Welcome to the international course on

Science Communication for Societal Impact

14-18 September, hosted online from Delft

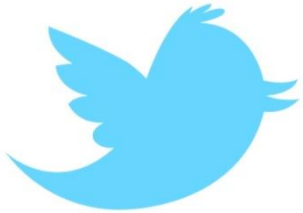
AESIS
NETWORK FOR
ADVANCING & EVALUATING THE SOCIETAL IMPACT OF SCIENCE

TU Delft

SCI COM NL

USC

DAY 2



#SciCom20
@AesisNet

OVERVIEW OF THE COURSE

Monday 14 September – Welcome and Introduction to Science Communication for Impact
Joost Ravoo & Roy Meijer, and Paul Manners

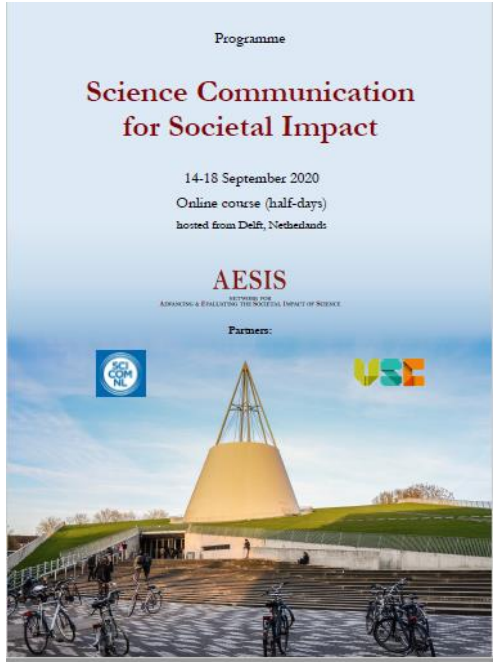
Tuesday 15 September – Science communication, university strategies, obstacles and criteria
Maarten van der Sanden & Alex Verkade

Wednesday 16 September – Facilitating science communication to society and lessons learned from COVID-19
Cissi Askwall & Anna Maria Fleetwood & Stefanie Molthagen-Schnöring

Thursday 17 September – Connecting Organisations for Societal Impact and Public & Policy Engagement
Ben Vivekanandan and Emily Jesper

Friday 18 September- Science Gallery Rotterdam: Science Communication and Societal Impact
Fred Balvert
Case study presentations

OVERVIEW OF TODAY'S PROGRAMME



Maarten van der Sanden

Collaboration Inside

- Science communication and university strategies
- The (potential) contribution of science communication to societal impact of research
- Universities and collaboration

Interaction: "challenges for university communicators"

Alex Verkade

Science Communication for Societal Impact: Obstacles and Criteria

- Public engagement: societal impacts of science communication
- Criteria for estimating successful communication in service of impact
- System interventions to improve impact through science communication

Maarten van der Sanden

Associate professor in Science Communication at Delft University of Technology

Collaboration Inside

impact through collaboration

Maarten van der Sanden, PhD.
Communication Design for Innovation
Dept. Science Education & Communication
TU Delft, The Netherlands

TU Delft

Convergence TU Delft, Erasmus Universiteit en Erasmus MC

Complex issues such as energy transition, digitisation and climate change cannot be approached from one or a few disciplines. It is therefore necessary to develop new convergent disciplinary connections between technical sciences, medicine and social and economic sciences. Against this background, the boards of TU Delft, Erasmus University Rotterdam and the Erasmus Medical Centre made agreements in April 2019 to structurally strengthen their collaboration.

Convergence Health and Technology post doc programme

Future of science communication as an impactful learning environment?

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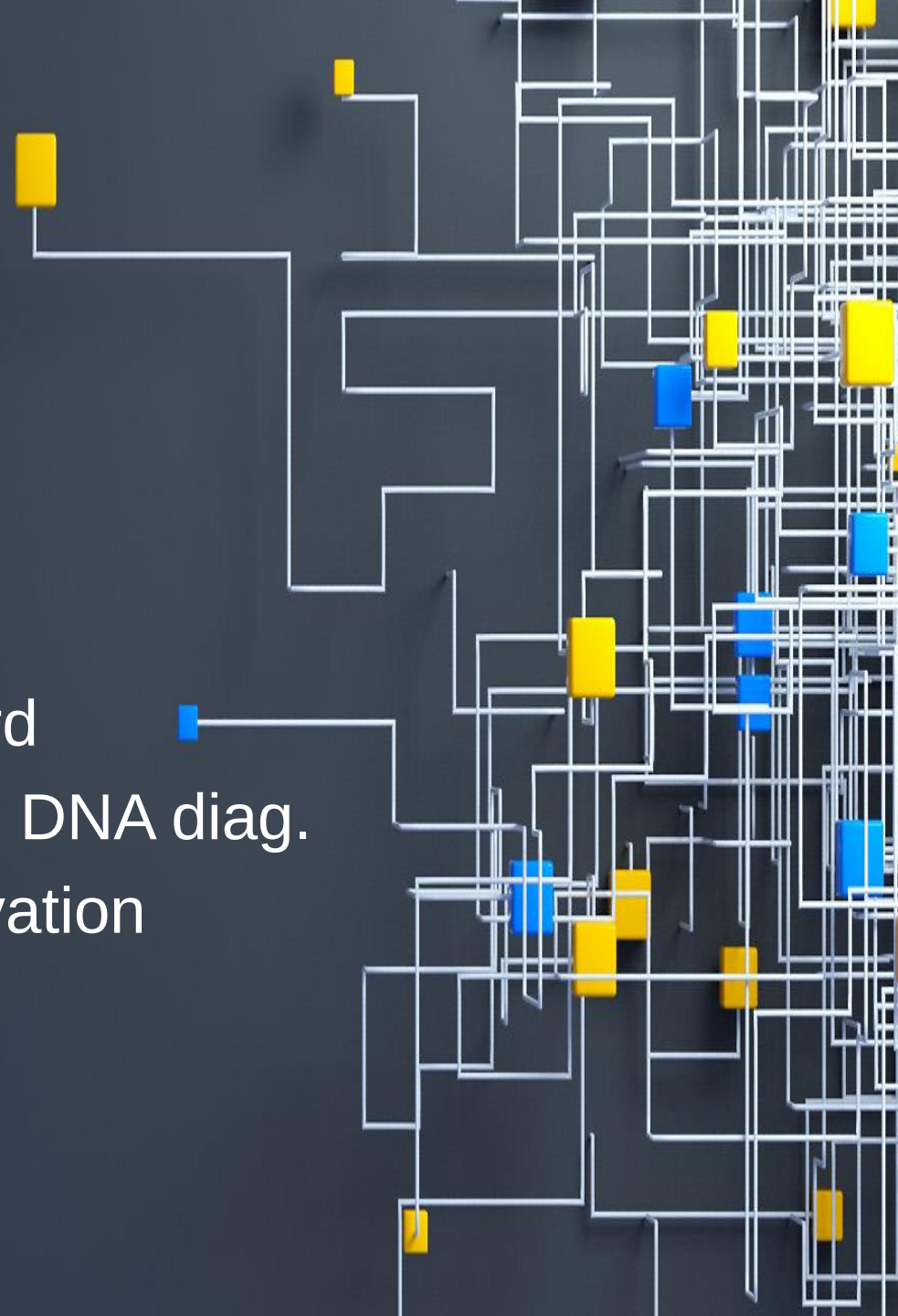
Who am I?

- MSc, biology / science & society
- Free lance science journalist
- PIO / spokesman university board
- PhD, social medicine / predictive DNA diag.
- Communication Design for Innovation
  - education
  - design-based research
  - community of practice



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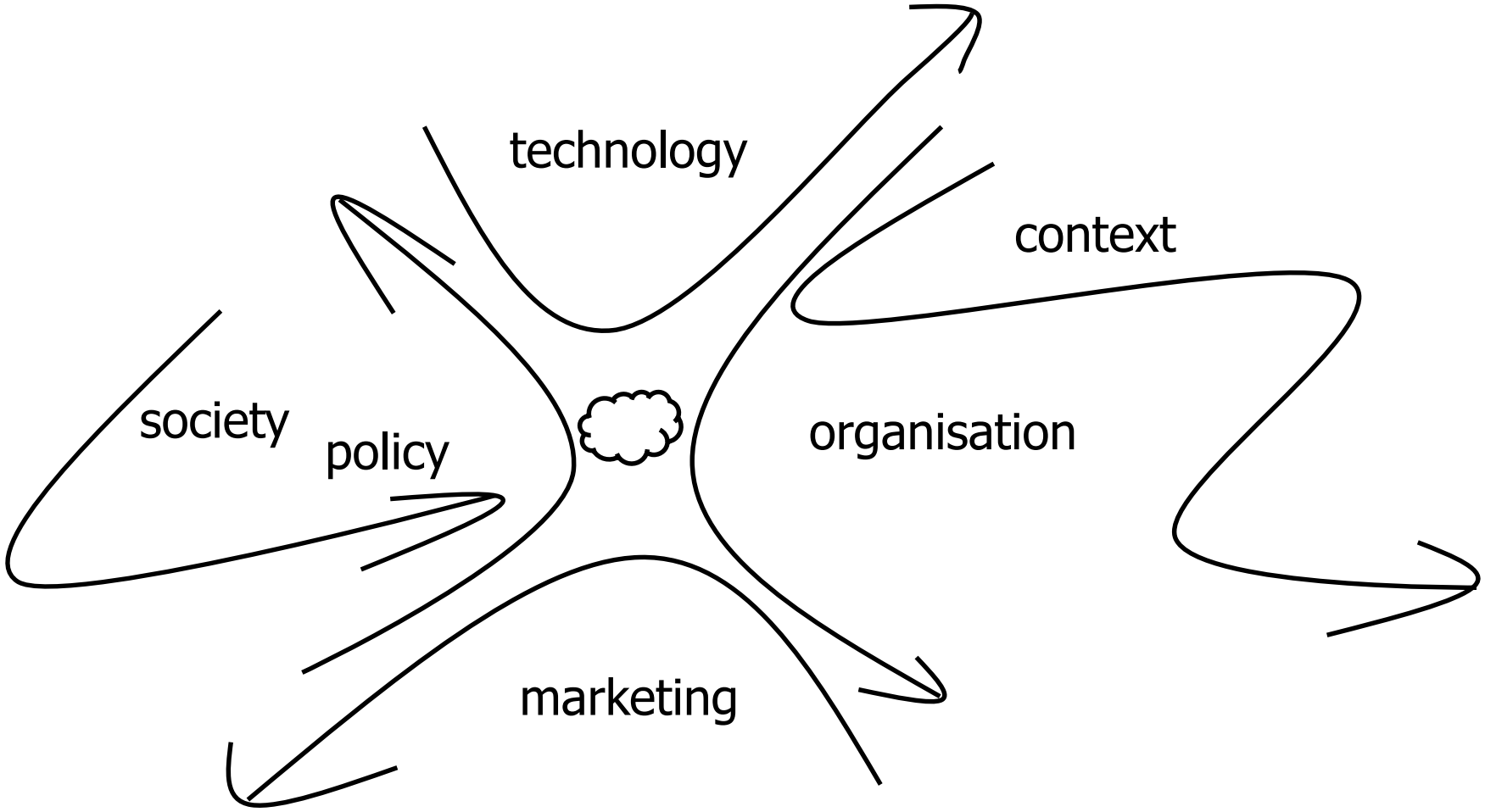
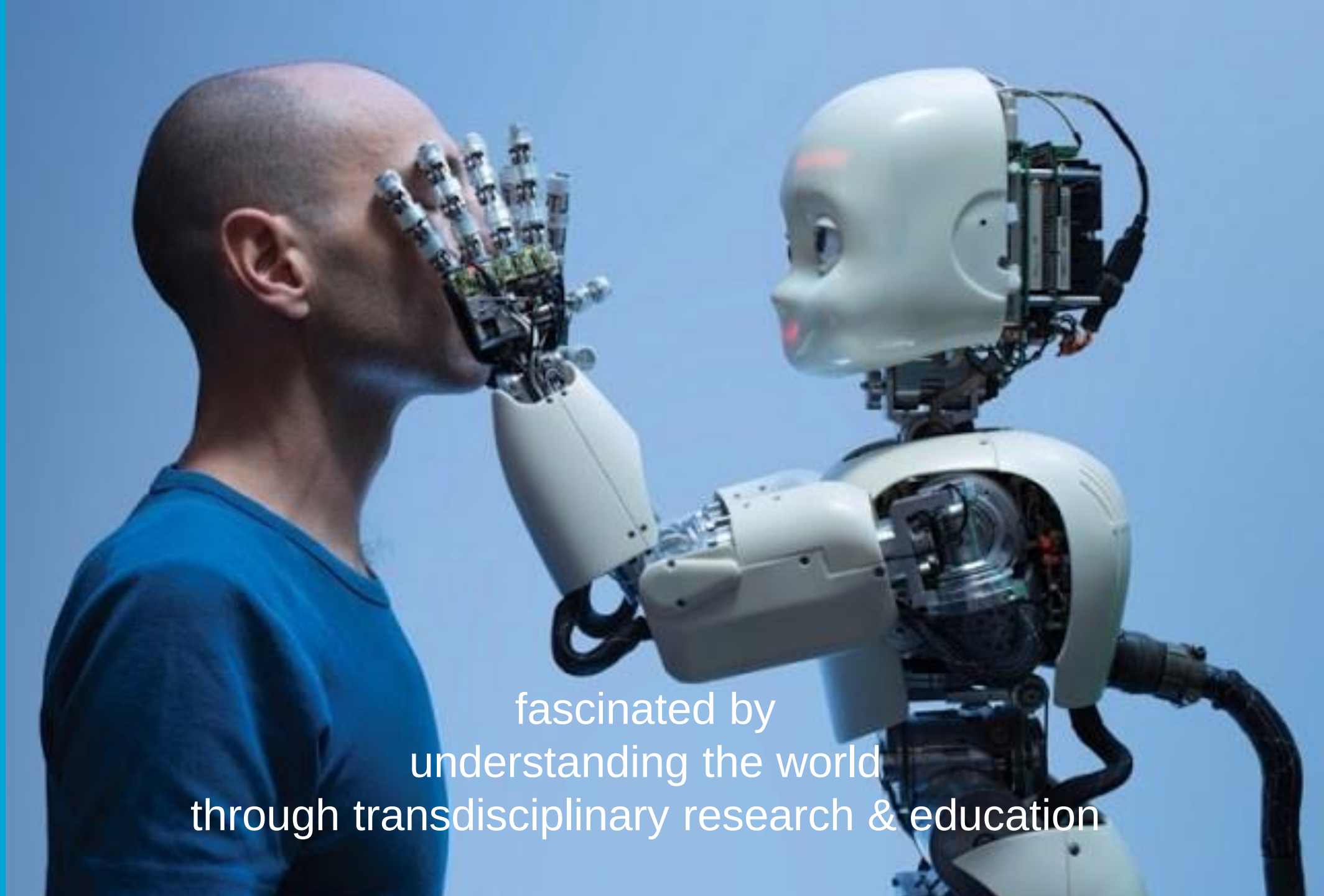
Berndnout Smilde, Nimbus Dumont, 2014

Emergent urgency to communicate: **systems approach**



(Van der Sanden, Evans & Priest, 2017)


human measure


fascinated by
understanding the world
through transdisciplinary research & education

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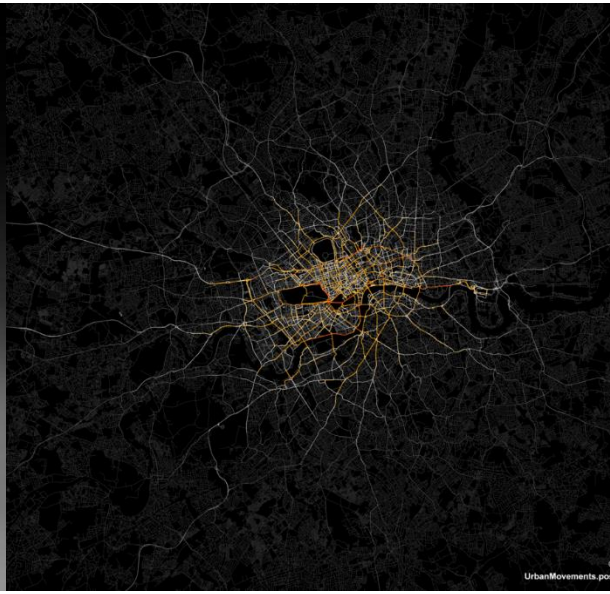
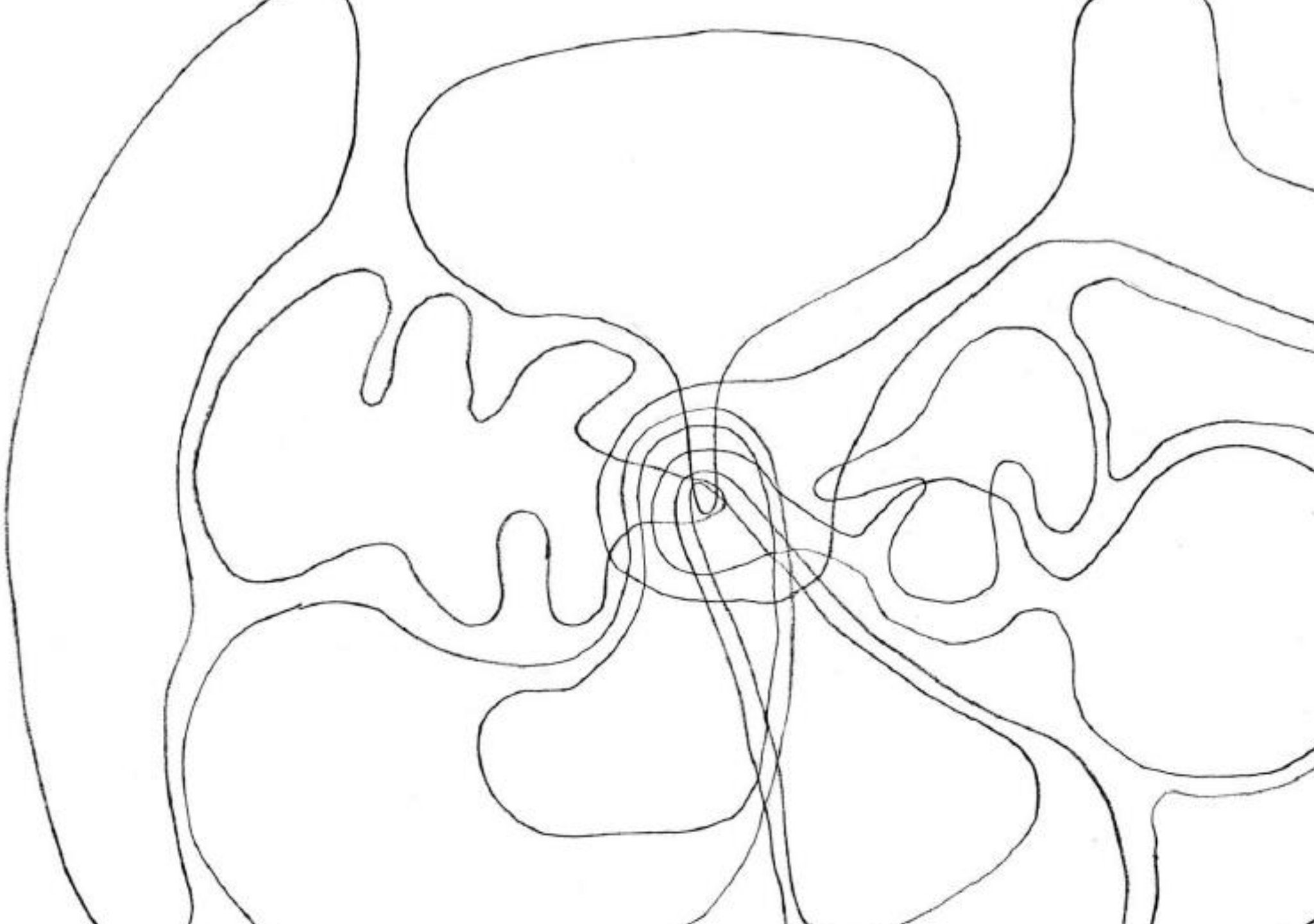
Research

decisions on interaction (HI) and tools

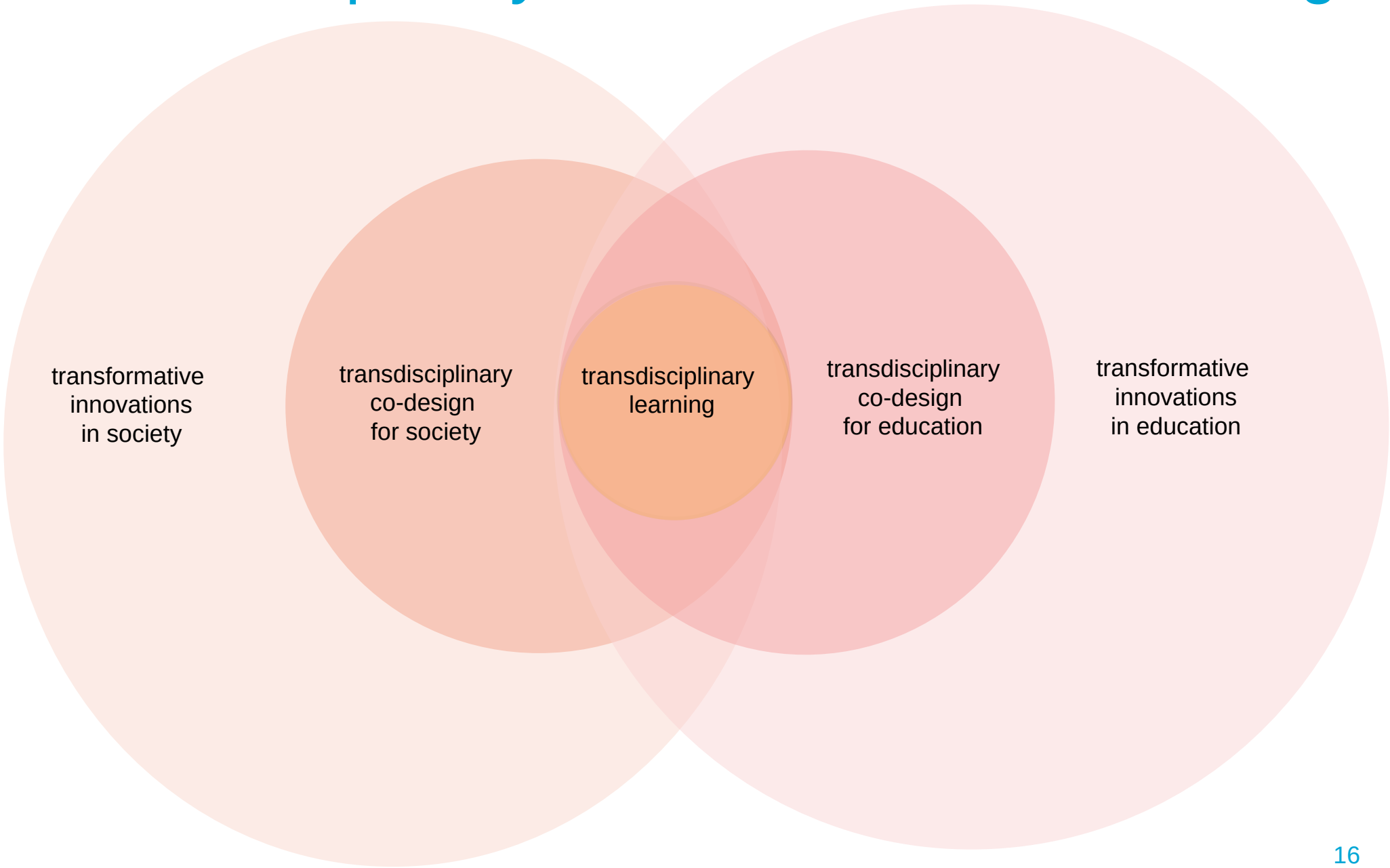
detail and the whole



complex dynamic networks & transdisciplinary learning



Transdisciplinary communication & learning



Future of science communication and its impact? Based on:

- human measure
- collaborative transdisciplinary learning

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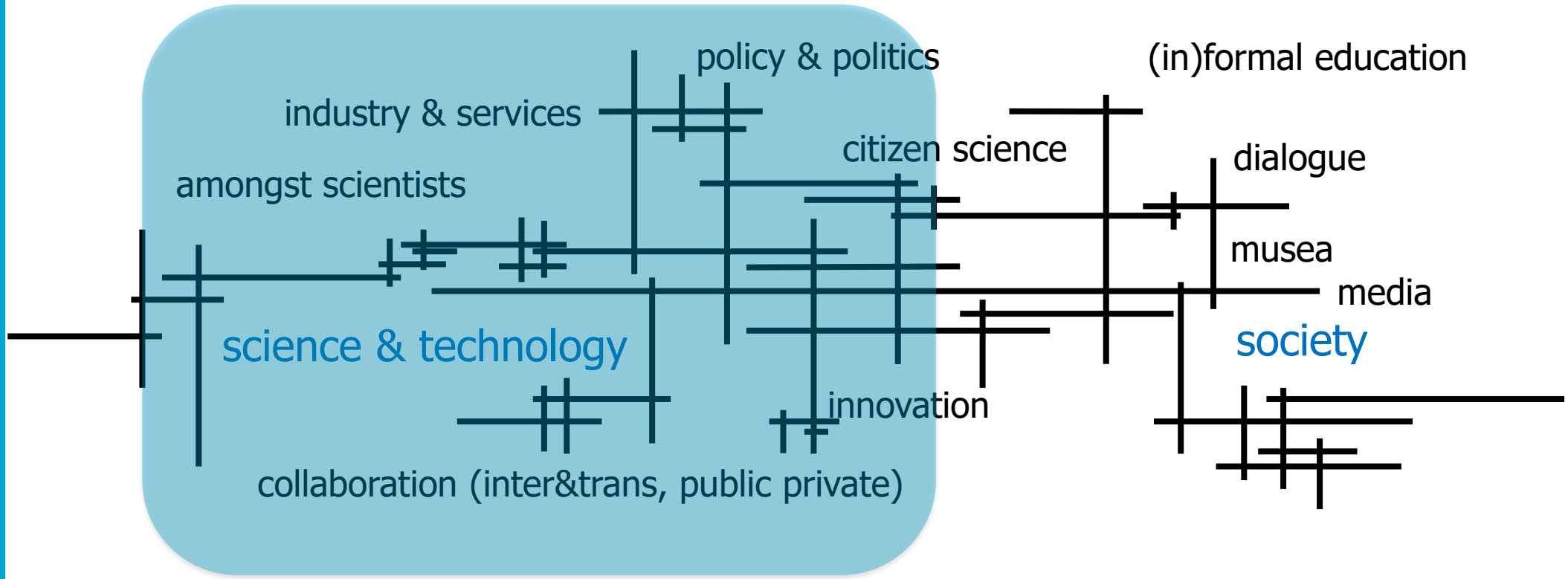
Share with you

- Science communication is an emergent dynamic element for change in the network of science and society through which…
- we learn collaboratively…
- and which enables or hinders us to build bridges between people who built new futures.

Science Communication Ecosystem



(Kalmar & Stenfert, 2020; Van der Sanden & Flipse, 2015; Davies & Horst, 2016; Trench et al, 2018)

Convergence TU Delft, Erasmus Universiteit en Erasmus MC

Complex issues such as energy transition, digitisation and climate change cannot be approached from one or a few disciplines. It is therefore necessary to develop new convergent disciplinary connections between technical sciences, medicine and social and economic sciences. Against this background, the boards of TU Delft, Erasmus University Rotterdam and the Erasmus Medical Centre made agreements in April 2019 to structurally strengthen their collaboration.

Convergence Health and Technology post doc programme

So…

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- we learn collaboratively…
- and which enables or hinders us to build bridges between people.

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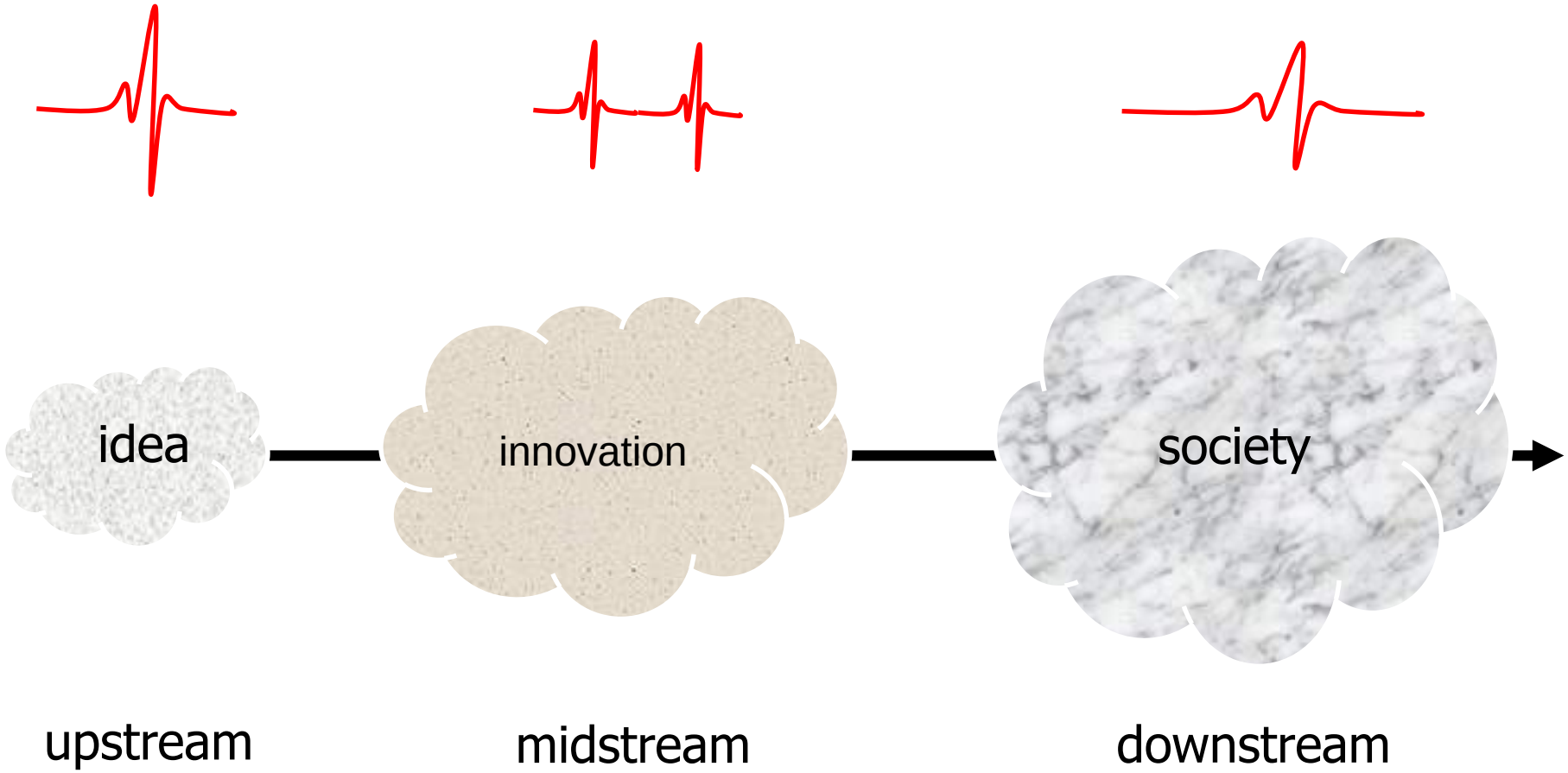
Variate heartbeat of interaction in convergence



That entails…

- Science communication is an emergent dynamic element for change in the network of science and society through which…
- we learn collaboratively…
- and which enables or hinders us to build bridges between people.

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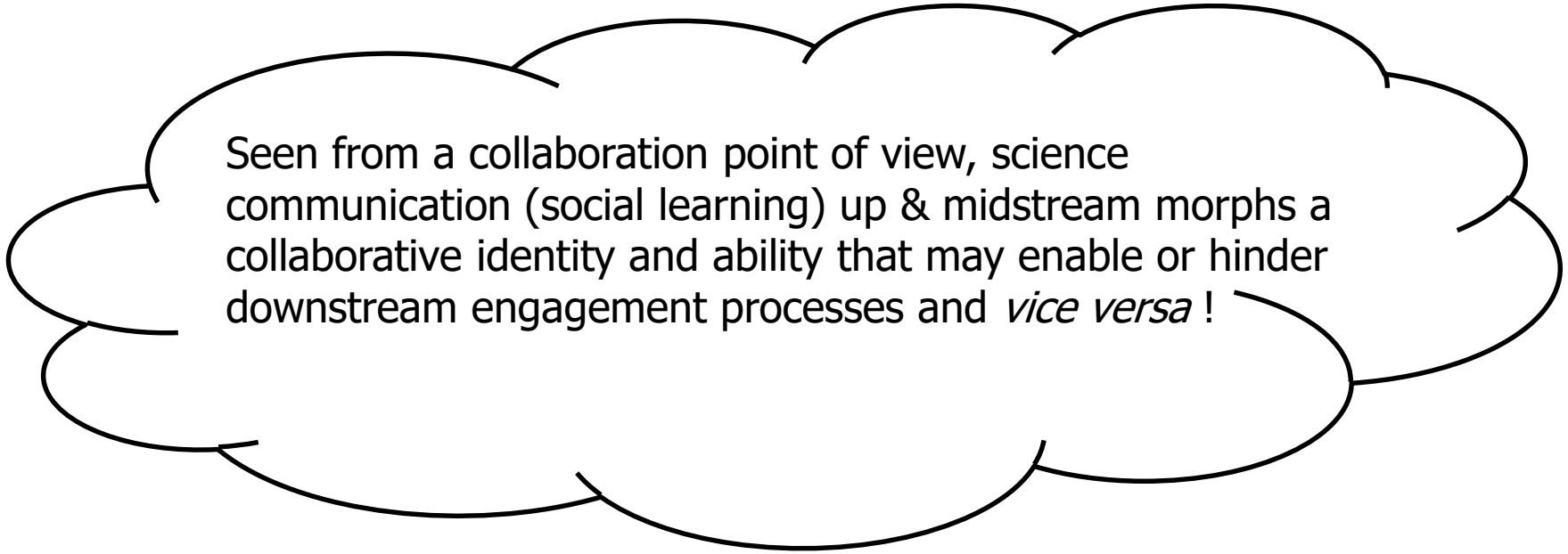
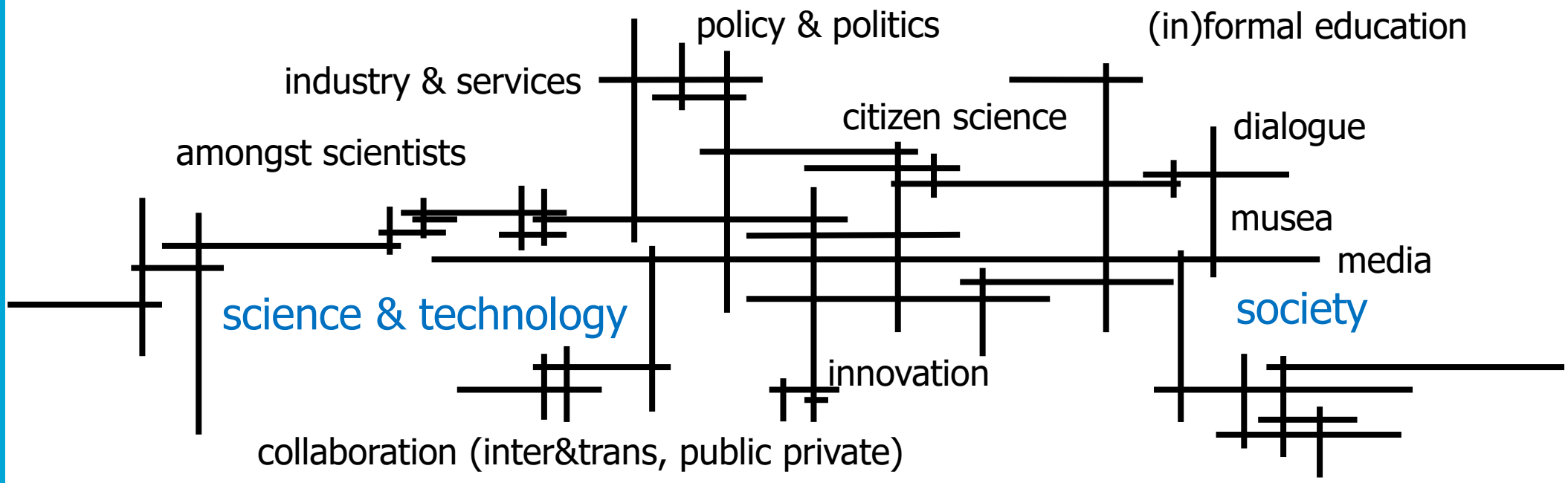
Social learning (Wenger, 2000)

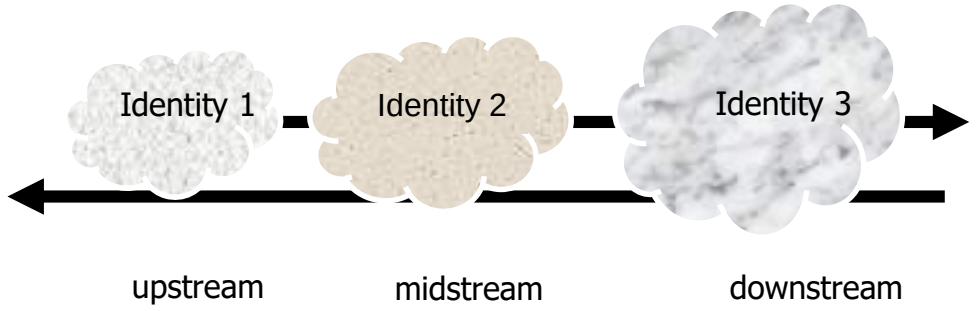
engagement, alignment and imagination

" […] whenever the two are in close tension and either starts pulling the other, learning takes place. Learning so defined is an interplay between social competence and personal experience. It is a dynamic, two-fold relationship between people and the social learning systems in which they participate. It combines personal transformation with the evolution of social structures."



Science Communication Ecosystem

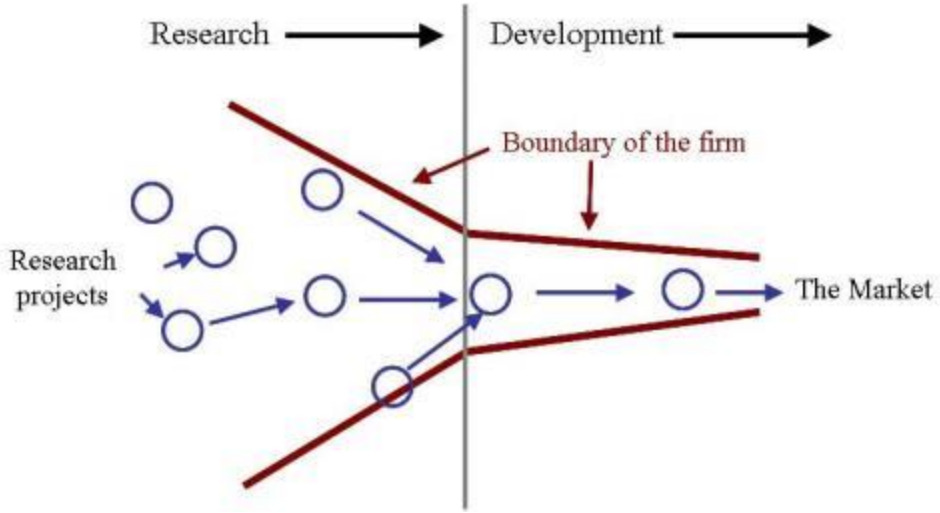




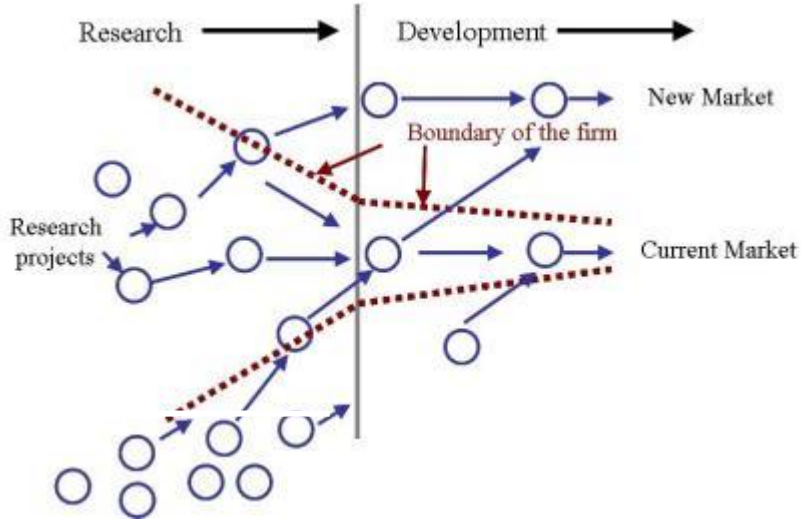
And leads to

- Science communication is an emergent dynamic element for change in the network of science and society through which…
- we learn collaboratively…
- and which enables or hinders us to build bridges between people.

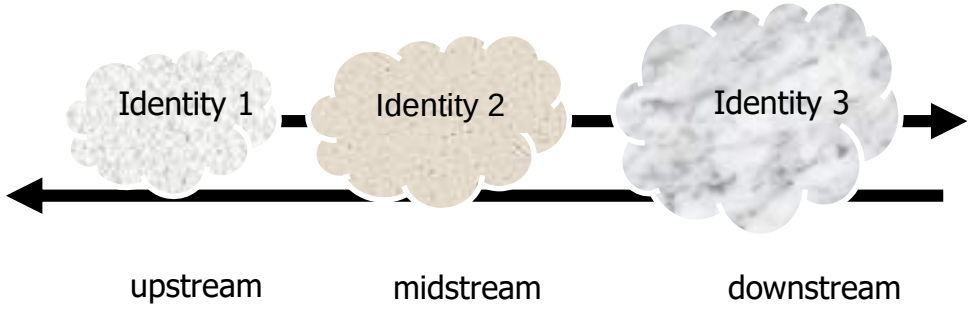
Open innovation (Chesbrough, 2006)

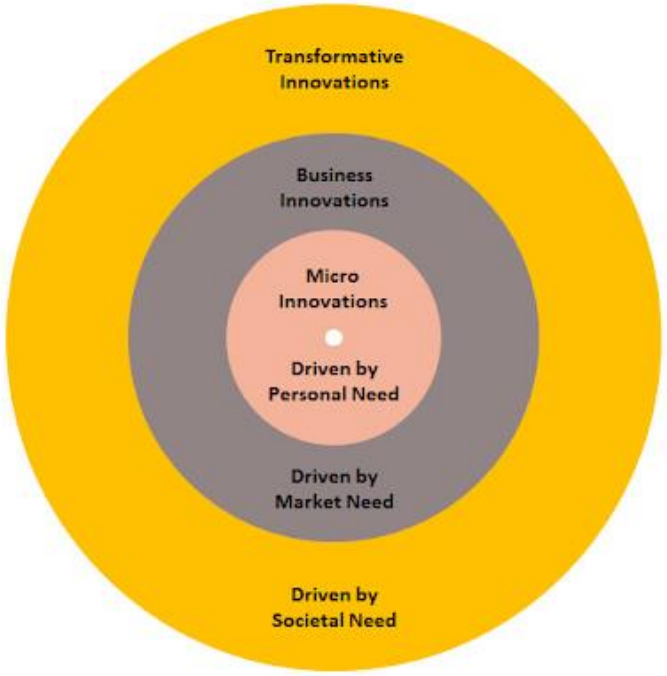


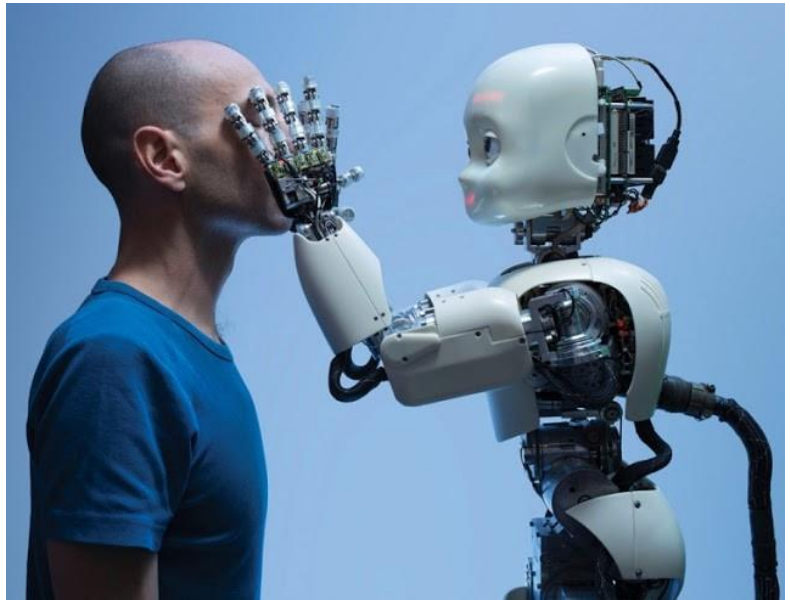
closed & linear



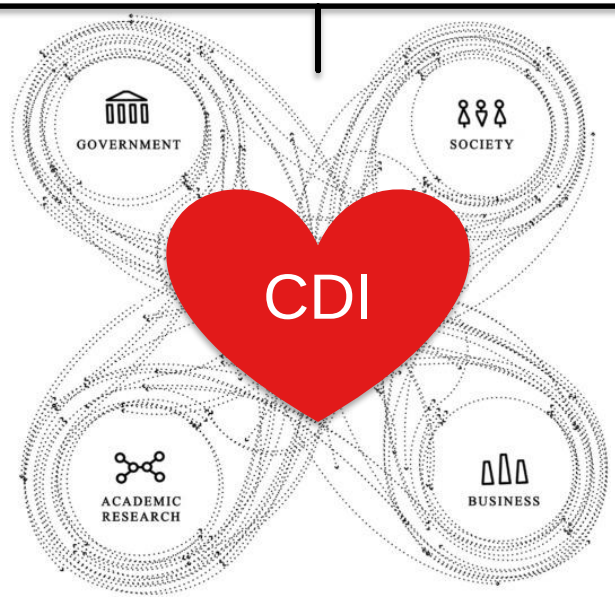
open iterative & adaptive







It combines personal transformation with the evolution of social structures



It combines personal transformation with the evolution of social structures at all levels

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Take aways

- Science communication is an emergent dynamic element for change in the network of science and society through which…
- we learn collaboratively…
- and which enables or hinders us to build bridges between people…
- who interact within science and technology up-, mid- and downstream at the same time…
- to foster and further the complex immediate relations between science, technology & society on a human measure

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Thanks! Suggestions? Questions?

Maarten van der Sanden, PhD.
Communication Design for Innovation
Dept. Science Education & Communication
TU Delft, The Netherlands

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Break

We will be back at ***10.05 (GMT+2)***

Future of science communication?

- Could science communication become a trail blazer for scientific development through its collaborative power?
- If yes, does that generate impact? For what or whom?
- If yes, what does that take for science communication professionals? For university communicators more specific? For the education of your future colleagues?

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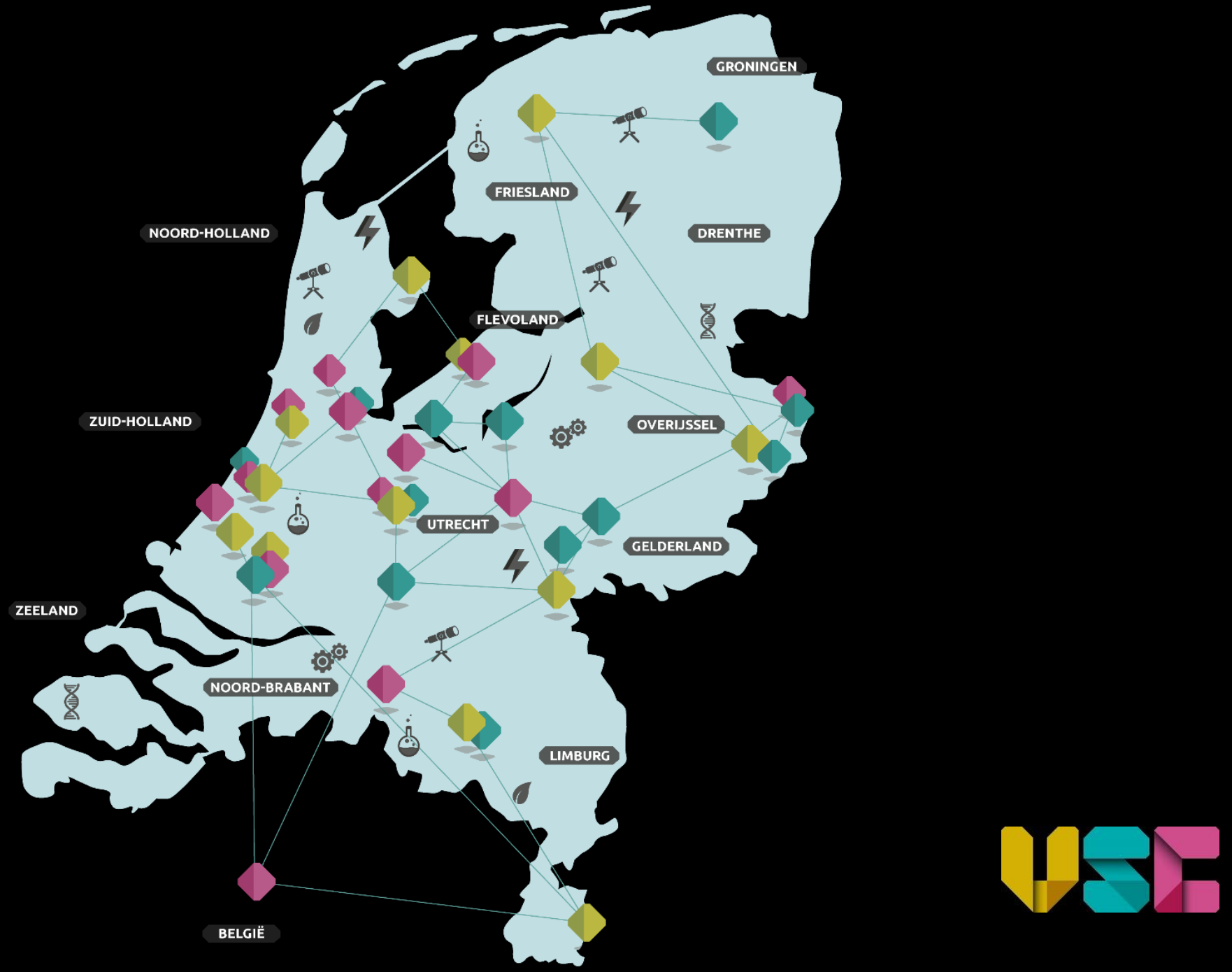
Break

*We will be back at **11.10 (GMT+2)***

Alex Verkade

Director of the Dutch Organisations of Science Museums and Science Centers, VSC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FLEVOLAND
ZUID-HOLLAND
OVERIJSSEL
UTRECHT
GELDERLAND
ZEELAND
NOORD-BRABANT
LIMBURG
BELGIË

SCIENCE COMMUNICATION FOR SOCIETAL IMPACT

– OBSTACLES AND CRITERIA

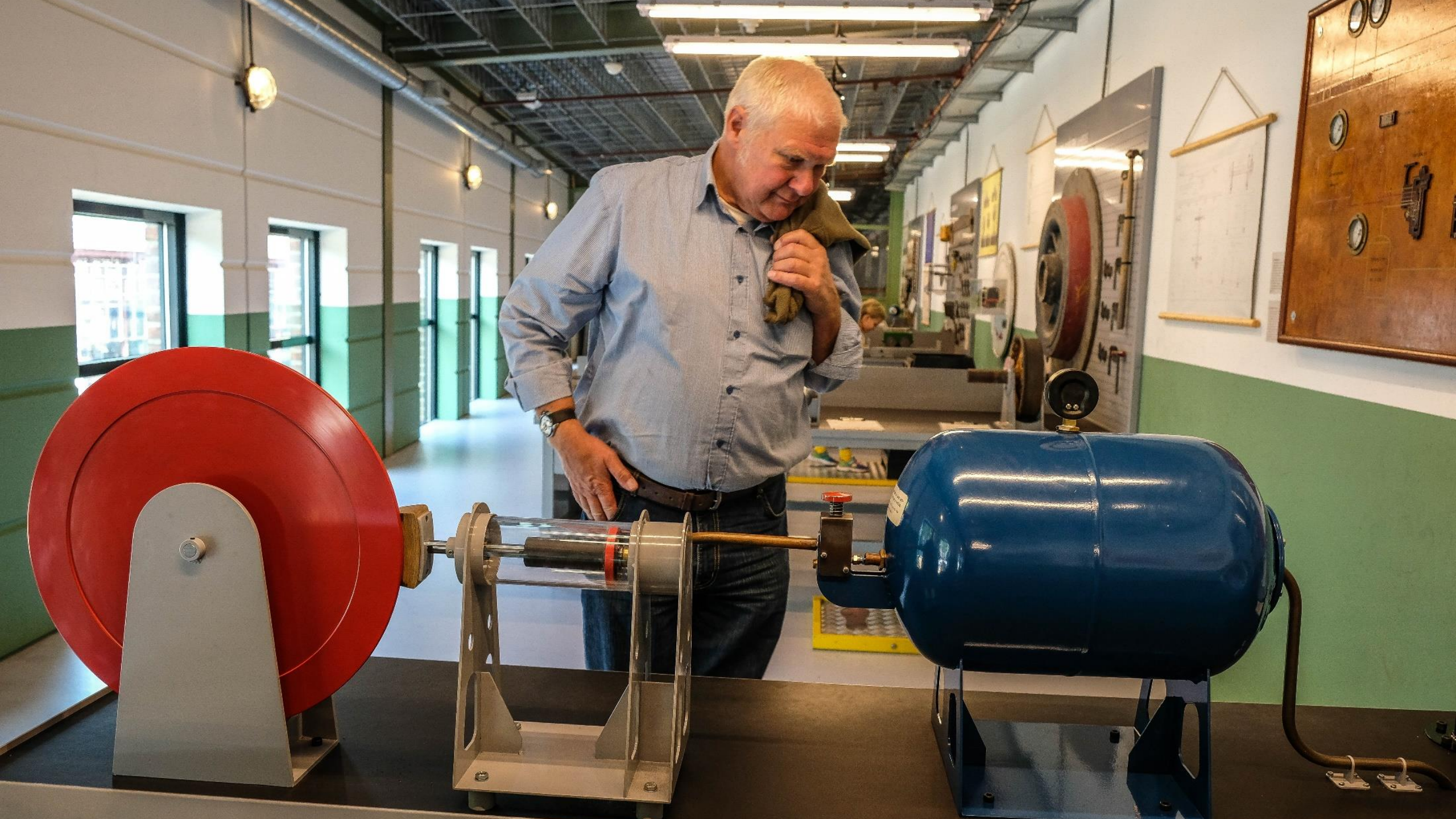
Alex Verkade - Sep 15, 2020

@alexverkade

WHAT ARE YOUR FAVORITE EXAMPLES OF SCIENCE COMMUNICATION?

Please answer in chat


moendoes
EXPEDITIE
moendoes
Breng als team wetenschappers een onbekende planeet in kaart
SNS REAAL
moendoes
SOMMETJES
moendoes
PAGINA UIT BIOLOGIEBOEK




CAUTION
240 VOLTS
Girlsday

SOME MORE EXAMPLES

MOOC

science center exhibit

smartphone app with historic walk

citizen science project

childrens lectures

discussion events with citizens

city science festival

school project in lower SES neighborhood

TV interview

university museum

podcast series

serious game

Science communication (sci com): the use of suitable communication skills, means and activities to stimulate and reward public engagement with science.

(ME

De Praktijk / 200+ sci com projects

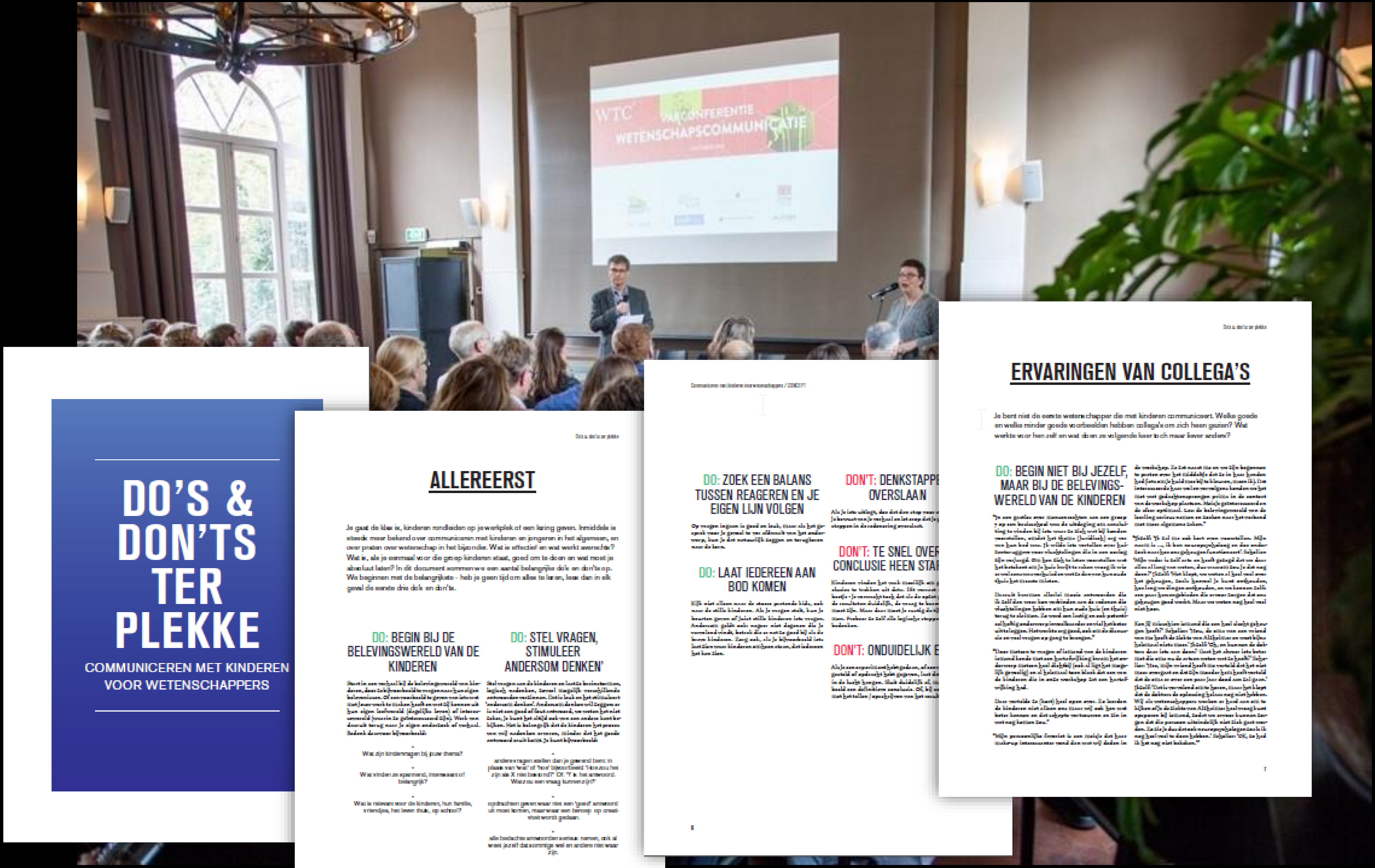
Rathenau Institute / sci com policy research

VSC / community mgmt, advocacy

Amsterdam, 1 child, death metal


moendoes
EXPEDITIE
moendoes
Breng als team wetenschappers een onbekende planeet in kaart
SNS REAAL
moendoes
SOMMETJES
moendoes
PAGINA UIT BIOLOGIEBOEK


CAUTION
240 VOLTS
Girlsday


WTC
VAKCONFERENTIE
WETENSCHAPSCOMMUNICATIE
DO'S & DON'TS TER PLEKKE
COMMUNICEREN MET KINDEREN VOOR WETENSCHAPPERS
ALLEREERST
Je gaat de klas in, kinderen rondleiden op je werkplek of een lezing geven. Inmiddels is steeds meer bekend over communiceren met kinderen en jongeren in het algemeen, en over praten over wetenschap in het bijzonder. Wat is effectief en wat werkt averechts? Wat is, als je eenmaal voor die groep kinderen staat, goed om te doen en wat moet je absoluut laten? In dit document sommen we een aantal belangrijke do's en don'ts op. We beginnen met de belangrijkste - heb je geen tijd om alles te lezen, lees dan in elk geval de eerste drie do's en don'ts.
DO: BEGIN BIJ DE BELEVINGSWERELD VAN DE KINDEREN
DO: STEL VRAGEN, STIMULEER ANDERSOM DENKEN'
DO: ZOEK EEN BALANS TUSSEN REAGEREN EN JE EIGEN LIJN VOLGEN
DO: LAAT IEDEREEN AAN BOD KOMEN
DON'T: DENKSTAPPE
OVERSLAAN
DON'T: TE SNEL OVER
CONCLUSIE HEEN STA
DON'T: ONDUIDELIJK E
ERVARINGEN VAN COLLEGA'S
Je bent niet de eerste wetenschapper die met kinderen communiceert. Welke goede en welke minder goede voorbeelden hebben collega's om zich heen gezien? Wat werkte voor hen zelf en wat doen ze volgende keer toch maar liever anders?
DO: BEGIN NIET BIJ JEZELF, MAAR BIJ DE BELEVINGSWERELD VAN DE KINDEREN


Brouwerij 't IJ

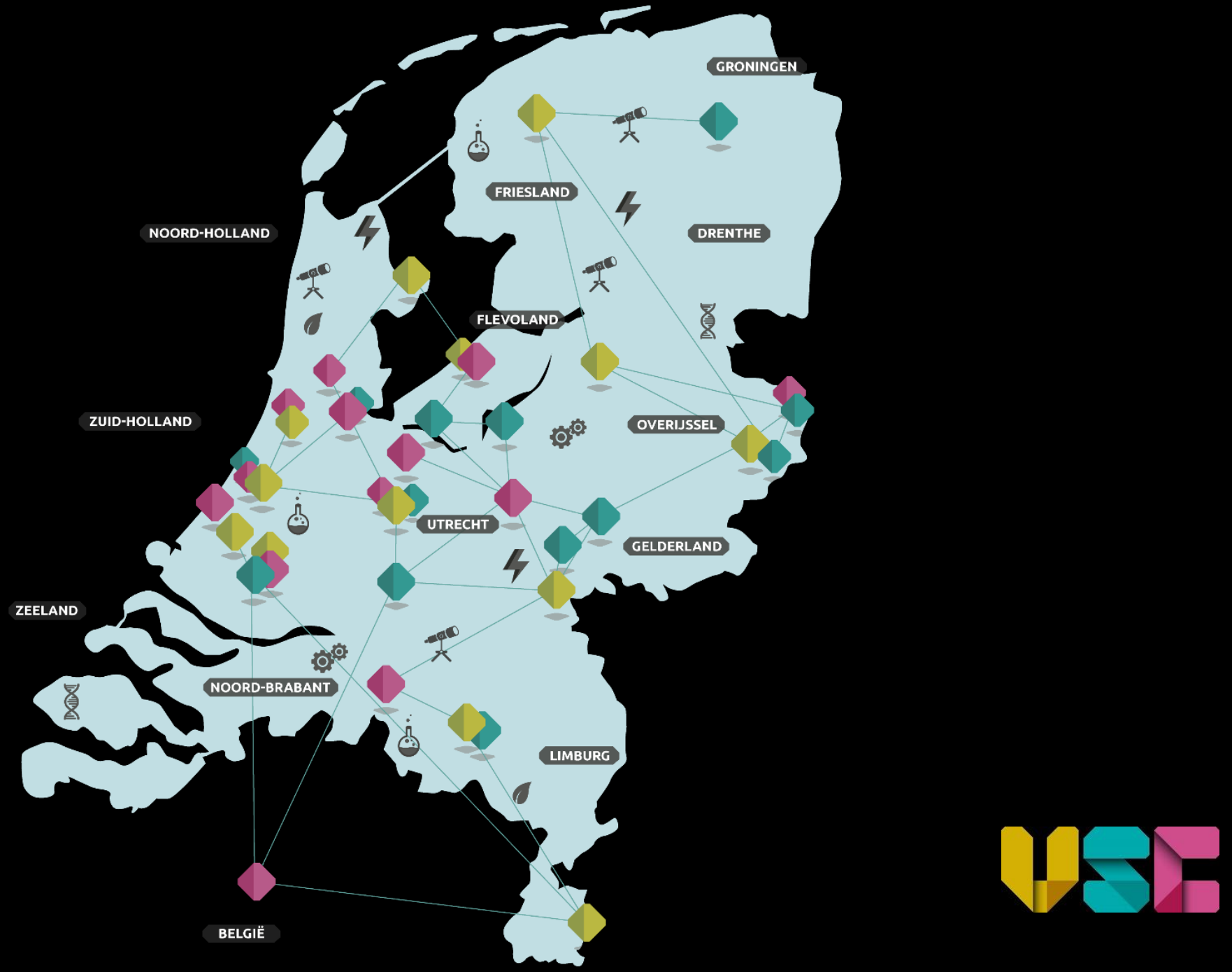
ME

De Praktijk / 200+ sci com projects

Rathenau Institute / sci com policy research

VSC / science centers & museums, community mgmt, advocacy

Amsterdam, 1 child, death metal)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FLEVOLAND
ZUID-HOLLAND
OVERIJSSEL
UTRECHT
GELDERLAND
ZEELAND
NOORD-BRABANT
LIMBURG
BELGIË

WHY SCI COM?

Why should we* want to do science communication at all?

5 minute discussion in chat

* society, academia, individuals

WHY SCI COM? SOME ANSWERS

1. Tax money spending transparency
2. Democracy demands people co-decide
3. Understanding science gives people autonomy
4. Public adoption of innovations and new insights
5. It improves science itself
6. Generating support for science (funding)
7. Etc.

SAME BUT TRANSLATED INTO POSSIBLE POSITIVE IMPACTS

1. Increased knowledge about what is being done with tax money
2. More (support for) science based policies
3. Higher quality of life through more science based decisions in individuals
4. Faster innovation
5. Scientific research and applications more attuned to societal demands
6. More support for the scientific enterprise

SCI COM TODAY

- money and time wasted on bad projects
- skewed audience, lost groups
- little progress over the years


EXIT
LAB SAFETY TIPS
GC/MS
PROGRESS

The mysterious long-distance transport of giant mineral dust particles

MICHÉLLE VAN DER DOES performed her PhD research at the Royal Netherlands Institute for Sea Research (NIOZ) and graduated at VU. She now works at the Alfred Wegener Institute Helmholtz Centre for Marine and Polar Research, Bremerhaven, Germany.
JAN-BEREND STUUT is associate professor at the Department of Earth Sciences, VU, and senior scientist at NIOZ.

→ **Reference**
M. van der Does et al., *Science Advances* **4** (12), eaau2768, doi:10.1126/sciadv.aau2768
The research was financed by both an NWO grant and an ERC grant awarded to Dr Jan-Berend Stuut and carried out at NIOZ – Royal Netherlands Institute for Sea Research on Texel.

"Mineral dust transported over the Atlantic Ocean has impact on the climate"

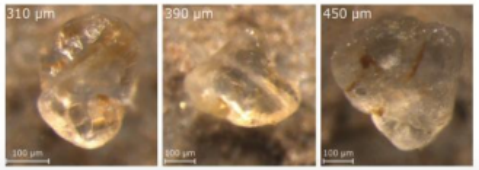
→ Large amounts of mineral dust are transported westwards over the Atlantic Ocean, originating from the Sahara Desert. This dust has several impacts on climate, both in the atmosphere and when it is deposited into the ocean. In the atmosphere, the dust particles can influence the amount of solar radiation reaching the Earth's surface, by reflecting some of it back into space. The dust can also trap the outgoing heat, having a warming effect on climate, similar to what greenhouse gasses do. These so-called radiative effects strongly depend on the dust particles' size, shape and mineralogy. In the ocean, the carbon cycle is impacted, since the dust particles deliver important nutrients which algae use to grow, during which they take up CO_2 from the air. The dust particles are also involved in the settling of the freshly-produced organic matter, acting as anchors that drag the algae down to the ocean floor, where the organic carbon can be stored for thousands of years.

Several studies have looked at the amount of dust and the size of the dust particles on both sides of the Atlantic: in the east, close to the Sahara Desert, but also in the Caribbean in the far west. In our study, Saharan dust was collected along a transect from east to west, covering the full width of the Atlantic, using autonomous dust-collecting buoys and submarine sediment traps. Among other things, this showed the seasonality of dust transport and deposition: most dust is deposited over the Atlantic Ocean in summer, and the dust particles are also larger than in winter, due mainly to increased convection over the African continent during summer and high-level (>3km) transport through the atmosphere.

A surprising result were the so-called giant dust particles, which are defined as >0.075 mm in diameter. Normally, the average particle size is around 0.012 mm in summer, and 0.009 mm in winter at the same location. We found individual particles of up to almost 0.5 mm in size up to 3,500 km from the west African coast, which is an astonishing distance for such large particles. Conventional physical models are unable to explain such long-distance transport, since these giant particles are too large and heavy to be transported very far. Since there is no clear understanding of how the transport of these giant dust particles occurs over these vast distances, computer models are unable to include them in their simulations, and thus their impact on climate cannot be predicted accurately.

Therefore, we examined four mechanisms that can help these giant particles travel over vast distances. The first mechanism is transport at high wind speeds, but the wind speeds that are required to facilitate transport over several thousands of kilometers have never been observed in nature. Second, turbulence in the air could move the dust particles up, stirring the air as it travels westward, but turbulence can also act downwards instead of up, actually increasing the speed at which the particles are brought down. The third mechanism is related to the possibility of repeated convective uplift, which happens in large cumulonimbus clouds – the typical anvil-shaped convective clouds that are characteristic for the tropics – where the particles can be lifted up to 12 km altitude, instead of their regular altitude of 5 to 7 km. We calculated that a minimum of four uplifts are needed to transport the giant particles to our first sampling site, 2,400 km from the west African coast, and six repeated uplifts to the sampling site at 3,500 km. Since the amount of dust particles is greatly reduced with each uplift, perhaps another mechanism could be at play, too. The fourth mechanism we explored relates to electric charge, which acts like static electricity that can compensate the particle's weight. This charge can be generated when dust particles collide into each other continuously, which tends to occur frequently in the dense and turbulent air layer that transports the dust during summer. The electric charge seems to be most efficient for quartz particles, which is also the main mineral that we observe among the giant particles. As always, it is most likely a combination of the four mechanisms that causes the long-distance transport of giant mineral dust particles.

Now that we have some realistic ideas about potential mechanisms that can facilitate the transport of giant dust particles over such long distances, more research should focus on their individual and collective contribution to radiative properties of the atmosphere. Ultimately, these mechanisms should be incorporated into climate models so that these giant particles can be included in the simulations that so far only considered particles <0.020 mm. The observed and now explained order-of-magnitude increase in the dust particles' size that needs to be described by climate models will hopefully lead to a better understanding of the impact these giant particles are having in regional and global climate, and also lead to better predictions for future climate scenarios. Ω



→ **Figure**
Microscope images of giant dust particles that were collected over the Atlantic Ocean (own photo; part of figure published in Science Advances).

Sound waves reveal immune cell dynamics

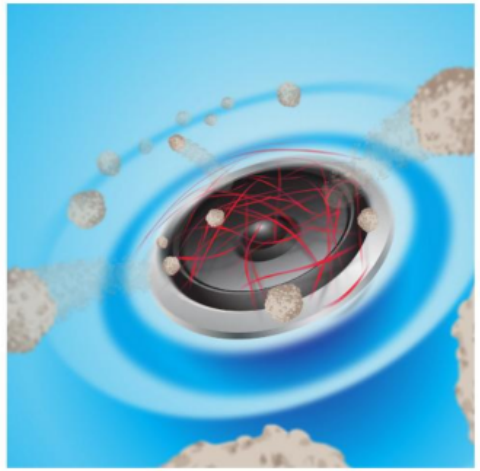
DOUWE KAMSMA finished his PhD at the Physics of Living systems group, VU, and is currently an R&D Engineer at spin-off company LUMICKS

→ Viruses are enemies we are all too familiar with during the winter months. Luckily, not every pathogenic attack is successful. Our body is guarded against pathogens by T cells, white blood cells that play a key role in our immune system. When viruses or bacteria invade, T cells need to migrate rapidly from blood vessels to the inflammation site to restrain the offender. To do so, they need to adhere to the endothelial cells which form the first layer of the blood vessel wall and then leave the vein towards the infected site. Strength and speed of this process are crucial to a successful outcome of the immune response. However, it is difficult to determine which factors play a role in the adhesive process due to the intrinsic variability between cells. To overcome this limitation, we modified a recently developed single-molecule technique called acoustic force spectroscopy, and applied it to study the binding kinetics and strength of T cells in a model system mimicking a blood vessel wall, allowing us to perform many measurements in parallel and in a well-controlled environment.

Our technology allows to exert forces onto cells by exploiting the pressure generated by acoustic standing waves. We perform our experiments in a small microfluidic chamber, where we have precise control of factors which might affect the adhesion process of cells, such as temperature, salt concentration and flow speed. To investigate how T cells adhere to a blood vessel, we coated a microfluidic channel with fibronectin, a protein which is present in the blood vessel wall and is responsible for T-cell attachment. Subsequently, we introduced T cells (which we purified from donor blood) into the microchannel. After most of the cells were bound to the fibronectin layer, we switched on an acoustic wave, which we carefully tuned in a way that it could exert a well-defined force on the cells. By tracking cells microscopically, we could then observe what happened to T cells: the ones who were binding strongly to the fibronectin layer stayed still on the surface, while the ones who were more loosely bound detached and get pushed away by the acoustic force. Since the cells are much smaller than the field of view, we could follow the adhesion process of hundreds of cells at the same time, allowing us to get statistically significant results, correcting for the intrinsic variability between cells.

Our newly developed method, scAFS (single-cell acoustic force spectroscopy), is therefore perfectly suitable to test how different players of the immune system can influence the attachment of T cells to the blood vessel wall. An example of these players are interleukins, growth factors which regulate the immune system. By performing cell adhesion measurements and following the motion of the cells, we found that when this agent is present in the solution filling the microfluidic channel, the binding kinetics of the cells is faster, while the adhesion strength remains the same. The faster kinetics likely increase cells' chance to bind to the vessel wall in the blood flow to infiltrate inflamed tissues and locally coordinate the immune response, helping our body to protect us from pathogens in a more efficient way.

The system we developed can therefore be used to obtain insights into cell adhesion process, which can potentially be employed in diagnostic or in drug screening. Understanding how T cells adhere to the vessel wall and which factors are influencing this process will ultimately help in developing better drugs to increase the likelihood of success of our body's immune response. As cell adhesion processes are not limited to T cells but affect many biologically relevant mechanisms, such as cancer invasion, we expect that our method of quantifying adhesion kinetics will open up a wide range of potential applications in research and the clinic. Ω



"A new tool for immunotherapy and drug screening"

→ **Figure**
Cartoon of white blood cells (in white) attached to a layer of fibronectin (red fibres), a protein covering our blood vessels. When cells do not attach strongly enough to the blood vessels, they can be pushed away by sound waves.

→ **Reference**
D. Kamsma *et al.*, *Cell Reports* **24** (11), 3008–3016 (2018)

SCI COM TODAY

- money and time wasted on low impact projects
- skewed audience, lost groups
- little progress over the years

+ growing recognition of importance
+ motivated professionals and amateurs

HOW DO WE IMPROVE IMPACT?

Break out until...

Discussion guided by 4 questions

System analysis, theory of change

Suggestions for interventions

QUESTIONS

1. Who does / should do sci com?
2. What motivates them to do so?
3. How could we stimulate and support *individuals* to improve their impact?
4. How could we make the *population* improve?


BREAK

HOW DO WE IMPROVE IMPACT?

Analysis

Theory of change

Actions and interventions

MY ANALYSIS

Scientists are main determinant

Sci com is a hobby, not work

No career path for scientists

Little recognition and reward in academia

No incentive or time for improvement

MY THEORY OF CHANGE

MY INTERVENTIONS

- Distinguish high from low quality
- If high quality, recognize and reward as work
- Continuously evaluate, innovate, share lessons
- Stimulate ongoing conversation about impact
- Connect stakeholders

QUALITY CRITERIA

Rathenau Institute 2016-2017

From literature and conversations

Technical vs. normative criteria, in rubrics

Initially made for judging project proposals

But the road *is* the destination

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Onderzoek & dialoog | Wetenschap, technologie en innovatie

	PROJECTCONSISTENTIE	ZIT HET PROJECT GOED IN ELKAAR?			
1.1	Doelen	Worden doelen begrijpelijk beschreven? Zijn doelen SMART geformuleerd? Is er een helder onderscheid tussen doelen en middelen?	Is gericht op impact. Formuleert duidelijke doelen, als uitgangspunt van het project. Doelen zijn waar mogelijk SMART geformuleerd. Geeft aan of het gaat om kennisoverdracht, attitudeverandering en/of acties bij de doelgroep. Doelen hebben niet alleen te maken met corporate communicatie, marketing en/of studentenwerving.	Doelen zijn te vaag geformuleerd en daardoor niet toetsbaar. Maakt niet helemaal helder onderscheid tussen typen doelen en/of tussen doelen en middelen.	Middel is uitgangspunt, doel weinig doordacht, te algemeen. Gooit kennisoverdracht en attitudeverandering op één hoop. Doelen hebben niet te maken met maatschappelijke impact, alleen met marketing van de instelling.
1.2	Doelgroepen	Worden doelgroepen duidelijk omschreven en afgebakend?	Richt zich op een of meer duidelijk omschreven doelgroepen, die passen bij het doel.	Richt zich op doelgroepen die niet duidelijk omschreven of afgebakend zijn. Richt zich op doelgroepen die niet kloppen met de doelen.	Richt zich op 'algemeen publiek' zonder verdere precisering.
1.3	Efficiëntie	Past het budget en de begrote inzet bij de geplande werkzaamheden? Zijn de bedragen bij begrotingsposten ruwweg realistisch?	Laat zien dat de inzender goed begrijpt hoe kosten zich verhouden tot werkzaamheden. Omschrijft een geloofwaardig, uitvoerbaar project met passende uren/kosten. Heeft een evenwichtige begroting, die past bij de ambities. Heeft voorwerk gedaan door bij te betrekken uitvoerders offertes aan te vragen.	Heeft de meeste bedragen en uren redelijk tot goed ingeschat, maar overschat / onderschat bepaalde taken. Heeft voor externe kosten geen offerte/schatting aangevraagd.	Wekt de indruk dat de inzender geen goed idee heeft van wat zaken kosten. Is veel te duur of veel te goedkoop voor wat geleverd wordt. Heeft een onevenwichtige begroting, die op sommige aspecten van het project veel ruimer begroot is dan op andere. Heeft geen experts om hulp gevraagd om goed te kunnen schatten.

QUALITY CRITERIA GOLD RULES

1. Start with goal and target group
2. Engage target group ASAP
3. Involve experts early on
4. Reflect & evaluate early and brutally
5. Share your lessons

QUALITY CRITERIA CONVERSTAIONS

Sci com is growing in perceived importance systemwide

We need to clearly distinguish system from individual

Formal recognition is needed, but also informal culture change

There is a gap between impact people and sci com people in organisations

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WHERE ARE WE NOW IN NL

New €1M / yr funding call for sci com through research council NWO

Criteria geared towards impact

First round deadline = Sept 22

“Just as the public must be educated on scientific topics, so must the scientific community be educated on public attitudes and opinions.”

Chris Mooney (2010) - Do Scientists Understand the Public?

ASK ME MORE

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WETENSCHAPSMUSEA
EN SCIENCE CENTERS

Break

We will be back at ***12.10 (GMT+2)***

Thank you

Enjoy lunch!

OVERVIEW OF THE COURSE

Monday 14 September – Welcome and Introduction to Science Communication for Impact
Joost Ravoo & Roy Meijer, and Paul Manners

Tuesday 15 September – Science communication, university strategies, obstacles and criteria
Maarten van der Sanden and Alex Verkade

Wednesday 16 September – Facilitating science communication to society and lessons learned from COVID-19
Cissi Askwall & Anna Maria Fleetwood, and Stefanie Molthagen-Schnöring

Thursday 17 September – Connecting Organisations for Societal Impact and Public & Policy Engagement
Ben Vivekanandan and Emily Jesper

Friday 18 September- Science Gallery Rotterdam: Science Communication and Societal Impact
Fred Balvert
Case study presentations