Learning geology using VR: student feedbacks on the VirtuaField applications

S. Viseur, F. Civet, J. Lamarche, M. Rizza, L. Benedetti, J. Fleury, L. Jorda, O. Groussin, J. Borgomano, P. Léonide.

Introduction

Virtual Reality : An artificial environment which is experienced through sensory stimuli (such as sights and sounds) provided by a computer and in which one's actions partially determine what happens in the environment

Augmented Reality : superimposes a computer-generated image on a user's view of the real world, thus providing a composite view
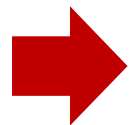
VR gets into daily life for gaming…

… But also into professional life

➡ **Why not for applications in Geosciences?**

Introduction

- **Astronomy, Geology, Geomorphology: Sciences of observations**

Field trips:
How to observe, collect data, and interpret
→ Compiling skills acquired in class rooms

Introduction

... But only few field trips/year
... And:

Dangerous zones:

Conflicting zones

Dangerous or technical access:
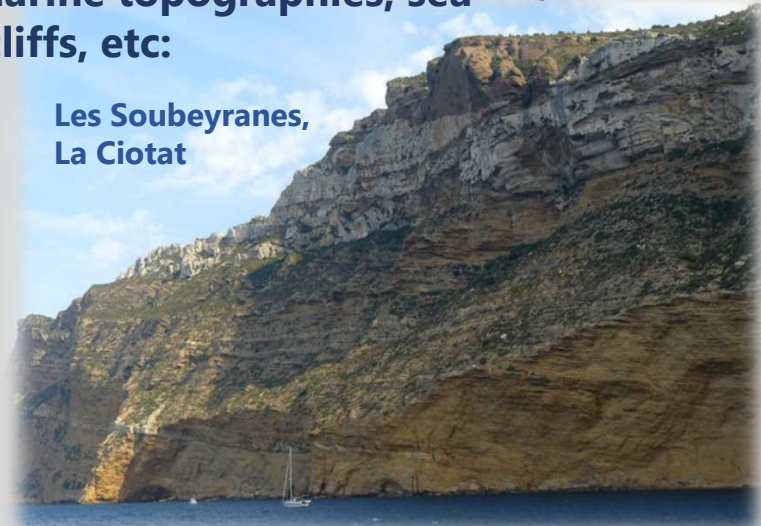

Humanly inaccessible outcrops

Extra-terrestrial surfaces:

67P/C-G Comet

[Jorda et al. 2016, Icarus]

Submarine topographies, sea-side cliffs, etc:

Les Soubeyranes, La Ciotat

Introduction

... But only few field trips/year

... And:

Dangerous zones:

Conflicting zones

Dangerous or technical access:

DANGER
RISQUE
DE CHUTE

Or simply far away..

(expensive, time consuming,...)

Introduction

... But only few field trips/year

... And:

Dangerous zones:

Or simply far away..

(expensive, time consuming,...)

Virtual Reality

Unique way to plenty observe geological or geomorphological features

- **Full 3D view**
- **preserve 1:1 scale**
- **numerical data**

☞ **Virtual field trips**

Outline

- **Pedagogical project *VirtuaField***

- First applications

Pedagogical project in AMU

- *VirtuaField* project:

- **Grant from « Simulation Applied to Pedagogy » project** *(2019-2021*)**, AMU** (Aix-Marseille University)
  - → Computers, headsets, softwares

- **VirtuaField applications:** implemented by VR2Planets
  - **- Proto 1.0 of Virtuafield**

    Due to COVID-19: student testing and feedbacks were postponed. Not enough feedbacks.

  - **- Other applications tested: VR2Mars/VR2Chury** *(Astronomy)*

Pedagogical project in AMU

- **Goal #1 : to discover more ouctrops!**

**Field case libraries:**

Virtual field trips in exploratory mode

- Autonomous
- Solo trip or group trip (online)
  → Meet around the same field case from different locations (rooms, towns, countries…).
- Free movements
- Visualisation of data or pedagogical information

Oman

Italy

Pedagogical project in AMU

- **Goal #2 : to train students to field practice → Skills**

In sport: Jump rope → boxer training = learning specific physical skills
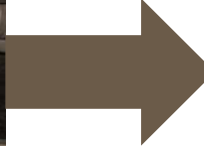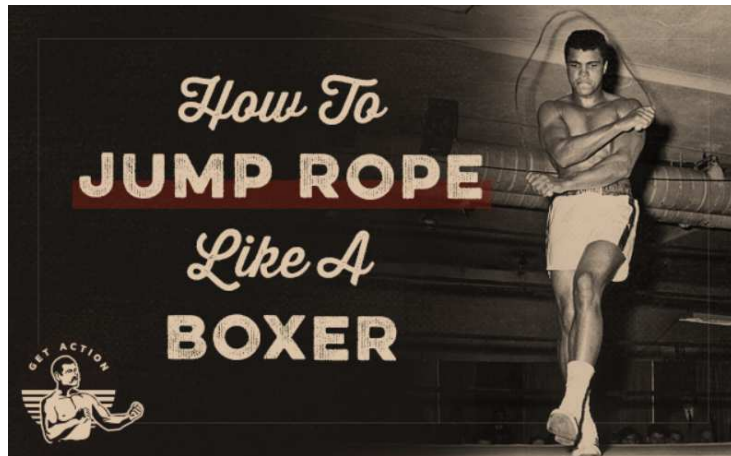
For field trip: Also need to learn specific practical and intellectual skills

- Where to collect data?
- How to draw logs?
- How to measure?
- …
→ Facilitate real field trips

Pedagogical project in AMU

- **Serious game :**

[Gameblog.fr]

Problem to solve, as in video games

Serious game = Examination

Virtual field trips in evaluation mode:
- Problem to solve
- Scoring student responses or behaviors

→ **Benefits :**
- Autonomous
- Individual visits *(not possible in effective field for security reason)*
- Debriefing: review results with professor

Outline

- Pedagogical project *VirtuaField*

- **First applications**

First Applications

- **VR2Planets softwares:**

3D Cave

- Group sessions (up to 15 persons)
  (<u>meaning a single point of view</u>)
- Autonomous or manual flyover
  landscapes
- Possibility to interact with the terrain
  and to extract quantifiable information

Headset

- Flexibility of use (portable) and intuitive
- Possibility to interact with objects
- Possibility to collaborate in the scene
  (through network)
- 1 set up per user (computer + headset)

First Applications

- **Headset:** comfortable, network meeting

Individual #1
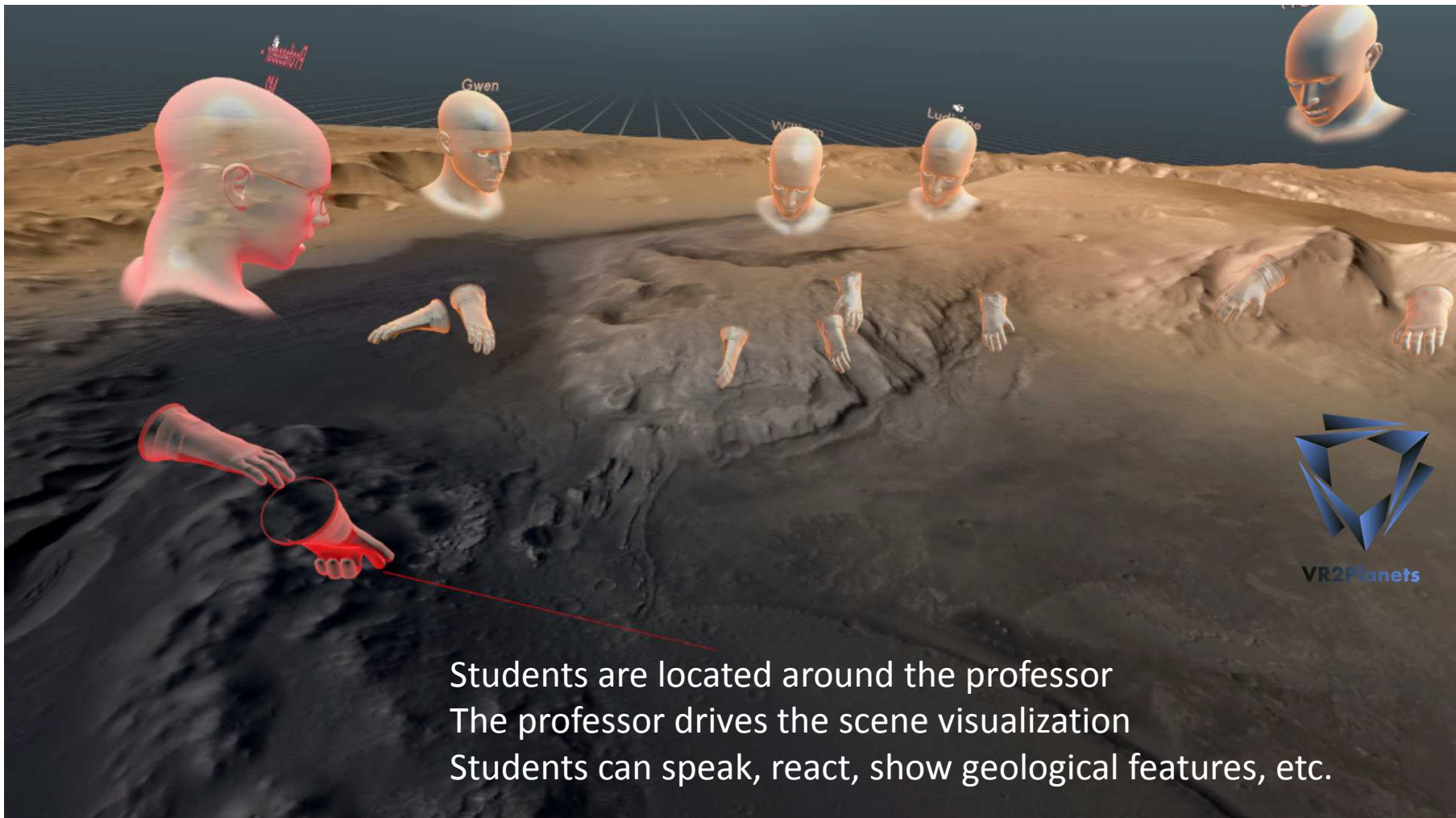
More than 2 hours in the scene

Individual #2

View of individual #1 in the scene, including individual #2

VR2Planets

First Applications

- **Functionnalities of tested Proto1.0 of VirtuaField:**

A professor supervises the field trip, but...

Students are located around the professor
The professor drives the scene visualization
Students can speak, react, show geological features, etc.

First Applications

- **Functionnalities of tested Proto1.0 of VirtuaField:**
  ...The professor can let students go alone to parallel sessions, from which they can request professor help
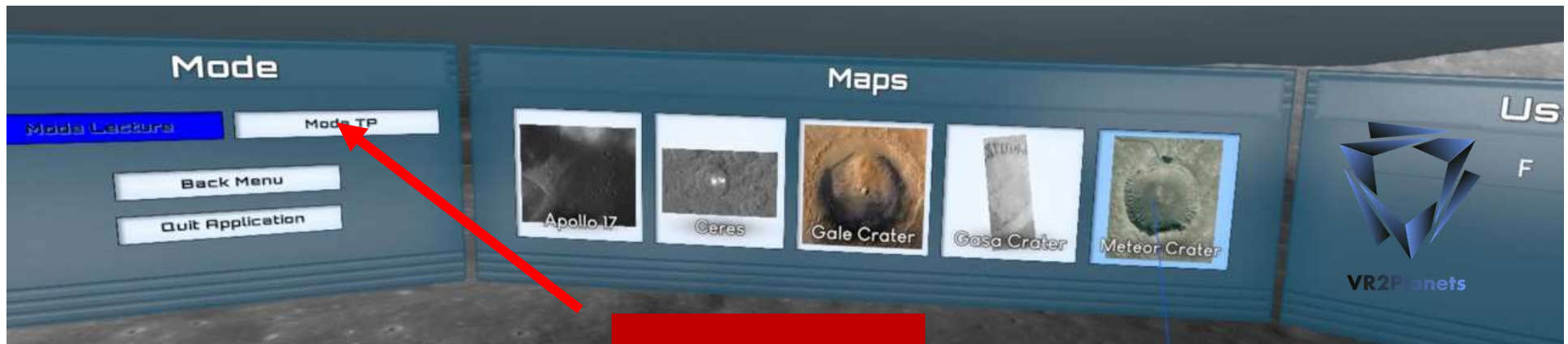
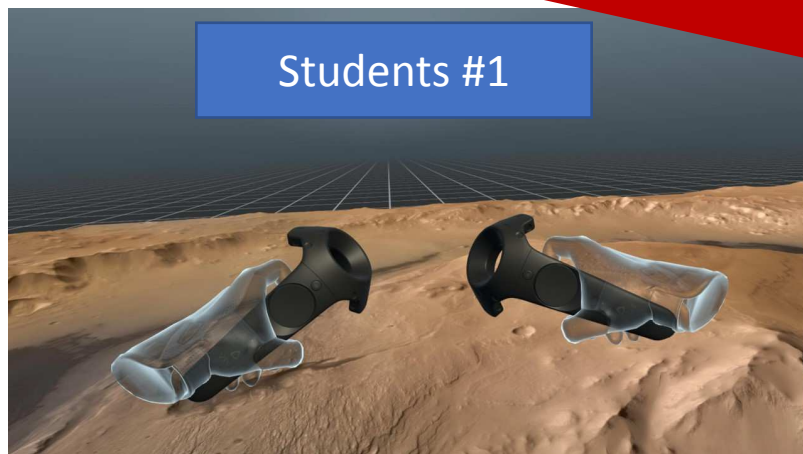# First Applications

- **Functionnalities of tested Proto1.0 of VirtuaField:**

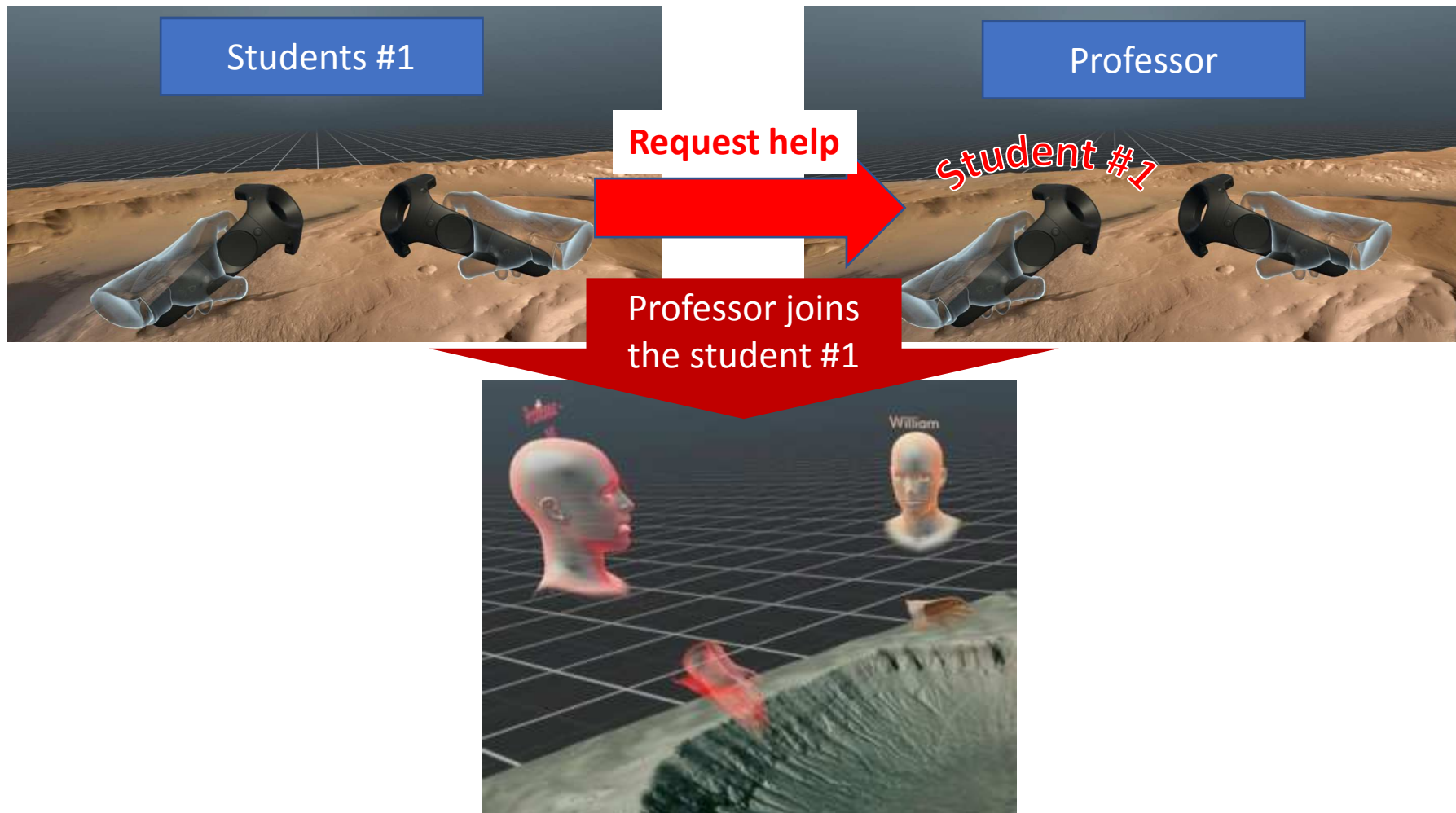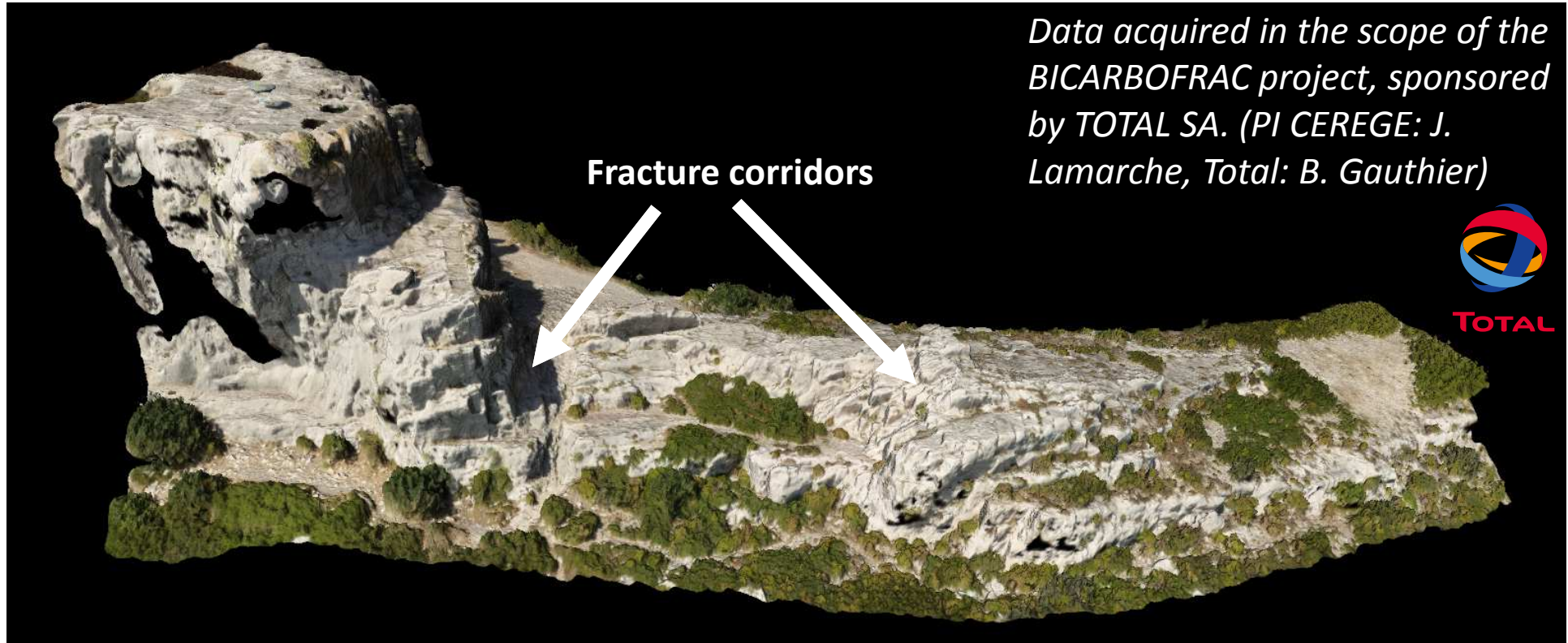 ...The professor can let students go alone to parallel sessions, from which they can request professor help

First Applications

- **Proto1.0 - Case Study : La Fare les Oliviers (SE France)**

Data acquired in the scope of the BICARBOFRAC project, sponsored by TOTAL SA. (PI CEREGE: J. Lamarche, Total: B. Gauthier)

Fracture corridors

- HR protogrammetric data   *(J. Fleury, CEREGE)*
- 10kmx10km DEM and orthophoto
- …

Link of the demonstration (border effects are due to registration):
https://www.youtube.com/watch?v=j6JrJcrdUa8&feature=youtu.be

First Applications

- **Before testing the Proto1.0 application:**

Our first objective to train students

[Gameblog.fr]

Problem to solve, as in video games

Serious game = Examination

Virtual field trips in evaluation mode:
- Problem to solve
- Scoring student responses or behaviors

→ **Benefits** :
- Autonomous
- Individual visits *(not possible in effective field for security reason)*
- Debriefing: review results with professor

First Applications

- **After testing the Proto1.0 application:**

Field trip simulation

Virtual field trips with Professor:

- Work online with student groups
- Two modes:
  - o Professor supervises the field trip
  - o Individual work of students (parallel sessions)

→ **Benefits :**

- To prepare a field trip
- To review or supplement an already done field trip

Our additional objective to train students

Develop specific tools to allow virtual field trip simulation with student group

First Applications

- **Feedbacks:**
  - ➢ *From VR2Chury & VR2Mars (Astronomy application)*

Sensitivity issues

Qualitative: few issues

- • Vertigo: sit down → remove vertigo, nausea, etc.
- • **Issue to solve:** deep correction of glasses

Statistics: among ~100 students (college to PhD)

	Nothing	A little	A lot
nausea	83%	17%	0
Headaches	100%	0	0
Eye pain	100%	0	0
Vertigo	67%	17%	16%
Other	100%	0	0

First Applications

- **Feedbacks:**
- ➢ *From VR2Chury & VR2Mars (Astronomy application)*

General feedbacks

- *100% recommend the VR application*
- *The more active the user, the greater the experience*
- *Need smooth displacement and visualization*

Statistics on ergonomy

Easy	Adaptation period	Difficult
83%	17%	0

Linked to the use of high-tech software (games, etc.)

- ➢ *Proto1.0 of VirtuaField: by professors/researchers*
  - *Interest of online meeting on the same field location*
  - *3D immersive in group works: facilitate exchanges*
  - *Simulation of field trips: generate new objectives and benefits*
  - *No sensitive issue observed*

Discussion

- **Use of Virtual Reality in pedagogy**
  - **Do not replace effective field trips but:**
    - Prepare to field trips
    - Review or supplement already done field trips
  - **For pedagogy purpose:**
    - Focus on specific skills (*such as in sport*)
    - Importance of debriefing sessions (in virtual scenes or outside)

- **First feedbacks:**
  - ☹ Due to COVID-19: student testing and surveys have been postponed. Not enough feedbacks for stats.
  - ☺ Tests with professors/researchers during lockdown:
    - New objectives: field trip simulation with two modes
      professor supervision ⇔ student individual works
    - Interest of online meeting between several people
    - Developing specific tools
  - ☺ Other tests on VR applications: few issues, 100% recommend

Virtual Geoscience Conference 2020
21-23 October 2020, in Marseille

Abstract submission: deadline **June 30**

Short courses on VirtuaField

Details on the VGC [short course page](#).

https://vgc2020.sciencesconf.org/

Thanks for your attention!