

# BRITEC Experience: Researcher's Perspective

Dr. Christos Giannaros

24 March 2021



## SCIENTIX

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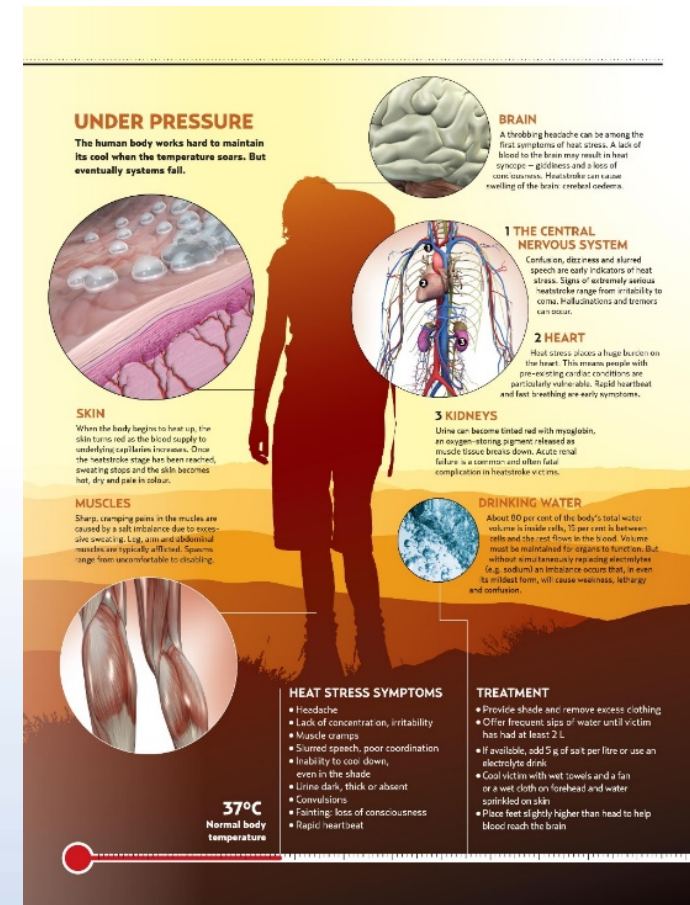
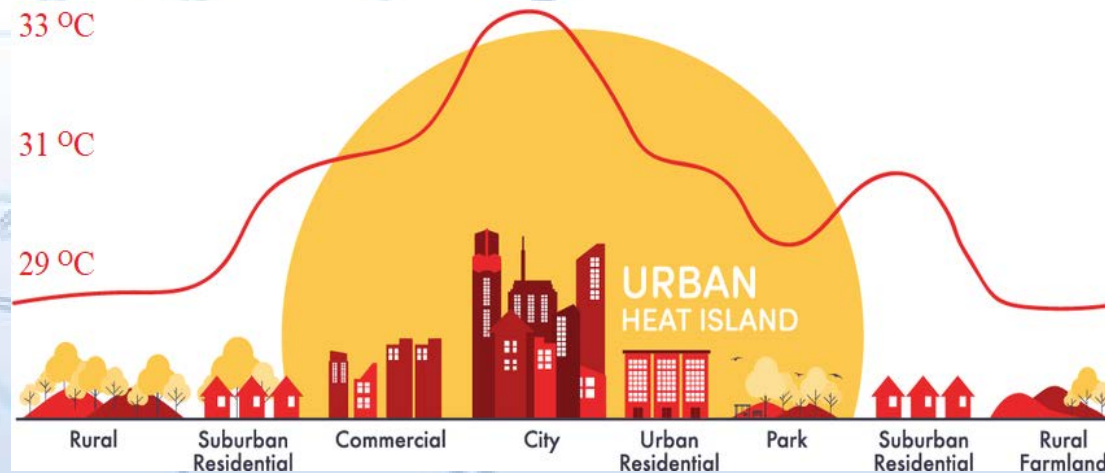
Ibercivis



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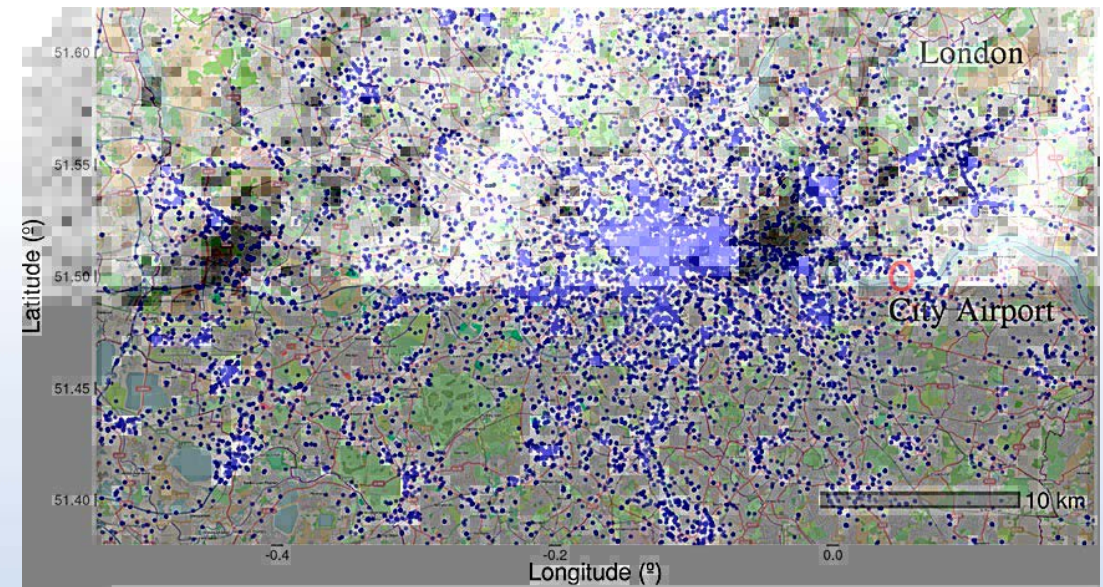
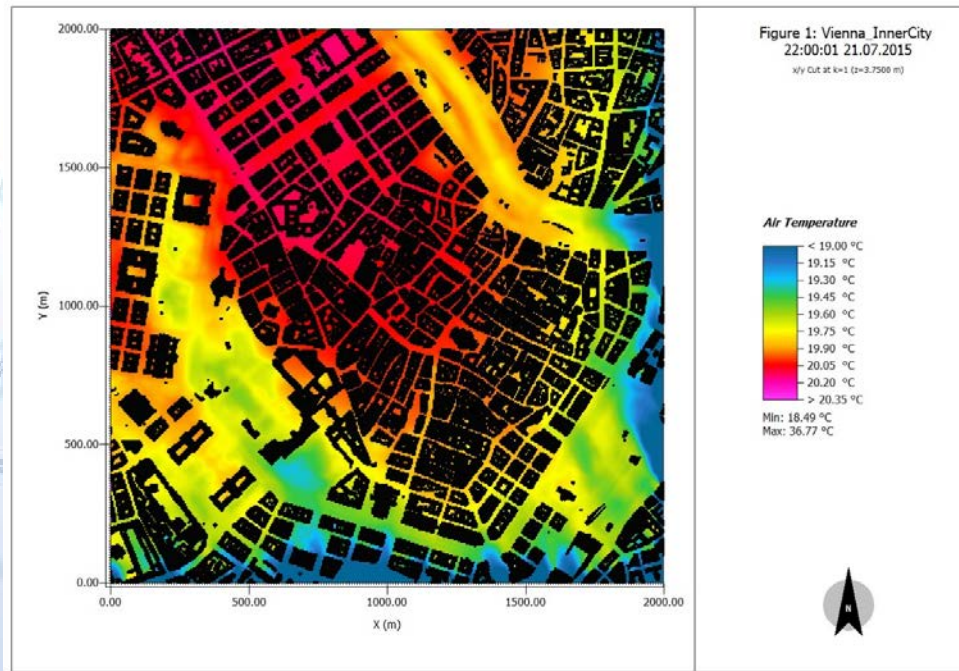
# Research Problem

- High-temperature weather conditions
- Urban Heat Island (UHI)
- Human thermal comfort



# Research Problem

- UHI: A highly localized phenomenon
- Citizen-science environmental monitoring



Source: Overeem et al., 2013

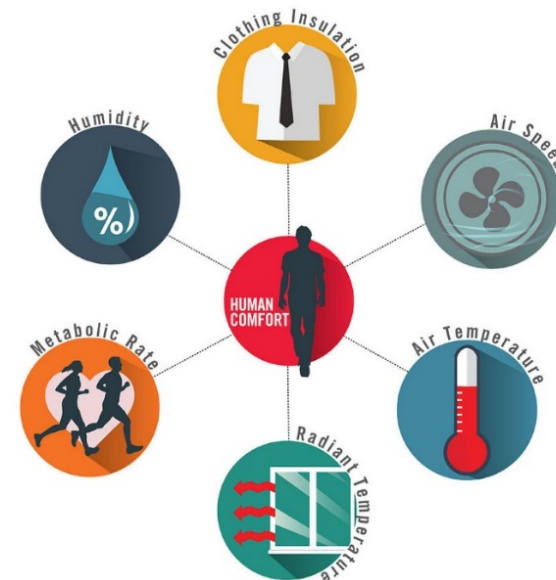
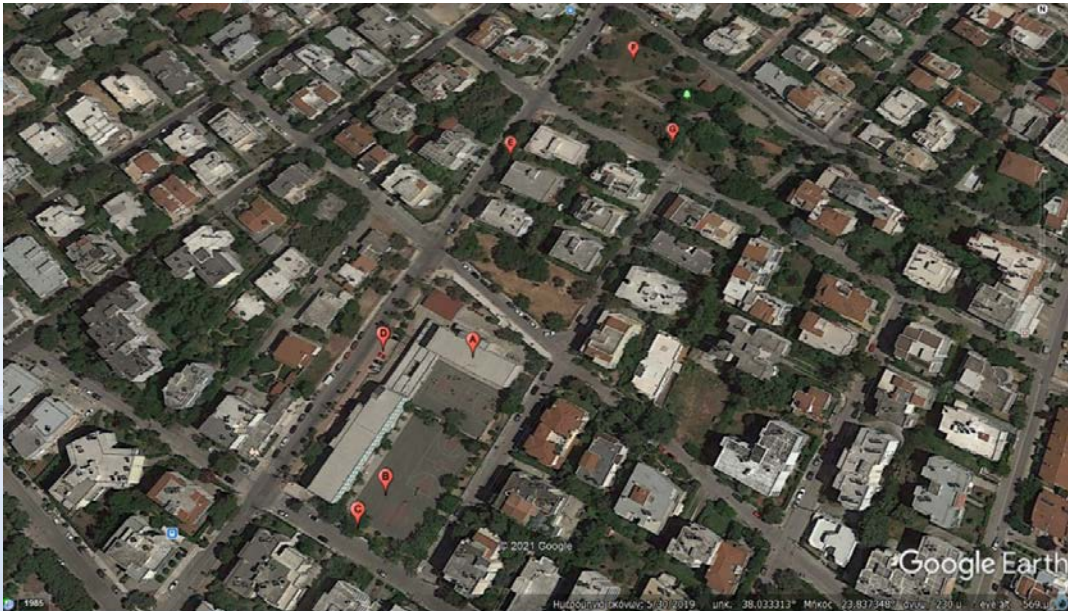




# Research Experiment

## Human thermal comfort:

- Meteorological factors -> Measurements using a pocket weather meter
- Physiological factors -> Activity, clothing and personal information



# Research Experiment

- Guided data processing
- Report on specific research questions

BRITEC: Ανάλυση δεδομένων 1ης μέτρησης: 11 Νοεμβρίου 2019

1ο Γενικό Λύκειο Βριλησίων

**1. Διαφοροποίηση δείκτη θερμικής αίσθησης σε συνάρτηση με τον τόπο και τα χαρακτηριστικά αυτού (θερμοκρασία, υγρασία, ταχύτητα αέρα, νεφοκάλυψη)**

## ΟΜΑΔΑ 1

Σημείο 2: η θερμική αίσθηση της ομάδας είναι μεγαλύτερη από αυτή του σημείου 1. (σχολική αίθουσα – προαύλιο σε σκιά)

Σημείο 3: η θερμική αίσθηση της ομάδας είναι μικρότερη από εκείνες των σημείων 1 και 2. (προαύλιο σε ήλιο) **Σημεία 2 και 3: ίδια θερμοκρασία αέρα, ίδιο ποσοστό υγρασίας, Σημείο 3: 0,1 m/s ταχύτητα ανέμου**

Σημείο 4: η θερμική αίσθηση της ομάδας είναι μικρότερη από όλα τα παραπάνω σημεία. (δρόμος σε σκιά) **Σημείο 4: αυξάνεται το ποσοστό της σχετικής υγρασίας σε σχέση με τα προηγούμενα (65,2%)**

Σημείο 5: η θερμική αίσθηση της ομάδας αυξάνεται σε σχέση με το σημείο 4 αλλά παραμένει μικρότερη από τα παραπάνω. (δρόμος σε ήλιο)

Σημείο 6: η θερμική αίσθηση της ομάδας είναι μικρότερη από όλα τα άλλα σημεία και



# Research Opportunities

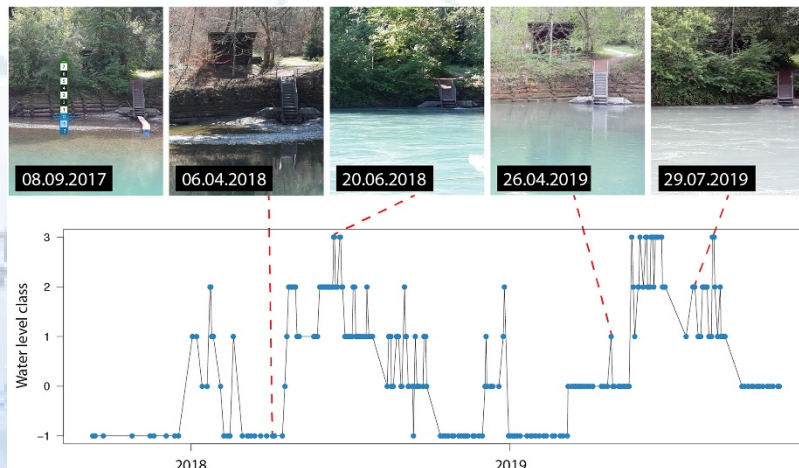
**Large-scale projects: e.g., BRITEC field experiment in several schools within a city (e.g., Athens, Greece) throughout a year**

- **Assistance in data collection (students)**
- **Assistance in project's actions coordination (teachers)**
- **Acceleration of the research process**
- **Understand how people perceive our research -> Adapt communication and dissemination**

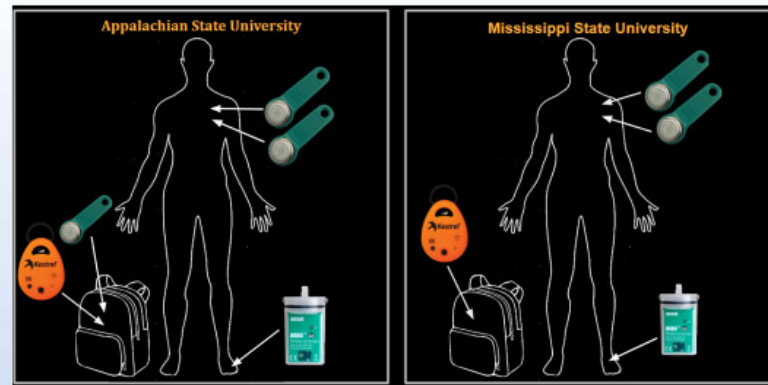


# Research Opportunities

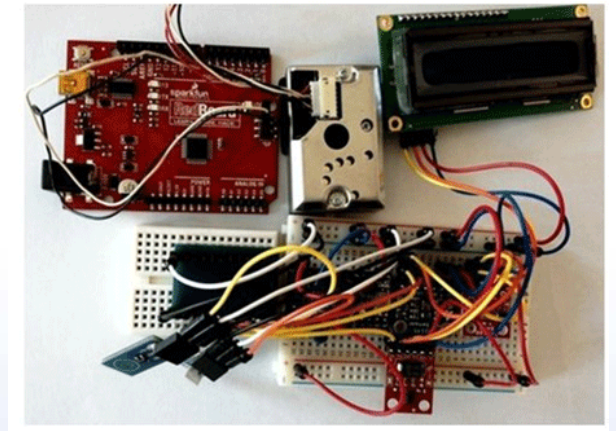
- Extensive deployment of low-cost, citizen-science and/or crowd-sourced sensors and devices
- Wearable tools and smart gadgets



Source: Strobl et al., 2019



Source: Bailey et al., 2019



Source: Pető and Király, 2019






# Research Challenges

- Students' participation and motivation

Κλιματική Αλλαγή ή Κλιματική Κρίση

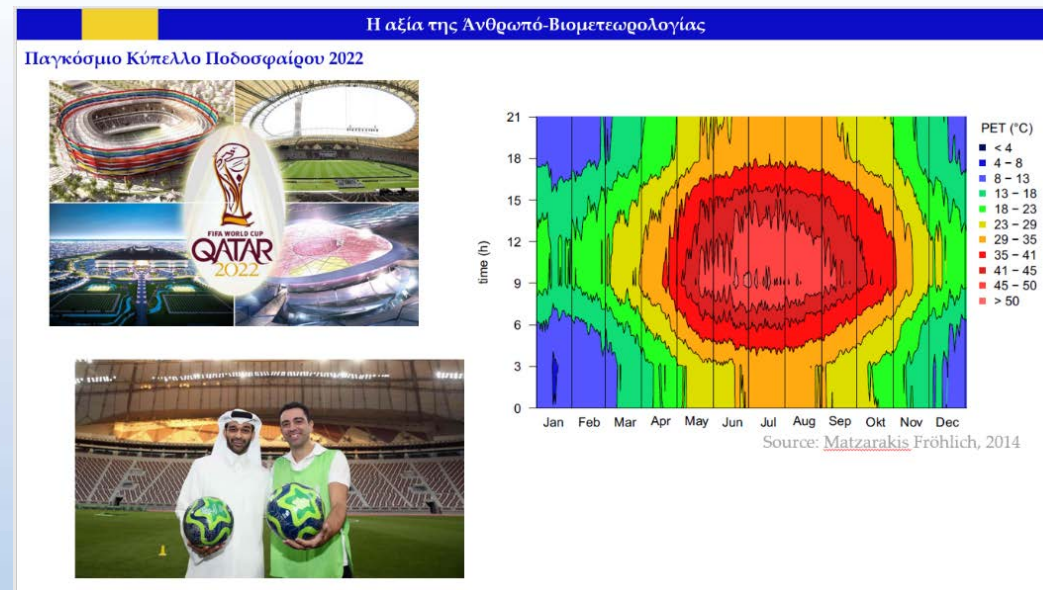
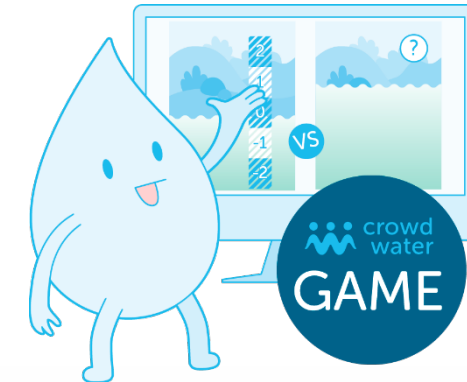

the guardian

It's a crisis, not a change, the six Guardian language changes on climate matters



"The climate emergency is right here, right now."

and the billions of others around the world who want to solve our climate crisis.





# Research Challenges

- **Adaptation and incorporation of a research project into the standard school programme (Particularity)**
- **Data quality**
- **Ethics (e.g., GDPR)**



# Summary

- **Great experience** 
- **Significant opportunities** 
- **Manageable challenges** 
- **Go for it!**



# Thank you!



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# Citizen science in the classroom

## Collaboration with teachers

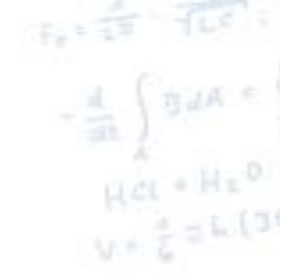
Adrián Gollerizo Fernández (Escuela IDEO, Madrid)

24th March 2021



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# Introduction: Citizen science in the classroom



## Citizen science projects in the classroom...

- Allow students to participate in advanced research, increasing academic performance.
- Introduce students into the process of science and the scientific method.
- Help develop positive attitudes towards science among students.
- Offer teachers an innovative approach to science learning and an enriching professional development opportunity.

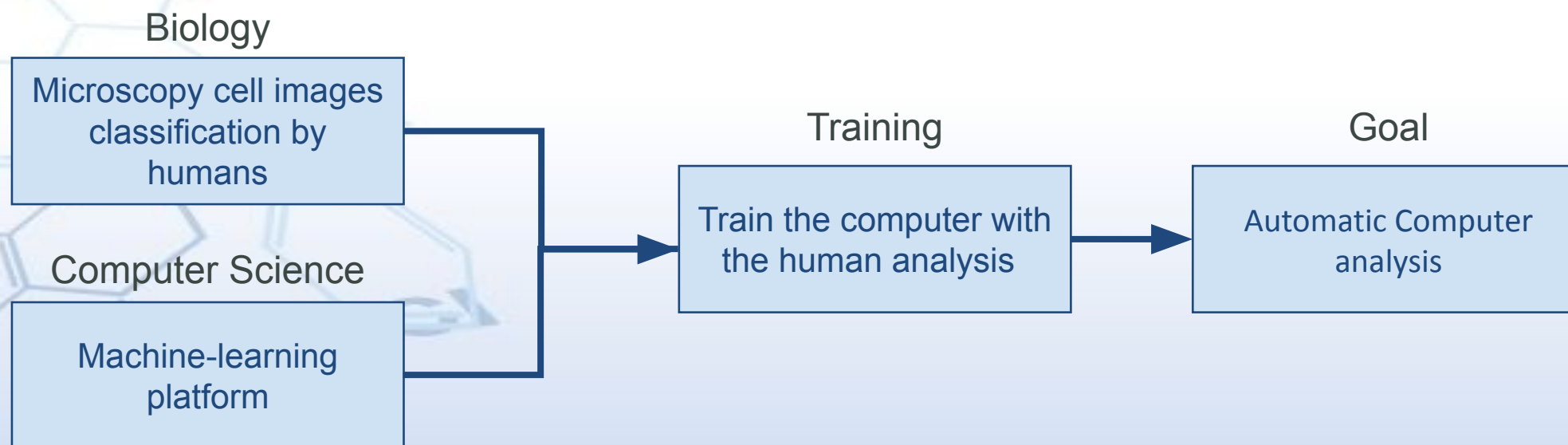


# A classroom experience: Cellspotting project



**Cellspotting. *Let's fight cancer together!***

Machine learning to classify microscopy images of cancer cells





# A classroom experience: Cellspotting project



**Cellspotting. *Let's fight cancer together!***

## Main goals:

- To observe cell images obtained by fluorescence microscopy
- To sketch and legend the main components of the cell.
- To understand the apoptosis and necrosis processes and to identify the morphological characteristics of the two types of cellular death.
- To approach students to the techniques used in apoptosis-inducing drug delivery research in tumour cells



# A classroom experience: Cellspotting project



Cell Spotting: Contribute

3 How many live cells do you see?

Channels ☒ Normal ☐ Blue ☐ Green

5 6 7 8 9 10

1

2

4

How many live cells are there? And dead? The cells in the first sample image are alive, while the ones in the below image are dead.

Example of live cells

Example of dead cells

Apoptosis

Necrosis

alive

live cells Cell Content Release Mitochondria Distribution Remarks

Image source: Socientize



# A classroom experience: Cellspotting project



The project was implemented in Biology and ICT classes:

- Secondary Education: 3º ESO & 4º ESO
- Bachillerato: 1º & 2º Bachillerato





# A classroom experience: Cellspotting project

## Before starting...

- Previous lessons. The Cell (Biology) & Introduction to programming languages and machine learning (ICT)
- Lecture by the researcher (1)



## Implementation of the project

- Cell analysis using Cellspotting:
  - Identify alive cells
  - Cell content release
  - Mitochondria distribution
  - Other remarks

## After the implementation

- Lecture by the researcher (2)
- Evaluation



# Lessons learned

Some of the lessons learned from this experience are:



- **Communication** between the researcher and the teacher is essential.
- **Communication** between the researcher and the students is very valuable.
- There should exist a **common goal**, shared by the teacher and the researcher.
- An effort should be made to link the **educational value** behind the project with the school's educational project and the national educational curriculum.
- The researcher and the teacher should work together in the design of the **evaluation of the project**, from an educational point of view.
- The **sense of community** is very important for the students.

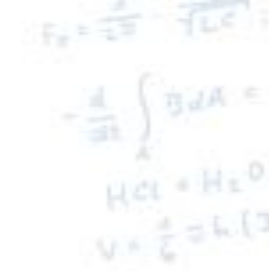


# Thank you!



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# Citizen Science & Education: what about data?

Dr. Mieke Sterken

24/03/2021



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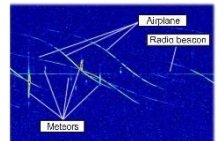
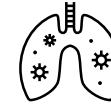
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Citizen Science facilitator  
(40%)

**KU LEUVEN**

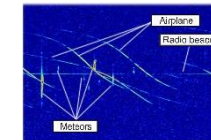
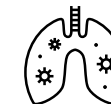


<https://monster.aeronomie.be/>  
Radio Meteor Zoo on Zooniverse.org

Citizen Science facilitator  
(40%)

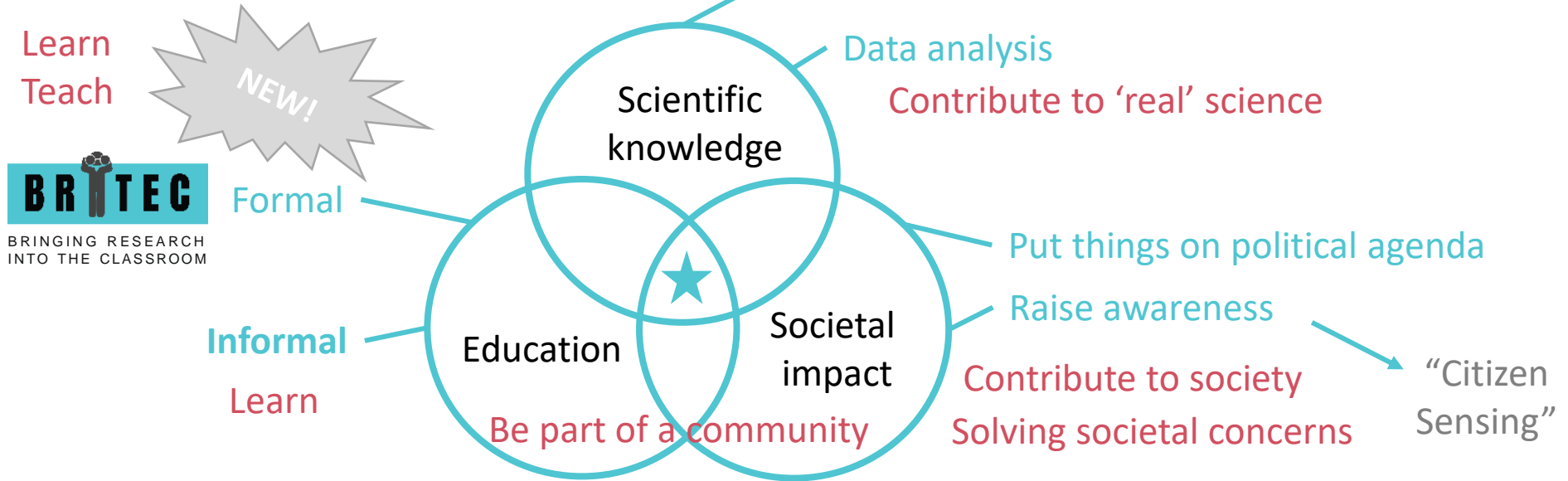
Citizen Science advisor  
(60%)

**KU LEUVEN**



- Data Management
- Privacy & Ethics

# Citizen Science: a choice

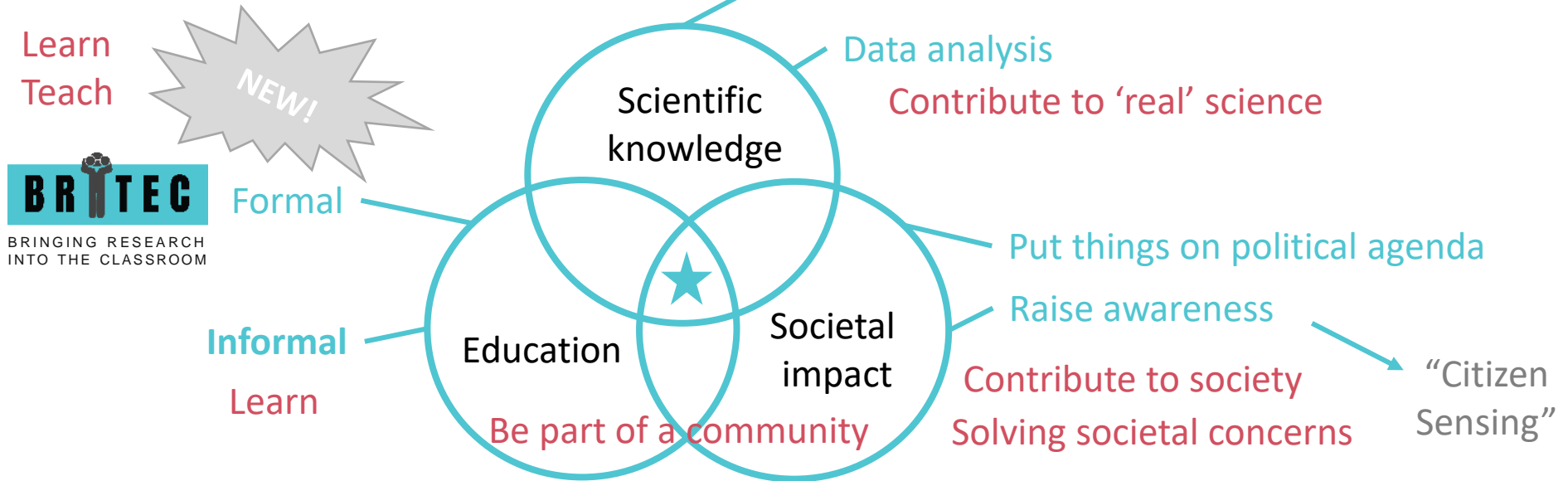




## Citizen Science:

### a choice

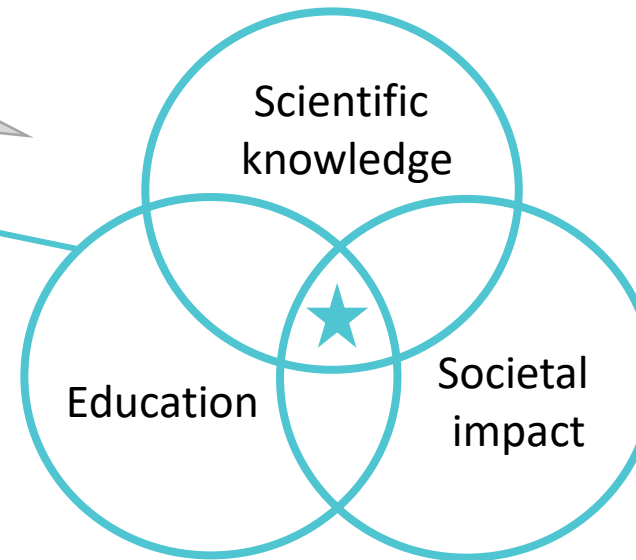
- deliberate
- free
- motivations!



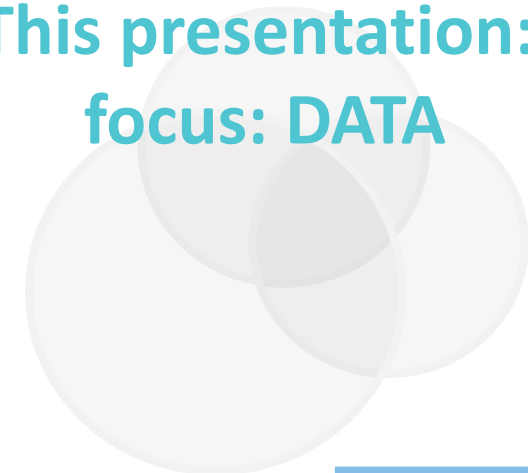
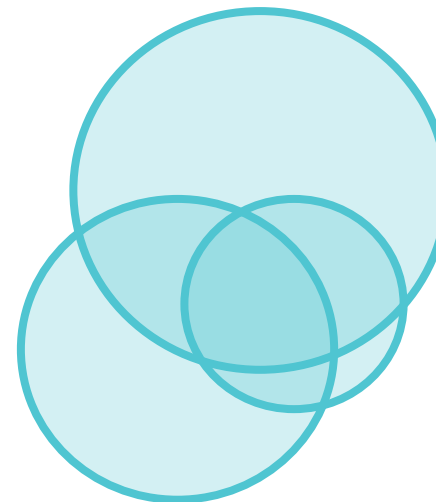
## Citizen Science:

### a choice

- deliberate
- free
- motivations!



This presentation:  
focus: DATA



## Pitfalls & Fears



“Can we TRUST the data they retrieved?”



They don't register  
observations  
(accurately)

Motivation,  
Mindset



They have different  
interpretations

Obs – Interpr.



They make mistakes,  
e.g., they don't  
register certain  
species

Knowledge

## Solutions



“Can we TRUST the data they retrieved?”



They don't register observations (accurately)

Motivation,  
Mindset



**Numbers:** duplications



**Numbers:** large sample sizes



They have different interpretations

Obs – Interpr.



**Protocol:** peer-review



They make mistakes,  
e.g., they don't register certain species

Knowledge



**Protocol:** education on the topic



## Solutions



Numbers: duplications

### Curieuzeneuzen

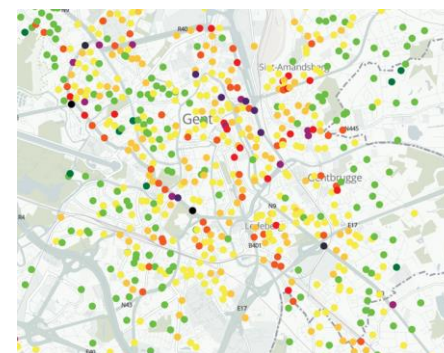
(air quality)

20,000 participants

<https://2016.curieuzeneuzen.be/en/>



©CurieuzeNeuzen – De Standaard



NO2 – mei 2018 (ppmv)

©CurieuzeNeuzen/DeStandaard

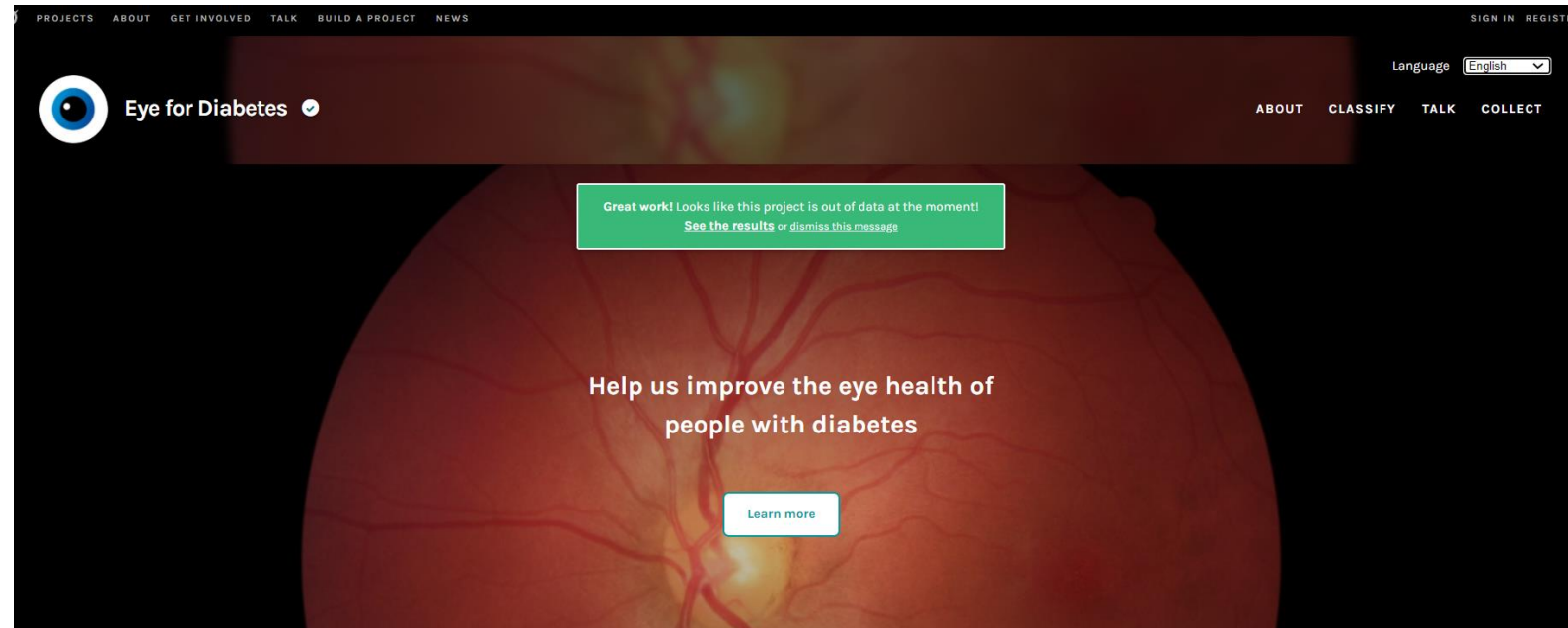
Duplication: 2 sampling units per participant

## Solutions



Numbers: duplications

replications: 10x  
(pre-study: 25x)



Eye for  
Diabetes

(Zooniverse)

<https://www.zooniverse.org/projects/oogvoordibabetes/eye-for-diabetes?language=nl>



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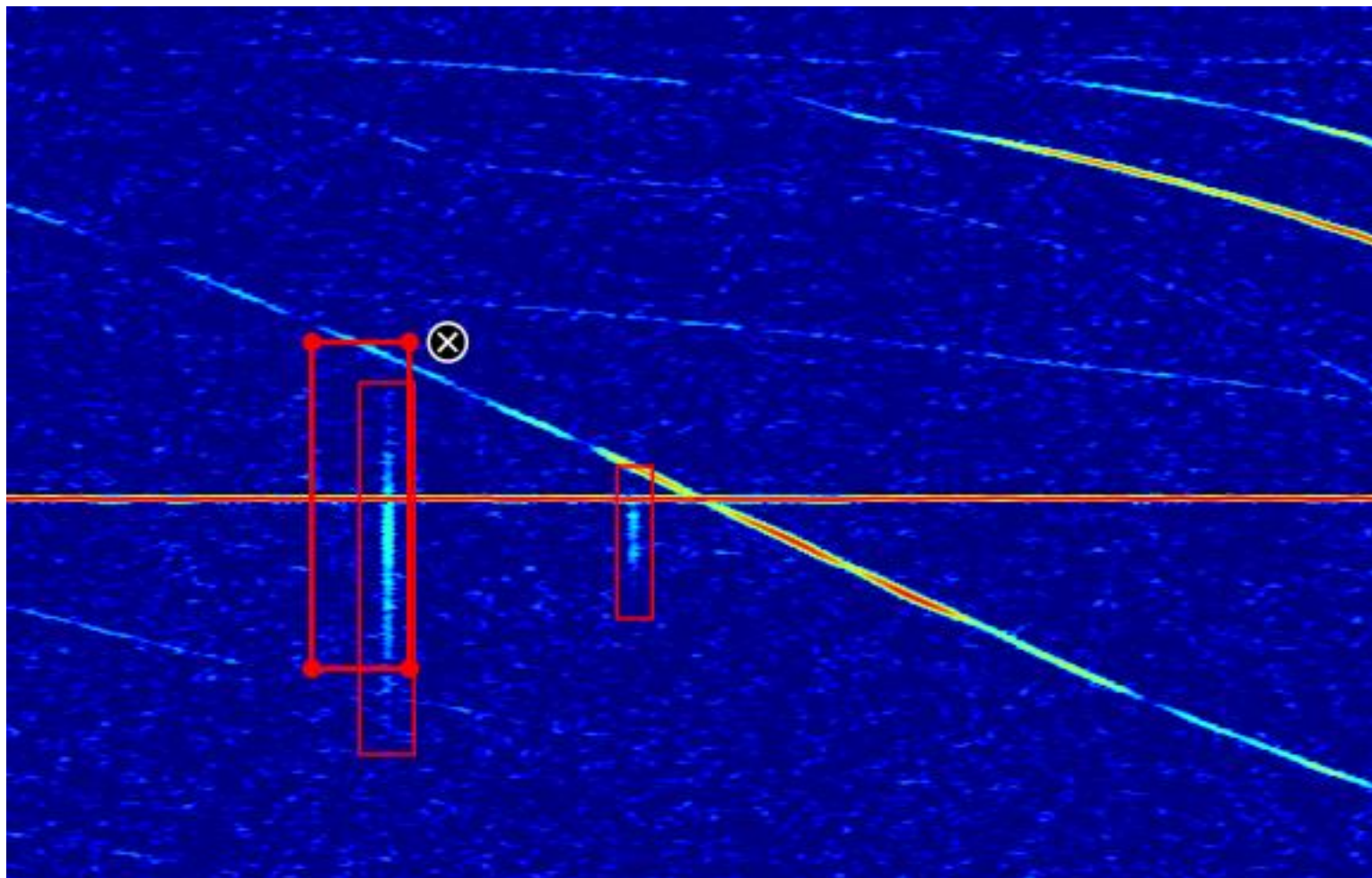
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SCivil  
Citizen Science  
Vlaanderen

## Solutions



Numbers: duplications



Radio Meteor  
Zoo

(Zooniverse)

<https://www.zooniverse.org/projects/zooniverse/radio-meteor-zoo/classify>



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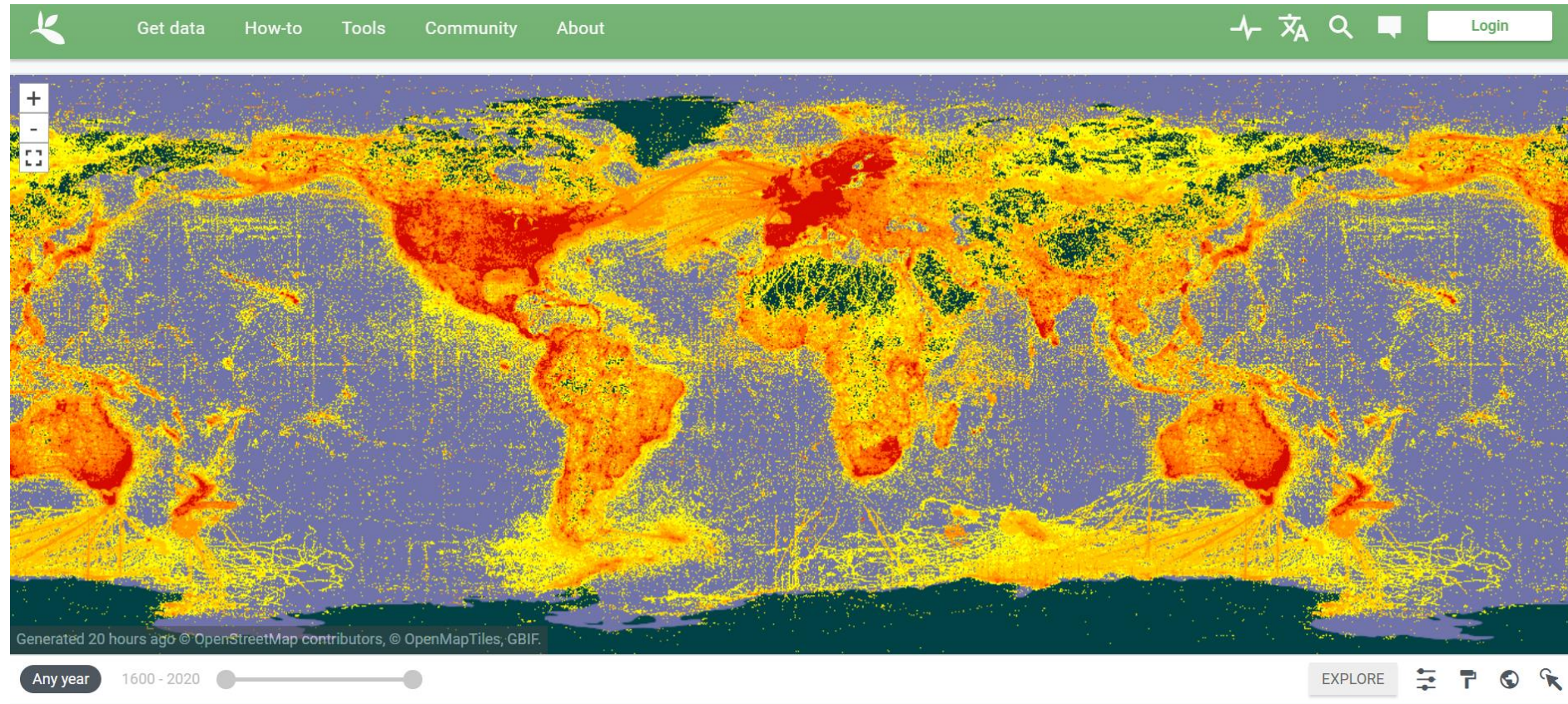
## Solutions



Numbers: large sample size



Okt 2020: **1,6 billion observations** >5000 peer-reviewed papers



Erasmus+





## Solutions

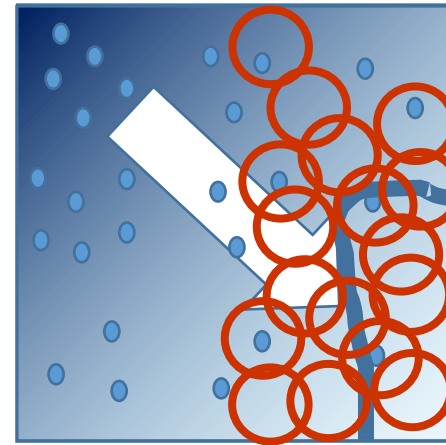
Large sample sizes  
allow you to do  
**post-systematization**  
of your data

Opportunistic data

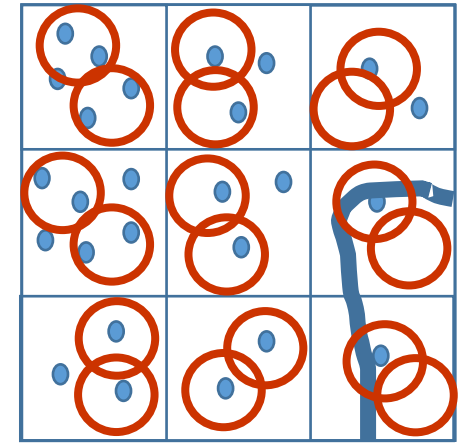
vs.

Systematic data

e.g., Biodiversity research, invasive species, climate change



6 per km<sup>2</sup>  
No trend?



19 per km<sup>2</sup>  
+ trend!

*Bain 2016*  
*Bird et al. 2014*  
*Hill 2012*  
*Isaac et al. 2014*  
*Pocock et al. 2019*  
*van Strien et al. 2013*

## Solutions

Large sample sizes  
allow you to do  
**post-systematization**  
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Bain 2016  
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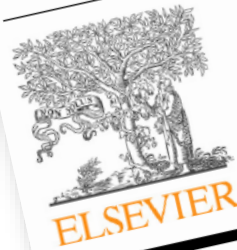
Opportunistic

Biological Conservation 173 (2014) 144–154

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: [www.elsevier.com/locate/biocon](http://www.elsevier.com/locate/biocon)



### Statistical solutions for error and bias in global citizen science datasets

Tomas J. Bird<sup>a,b,\*</sup>, Amanda E. Bates<sup>b</sup>, Jonathan S. Lefcheck<sup>c</sup>, Nicole A. Hill<sup>b</sup>, Russell J. Thomson<sup>b</sup>,  
Graham J. Edgar<sup>b</sup>, Rick D. Stuart-Smith<sup>b</sup>, Simon Wotherspoon<sup>b</sup>, Martin Krkosek<sup>d</sup>, Jemina F. Stuart-Smith<sup>b</sup>,  
Gretta T. Pecl<sup>b</sup>, Neville Barrett<sup>b</sup>, Stewart Frusher<sup>b</sup>

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<sup>b</sup> Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Tasmania 7001, Australia

<sup>c</sup> Virginia Institute of Marine Science, College of William & Mary, PO Box 1346, Gloucester Point, VA 23062-1346, USA

<sup>d</sup> Department of Ecology and Evolutionary Biology, Ramsay Wright Zoological Laboratories, University of Toronto, 25 Harbord St., Toronto, ON M5S 3G5, Canada

ARTICLE INFO

Article history:  
Received 5 February 2013

ABSTRACT

Networks of citizen scientists (CS) have the potential to observe biodiversity and species distributions at global scales. Yet the adoption of such datasets in conservation science may be hindered by a perception

15 per km<sup>2</sup>  
+ trend!



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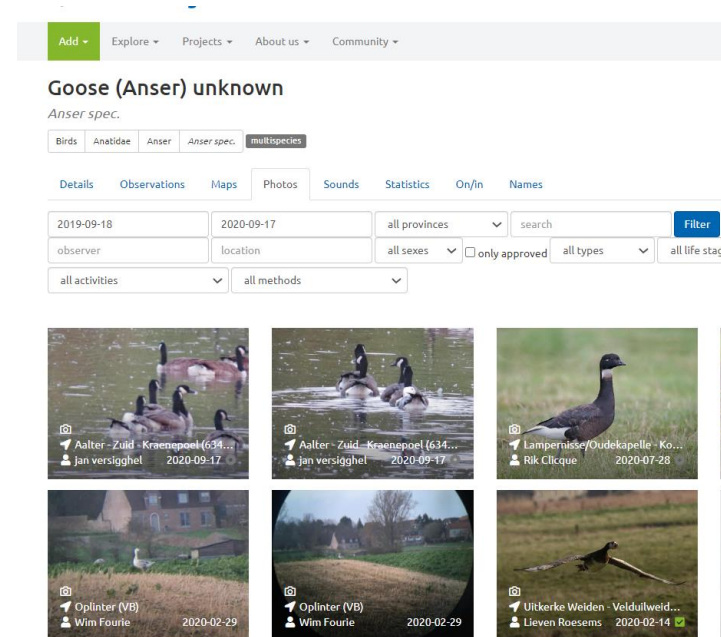
Scivil  
Citizen Science  
Vlaanderen

# Solutions



## Protocol: peer-review

- By scientists
- By highly experienced amateurs



Waarnemingen.be



Erasmus+

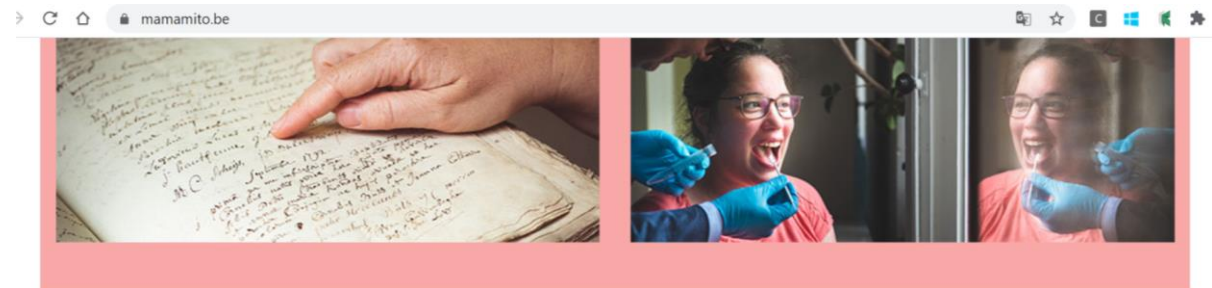


## Solutions



Protocol: education

# MAMAMiTO



Partnership for education:  
a.o. Familiekunde Vlaanderen

Zo werkt het



Registreer

jezelf en maak  
je eigen  
beveiligd  
profiel aan



Duik

stap per stap  
je moederlijke  
lijn in



Wij helpen

jou je  
stamboom  
uit te breiden



Check

je stamboom  
via ons team



Print

je moederlijke  
stamboom af



Vind

je verre  
maternale  
verwanten



Help

de wetenschap  
door je  
Mito-DNA  
te laten testen

<https://mamamito.be/>



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## Advantages of working with schools



“Can we TRUST the data they retrieved?”



They don't register  
observations  
(accurately)

Motivation,  
Mindset



**Numbers:** duplications



**Numbers:** large sample sizes



They have different  
interpretations

Obs – Interpr.



**Protocol:** peer-review



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## Advantages of working with schools



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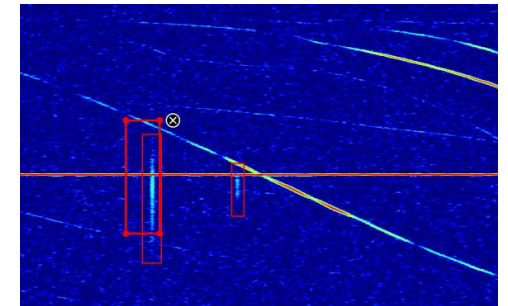
**Numbers:** large sample sizes

Power of the numbers: 20-30 students per class

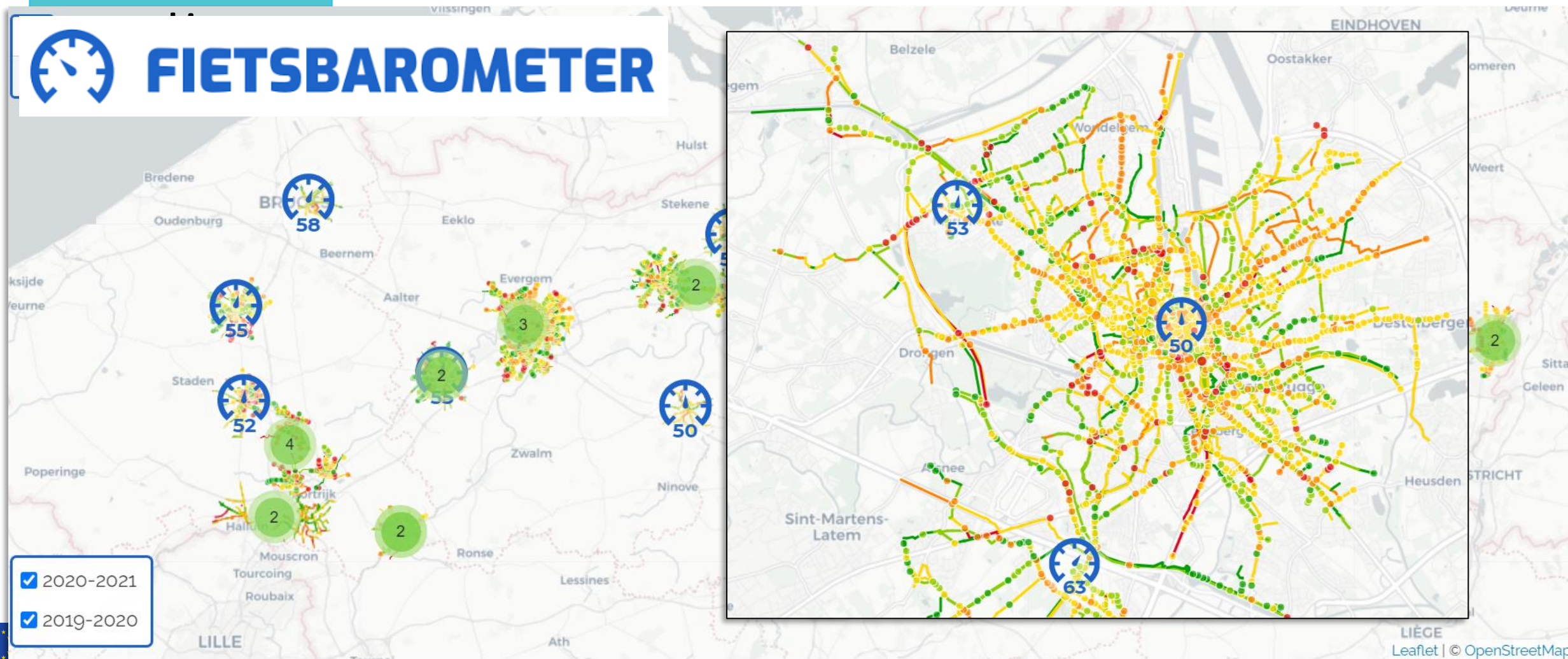
e.g. RMZ: ran out of data on Zooniverse last semester!

+ big EXTRA advantage: Time Series!

e.g. Fietsbarometer: streets covered because the students go to school anyway!



## “Can we TRUST the data they retrieved?”



## Advantages of working with schools



“Can we TRUST the data they retrieved?”



**Numbers:** duplications



**Numbers:** large sample sizes

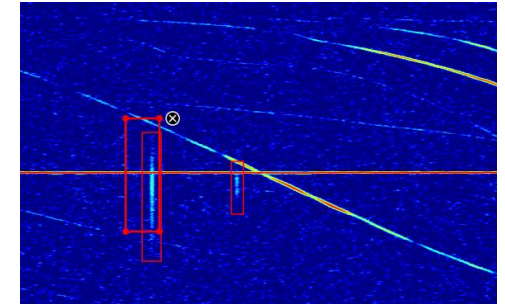


**Protocol:** peer-review



**Protocol:** education on the topic

Power of the  
numbers:  
20-30 students  
per class



Teachers as reviewers / dataguards



## Advantages of working with schools



Gemeentelijk Technisch Ins  
Daalkouter 30 1840 LONDE  
[www.gttil.be](http://www.gttil.be) info

### The magnificent wo meteors



(Credits: <https://www.ibizavandaag.nl/ibiza-nieuws/voor-in-je-agenda-meteorenreg>)

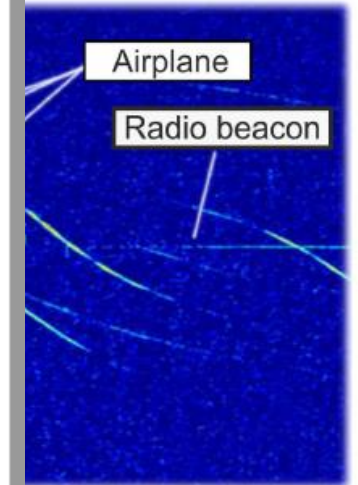
Acknowledgements to Engineer Stijn Calders, Space Physics  
division @ BIRA-IASB, Belgium & the Erasmus+ BRITEC-proj



Educational pack developed by Wim Van Buggenhout (GTIL school L  
collaboration with Ir. Stijn Calders (BIRA-IASB, Belgium), facilitated b  
Prof. Katrien Kolenberg (KULeuven university, Belgium) in the frame  
project BRITEC ('Bringing Research Into the Classroom'). Translate

#### 3.3.1 Day 1: Monday, Oct 19th, 2020


that this course contains a  
going to search for meteors on a  
ch a spectrogram. Go to the  
[subjects/zooniverse/radio-meteor-](https://subjects.zooniverse/radio-meteor-)  
e red rectangular boxes around



-axis representing in these  
sed?



## Advantages of working with schools



“Can we TRUST the data they retrieved?”



**Numbers:** duplications



**Numbers:** large sample sizes

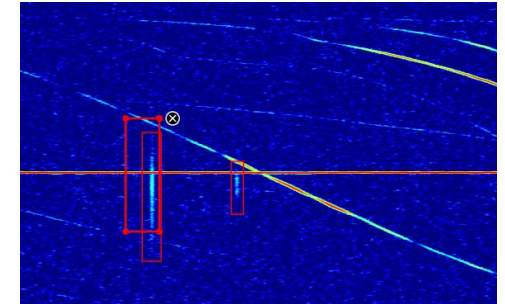


**Protocol:** peer-review



**Protocol:** education on the topic

Power of the  
numbers:  
20-30 students  
per class



Teachers as reviewers / dataguards

Teachers as educators/ambassadors:  
provide thorough training on the protocol

**AND the motivation!**



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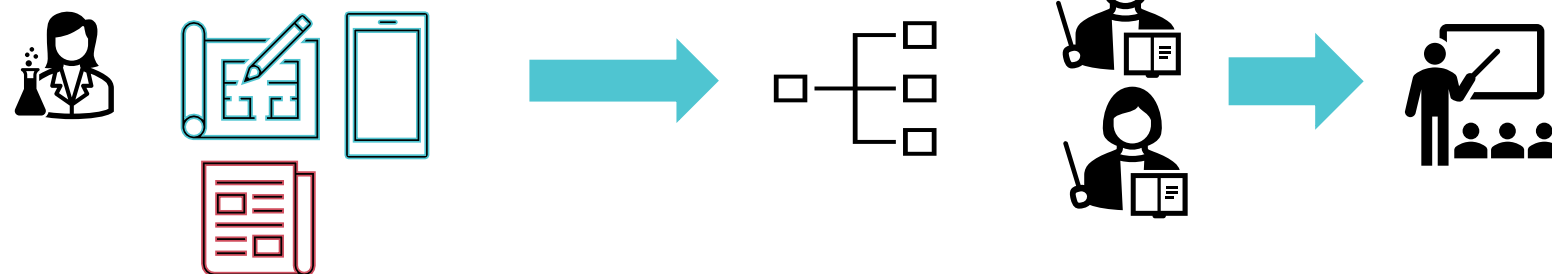


KU LEUVEN

SCivil  
Citizen Science  
Vlaanderen

## Ways of engaging

1



*Harlin et al. 2018*



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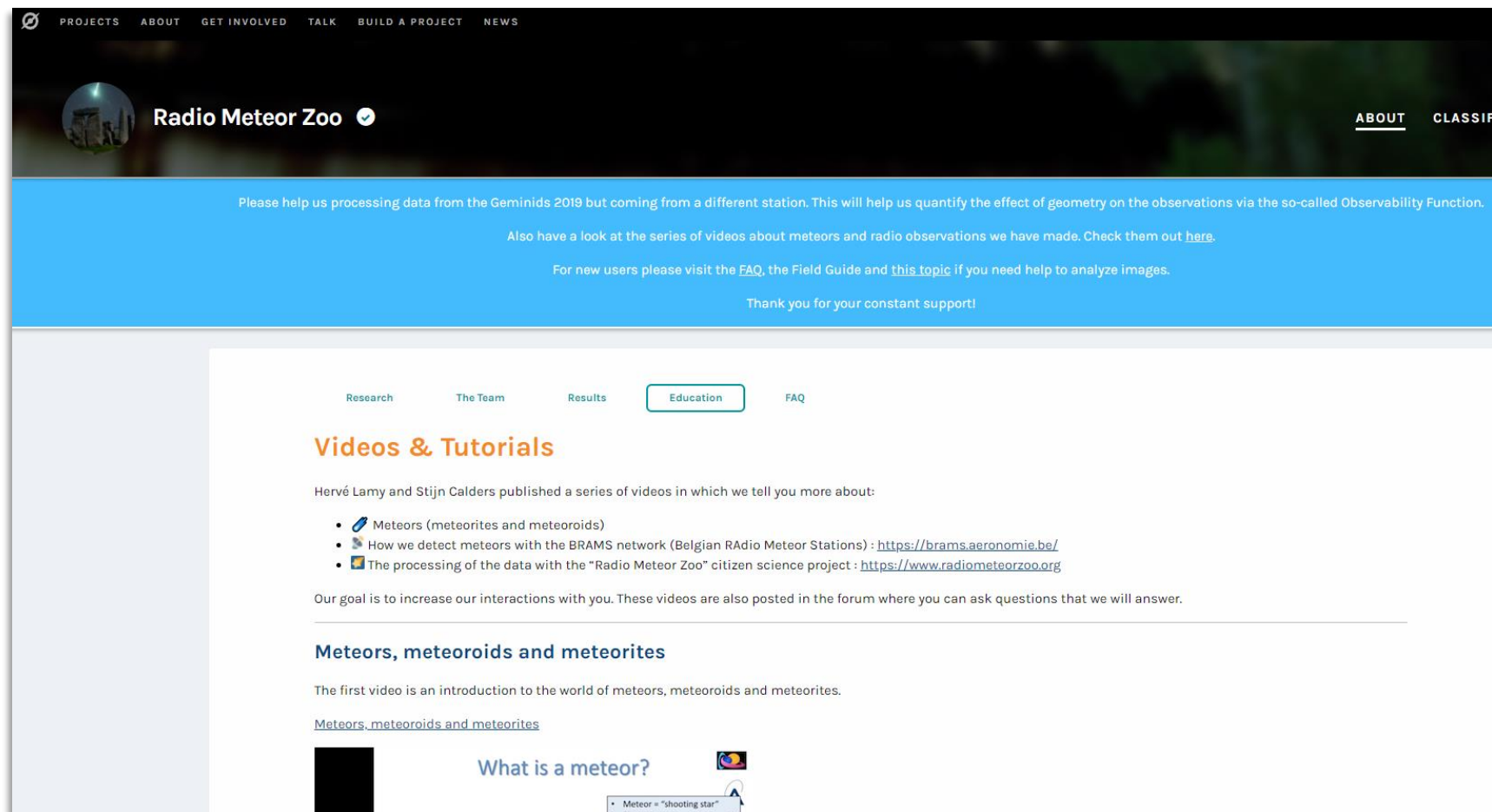
Scivil  
Citizen Science  
Vlaanderen

## Ways of engaging

1

### Radio Meteor Zoo

=> Zooniverse



The screenshot shows the Radio Meteor Zoo website. The header includes navigation links: PROJECTS, ABOUT, GET INVOLVED, TALK, BUILD A PROJECT, and NEWS. Below the header is a dark banner with the Radio Meteor Zoo logo and a checkmark. To the right of the banner are links for ABOUT and CLASSIFICATION. The main content area has a blue background with text: "Please help us processing data from the Geminids 2019 but coming from a different station. This will help us quantify the effect of geometry on the observations via the so-called Observability Function. Also have a look at the series of videos about meteors and radio observations we have made. Check them out [here](#). For new users please visit the [FAQ](#), the Field Guide and [this topic](#) if you need help to analyze images. Thank you for your constant support!". Below this is a white section with a navigation bar: Research, The Team, Results, Education (highlighted), and FAQ. The section is titled "Videos & Tutorials" and contains text: "Hervé Lamy and Stijn Calders published a series of videos in which we tell you more about:". This is followed by a bulleted list: "• Meteors (meteorites and meteoroids)", "• How we detect meteors with the BRAMS network (Belgian RAdio Meteor Stations) : <https://brams.aeronomie.be/>", and "• The processing of the data with the 'Radio Meteor Zoo' citizen science project : <https://www.radiometeorzoo.org>". Below the list is text: "Our goal is to increase our interactions with you. These videos are also posted in the forum where you can ask questions that we will answer.". The section is titled "Meteors, meteoroids and meteorites" and contains text: "The first video is an introduction to the world of meteors, meteoroids and meteorites." and a link: "[Meteors, meteoroids and meteorites](#)". At the bottom, there is a video player with the title "What is a meteor?" and a thumbnail showing a meteor.

Harlin et al. 2018



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## Ways of engaging

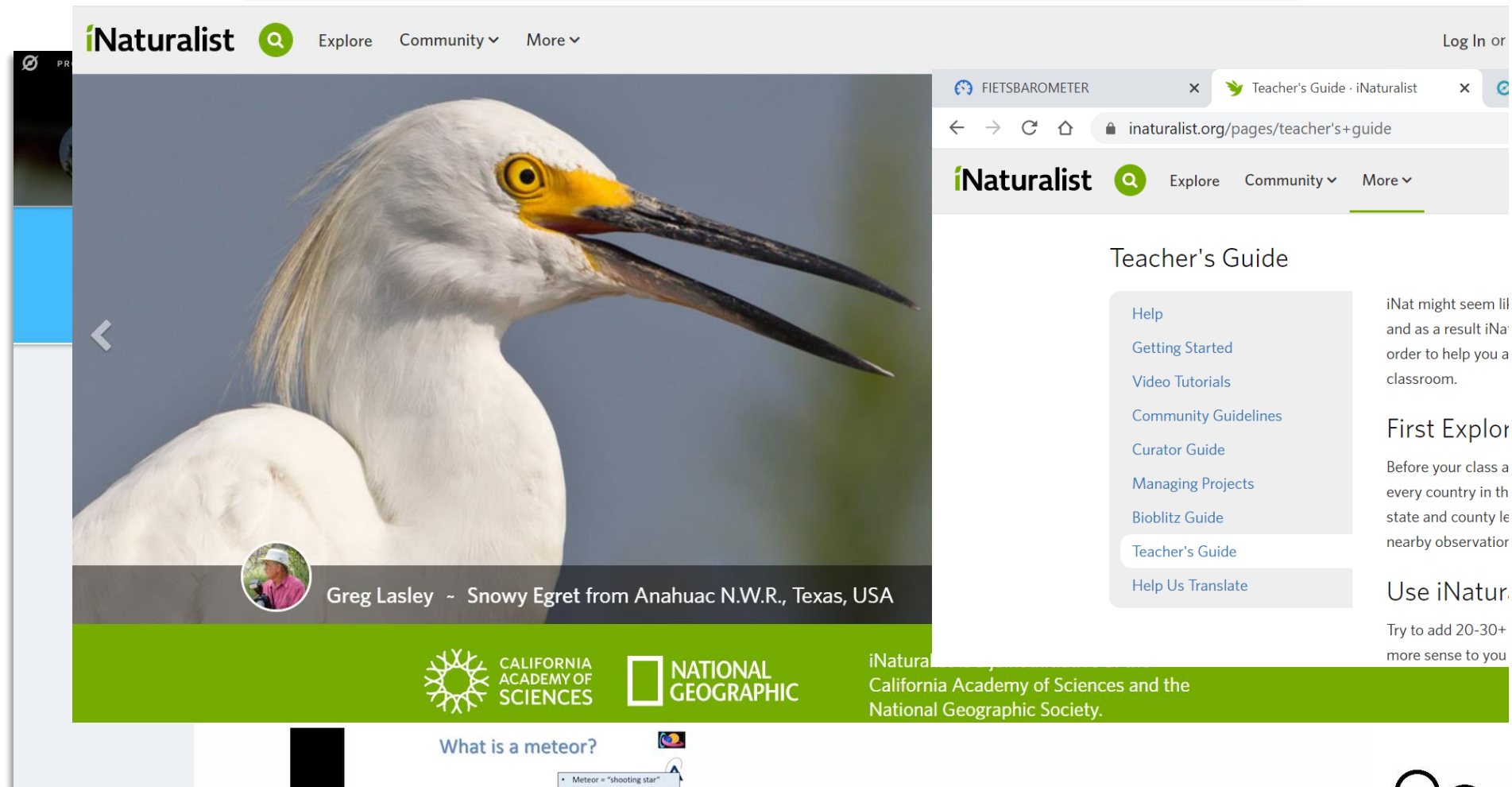
1

Radio Meteor Zoo

=> Zooniverse

iNaturalist

=> Own platform



Harlin et al. 2018



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## Ways of engaging

1

Radio Meteor Zoo

iNaturalist

The screenshot shows a web browser with multiple tabs. The active tab is 'Oog voor diabetes - Oog voor Diabetes'. The address bar shows 'oogvoord diabetes.be'. The website has a blue header with the logo 'OOG VOOR DIABETES'. Below the header, there are three main sections: 'BURGERWETENSCHAP?', 'LESPAKKETTEN?', and 'WAT MET AL HET GEANALYSEERDE MATERIAAL?'. The 'LESPAKKETTEN?' section is highlighted and contains the following text:

In samenwerking met de [Diabetes Liga](#) en drie studenten van de lerarenopleiding aan de VUB werd een Oog voor Diabetes-lespakket ontwikkeld dat gratis wordt aangeboden op [KlasCement](#), het online leerplatform van de Vlaamse Overheid. Het lespakket is gericht op leerlingen van de tweede graad (ASO, BSO, TSO, KSO) en geeft onder andere informatie over:

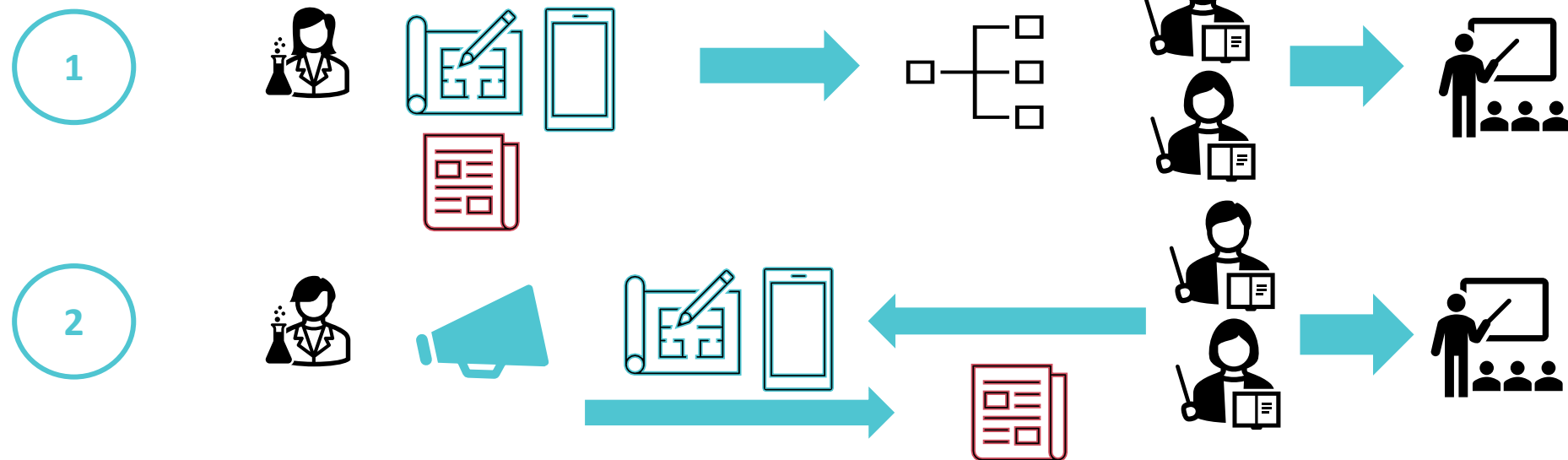
- wat diabetes is;
- het verschil tussen type 1 en type 2;
- de symptomen en complicaties van de ziekte;
- hoe type 2 te voorkomen

Below the list, there is a small image of a person using a laptop. To the right of the main content, there is a sidebar with a paragraph of text and a link 'Meer nieuws'. At the bottom of the website, there is a green footer with logos for 'CALIFORNIA ACADEMY OF SCIENCES' and 'NATIONAL GEOGRAPHIC', and the text 'California Academy of Sciences and the National Geographic Society'. Below the footer, there is a small section titled 'What is a meteor?' with a small image of a meteor.

Harlin et al. 2018

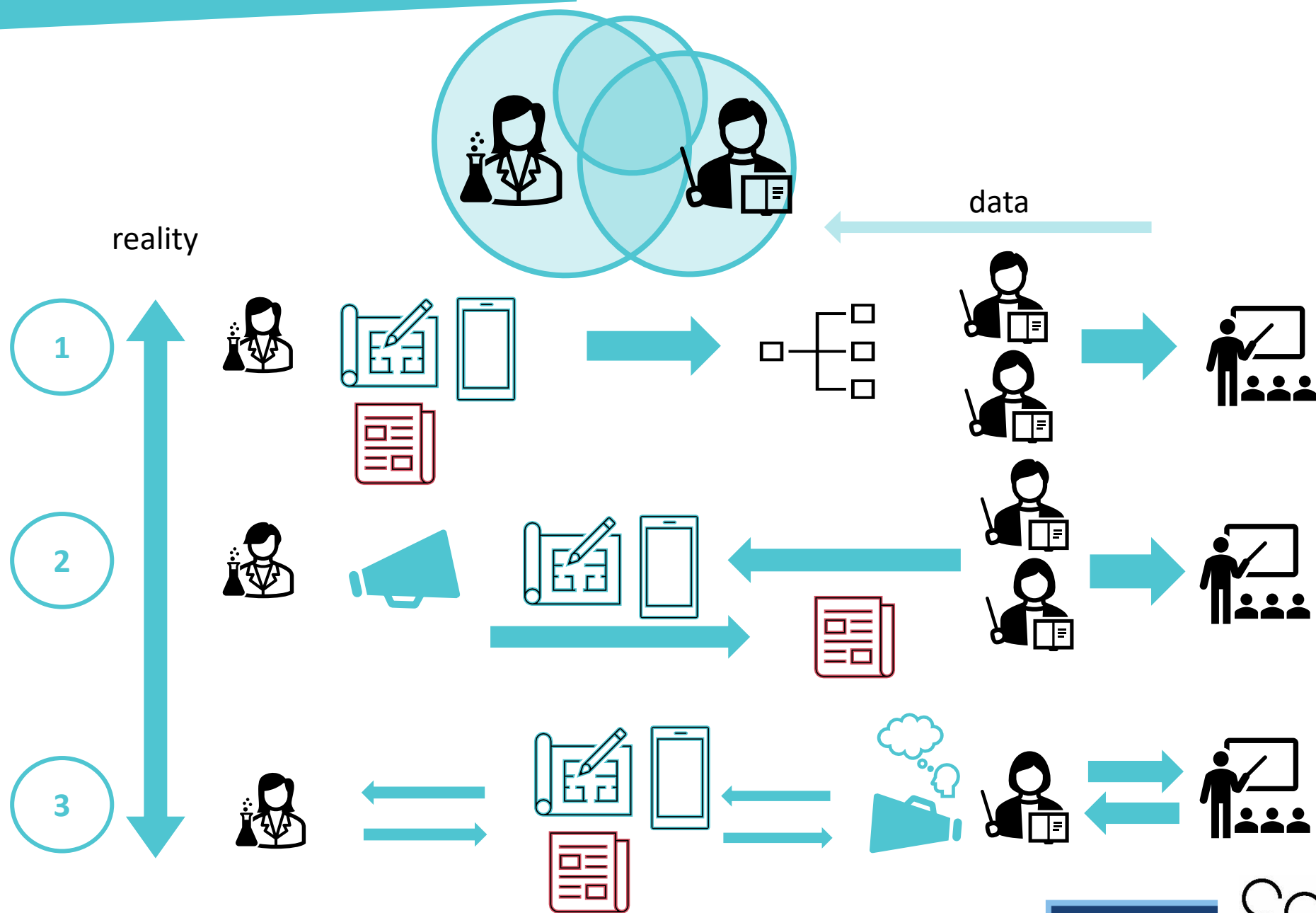


## Ways of engaging



*Harlin et al. 2018*

# Ways of engaging



Harlin et al. 2018



## References



**Bain R.** 2016. Citizen Science and Statistics. *Significancemagazine.com*, Feb 2016, pp. 16-21.

**Bird TJ et al.** 2014. Statistical solutions for error and bias in global citizen science datasets. *Biological Conservation* 173; 144-154.

**Harlin J. et al.** 2018. Turning Students into Citizen Scientists. In: Hecker S. et al., 2018. *Citizen Science: Innovation in Open Science, Society and Policy*. UCL Press, London.

**Hill MO,** 2012. Local frequency as a key to interpreting species occurrence data when recording effort is not known. *Methods in Ecology and Evolution*, 3, 195-205.

**Isaac NJB et al.** 2014. Statistics for citizen science: extracting signals of change from noisy ecological data. *Methods in Ecology and Evolution*, 5, 1052-1060.

**van Strien A, van Swaay CAM, Termaat T.** 2013. Opportunistic citizen science data of animal species produce reliable estimates of distribution trends if analysed with occupancy models. *Journal of Applied Ecology*, 50, 1450-1458.

Bain 2016

Bird et al. 2014

Harlin et al. 2018

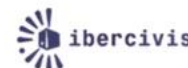
Hill 2012

Isaac et al. 2014

van Strien et al. 2013



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# Thank you!

Questions?  
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# SCIENTIX

The community for science  
education in Europe



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