Assists professional preparation (e.g. medical education)

- Social skills and language perfection

Online Collaboration

- Software supported in many ways (roadmap, meetings)

- Collecting and storing knowledge for a whole group

- Work with others from any location

HARDWARE

Computer

+ Possibility of high performance → increased image quality

+ Remote Desktop → Increased security

+ Expandable and versatile

- Only 2D Presentation without special devices

- Stationary device

HARDWARE

Virtual Reality Headsets

+ Several compatible products on market

+ Today it's just like buying a printer

+ Immersive interaction within the 3D envinronment

- Higher costs due to powerful hardware

- User can only see 3D, no surrounding

- Motion sickness

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HARDWARE

Smartphones

+ All the time and everywhere mini computer

+ Also cheaper models offer 3D hardware acceleration

+ Multipurpose usage (communication, VR, AR)

- Small display

- Many are less powerful → reduced image quality

HARDWARE

Augmented Reality Glasses

+ Standalone models → no need of computer connection

+ Lightweight and easy to use

+ Mixed Reality with environment

- Less powerful → reduced image quality

- Just a few products on the market

- Smaller view space
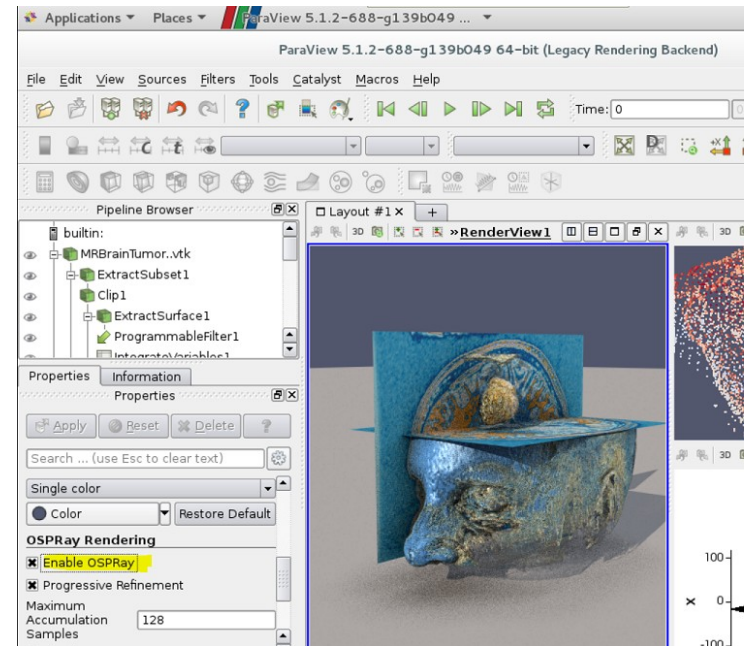
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SOFTWARE

ParaView (Kitware)

+ Commonly software used in science

+ Basic VR rendering

+ Supports many file types

+ Programmable (Filter, Interface,

                    Import/Export)
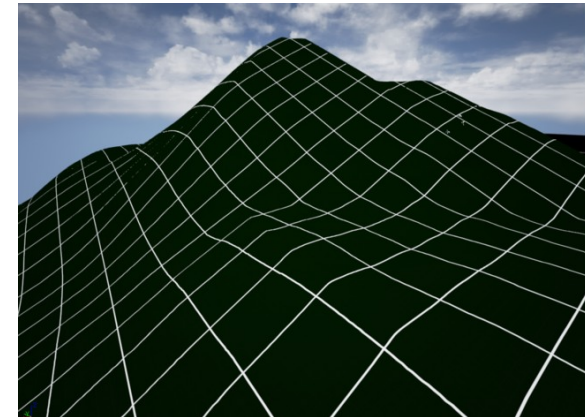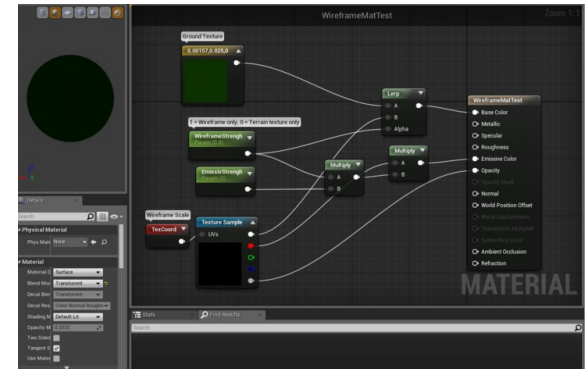

- User Interface and Bugs

- High training period

SOFTWARE

Unreal Engine (Epic Games)

+ Widely used 3D Engine

+ Supports many file types

+ Programmable (C++, Visual Scripting)

+ Asset market (code, 3D environment, plugins)

+ Multi device and multi platform support


- High training period caused by versatility

Steam (Valve)

+ Widely distributed platform (> 18,8 million live users in 02/2020)

+ Ongoing development by growing games industry

+ Multi platform support (Windows, MacOS, Linux)

+ Solves distribution and networking barrier

   (Accounts, Softwareupdates,

    Session Management, Push 2 Talk)

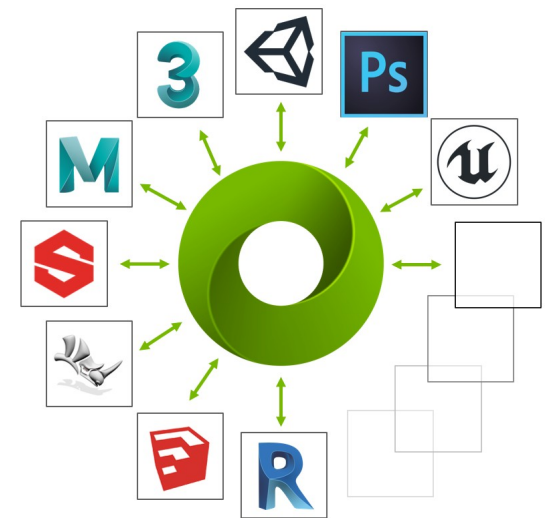- Commonly known as a gaming platform

- Account required
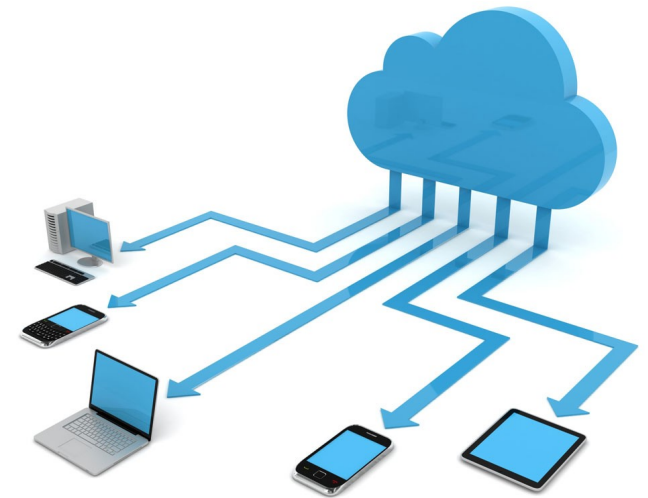
Omniverse (Nvidia)

+ Universal interoperability across applications and 3D ecosystem

+ Real-time scene updates

+ Open-standards and protocols

+ Open-source Universal Scene Description

+ Nvidia is leading in 3D accelerators

- Under development

- In Unreal Engine yet Editor only support

COLLABORATIVE VR

advantages in diagnostics and surgery

Data interpretation and modification

- More intuitive usage reduces misinterpretation

- The complexity of VR for the brain supports a new view on known things

- Usage of virtual surgical instruments
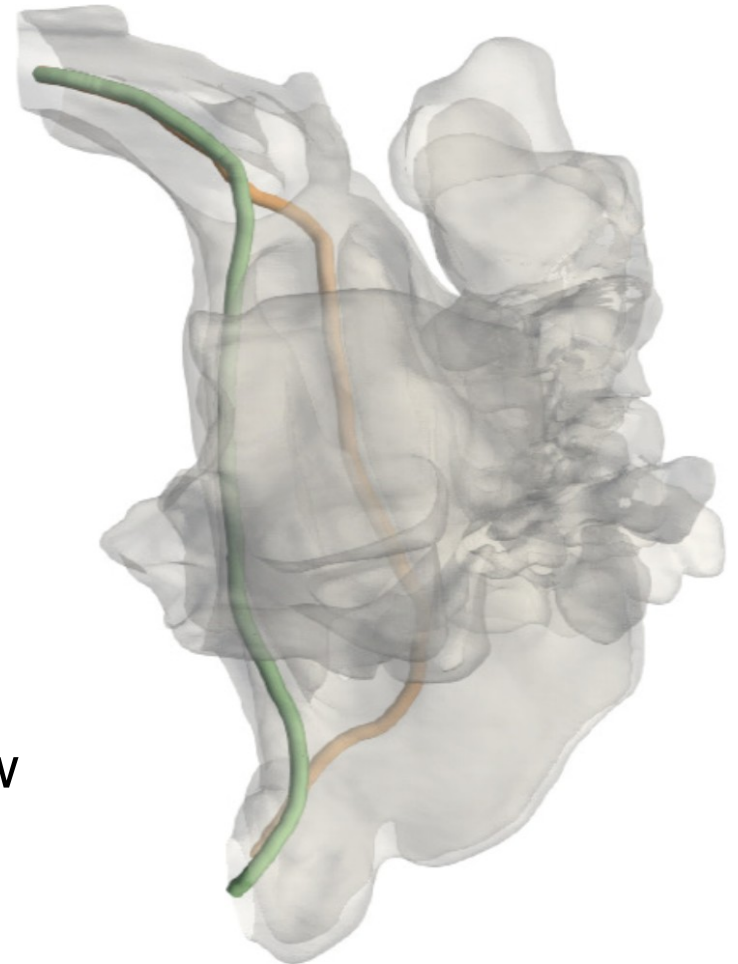
in cooperation with colleagues.

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COLLABORATIVE VR

especially in Rhinology

High complex 3D geometry

- Internal nose and respiratory tract
- Streamlines / Particles

Virtual surgery

- Geometry modification
- shows resulting changes of the airflow
- A virtual surgery is reversible

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HIGH PERFORMANCE COMPUTING

when hardware limitations are not the issue

Speed

High performance is synonymous with (very) fast calculations.

→ Fast recalculation on model changes

→ Client PC is no bottleneck anymore

Fault tolerance

If part of the system fails, the entire HPC system doesn't fail.

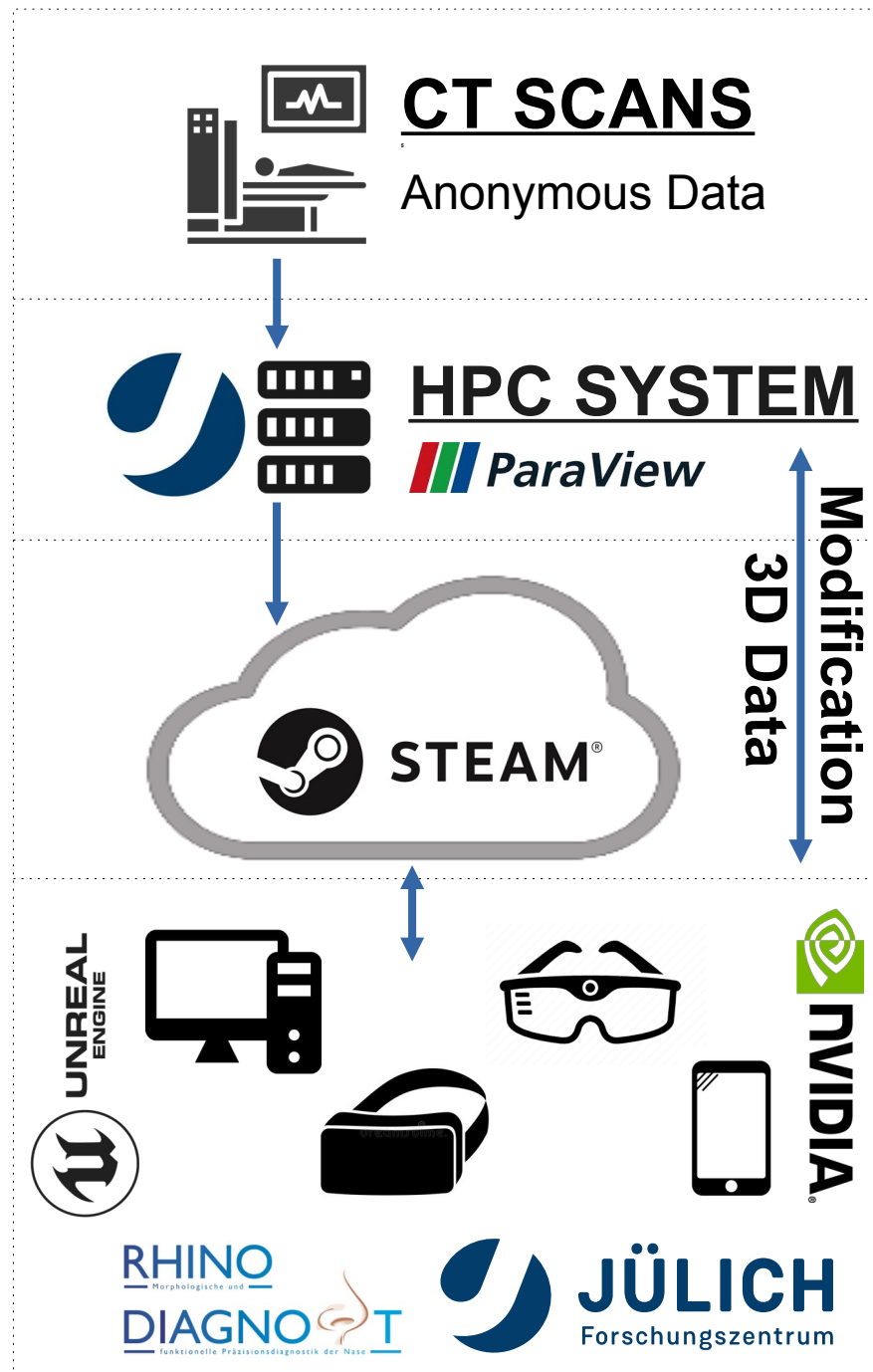→ Simple task distribution

→ Reliable task management

COLLABORHINO APP

a challenging workflow

A patient sends digitalized and anonymized CT scans to HPC System which runs the simulation and provides the data to another server or clients.
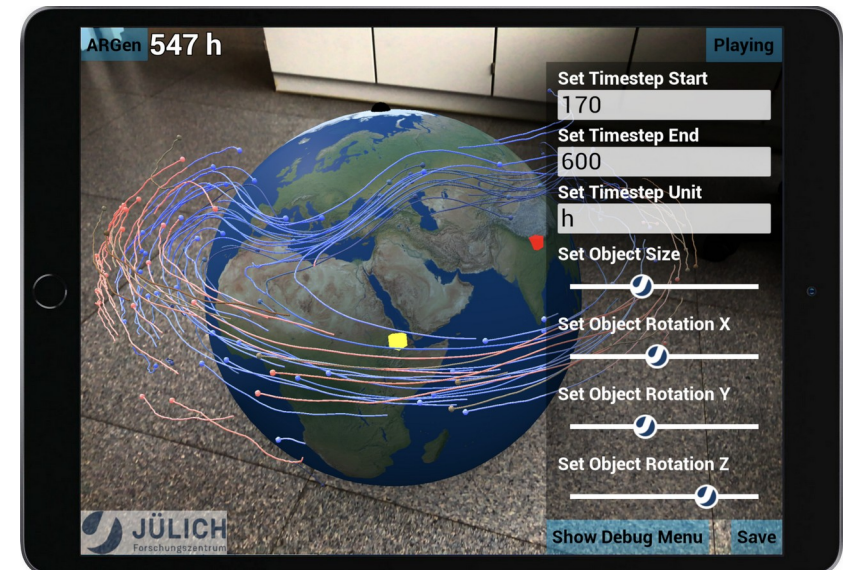
A client uses the Unreal Engine based VR/AR/Desktop application published on Steam.

Steam is managing network sessions and audio communication between multiple users which work together on the same data synchronized through Nvidia Omniverse and HPC System.

CT SCANS
Anonymous Data

HPC SYSTEM
ParaView

STEAM

Modification
3D Data

UNREAL ENGINE

NVIDIA

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COLLABORHINO APP

but flexible usage

COLLABORHINO APP

development footage

WHAT'S NEXT?

ongoing development

Extend virtual surgery to Virtual Reality headsets using hand tracking controller.
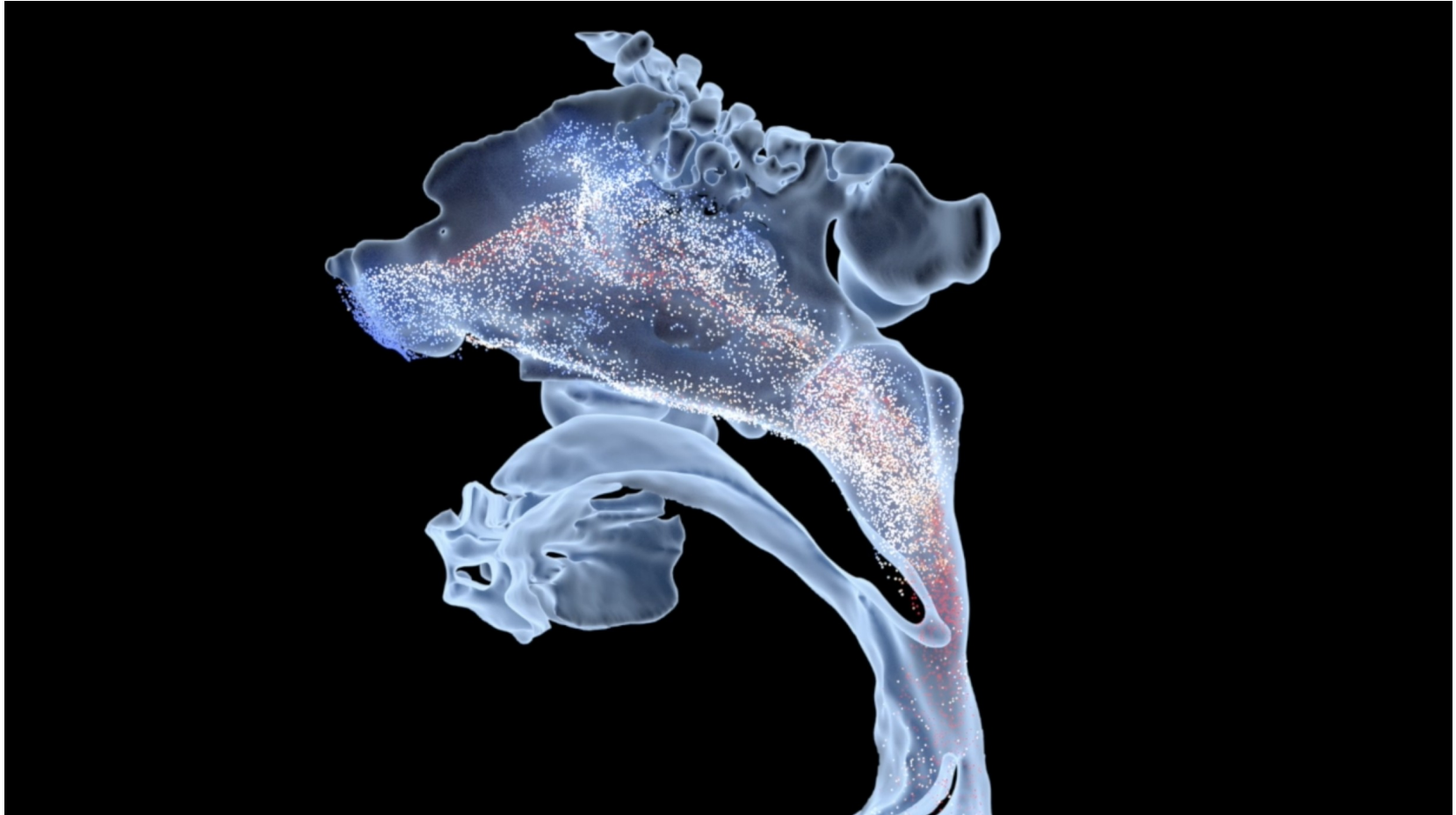
Implement exchangeable data providers to connect to e.g. Nvidia Omniverse.

Animate the airflow or display rendered simulation videos depending on the clients hardware.

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development footage

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QUESTIONS?