



The Societal Role of Scientists in Induced Seismicity

*Lessons Learned from Groningen
(The Netherlands)*

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Belgium



"Le parole hanno un peso"



"Le parole hanno un peso"

M2.8 Assen earthquake – 26.12.1986

Asser geograaf wilt aardbeving aan gaswinning

ASSEN, dinsdag

De Asser geograaf drs. M. van der Sluis is ervan overtuigd, dat de onverwachte aardbeving die zijn woonplaats teisterde op Tweede Kerstdag het gevolg is van het leeghalen van het gasveld bij Slochteren.

„Wij hebben hier in het noorden nog nooit een aardbeving gehad. En de gaswinning bij Slochteren is de enige belangrijke verandering in de ondergrond, die hier de laatste honderden jaren heeft plaatsgevonden. Het ligt daarom erg voor de hand, dat de gaswinning en de beving alles met elkaar te maken hebben en de kans is zeer groot, dat meer aardschokken volgen.”

Van der Sluis, leraar milieukunde aan een HBO-school in Groningen, wil dat er een onafhankelijk onderzoek komt naar het verband tussen gaswinning en aardbevingen, omdat de NAM te veel partij is. Verder vreest de docent dat de stabiliteit van de Groningse en Drenthse zoutkoepels, die de NAM wil gebruiken voor de opslag van aardgas, gevaar loopt. „De gaswinning activeert de breuklijnen, waardoor de koepels verstoord raken.”

Woordvoerder F. Duut van de NAM heeft geen zin om op dergelijke „flauwekul” te reageren. „Wij verwijzen dit beslist naar het rijk der fabelen.”

M. Van der Sluis:

“It is evident that the gas extraction and the earthquake are related, and that more earthquakes can most probably be expected.”

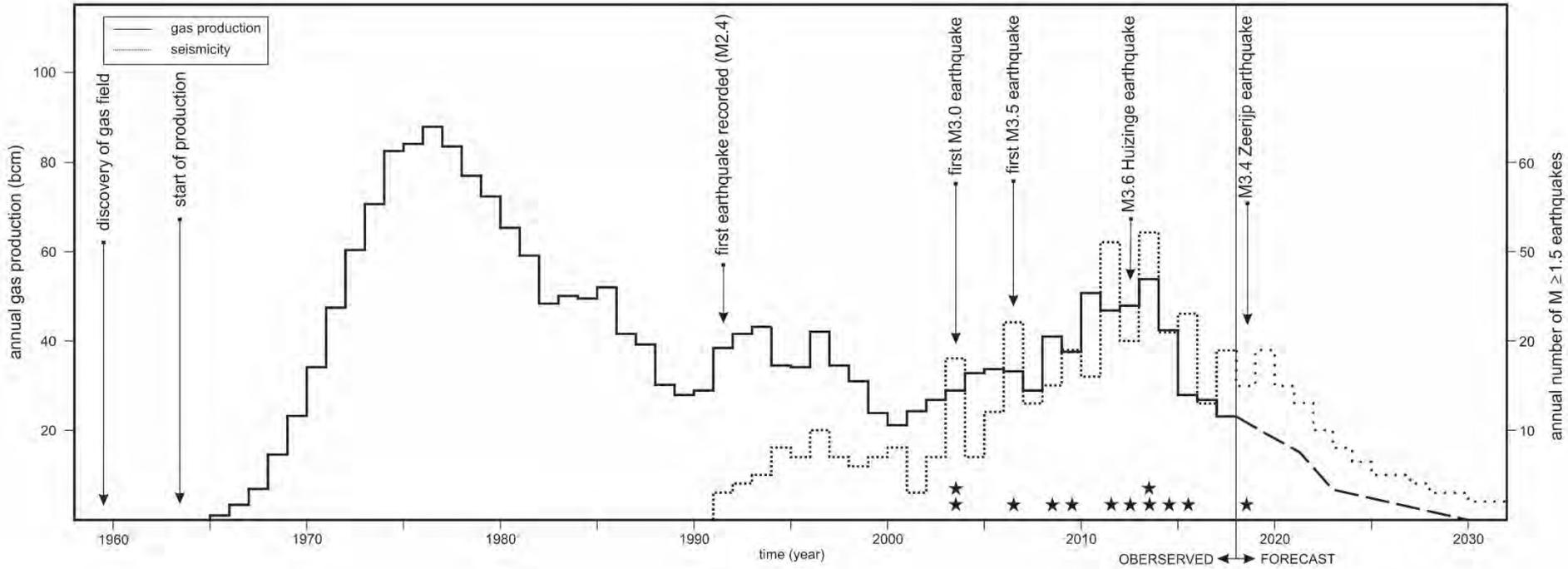
Spokesperson of NAM:

“We do not react to such balony.”

“We definitively relegate this to the realm of fairy tales.”



The Groningen gas field – gas production & seismicity



Sintubin 2018

The “Ommelanden” of Groningen



“Disaster in slow motion”



“Disaster in slow motion”



“Disaster in slow motion”



“Disaster in slow motion”



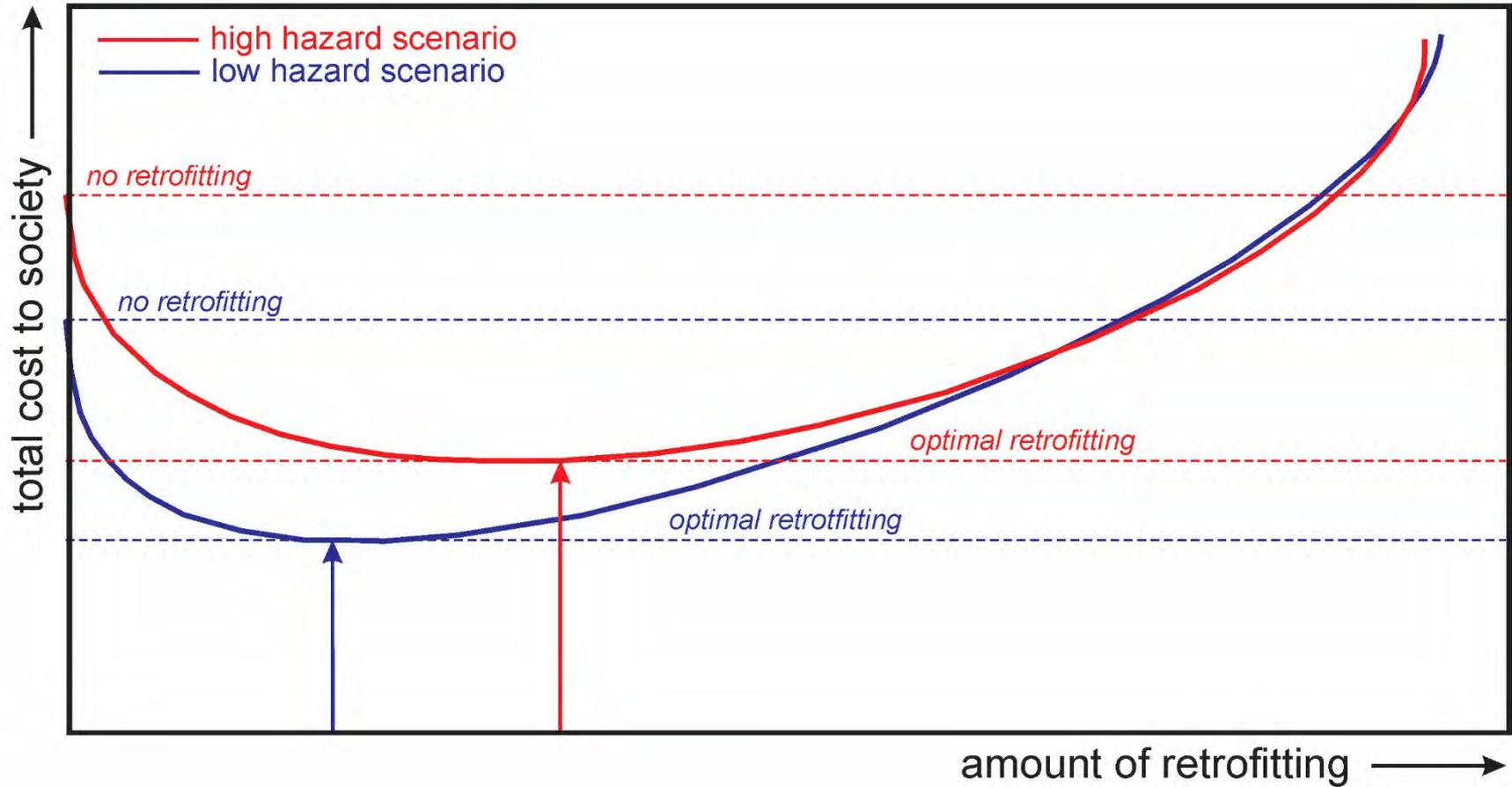
“Disaster in slow motion”



"Disaster in slow motion"

WICKED PROBLEM

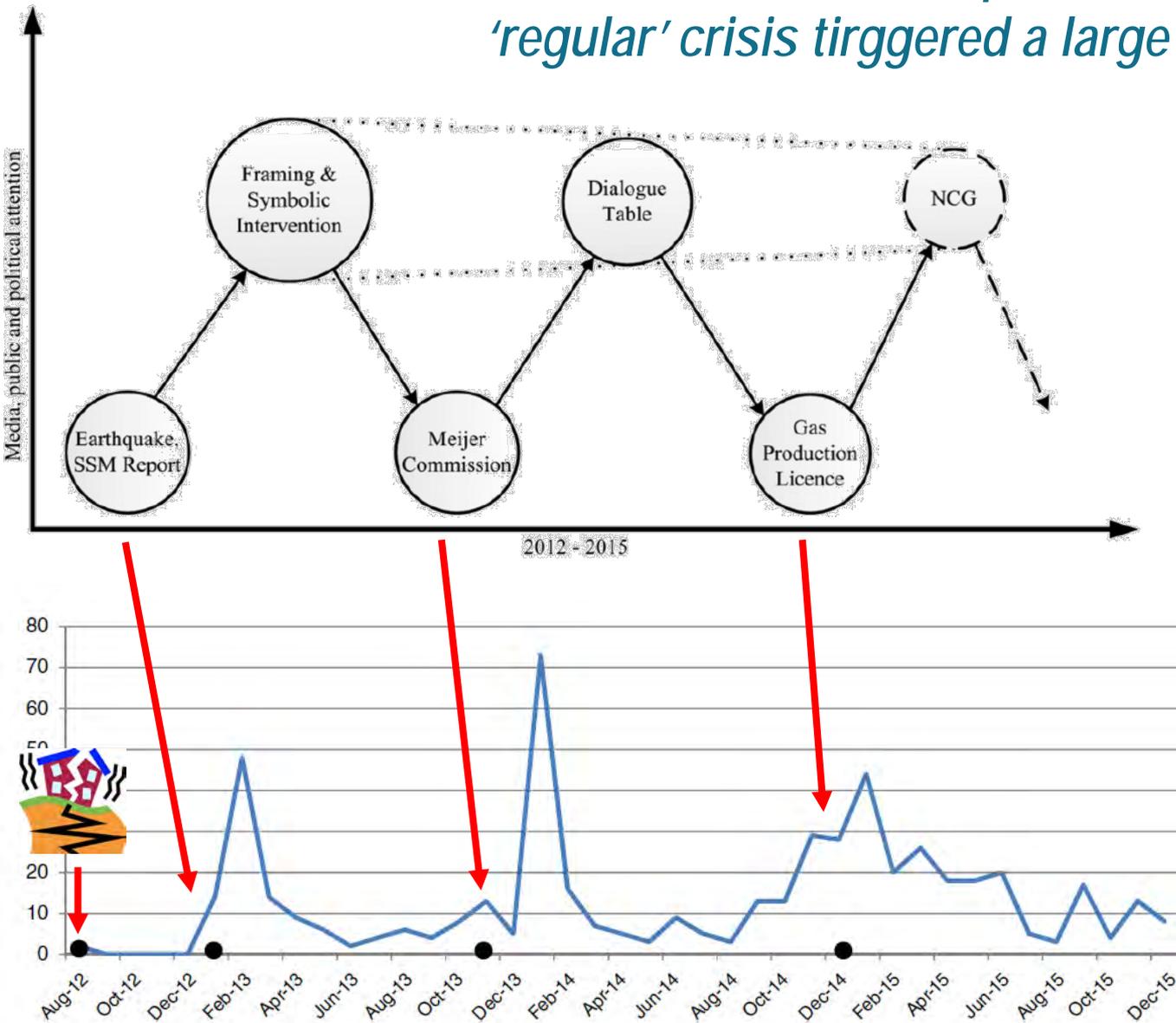
The Wicked Problem of Earthquake Hazard ... (EOS, Stein et al. 2018)



After Stein et al. 2018

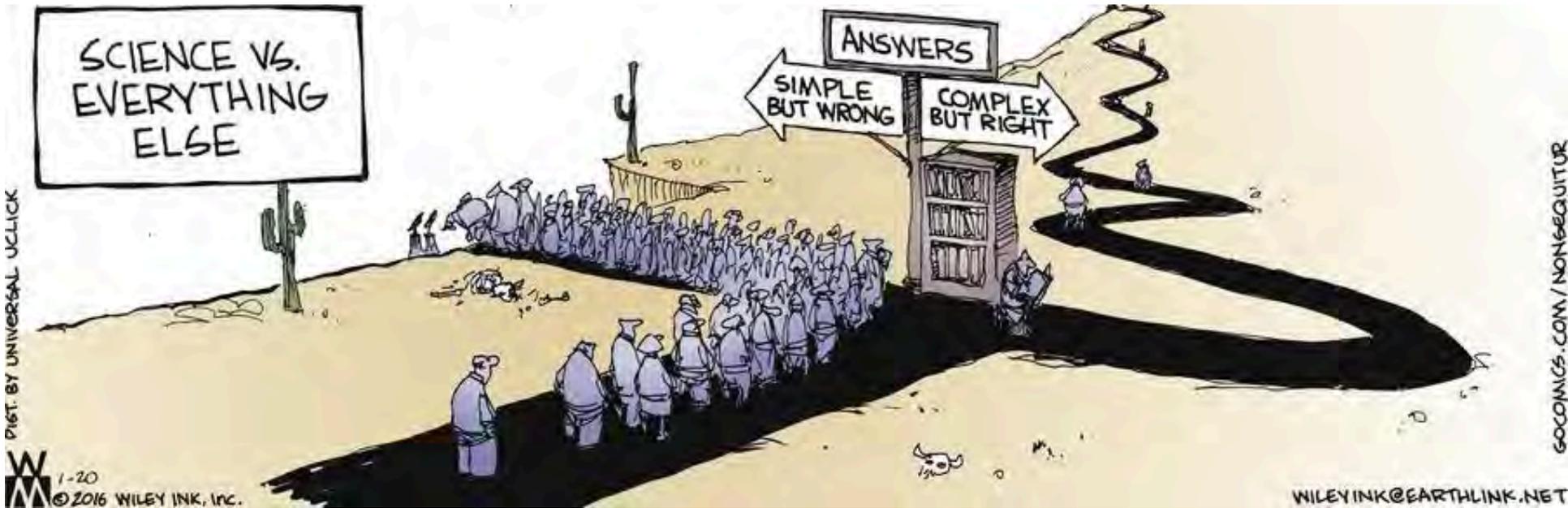
“In the case of earthquakes in Groningen, a small ‘regular’ crisis triggered a large ‘institutional’ crisis.”

Schmidt et al 2018



Schmidt et al. 2018

Science outreach failure



RISK MESSAGE MODEL



BRON VAN ONZE ENERGIE

Werken bij
NAM

Schade
melden

English
information

Contact en
Pers



Gas- en oliewinning

Veiligheid, milieu en schade

NAM en de samenleving

Techniek en innovatie

Feiten en cijfers

Nieuws

U bent in: Nederlandse Aardolie Maatschappij > Feiten en cijfers > **Onderzoeksrapporten**

Onderzoeksrapporten

Hier vindt u de resultaten van onderzoeken die gedaan worden door NAM.
Houd deze pagina regelmatig in de gaten voor updates.

juni 2018

Sorteer op: Datum (nieuw) ▾

Smallest Earthquake Magnitude that Can Trigger Liquefaction

This report contains a literature study of field observations, to establish an earthquake magnitude threshold ... [Lees meer](#)

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44

april 2018

Seismic risk assessment for a selection of seismic risk production scenarios for the Groningen field

Dit is het rapport 'Seismic risk assessment for a selection of seismic risk production scenarios for ... [Lees meer](#)

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maart 2018

Assurance Meeting on Exposure, Fragility and Fatality Models for the Groningen Building Stock (Long Version)

The studies and experiments into the response of buildings to earthquakes have been reviewed by an international ... [Lees meer](#)

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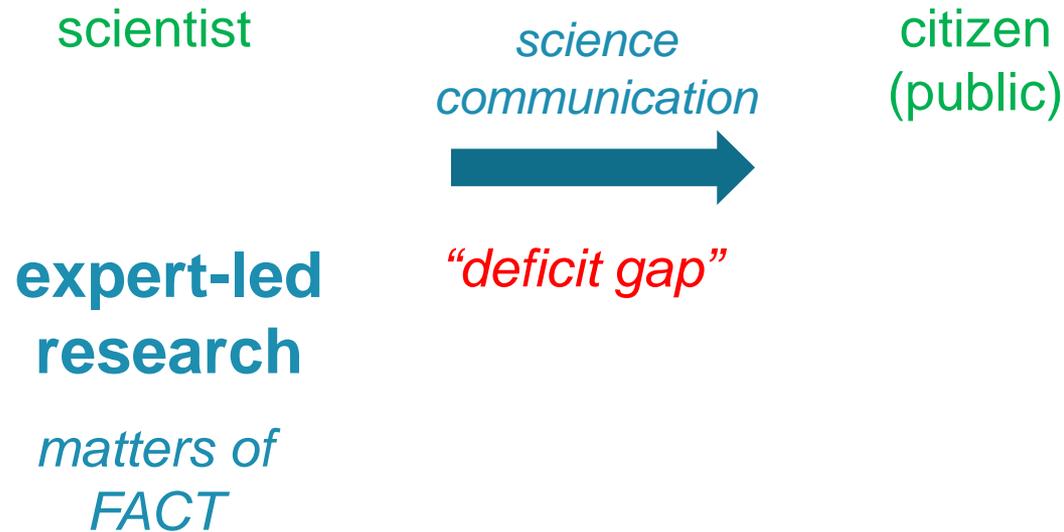
Assurance Meeting on Exposure, Fragility and Fatality Models for the Groningen Building Stock (Short Version)

The studies and experiments into the response of buildings to earthquakes have been reviewed by an international ... [Lees meer](#)

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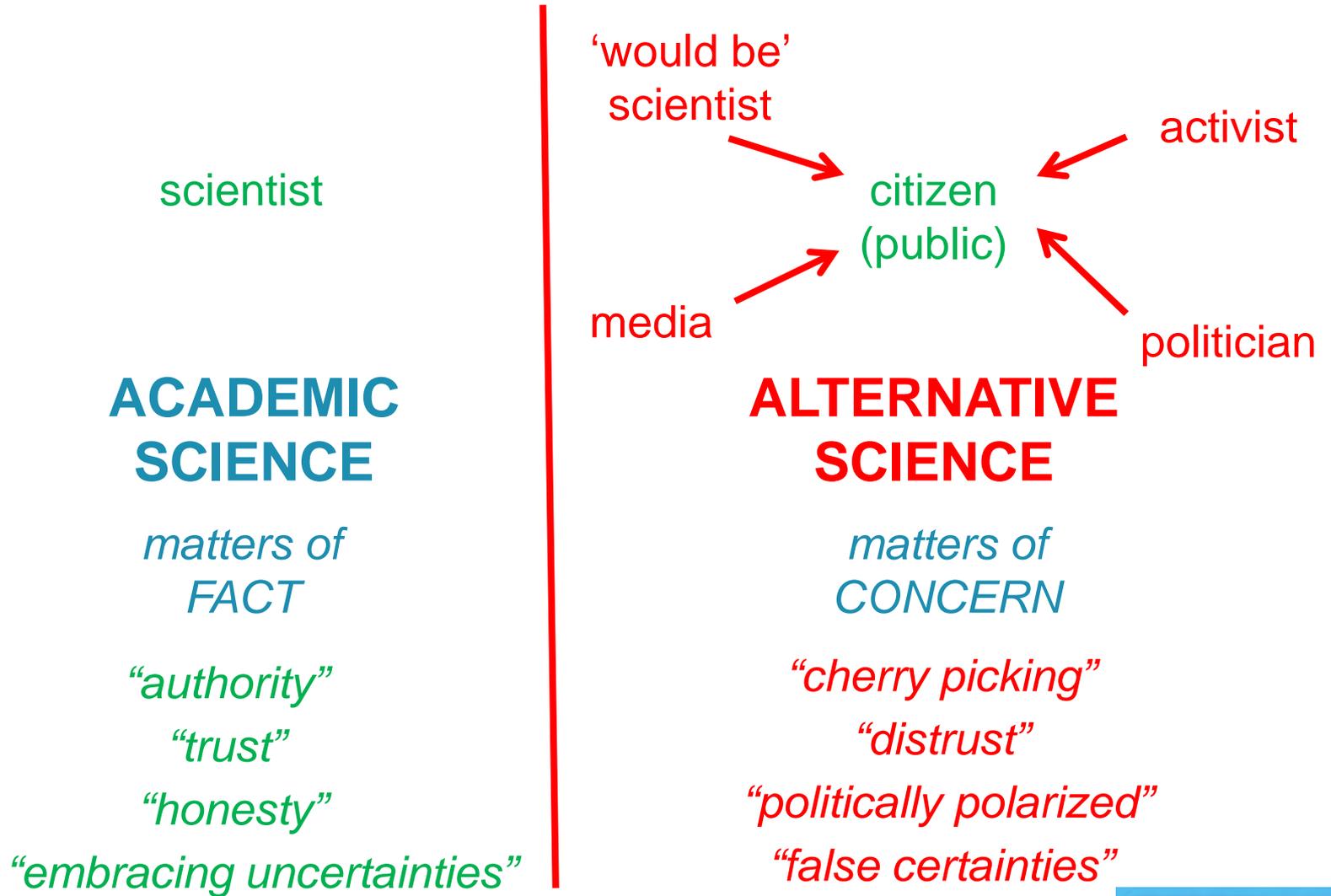
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RISK MESSAGE MODEL



“neutral mediator of knowledge”

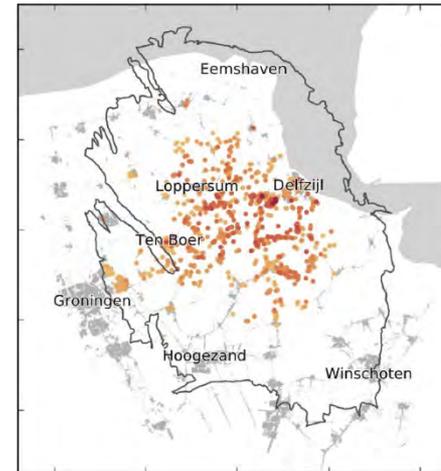
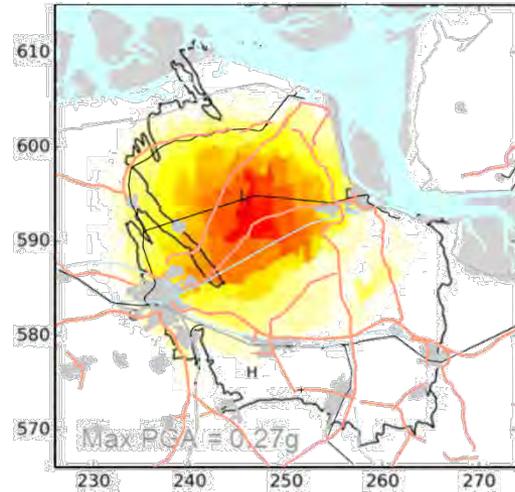
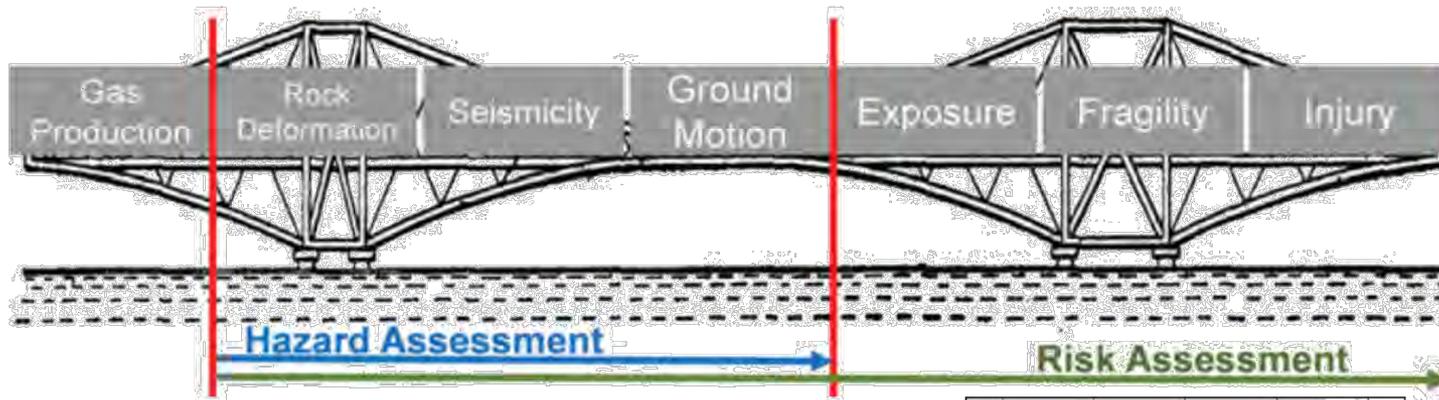
RISK MESSAGE MODEL



SOCIALLY-CONSTRUCTED PERCEIVED RISK (Sander 1993)

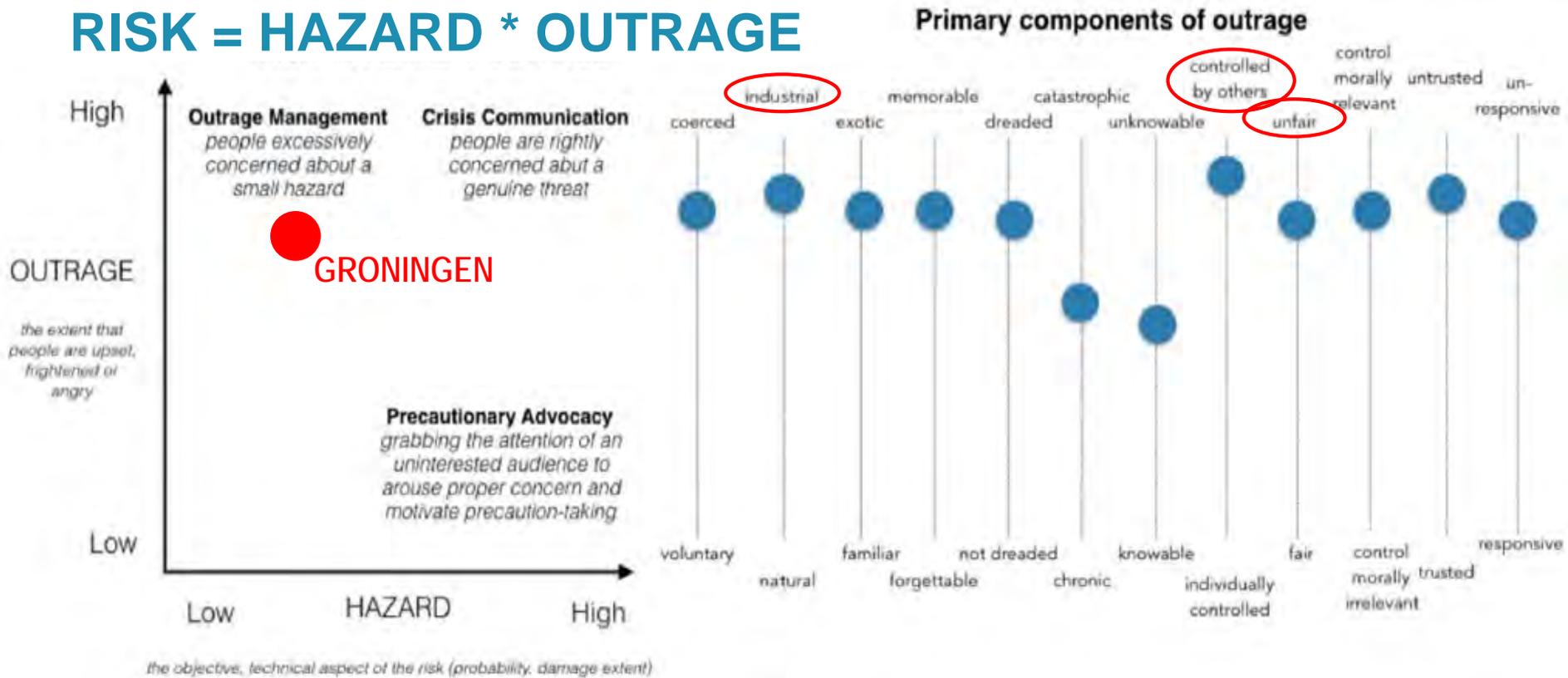
$$\text{RISK} = \text{HAZARD} * \text{VULNERABILITY}$$

Integrated Hazard and Risk Assessment



SOCIALLY-CONSTRUCTED PERCEIVED RISK (Sander 1993)

$$\text{RISK} = \text{HAZARD} * \text{OUTRAGE}$$



SOCIALLY-CONSTRUCTED PERCEIVED RISK (Sander 1993)

RISK = HAZARD * OUTRAGE

EXPERTS focus on hazard and ignore outrage

- ⇒ overestimate 'social risk' when hazard is high and outrage is low
- ⇒ underestimate 'social risk' when hazard is low and outrage is high

PUBLIC focuses on outrage and ignore hazard

- ⇒ overestimate 'social risk' when hazard is low and outrage is high
- ⇒ underestimate 'social risk' when hazard is high and outrage is low

RISK CONTROVERSY (Sander 1993)

"If people are outraged because they overestimate the hazard, the hazard needs to be explained!"

"If people overestimate the 'social risk' because they are outraged, the factors leading to the outrage need to be tackled!"

RISK PERCEPTION PARADOX (Wachinger et al. 2013)



VEILIGHEIDSREGIO
GRONINGEN

Leerlingen

Ouders

Leraren

Voorpagina

Weetjes

Groepslessen

Contact

Pers

Welkom op aardbevingenwijzer!

Bekijk hier weetjes over aardbevingen in Groningen

Wijzer worden over wat je doet bij aardbevingen?

RISK PERCEPTION PARADOX (Wachinger et al. 2013)

scientist

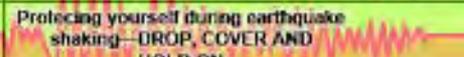
*higher
earthquake
awareness*



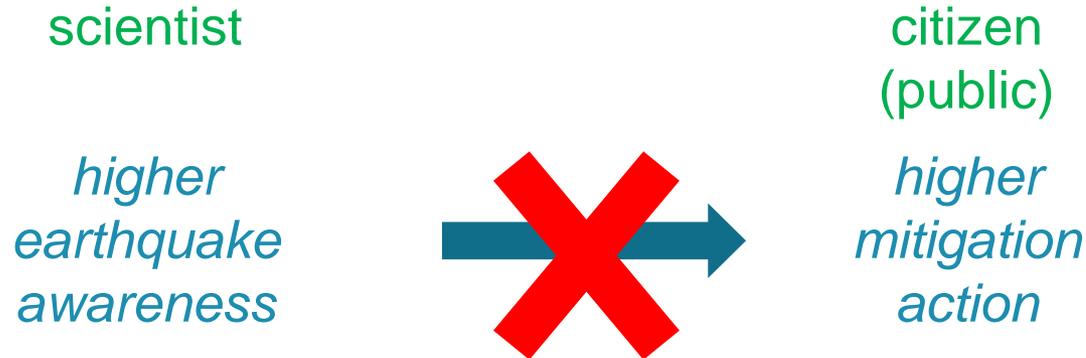
citizen
(public)

*higher
mitigation
action*



Steps For Earthquake Preparedness	
1	Identify potential hazards in your home and begin to fix them! 
2	Create a disaster preparedness plan. 
3	Prepare disaster supply kits. 
4	Identify your building's potential weaknesses and begin to fix them. 
5	Protecting yourself during earthquake shaking—DROP, COVER AND HOLD ON 
6	After the earthquake, check for injuries and damage. 
7	When safe, continue to follow your disaster preparedness plan. 

RISK PERCEPTION PARADOX (Wachinger et al. 2013)



“values and beliefs”

“identity affirmation”

“endemic unpreparedness”

“emotional distance”

“fatalism vs optimistic bias”

“What a geologists wants to tell is not what the community wants to hear!”

- The scientific community was **not prepared** when the 2012 Huizinge earthquake took everyone by surprise!
- The scientific community was initially **not interested** in the Groningen case!
- Science has been completely **expert-led**, focussing on technical and physical aspects of the induced seismicity!
- Science communication has been a **one-way transfer** of scientific information!

REACTIONS TO THE LATEST HIGGS BOSON ANNOUNCEMENT...

MAYBE WE WILL
BEGIN TO
UNDERSTAND
HOW MATTER
HOLDS
TOGETHER!



SCIENTISTS

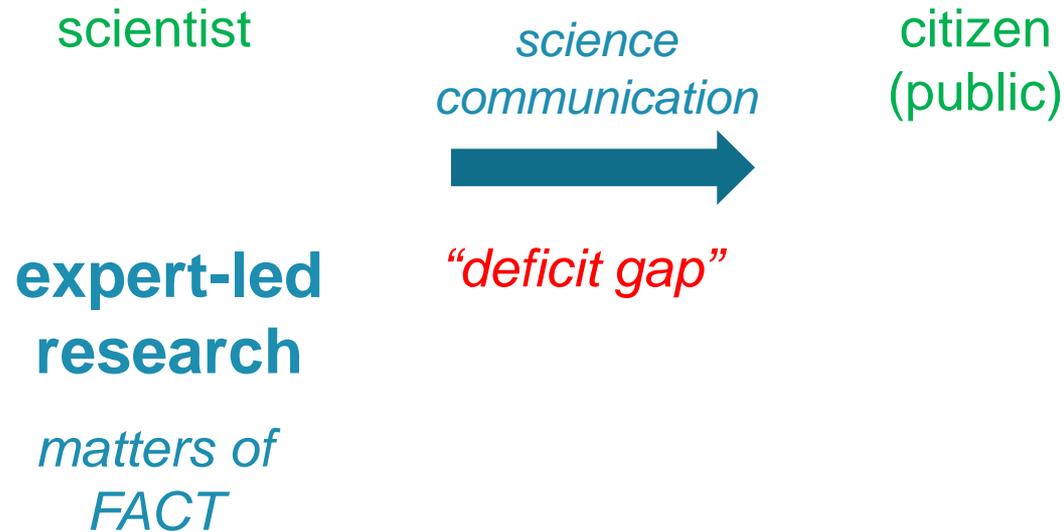
GOSH, I
WONDER
WHAT KIM
KARDASHIAN
IS DOING
RIGHT NOW.



THE PUBLIC

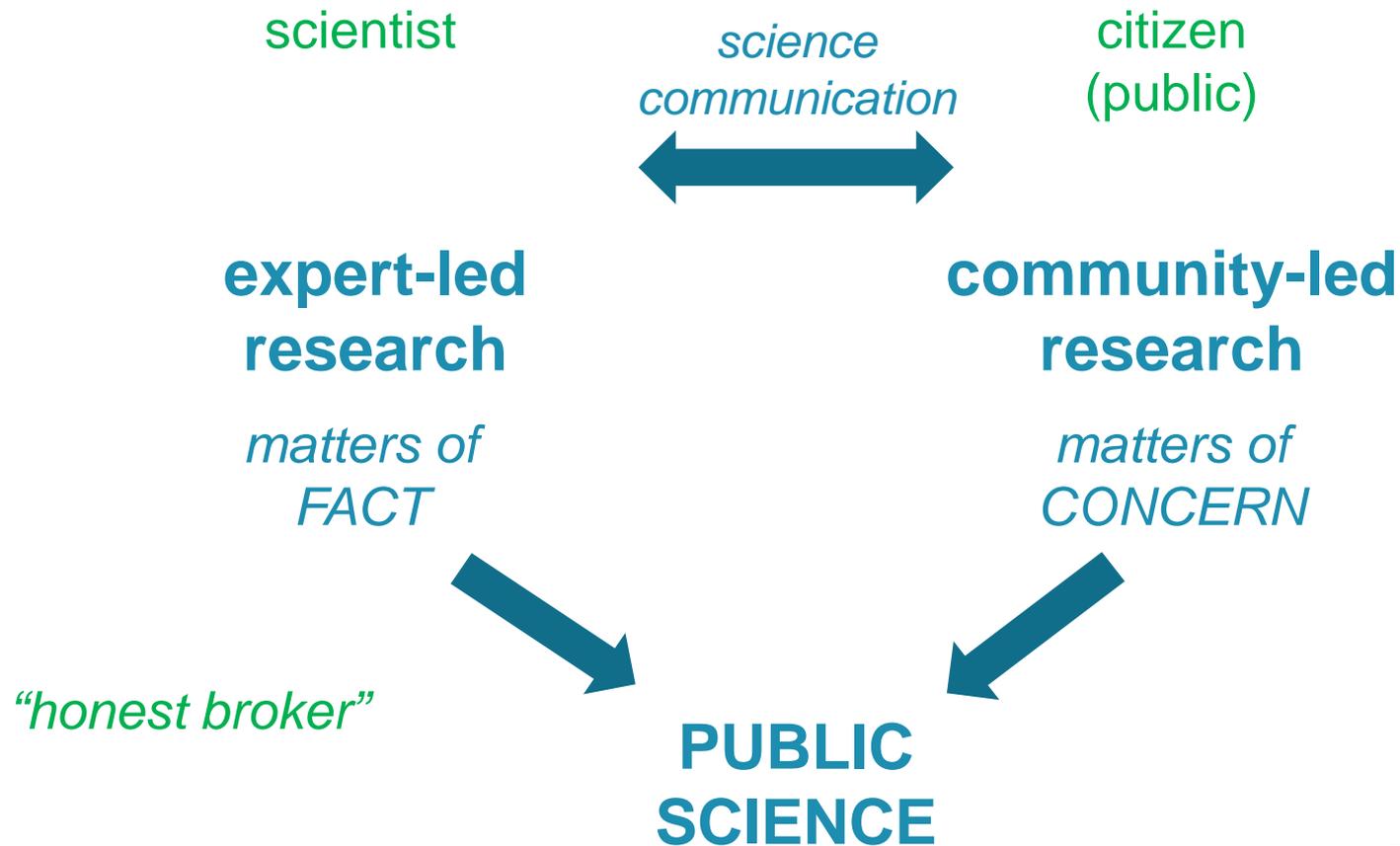
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RISK MESSAGE MODEL



“neutral mediator of knowledge”

RISK DIALOGUE MODEL



WHAT IS THE SOCIETAL ROLE OF SCIENTISTS IN INDUCED SEISMICITY?

- The communication as a scientist should always be **evidence-based!**
- A scientist is **servicing society!**
- As a **honest broker** a scientist tries to integrate societal concerns and scientific facts to open up a **range of options** to public and policy makers!
- A scientist doesn't make choices; people make choices; politicians make decisions the scientist's job is to **empower them** to make informed choices and decisions!
- There is **NO one-size-fits-all scenario** for (induced) earthquake risk communication!



“As well as having to learn how to ‘speak better’, geoscience communicators are going to have to learn to ‘listen better!’”

Iain Stewart & Deirdre Lewis 2017