

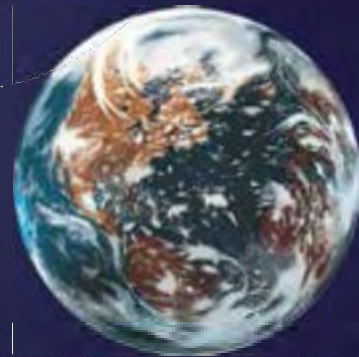
Think Global

World Citizenship & Responsibility in Science Communication & Education

PROF. DR. JOS VAN DEN BROEK

SCIENCE COMMUNICATION & SOCIETY

UNIVERSITEIT LEIDEN • THE NETHERLANDS



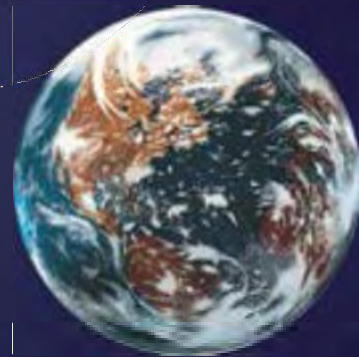
Theme 1	Theme 2	Theme 3	Theme 4	Theme 5
Knowledge exchange & co-creation	New perspectives on networks & public outreach	Firms: innovation management in transition	Social Innovations & transformations to sustainability	The future of the university & higher education
Ethical issues in knowledge, information & data sharing	New forms of science communication & outreach: involving the public	Sustainability and social responsibility increase		Empowering students to become engaged citizens, with impact on society
Research ethics in higher education	Universe Awareness & world citizenship	Global challenges & global risks		Global challenges & global risks
The Perverse System of Publish or Perish & responsibility	Citizen science & public involvement	Global consciousness & world citizenship		Global consciousness & world citizenship
	From top-down to bottom-up science communication			The Perverse System of Publish or Perish & responsibility
	The Dutch Science Agenda sham			'Bildung' in higher education



Theme 2

New perspectives on networks & public outreach

New forms of science communication
& outreach: involving the public



Nice to know

Need to know

Ought to know

**CULTURAL
INCOMPETENCE**

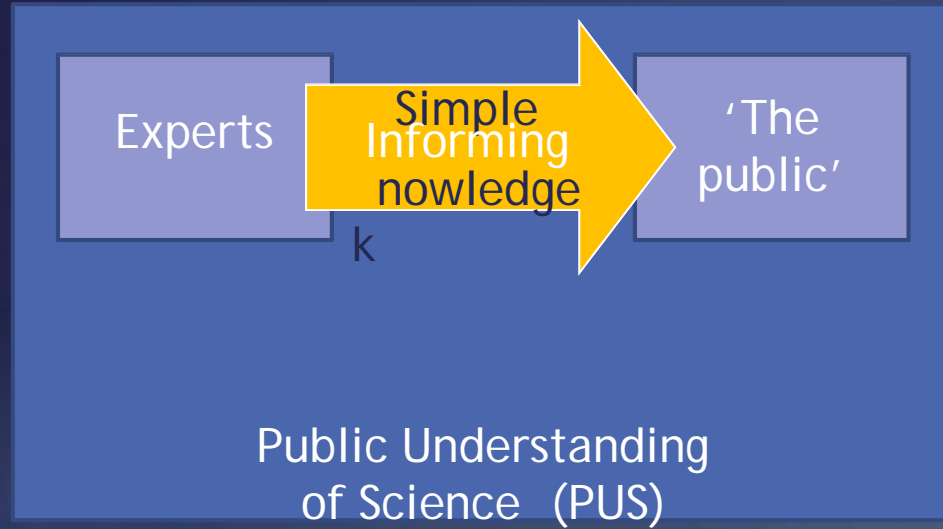
Force-feeding
superior
knowledge

Top-
Down
(‘Push’)

Knowledge
transmission



'Good old' top-down science communication



Force-feeding metaphor of science communication



Nice to know

Need to know

Ought to know

**CULTURAL
INCOMPETENCE**

Force-feeding
superior
knowledge

Top-
Down
(‘Push’)

Knowledge
transmission

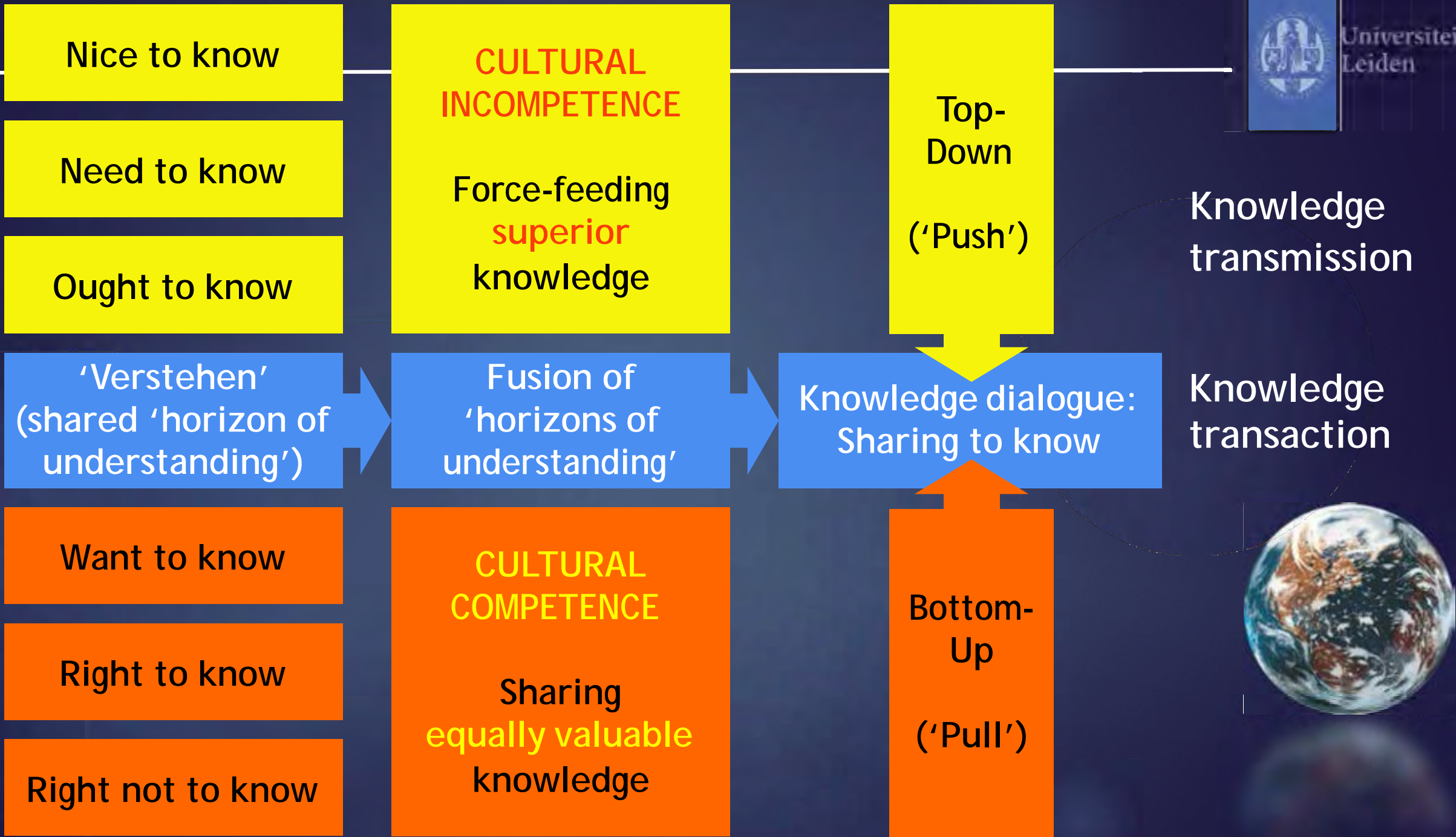
Want to know

Right to know

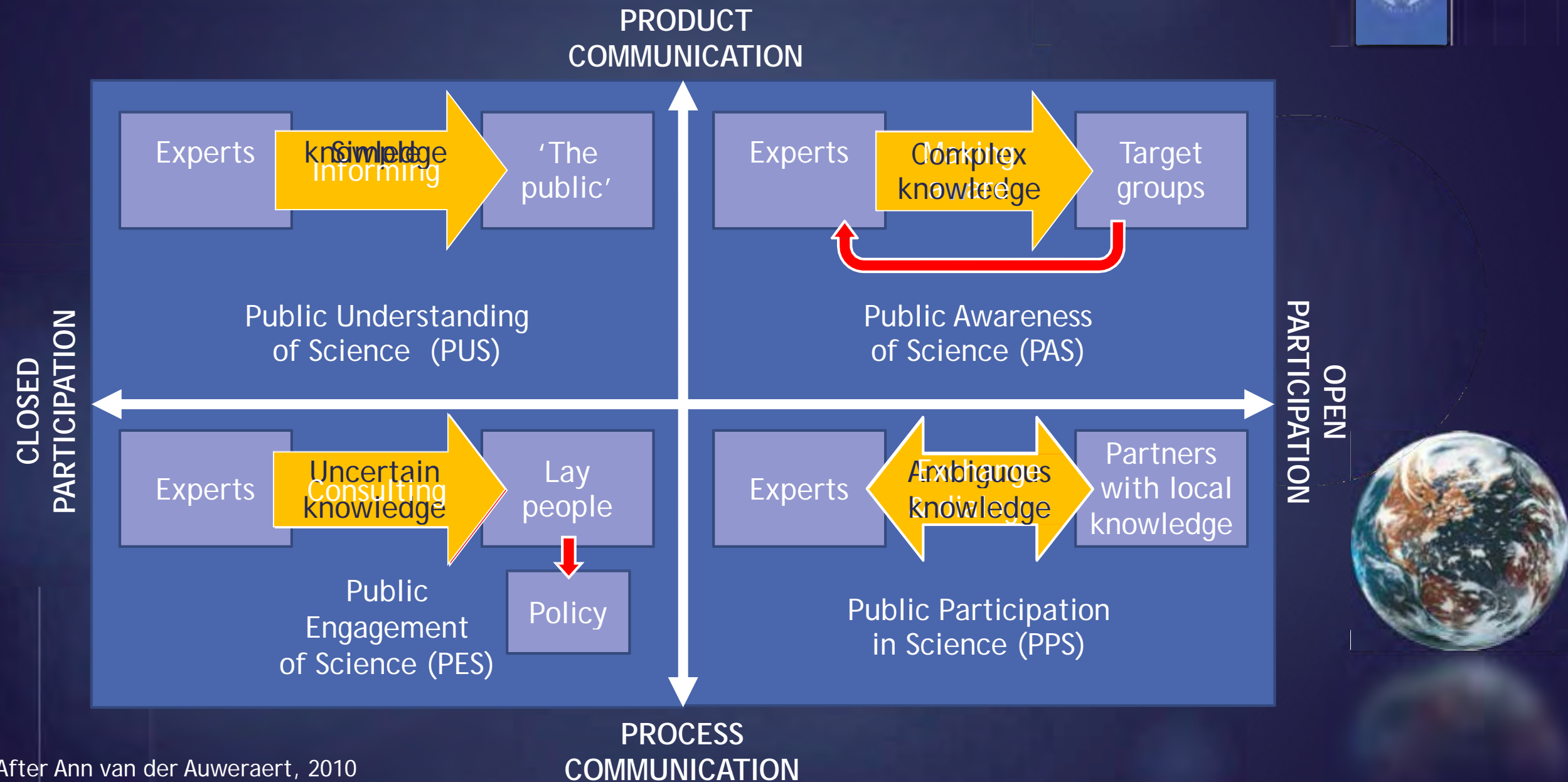
Right not to know

Bottom-
Up
(‘Pull’)

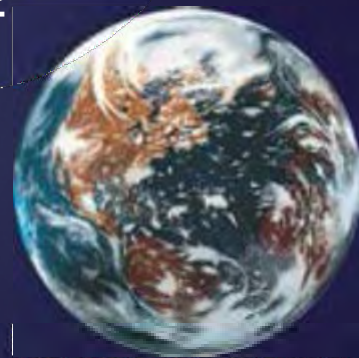
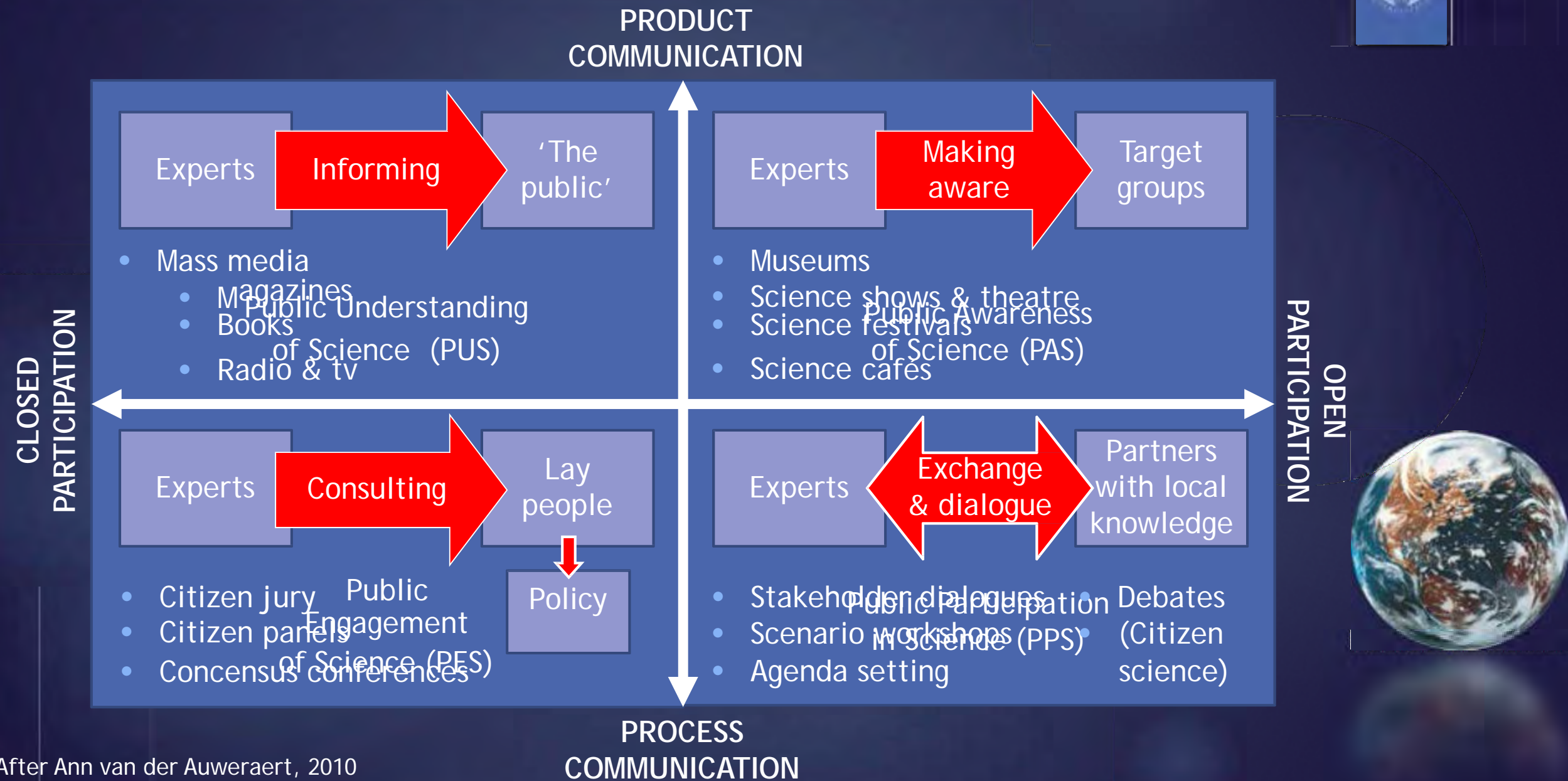




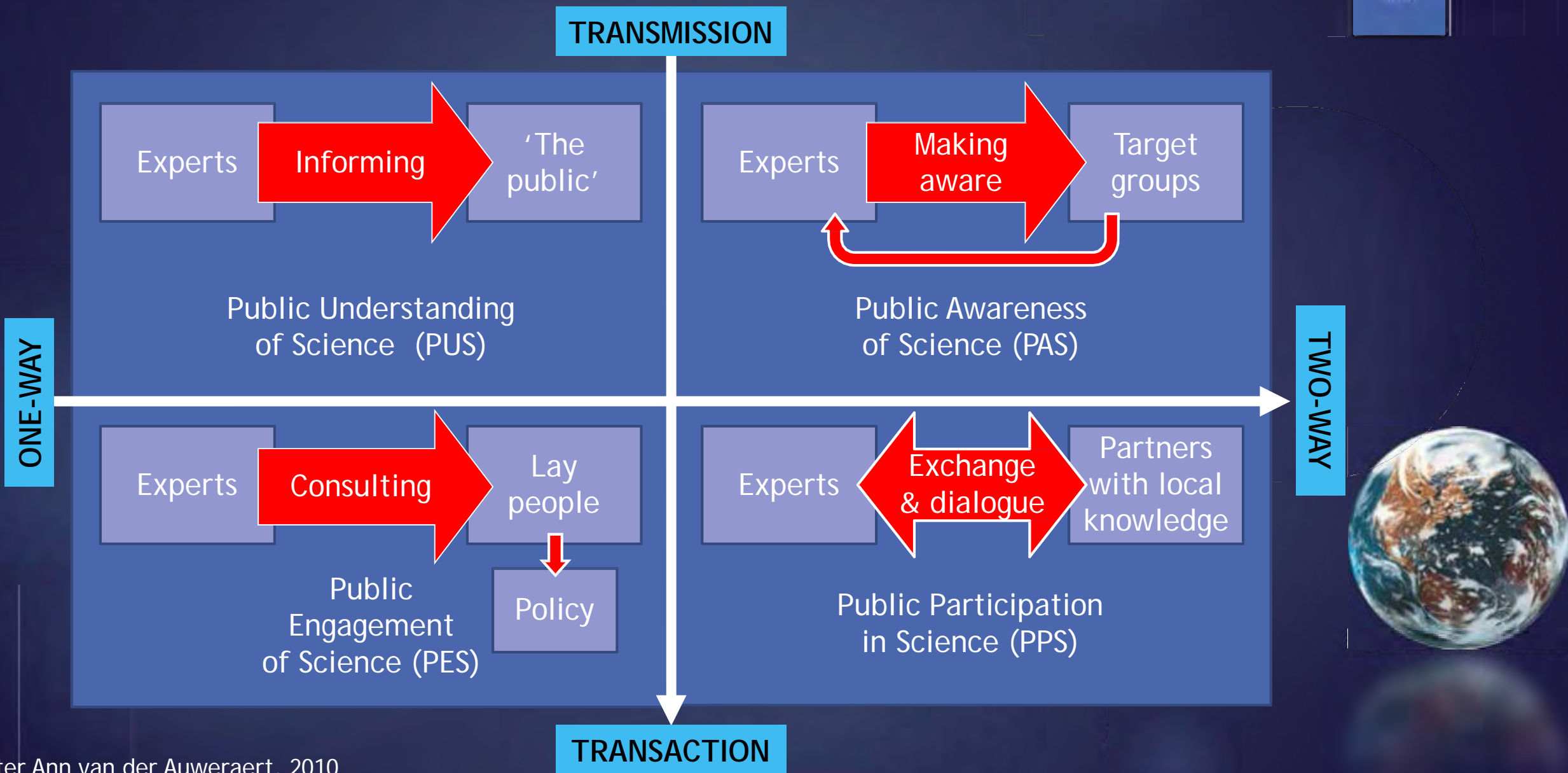
Science communication quadrant



Science communication quadrant



Science communication quadrant

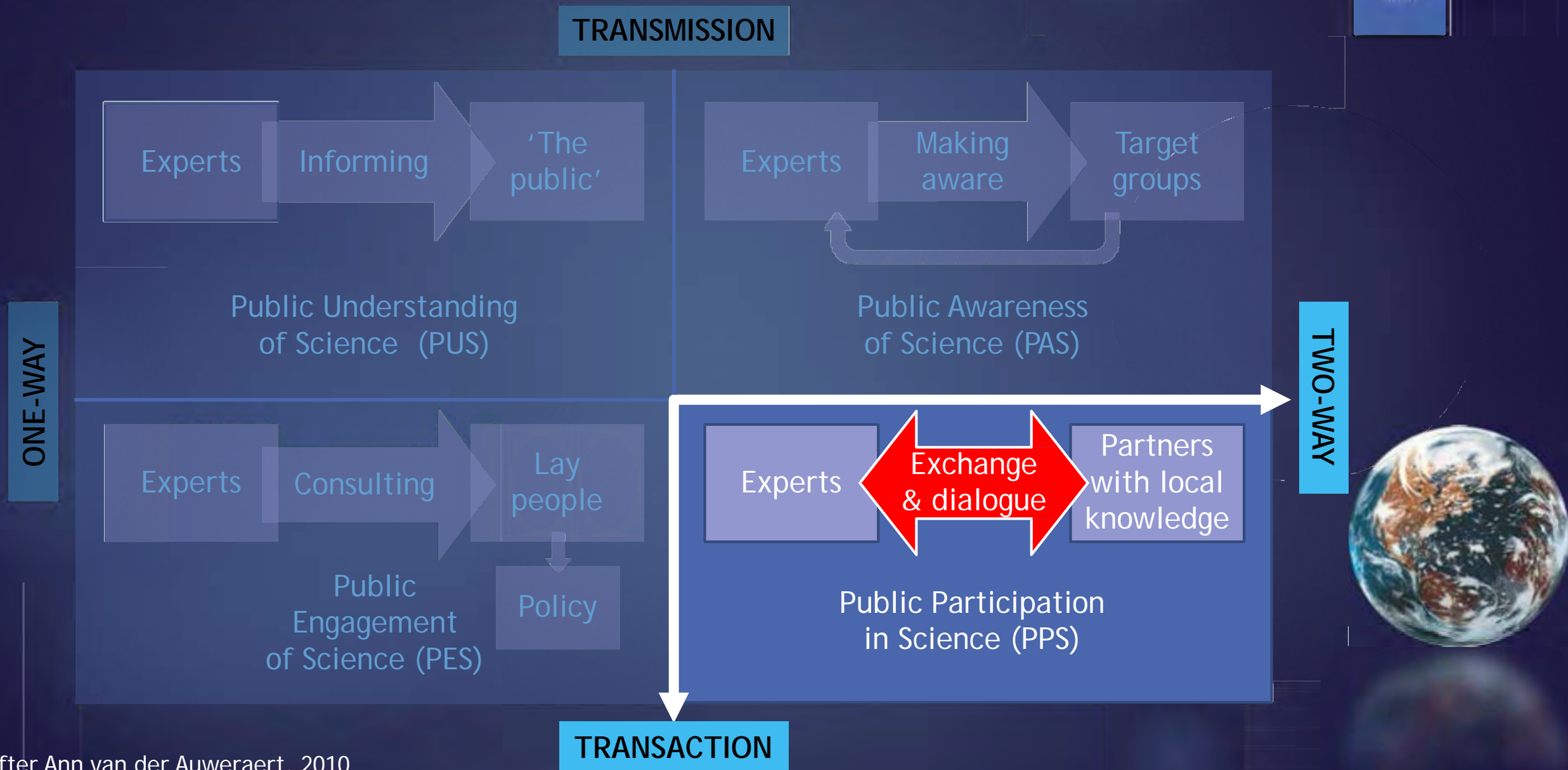


Increasing complexity and uncertainty of scientific knowledge

- ▶ From large, anonymous groups to **small conversation groups**
- ▶ From little interaction to **intensive interaction**
- ▶ From mass-media communication to **interactive communication**
- ▶ From knowledge-driven to **problem solving-driven**
- ▶ From applicability to **serviceability**
- ▶ From supply-driven to **demand-driven**
- ▶ From transmission (top-down) to **transaction (bottom-up)**
- ▶ From closed to **open**
- ▶ From product communication to **process communication**
- ▶ From objective knowledge to **socially constructed knowledge**
- ▶ From ignorant public to **competent public**
- ▶ From short-term to **long-term interaction**



Public Participation in Science (PPS) is gaining momentum



Even e.g. low-literate diabetes patients are experts, in a way!

¿QUÉ ES LA DIABETES?

La diabetes significa que usted tiene demasiada azúcar en la sangre. Los problemas de nivel alto de azúcar en la sangre comienzan cuando su cuerpo ya no fabrica suficiente de una sustancia química u hormona llamada insulina.

Su cuerpo cambia la mayor parte de los alimentos que usted come en un tipo de azúcar. Esta azúcar viaja en su sangre a todas las células de su cuerpo. Las células de su cuerpo necesitan azúcar para darle energía.

La insulina ayuda a que el azúcar se mueva de su sangre a sus células. Sin insulina, sus células no pueden obtener el azúcar que necesitan para mantenerlo saludable.

Al mover el azúcar de su sangre a las células de su cuerpo, la insulina ayuda a mantener normal su nivel de azúcar en la sangre (no muy alto, ni muy bajo). Cuando usted no tiene suficiente insulina para bajar los niveles de azúcar en la sangre, usted tiene diabetes.

Nadie sabe qué causa la diabetes. Usted no puede contagiarse de diabetes ni transmitirla a otra persona. La diabetes puede y debe ser tratada. Los niveles altos de azúcar en la sangre pueden causar serios problemas de salud. Una prueba sencilla puede decirle si usted tiene diabetes. Para más información, hable con su médico o visite su clínica de salud.

Preparedness for Global Infectious Disease Communication
© 2009 Learning About Diabetes Inc. Translated from Spanish - version Rev. (21)



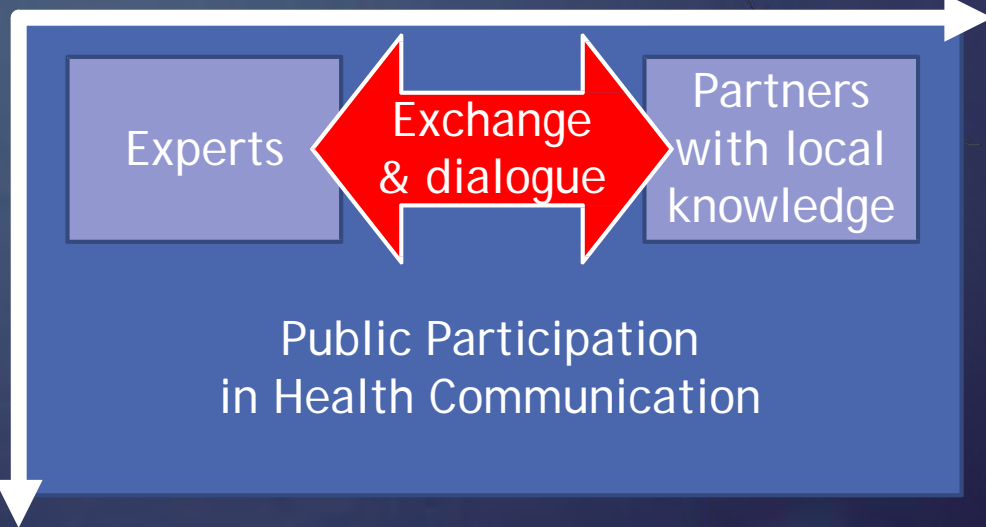
INSULINA



CÉLULA DEL CUERPO



Who is the diabetes expert?



TWO-WAY



TRANSACTION

Low-literate diabetes patients are experts, too!

They don't
know what
diabetes is...


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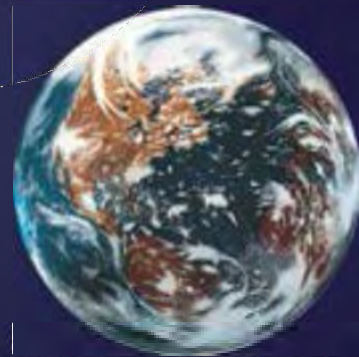
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Proyecto de alfabetización en salud (P.A.S.)
© 2009 Learning About Diabetes (L.A.D.) Todos los derechos reservados. Rev. 2/11



Low-literate diabetes patients are experts, too!

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DIABETES KNOW THE SIGNS



Tired or sleepy a lot



Need to urinate often



Numb or tingling hands or feet



Wounds that won't heal



Vaginal infections



Problems having sex



Blurry vision



Sudden weight loss



Hungry all the time



Always thirsty

Talk to your doctor if you have any of these problems, especially if you have any of them for a week or more.

They don't know what diabetes is...

but they know how it feels!



Patient participation & co-creation

Delen in macht en onmacht biedt inzicht in het alledaagse leven van kinderen met diabetes en in de machts- en afhankelijkheidsrelaties tussen kinderen, ouders en behandelaars. Het kernargument is dat kinderen deel uitmaken van praktijken, ook van die praktijken waarin hun perspectieven, kennis en ervaring niet actief worden verwelkomd en (h)erkend.

Mede door kinderen met diabetes in het onderzoek zelf te betrekken is diepgaand inzicht verkregen in: de leefwereld en competenties van kinderen, de mate waarin kinderen en volwassenen met elkaar kunnen samenwerken en wat een goede samenwerking in de diabeteszorg in de weg staat. Bovendien heeft het participatieve traject de meerwaarde van kindparticipatie zichtbaar gemaakt voor de diabeteszorg en voor gezondheidsvoorlichting aan kinderen.

Delen in macht en onmacht
Kindparticipatie in de (alledaagse) diabeteszorg

Delen in macht en onmacht

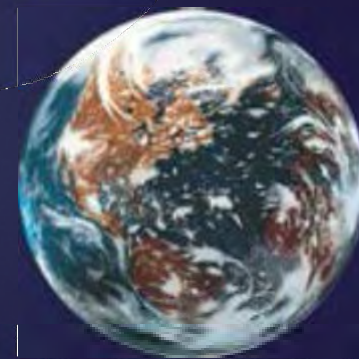
Kindparticipatie in de (alledaagse) diabeteszorg

/ Christine Dedding

/ Christine Dedding



Sharing Power & Frustration: Child Participation in Daily Diabetes Care

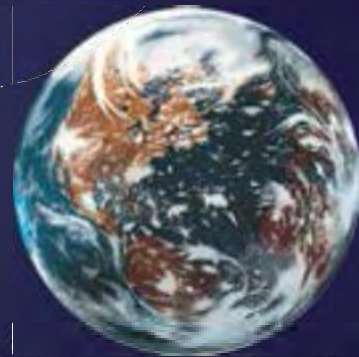


Source: Christine Dedding, 2009

Patient participation & co-creation



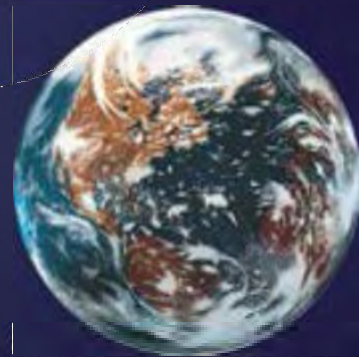
*Empowering children:
informed consent comics
from our department
(including co-creation)*



Theme 2

Public outreach & Citizen science

New forms of science communication
& outreach: involving the public



Griep in Nederland voorbij

8 april 2016 - De griep epidemie in Nederland is voorbij. Er is nog regionaal lichte griep in Utrecht en Noord-Holland. Landelijk gezien bedroeg het aantal influenza-achtige ziektebeelden in week 13 nog slechts 241 gevallen per 100.000 inwoners. Dat is veel lager dan de week ervoor (445 per 100.000). Omdat de epidemische grens in de eerste week van april bij de Grote Griepmeting op 284 per 100.000 ligt, was er in week 13 al geen sprake meer van een epidemie. De griep heeft dit seizoen 12 weken lang geduurd.

28 Mar - 3 Apr 2016

ILI / 100,000

> 1500

> 500

< 500



 <http://www.influenzanet.eu>

*"The flu season
in The Netherlands
is over at last!"*

De Grote Griepmeting - April 8, 2016



<http://www.influenzanet.eu/>



Developing the framework for an epidemic forecast infrastructure.

<http://www.epiwork.eu/>

The Seventh Framework Programme (FP7) bundles all research-related EU initiatives.



InfluenzaNet is a system to monitor the activity of influenza-like-illness (ILI) with the aid of volunteers via the internet. It has been operational in The Netherlands and Belgium (since 2003), Portugal (since 2005) and Italy (since 2008), and the current objective is to implement InfluenzaNet in more European countries.

In contrast with the traditional system of sentinel networks of mainly primary care physicians coordinated by the European Influenza Surveillance Scheme (EISS), InfluenzaNet obtains its data directly from the population. This creates a fast and flexible monitoring system whose uniformity allows for direct comparison of ILI rates between countries.

Any resident of a country where InfluenzaNet is implemented can participate by completing an online application form, which contains various medical, geographic and behavioural questions. Participants are reminded weekly to report any symptoms they have experienced since their last visit. The incidence of ILI is determined on the basis of a uniform case definition.

Participating countries and volunteers:

 13865

 4583

 1857

 4070

 7789

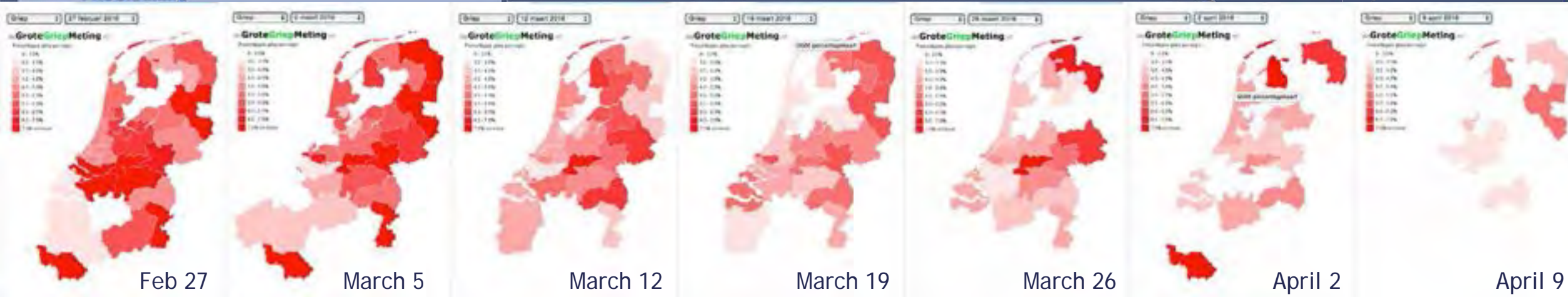
 0

 6482

 979

 620

De Grote Griepmeting: Development of influenza in The Netherlands & Flanders



ARTICLE

MOTIVATION AND LEARNING IMPACT OF DUTCH FLU-TRACKERS

21/01/2016

Abstract:

Many citizen science projects deal with high attrition rates. The Dutch Great Influenza Survey is an exception to this rule. In the current study, we conducted an online questionnaire (N=1 610) to investigate the motivation and learning impact of this loyal, active participant base. Results show that the desire to contribute to a larger (scientific) goal is the most important motivator for all types of participants and that availability of scientific information and data are important for learning. We suggest similar projects seek (social) media attention regularly, linking project findings to current events and including the importance of participants' contribution.

Authors:

Anne M. Land-Zandstra, Mara van Beusekom, Carl Koppeschaar, Jos van den Broek

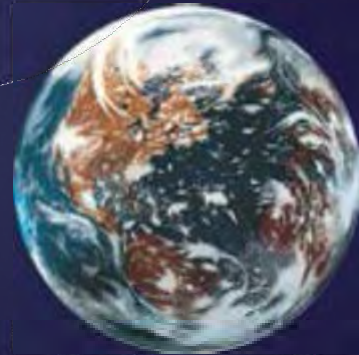
"The desire to contribute to a larger (scientific) goal is the most important motivator for all types of participants.

Availability of scientific information and data are important for learning."

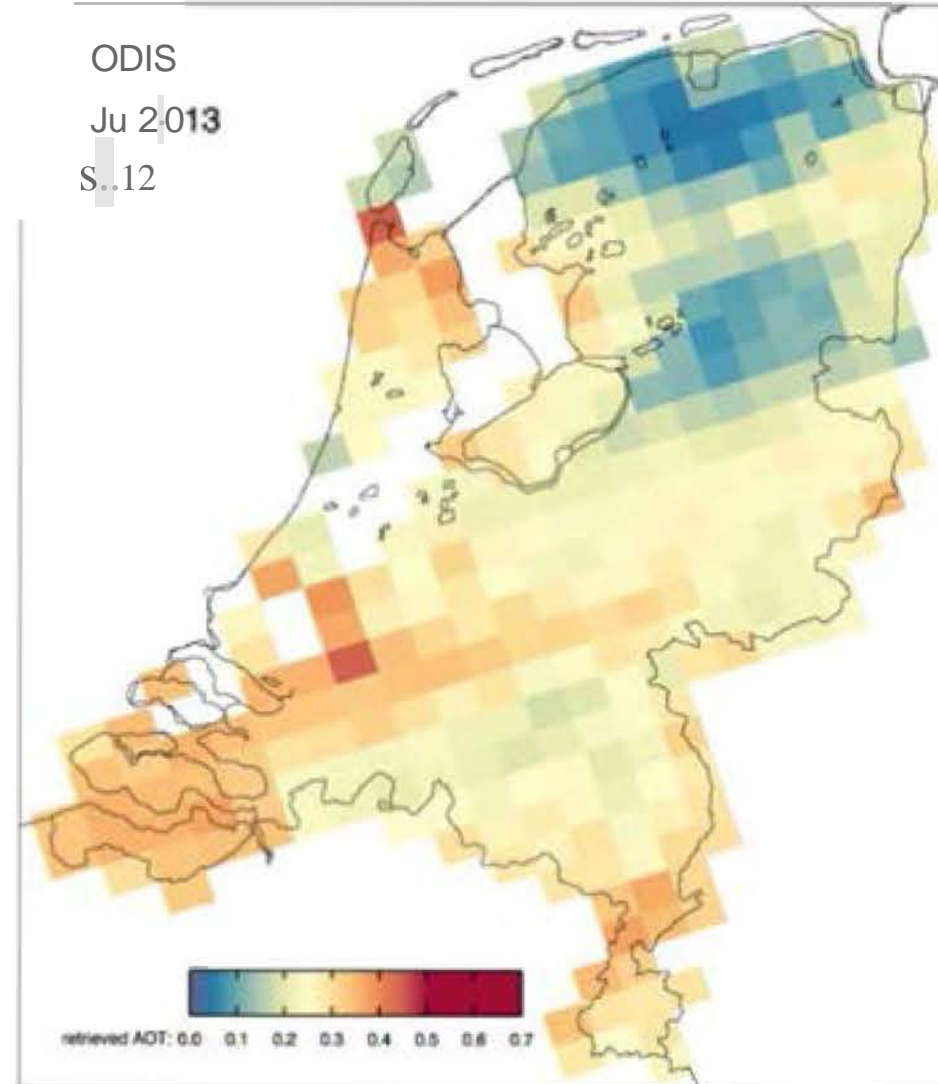
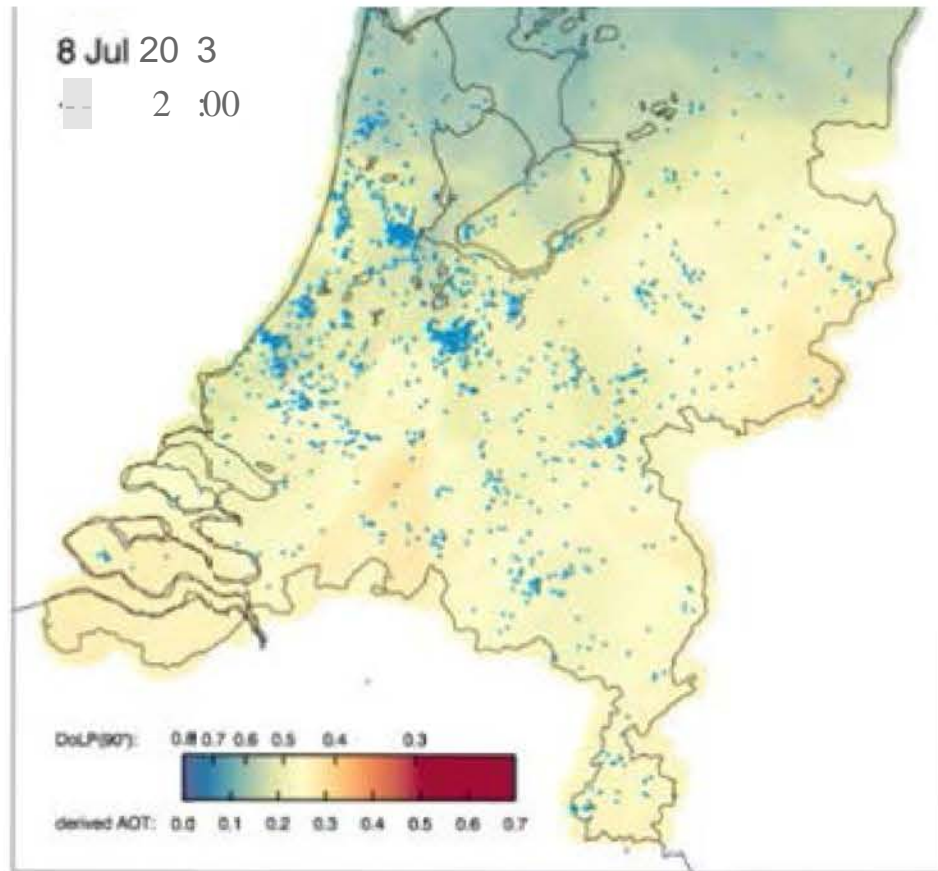
Source: Anne Land *et al.*,
J.Sci.Comm., Jan 21, 2016



Public involvement & Citizen science (2): Measuring dust particles



Public involvement & Citizen science (2): Measuring dust particles



Article

P | U | S

Citizen science on a smartphone: Participants' motivations and learning

Public Understanding of Science
2016, Vol. 25(1) 45–60
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DOI: 10.1177/0963625115603406
pus.sagepub.com
SAGE

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Leiden University, The Netherlands

Abstract

Citizen science provides researchers means to gather or analyse large datasets. At the same time, citizen science projects offer an opportunity for non-scientists to be part of and learn from the scientific process. In the Dutch iSPEX project, a large number of citizens turned their smartphones into actual measurement devices to measure aerosols. This study examined participants' motivation and perceived learning impacts of this unique project. Most respondents joined iSPEX because they wanted to contribute to the scientific goals of the project or because they were interested in the project topics (health and environmental impact of aerosols). In terms of learning impact, respondents reported a gain in knowledge about citizen science and the topics of the project. However, many respondents had an incomplete understanding of the science behind the project, possibly caused by the complexity of the measurements.

“Most respondents joined iSPEX because they wanted to contribute to the scientific goals of the project or because they were interested in the project topics (health and environmental impact of aerosols).”

Source: Anne Land *et al.*,
Public Understanding of Science,
Vol. 25(1) 45-60, 2016



Public 'Participation' in Science: The Dutch Research Agenda Scam

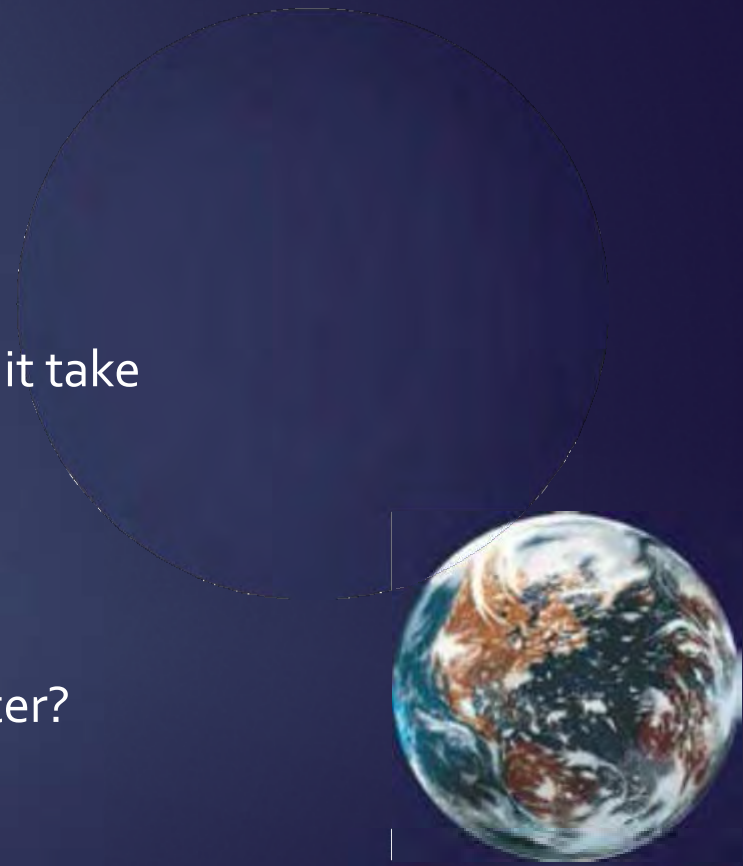
What would
you like to ask
scientists?



Public 'Participation' in Science: The Dutch Research Agenda Scam



- Why do people have legs?
- What are the secrets of the Great Pyramids?
- Have we really been to the Moon? Or is that a scam?
- Why do we believe that we evolved from apes?
- What is the secret of the Moon?
- What if the Sun suddenly stopped shining? How long would it take before mankind would get extinct?
- We have to investigate the existence of UFOs!
- What makes us smart?
- Is it possible that there is a flock of fish floating around Jupiter?





"The majority of the questions indicate that the general public doesn't have the slightest clue about what kind of concrete, achievable and relevant scientific questions they could ask."

The vast majority of the questions are irrational, google-able, science-fiction based or fully directed towards practical solutions."



Themes 3 & 4

Firms: innovation management in transition / Social Innovations & transformations to sustainability

Sustainability & social responsibility increase
Global consciousness & World citizenship
Global challenges & Global risks



The Netherlands

nationale
wetenschaps
agenda



Universiteit
Leiden



Rhetorical question

*Was this the right way
to establish a national
research agenda in
The Netherlands?*



9 SUSTAINABLE DEVELOPMENT GOALS



11
THE GLOBAL GOALS
For Sustainable Development



The Global Research Agenda is already there! (2)

Executive Summary



Extreme
Climate Change



Nuclear War



Global
Pandemic



Ecological
Catastrophe



Global System
Collapse



Major Asteroid
Impact



Super-volcano



Synthetic
Biology



Nanotechnology



Artificial
Intelligence



Unknown
Consequences



Future Bad
Global Governance

Global Challenges

12 Risks that threaten
human civilisation

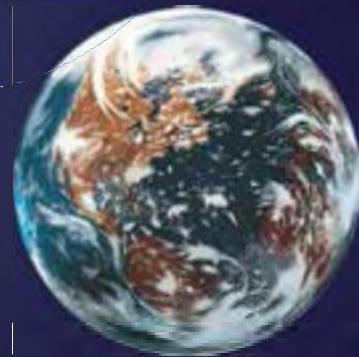
12 risks that threaten human civilisation



The Global Research Agenda is already there! (3)



"We live in an interconnected world with increasingly shared health problems and a commonality of interests."



Source: Priority Medicines for Europe and the World 2013 Update. World Health Organization, July 2013

Theme 5

The future of the university & higher education

Empowering students to become engaged
citizens, with impact on society





The Netherlands

e.g. the Canon of Dutch History

Ought to know

'Canonification'



Force-feeding metaphor of education



From Canonification to Bildung

Ought to know

'Canonification'

A **Canon** (or Canon of Knowledge & Testing) is a certain body of facts and data with a stamp of official acceptance and approval.

Opposed orientations

Ability to know
Desire to learn

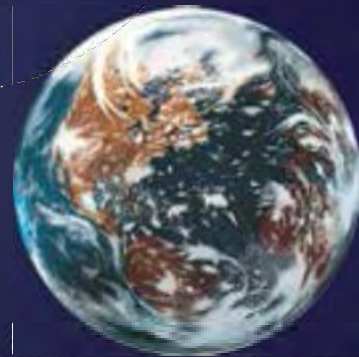
'Bildung'

Bildung (German for education & formation) refers to the German tradition of self-cultivation & the process of personal and cultural maturation.

Bildung is the way that the individual matures and takes upon him- or herself ever bigger personal responsibility towards family, friends, fellow citizens, society, humanity, our globe, and the global heritage of our species, while enjoying ever bigger personal freedoms.

It is the enculturation and life-long learning that forces us to grow and change, it is existential depth, it is life-long interaction and struggles with new knowledge, culture, art, science, new perspectives, new people, and new truths, and it is being an active citizen in adulthood.

Bildung is a constant process that never ends.



'Canonification'

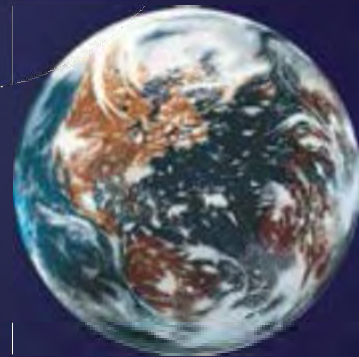
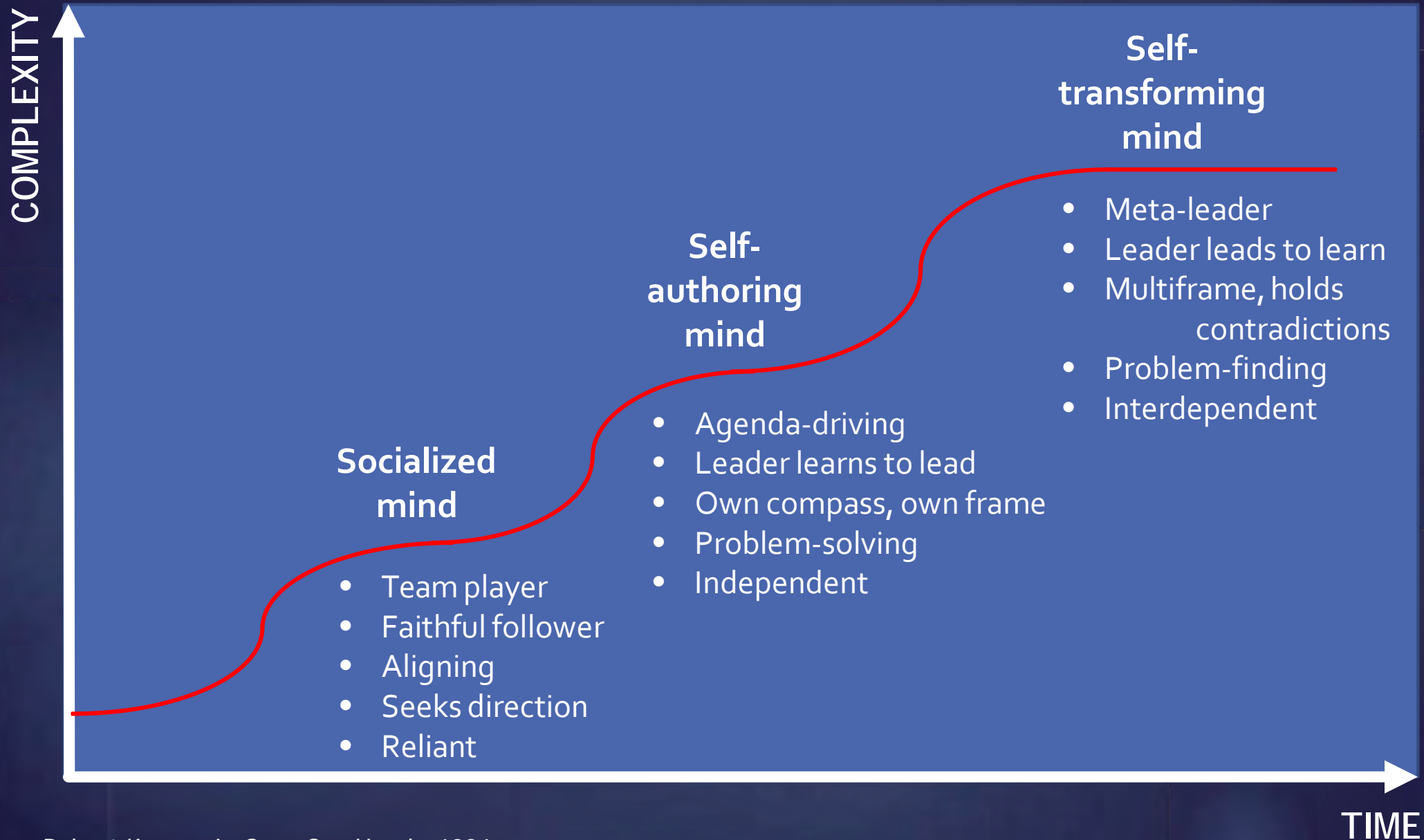
- Static
- Closed
- Moment-oriented
- Location-oriented
- Settled
- Learning answers
- Authoritarian
- Top-down

Opposed orientations

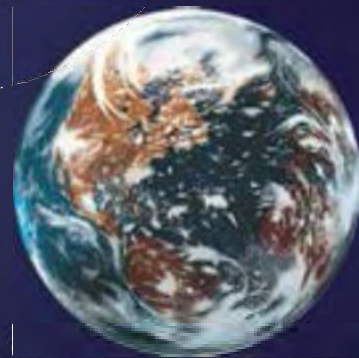
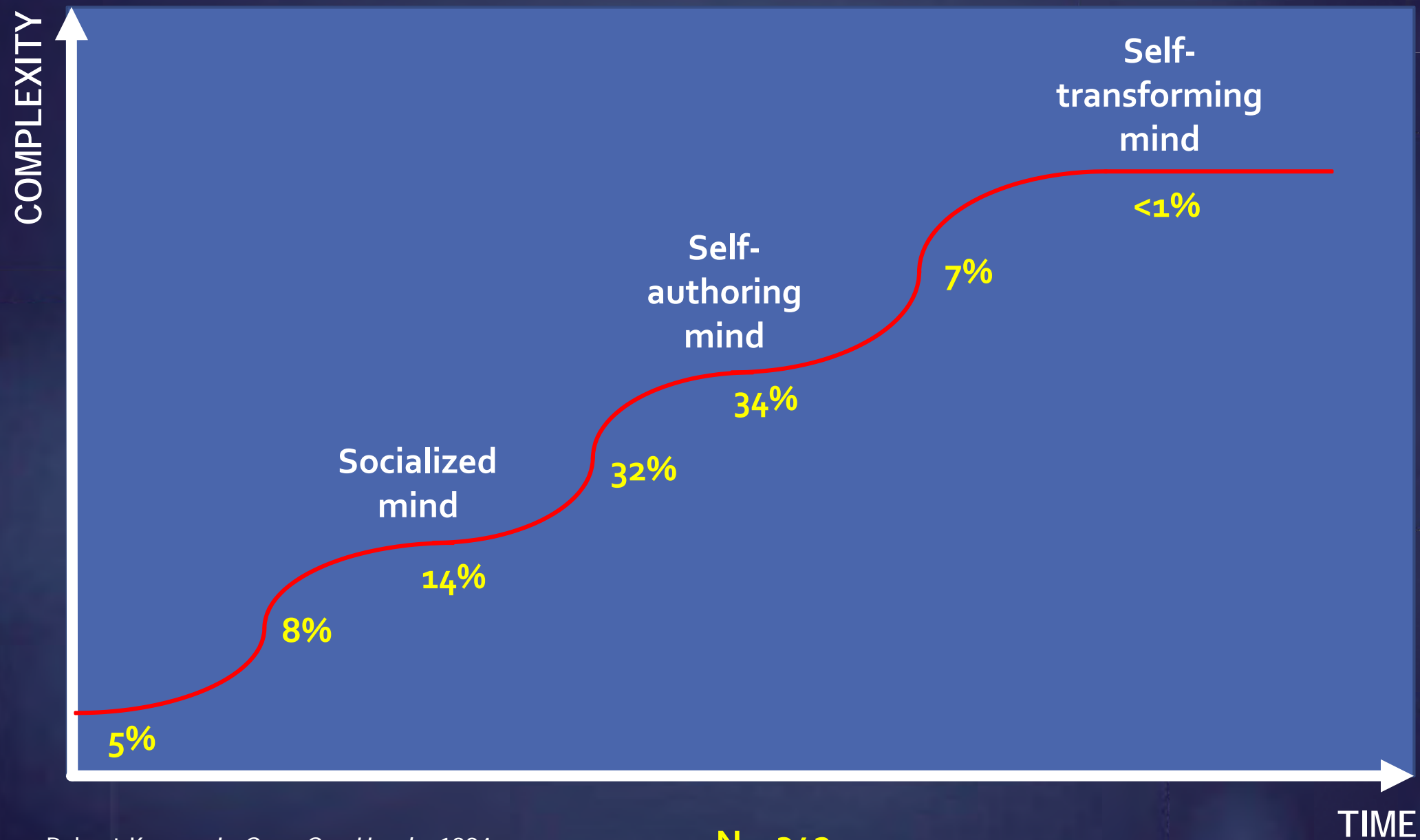
Bildung

- Dynamic
- Open
- Context-oriented
- World-oriented
- Journey
- Exploration, asking questions
- Developing own authority
- Bottom-up

Three plateaus in adult mental development



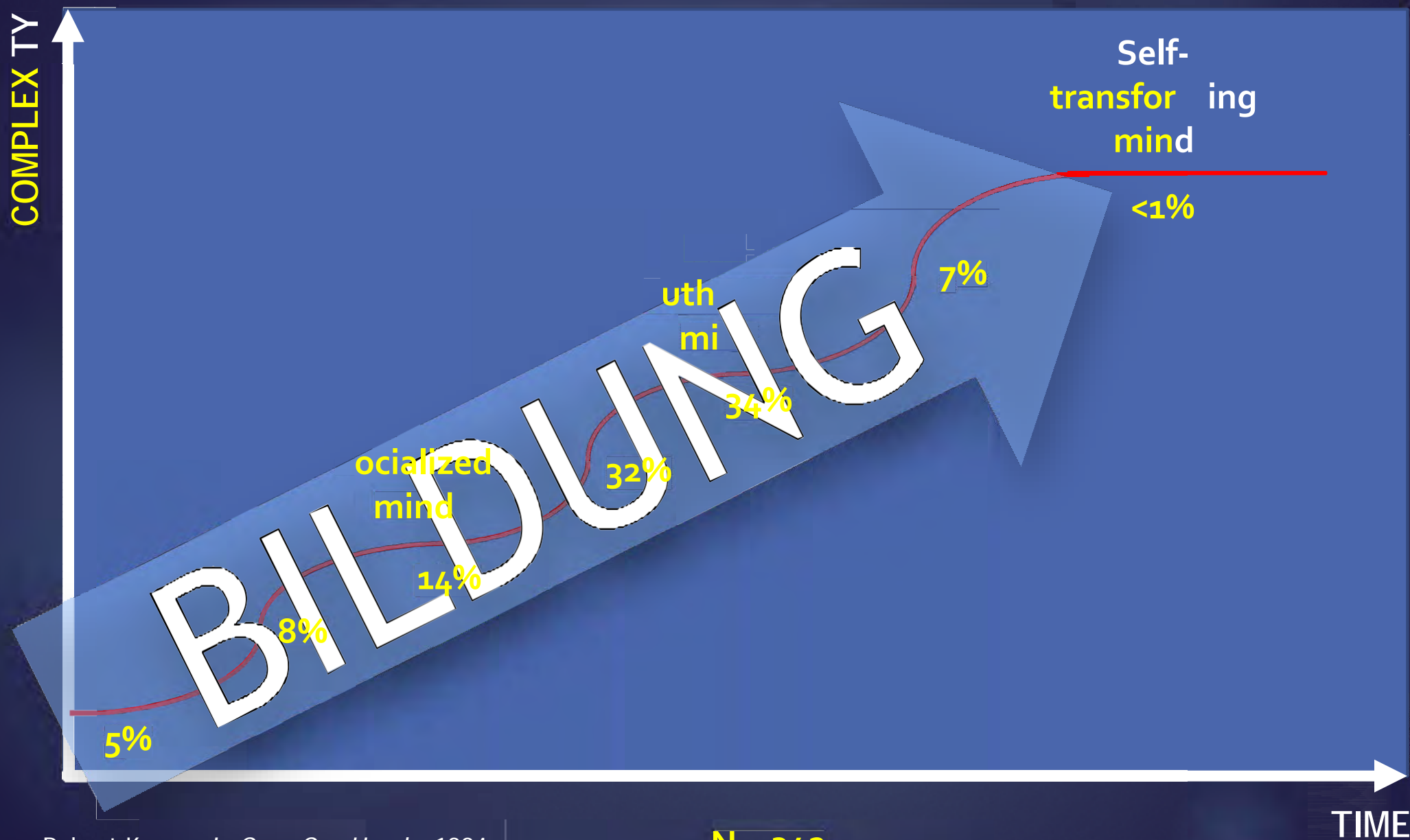
Distribution of levels of mental complexity among adults



Source: Robert Kegan, *In Over Our Heads*, 1994

N = 342

Our working hypothesis

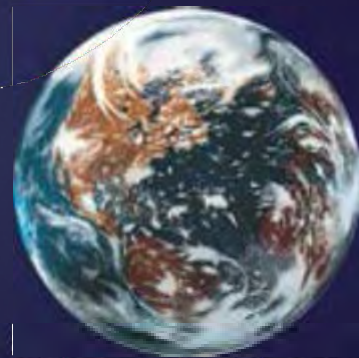


Source: Robert Kegan, *In Over Our Heads*, 1994

Theme 5

The future of the university & higher education

Societal issues are becoming part of the curriculum – again (“Back to the Sixties”)



Geneesmiddelenonderzoek, communicatie & maatschappij

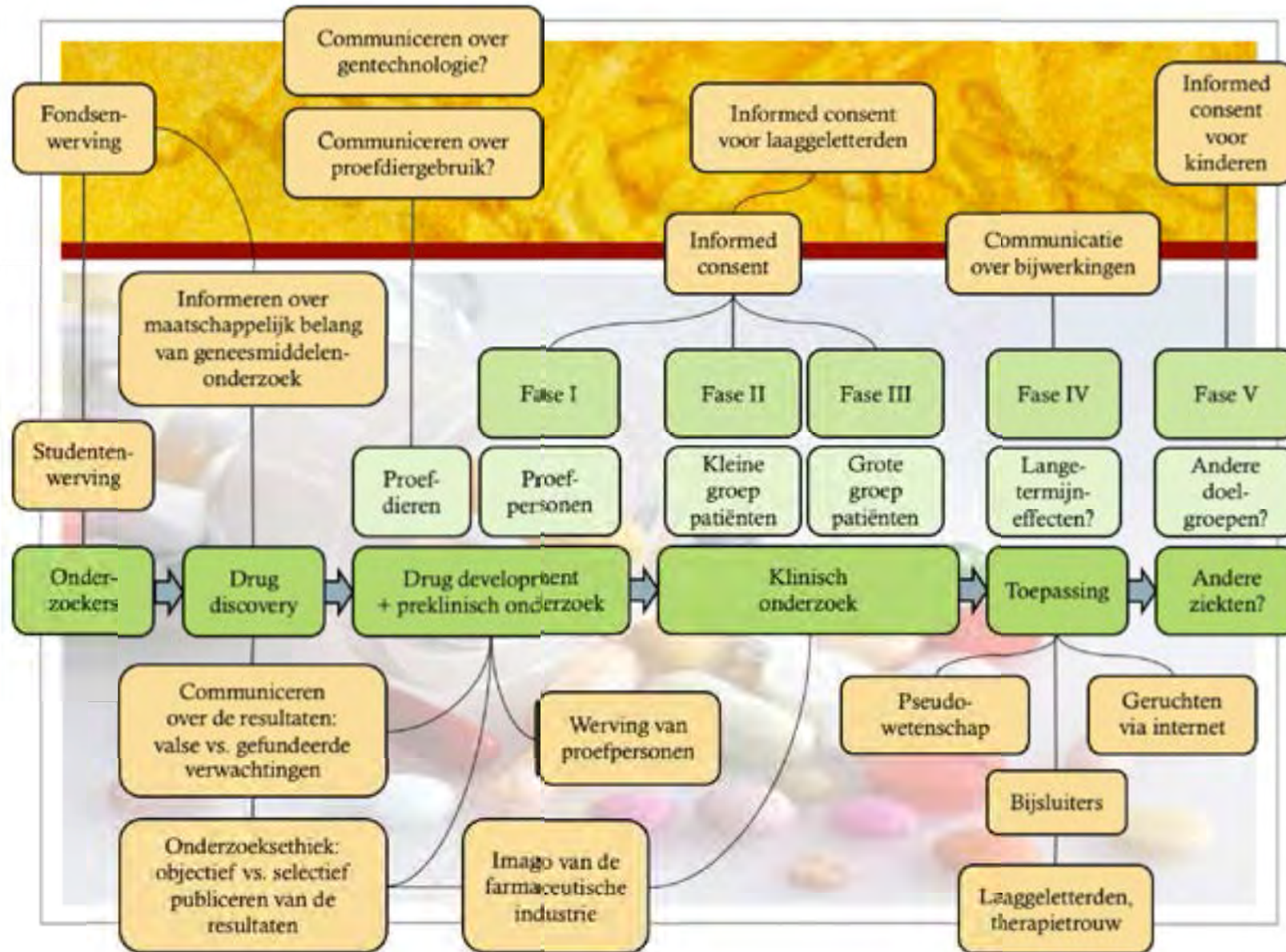
Prof. dr. Jos van den Broek • Science Communication & Society • FWN



College 2a Onderzoeks- ethiek

E.g. a lecture
plus discussion
on research
ethics





Investigating communicative aspects during the whole process of drug development



Wat mag wel?
Wat mag niet?

- Racisme
- Geneticisme
- Seksisme
- IQ-isme
- **Speciesisme**



Ethical issues:
What do we
allow, and why?



Table 6.10.1: Trend in estimated number of malaria cases and deaths, 2000-2010

Number of cases (000's)

Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	% reduction since 2000
Africa	175 000	179 000	183 000	188 000	190 000	191 000	189 000	187 000	182 000	179 000	174 000	1%
Americas	2 500	2 000	1 800	1 800	1 700	1 900	1 600	1 300	1 000	1 100	1 100	56%
Eastern Mediterranean	10 000	9 000	9 000	11 000	8 000	8 000	8 000	10 000	11 000	11 000	10 000	0%
Europe	38	28	24	19	11	6	3.1	1.4	0.7	0.3	0.2	99%
South-East Asia	33 000	32 000	30 000	31 000	32 000	33 000	29 000	28 000	29 000	30 000	28 000	15%
Western Pacific	3 000	2 600	2 300	2 600	2 900	2 400	2 600	2 100	1 800	2 000	2 000	33%
World	223 000	225 000	226 000	233 000	235 000	237 000	231 000	229 000	225 000	222 000	216 000	3%
Lower bound	170 000	172 000	173 000	175 000	177 000	181 000	172 000	169 000	165 000	163 000	149 000	
Upper bound	297 000	301 000	304 000	310 000	316 000	319 000	310 000	304 000	298 000	292 000	274 000	

Number of deaths

Region	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	% reduction since 2000
Africa	682 000	705 000	726 000	740 000	748 000	740 000	727 000	701 000	654 000	630 000	596 000	13%
Americas	2 300	2 000	1 500	1 500	1 600	1 800	1 500	1 300	1 000	1 200	1 200	48%
Eastern Mediterranean	17 000	17 000	18 000	17 000	16 000	16 000	16 000	16 000	15 000	16 000	15 000	12%
Europe	3	4	2	1	1	1	0	0	0	0	0	100%
South-East Asia	46 000	41 000	37 000	36 000	38 000	39 000	32 000	33 000	37 000	39 000	38 000	17%
Western Pacific	7 300	6 100	5 500	6 200	6 800	5 100	5 500	4 700	4 200	4 700	4 600	37%
World	755 000	771 000	789 000	801 000	810 000	801 000	782 000	756 000	711 000	691 000	655 000	13%
Lower bound	575 000	588 000	600 000	612 000	625 000	621 000	607 000	597 000	567 000	554 000	539 000	
Upper bound	969 000	992 000	1 018 000	1 034 000	1 053 000	1 045 000	1 023 000	992 000	944 000	932 000	906 000	

Source: World Malaria Report 2011. WHO, 2011.

The data comes from 106 malaria endemic countries and territories grouped by WHO regions.¹³

The world is
a bit bigger
than only the
Netherlands...



Source: WHO, 2011

The Future of Science and Technology, for freshmen (Honours College)



The screenshot shows the ChemistryWorld website. At the top, there's a navigation bar with 'HOME', 'NEWS', 'OPINIONS', 'FEATURES', 'REGULARS', 'JOBS', 'PODCASTS', and 'WEBINARS'. Below this is a search bar and a 'Search Chemistry World' button. The main content area features a large article titled 'Bacterium survives unnatural DNA transplant' by Emma Stoye, dated 7 May 2014. The article text describes a breakthrough in synthetic biology where a bacterium was engineered to use an unnatural base pair. To the right of the article is a 'Related Content' section titled 'On stranger nucleotides' by Josh Howgato, dated 25 February 2014. The website also includes a 'SHOP FIND A JOB BLOG REGISTER' section at the top right and a 'Subscribe for more chemistryworld' button on the right side.

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Bacterium survives unnatural DNA transplant

7 May 2014 Emma Stoye

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The first organism that can grow and replicate with an unnatural base pair in its DNA – giving the cell six nucleotides instead of the usual four – has been created by scientists in the US. Though efforts to engineer artificial nucleotides have been ongoing for decades, this is the first artificial base pair that a living cell can actually incorporate into its own DNA, giving it three base pairs instead of two. The technology could pave the way for advances in synthetic biology, allowing DNA to code for up to 152 new amino acids to produce unique proteins.

'For 30 years, the field of synthetic biology has climbed a "wall of doubt"'

The advance takes us closer to an expanded DNA biology that will have many exciting applications, says the lead researcher, Prof. George Church. Within every organism that exists in nature, DNA is made up of just two base pairs – adenine and thymine

anno 2014

Related Content

On stranger nucleotides

25 February 2014 Feature

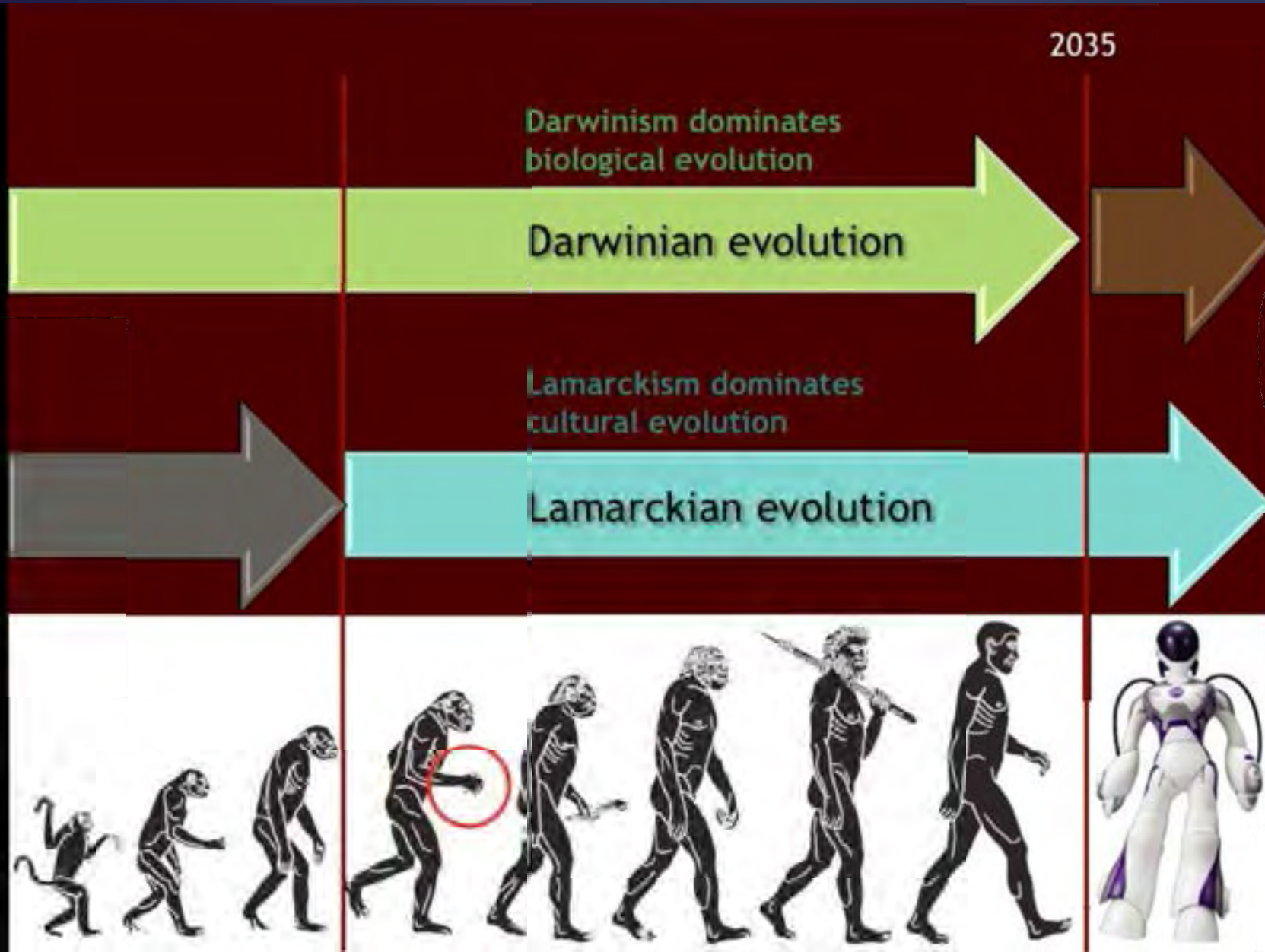
Chemists have been making artificial DNA base pairs for 20 years. Josh Howgato investigates

Your future will be (un)natural. It's up to you to decide...



Source: ChemistryWorld, 2014

The Future of Science and Technology, for freshmen (Honours College)



Your future will be (un)natural. It's up to you to decide...



George Church: The Future Without Limit

Geneticist George Church tinkers with DNA to fight disease, create new biofuels, and perhaps even resurrect extinct species.

Source:
National Geographic, 2016



Your future
without limit?
It's up to you
to decide...



*“There's a dark side to every technology.
Cars kill 33,000 people a year in the
United States, but that doesn't discourage
people from driving or riding in cars.”*

Your future
without limit?
It's up to you
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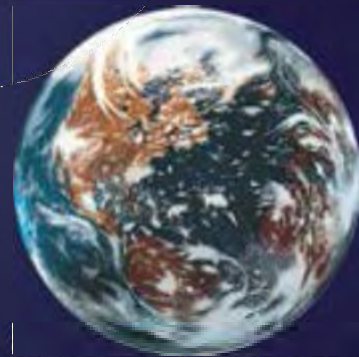


<http://news.nationalgeographic.com/news/innovators/2014/06/140602-george-church-innovation-biology-science-genetics-de-extinction/>

Theme 1

Knowledge exchange & co-creation

Ethical issues in knowledge,
information & data sharing



Digging in
the details:
publication
bias



Science in an age of globalisation

Sci

Table 6.1: Differences in disclosure and treatment according to funding source

	Industry funded (n=263)		Publicly funded (n=66)		p-value
Disclosure type					
All	198	75.29%	47	71.21%	0.498
Scientific	121	46.01%	46	69.70%	0.001
Positive outcomes					
All	154	77.78%	30	63.83%	0.047
Scientific	111	91.74%	29	63.04%	0.000
Terminated	34	12.93%	2	3.03%	0.021
Experimental therapy					
Diabetes treatment	253	96.20%	35	53.03%	
Non-diabetes treatment	8	3.04%	12	18.18%	
Foods and supplements	2	0.76%	19	28.79%	0.000†
Diabetes Type					
Diabetes Mellitus	7	2.66%	14	21.21%	
Only Type 1†	26	9.89%	12	18.18%	
Only Type 2†	230	87.45%	40	60.61%	0.000†

Notes. p-values are based on two-tailed proportional t-tests; † A clinical trial can test both on patients with diabetes type 1 and type 2; ‡ Chi-square test



Science in an age of globalisation

Scientific knowledge is considered by many a universal and free product, yet its producers are often embedded in geographically bounded networks of research collaboration. In an age of globalisation these local networks are challenged in order to find solutions to global problems such as climate change and worldwide health. This dissertation studies the reality and consequences of global science based on case-studies of the European science system and the global conduct of pharmaceutical clinical trials. It is shown that collaboration networks take on new stratified forms at multiple scales. This process is accompanied by changing publication practices that affect authorship norms, the prevalence and correction of errors in scientific publications and the conditions under which dissemination of research findings takes place. These insights require a rethinking of research and publication policies in light of globalisation.

School of Innovation Sciences
Eindhoven University of Technology

Funnel plot & publication bias



Digging in
the details:
publication
bias



New England Journal 29/12/2005 over VIOXX

Expression of Concern: Bombardier et al., "Comparison of Upper Gastrointestinal Toxicity of Rofecoxib and Naproxen in Patients with Rheumatoid Arthritis," N Engl J Med 2000;343:1520-8.

Gregory D. Curfman, M.D., Stanislav Morozov, Ph.D., and Jeffrey M. Drazen, M.D.

We have recently obtained information regarding inaccuracies in data in the report of the VIGOR (Vioxx Gastrointestinal Outcomes Research) study by Bombardier et al.¹ that raise concerns about certain conclusions in the article.

The VIGOR study was designed primarily to compare gastrointestinal events in patients with rheumatoid arthritis randomly assigned to treatment with rofecoxib (Vioxx) or naproxen (Naprosyn), but data on cardiovascular events were also monitored. Three myocardial infarctions, all in the rofecoxib group, were not included in the data submitted to the Journal. The editors first became aware of the additional myocardial infarctions in 2001 when updated data were made public by the Food and Drug Administration.

Until the end of November 2005, we believed that these were late events that were not known to the authors in time to be included in the article published in the journal on November 23, 2000. It now appears, however, from a memorandum dated July 5, 2000, that was obtained by subpoena in the Vioxx litigation and made available to the Journal, that at least two of the authors knew

also resulted in the misleading conclusion that there was a difference in the risk of myocardial infarction between the aspirin indicated and aspirin not indicated groups.

In addition, the memorandum of July 5, 2000,

Table 1. Data on Myocardial Infarctions Omitting the Three Events.*

Study Group	Person-Years of Exposure	No. of Myocardial Infarctions	Relative Risk	95% CI
Total				
Rofecoxib	1313	3	4.25	1.38 to 13.37
Naproxen	2316	4		
Aspirin indicated				
Rofecoxib	95	8	—	1.45 to —
Naproxen	92	0		
Aspirin not indicated				
Rofecoxib	2218	9	2.25	0.63 to 8.02
Naproxen	2224	4		

* The numbers of person-years of exposure as of February 10, 2000, have been estimated. Relative risks were estimated by Poisson regression; confidence intervals were calculated by the exact method.

We don't avoid
examples of
'Bad Pharma' in
our education.



Leiden University recently developed a small private online course (SPOC) on scientific integrity.

From July 2016 it will be an online open-source course.

Source: www.leidenuniv.nl



On Being a Scientist is an English-spoken fiction film (in episodes), about science and what it is like to be a scientist. But it also raises a lot of questions which may not have clear-cut answers. Among others about what science should be and the moral dilemma's anyone will encounter when working in science.



Theme 1	Theme 2	Theme 3	Theme 4	Theme 5
Knowledge exchange & co-creation	New perspectives on networks & public outreach	Firms: innovation management in transition	Social Innovations & transformations to sustainability	The future of the university & higher education
Ethical issues in knowledge, information & data sharing	New forms of science communication & outreach: involving the public	Sustainability and social responsibility increase		Empowering students to become engaged citizens, with impact on society

Think Global

(and have a wonderful workshop!)

Jos van den Broek • broek@science.leidenuniv.nl

