

# STAND UP FOR THE OCEAN



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INAUGURAL LECTURE BY PROF DR ERIK VAN SEBILLE

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*Mevrouw de Rector Magnificus,*

This is a climate crisis. And science hasn't been able to prevent it. The science underpinning the greenhouse effect has been known for almost a century now. Thousands of papers, dozens of reports. But all these efforts by the academic community have not put an end to the rise in carbon dioxide emissions. Why has academia failed to avert the climate crisis? And what can we, academics, do to turn the tide? How do we fit into the narrative? In a society where the youth glues itself to traffic intersections, private jets, and fine arts, how activist should academics be?

I am very excited to have been appointed as professor in oceanography and public engagement. In the coming 40 minutes, I will explain why the combination of oceanography and research into public engagement is such a good fit. And also convince you how we academics can be more effective in our interactions with society.

## Why the ocean matters

My argument starts with the ocean. Society is terracentric, too focussed on land. But more than 70% of the surface of our planet is covered by ocean. Why do we even call this planet earth, when it is so clearly water?

I remember very well when I first felt the immensity of the ocean. It was on the research vessel *Pelagia*, in the middle of the Atlantic Ocean. We'd been at sea for four weeks, and the captain called a man-overboard practice. We all had to put on our swimwear, and jump in. There I stood, 800 kilometres from land, four kilometres of water beneath me. I was so scared. But also intrigued, by the mysteries below me. From then onward, I wanted to become an oceanographer.

We know less of the deep ocean, than of the surface of Mars. Yet, the ocean is crucial to our climate. Twenty-six percent of the extra carbon dioxide that is emitted into the atmosphere is absorbed by the ocean<sup>1</sup>. You can think about this as a discount, courtesy of the ocean: emit a ton of carbon dioxide and deal with only 750 kilogrammes of it, because the ocean will absorb 250 kg. What a fantastic deal! Without the ocean, carbon dioxide levels would have been much higher than they are now. So let us say: 'thank you ocean!'

But this service comes at an environmental cost. The absorbed carbon dioxide decreases the pH of the ocean. This makes it more difficult for corals and some plankton to build a skeleton<sup>2</sup>. Furthermore, the carbon dioxide that does remain in the atmosphere traps extra heat, and most of that heat is absorbed by the

ocean. This leads to warming of the ocean. The warming affects ecosystems when organisms must adjust<sup>3</sup>. And it also leads to sea level rise because warmer ocean water expands upward<sup>4</sup>.

The ocean is thus facing a double whammy of warming and acidifying under increased carbon dioxide levels. But it's not only climate change that affects our ocean. Our economic system has allowed global society to exploit the ocean on an unprecedented scale. Industrial-scale fishing has diminished many commercial fish species to near-extinction<sup>5</sup>. And for those fish species that can still be caught, the fishing methods are now so efficient that fishing can be considered more like harvesting than like hunting<sup>6</sup>. Moreover, ship engines and other marine activities create an enormous amount of noise which drowns out the sounds that whales and other marine mammals use to communicate with each other<sup>7</sup>.

And then there is of course the plastic pollution. I'll come back to the issue about the intricate relation between plastic pollution and climate change later, but it is obvious that the large amount of plastic waste that lingers in our ocean does not benefit ecosystem health<sup>8</sup>.

## There is only one ocean

All these perils are a threat to our ocean. Ocean, not oceans. While at school you may have learned about the five or seven oceans, from the point of view of an organism living in the ocean, there is only one. Unlike land-dwelling organisms, marine organisms could in principle go from any location in the ocean to any other location without ever having to leave the ocean<sup>9</sup>. All regions of the ocean are fully connected. But that doesn't mean that all organisms always move throughout the entire ocean. Most can't, because most organisms are at the mercy of ocean currents<sup>10</sup>.

This interaction between the physical oceanography of ocean currents and the biogeography of marine ecosystems is what gets me really excited. Ever since my PhD fifteen years ago, I've been interested in how ocean currents move stuff around. This is called the Lagrangian perspective or framework<sup>11</sup>, and it's especially powerful for analysing connectivity: how and on what timescale is material transported from one location to another. My PhD research was on analysing the connectivity and transport of water, heat and salt between the Indian Ocean and the Atlantic Ocean and how that impacts global climate<sup>12</sup>. During my postdocs at the University of Miami and the University of New South Wales, and my lectureship at Imperial College London, I've collaborated with marine geneticists who wanted to understand how species move from one

location to another and which environmental conditions – and thus environmental selection – they experience during their journeys<sup>13</sup>. And in the last 10 years, I've used connectivity analysis to investigate the plastic polluting our ocean<sup>14</sup>, and how ocean currents transport plastic and where that all ends up<sup>15</sup>.

I'm so lucky all these years to have been surrounded by inspiring, good-natured supervisors, colleagues and collaborators. It's thanks to the more than forty postdocs, PhD students, Masters and Bachelor students and interns in the Utrecht oceanparcels team that we've become this successful. The people in the oceanparcels team have worked tirelessly to develop and apply novel computer codes and analysis techniques on marine plastic pollution, plankton, seaweeds, sea-ice, oil, tuna and nutrients. I look forward to continue working with my wonderful oceanparcels team. I also look forward to working with my equally wonderful new team at the Freudenthal Institute's Public Engagement and Science Communication group. More on that later. Special thanks go out to Henk Dijkstra who supported my return to Utrecht. And to Isabel Arends, Toine Pieters, Stefan Vandoren and Femke den Boer who offered me the opportunity to create this unique professorship in oceanography and public engagement. Add to that the more than 660 fantastic and inspiring collaborators and co-authors, and I can really say I'm standing on the shoulders of giants. I am fully aware and appreciate that I'm privileged and realize that not everyone has access to these chances and opportunities. It's time to make Iedereen Professor!<sup>16</sup>

## Tracking plastic pollution to play the blame game

Recently, my team and I have started a new oceanographic research line. I want to 'play the blame game': whose plastic is it you find on a beach? We use a Bayesian inference framework<sup>17</sup> to analyse the virtual plastic particle trajectories that we simulate with our open-source Parcels software<sup>18</sup>. I want to focus on macroplastic, the plastic items larger than roughly 5 centimetres. These larger items don't get nearly as much media attention as micro- and nanoplastic, because their ecotoxicological impact is much less. Simply put: there are only a few large species of marine animals that can swallow an entire soda bottle, but almost all organisms in the ocean can inadvertently ingest a nanoplastic particle<sup>19</sup>. And that nanoplastic particle may then also be much more toxic when it transfers into organs<sup>20</sup>.

While the impact of the larger macroplastic items may be less, there are at least five reasons why solutions to marine plastic pollution should start with cleaning up macroplastic pollution, and then specifically on the beach. First of all, Mikael Kaandorp, who recently graduated his PhD student in my team, found that large plastic items constitute more than 95% of all mass of plastic in the ocean. So, by

cleaning up macroplastic, we remove most plastic mass<sup>21</sup>. Secondly, Carmen Morales, a postdoc at the University of Cadiz who I collaborated with, found that most large plastic in the ocean originates from land<sup>22</sup>. And Victor Onink, who graduated from the University of Bern last year and who I extensively worked with the last five years, found that the plastic that does come from land stays near the coastline for a long time, constantly bouncing back and forth between the beaches and coastal ocean<sup>23</sup>. Third, Mikael Kaandorp also found that most fragmentation of plastic from large size to microscale happens on coastlines<sup>24</sup>. Realise that a one-and-a-half litre plastic bottle could in principle fragment into a million microplastic particles. Every large plastic item removed thus avoids a plethora of microplastics entering the ocean. The fourth reason is one many of you will be particularly excited to learn: environmental psychology research by my colleague Kayleigh Wyles has shown that cleaning up a beach is good for your mental health<sup>25</sup>. The mental health benefit of a beach-walk where you pick up the plastic litter you find is even higher than of a beach-walk where you try to ignore the plastic. And finally, if we ever want to hold the polluters accountable, then that will probably be most feasible for macroplastic. Because the origin of large plastic items may be identifiable<sup>26</sup>. How?

I envision an interdisciplinary research programme where oceanographers, archaeologists, chemists, biologists, geneticists, and legal scholars collaborate to build a minimum evidence base for accountability of who has responsibility for the plastic items found somewhere in the ocean or on a beach. In this program, oceanographers simulate the transport of large plastic items<sup>27</sup>, archaeologists construct a history of the item by considering it as an artefact<sup>28</sup>, chemists assess the degradation state and isotopic composition of the plastic item, biologists and geneticists identify the algae that have attached to the item which inform about its provenance<sup>29</sup>, and legal scholars identify what a minimum level of confidence is before an actor – which can be a person, a company or even an entire industry – can be held accountable.

I'm confident that in the not-too-distant future this will all be possible. Let me share an example from the LitterID workshops by Wageningen University and Research, organised by my colleagues Wouter Jan Strietman and Eelco Leemans<sup>30</sup>. In this project, a group of volunteers helped completely clean up a beach on Svalbard, north of Norway in the Arctic Ocean. When they were done, the team categorised all items: a pile of fisheries-related plastic, a pile of food packaging, a pile of bottle caps, a pile of cigarette butts, etcetera. They then carefully analysed, using techniques from archaeology, the peculiarities of the items in each category. And it was when they reached the 'cosmetic packaging' pile that they made a very



interesting and important observation: that almost all items were from male cosmetic products! Male shampoo bottles; male deodorants.

The question of course is: why this bias? It's not because male shampoo bottles drift differently than female shampoo bottles. No, it's most likely because most plastic ending up on Svalbard beaches comes from male-dominated fishing vessels. So here we have a proverbial smoking gun: the prevalence of male products points to a certain industry from a certain country being the polluter. If we can further fine-tune this analysis to point to individual ships, we might have a court case? Because throwing plastic waste overboard is prohibited by national and international law.

Of course, we can't and shouldn't develop such a programme solely within academia. Building the evidence base to successfully sue polluters requires active engagement with organisations that work on the ground, by cleaning up beaches. We can do this within the Dutch context, on Dutch beaches. My collaborators at Stichting De Noordzee, for example, have years of experience organising beach-cleanups and hence know a lot on the types of items found on Dutch coastlines; and when and where they arrive<sup>31</sup>.

But it might be even more impactful to do it on the small island developing states that bear the brunt of the plastic pollution issue, and where the financial incentive of clean beaches for tourism is even higher. On my recent sabbatical, I spent a month on Curacao. While a tropical island paradise from a tourist's perspective, Curacao faces many socioeconomic and environmental problems, from brain drain and poverty<sup>32</sup> to wastewater management<sup>33</sup> and coral demise<sup>34</sup>. While plastic pollution on their beaches is perhaps not the most pressing of these problems, it is the most visible. I joined a local beach clean-up and was shocked by what I saw: so much plastic litter! So much plastic! And from my discussions with academics on Curacao, I did realize that the visibility of plastics, and its close connection to socio-economic and personal activities on land, can be an effective entry-point for an island-wide public discussion around sustainability.

### The case for public engagement with oceanography

And that is the core of this inaugural lecture. I am convinced that the ocean can provide an extraordinary entry point for public engagement on sustainability. The ocean may not play a central part in most people's life. But most people do have a notion of the ocean as exciting, mysterious, perhaps even romantic<sup>35</sup>. There's a reason so many people go on beach holidays, and are then willing to pay a premium for a hotel room with ocean view. That many people love diving and

snorkelling. That 10% of Dutch households have an aquarium<sup>36</sup>. That Finding Nemo is the best-selling DVD of all time<sup>37</sup>. There's something special about the ocean.

And note that where I say ocean, I mean all salt-water bodies including seas and large estuaries. I'm inclusive in my definition of the ocean. As I said before, there is just one ocean, it's all connected. It's not useful, from a public engagement point of view, to distinguish between seas and ocean, or even between the Pacific, Indian or Atlantic Ocean. Internationally, this framing is strongly supported by the #droptheS movement, communicating that we should use the phrase ocean instead of oceans. In Dutch, this could be #maar1ocean, with a hat-tip to Kim van Ommering.

Why does this matter? Because one ocean helps to convey the communality and uniqueness of the ocean. The ocean is unique because it belongs to no-one. The ocean is, together with Antarctica and outer space, our only true global 'commons'. But where only a very few people have been on Antarctica or in outer space, everyone can experience being in or on the ocean. Sure, most people's direct experience with the ocean is coastal-bound, but the ocean currents will make sure that anything that happens there can get transported to the open ocean<sup>38</sup>. This gives anyone on a beach holiday a particular responsibility: don't lose your sandals or they might wash up on the other side of the globe. And it also gives us all as society a responsibility because the open ocean is so poorly protected. As former New York Times journalist Ian Urbina called it in his book *The Outlaw Ocean*<sup>39</sup>, the ocean is our last Wild West where mass-scale overfishing, wilful pollution, human trafficking, and even modern-day slavery are not uncommon. And don't forget the effects of climate change that I discussed before.

The flip side to this criminality is the ocean's beauty. The endless horizon from standing on a beach. The magnificent sunsets. The raw power of the waves. And, not least, the amazing marine animals. Especially what marine biologist sometimes denigratingly refer to as 'charismatic megafauna': the dolphins, whales, turtles, and cute clownfish. These organisms are the innocent victims of our careless use of the ocean. So, like every good story, the narrative of ocean sustainability has both villains and victims. Which begs the question: "where's the hero?" Perhaps the main question underpinning the combined remit of my professorship is "should ocean scientists take the role of the heroes?"

## Activating society through Public Engagement

Before I make a start answering that question, and since we're at the topic of terminology and wording, I want to take you on a small digression. Before I left for my sabbatical last autumn, I promised some of you to think of a different term for "public engagement". Because there's a problem with the term public engagement: it does not mean anything outside of academia. As academics we might understand that we refer to meaningful interactions between academic and non-academic publics, but to someone at a company or in government, this relation to academia is not at all clear in the term public engagement. It's an outward-looking term, and thus implies 'us' and 'them'. But that is exactly the "ivory-tower" concept of academia that we all want to get rid of.

Furthermore, the term "public engagement" misses the opportunity to convey the motivation: why do we do public engagement? When I get asked what the essence of public engagement is, I say it is 'research with and for society'. But "professor of oceanography and research with and for society" is a bit of a mouthful. As a short-hand version, I could live with the phrase 'society-activated research'. In Dutch that would be 'samenleving-geactiveerd onderzoek'. I appreciate that this is still somewhat vague, but it's a phrase that can be loaded with for example the different activities that we here in the Utrecht Open Science platform file under public engagement<sup>40</sup>. Science communication activates society by increasing scientific literacy. Stakeholder engagement activates academia by providing societally meaningful use-cases for research. Citizen science activates both society and academia by enlisting non-academics in research. And co-creation also activates both society and academia by asking the research questions that matter most. Let's see if the term sticks...

So let's explore how this society-activated research works in practice. A useful case study is the science communication around marine plastic pollution, and how that compares to science communication on ocean climate change. As I stated at the beginning of this inaugural lecture, we are in a climate crisis. And this worries me tremendously. Yet, most of the research in my team the last 10 years has been on plastic pollution. These two topics are of course related, but not the same. Plastic pollution is an atrocity, and society should be ashamed that we let it come this far that plastic can now be found everywhere from the deepest depths of the Mariana trench<sup>41</sup> to the sea ice of the Arctic<sup>42</sup>.

But plastic pollution does not pose an existential threat to our livelihoods and the structure of our socioeconomic system, as the climate crisis does. It is not even entirely clear how harmful the current levels of marine plastic pollution are<sup>43</sup>. So



don't get me wrong: I'm not a plastic-denier; but what keeps me awake at night is the looming climate catastrophe. Yet, the science communication and society-activated research of my team and myself focusses on our plastic pollution work; partly because that is where the funding comes from and also because that is what most public engagement requests are for. But here's what I now wonder about: Does communicating about plastic pollution distract from the climate crisis? Do people who hear from us about plastic pollution research improve their recycling habits but then book a flight to Thailand? Or, on the other hand, does the visibility of plastic pollution reinforce the idea that local socioeconomic choices can have remote impacts?

What's interesting about plastic pollution is that people refuse straws because they might end up in a turtle's nose. A strangled turtle is a very visual and uncanny image, and has been extremely effective in putting plastic pollution in the public spotlight as a serious issue.

### The role of academics in science communication

Answering this question about the perception of plastic pollution versus climate change requires sociological research, something that is beyond my own remit and expertise. But what I do consider my remit is investigating how academics can be most effective in science communication. Or, phrased in another, more economic perspective: "What is the added value of academics in communication?"

The landscape of science communication professionals is very diverse. Key players are of course the journalists, both employed by media organisations and self-employed. But also the communication officers at universities and research institutes. The vloggers, bloggers, tik-tokkers and other influencers. And the academics themselves. Most of us in the last category have no formal training in communication strategies. And even if we do have training, the ideas underpinning science communication are very rarely evidence-based. As my colleague Ionica Smeets has said, it is surprising that every step of the scientific workflow has a protocol, except science communication<sup>44</sup>. Then, we steer on intuition. We do science communication because we enjoy it. While that may be a good intrinsic motivation, it's not effective.

What's more: until very recently, most academics were not even recognised or rewarded for their communication activities. Most academics are the amateurs in a field full of professionals. So why and when do they have added value, and should they take time out of their busy schedules to engage in public dialogue?

## Why trust science?

The core of the answer to that question lies in trust. According to the Rathenau Institute, public trust in academia is high. In their March 2022 report, Dutch people rate their trust in 'wetenschap' with a 7.4 out of 10, which is more than trust in the courts of law, media, and politics<sup>45</sup>. And perhaps surprising to some of you, the Dutch public trust in academia has even gone up during the covid-pandemic. So even though I sometimes hear academics grumbling that there is so little trust in society, based for example on the explicit refutation of science by covid- and climate-deniers, I am more optimistic because the silent majority does trust academics.

It is this public trust in science and academia that science communication should leverage on. This suggests that indeed academics should take on the role of trusted hero. And science communication shouldn't focus on outcomes, but on the process. As Nieske Vergunst once said, scientists should communicate better "how the sausage is made". While I've been a vegetarian for more than 15 years now, I endorse that metaphor. It's much more important how science is done, and why; than what the results are.

During my sabbatical, I met with Professor Edward Maibach, one of the leading climate communication experts in the US. His idea is that effective climate communication is organized in triangular collaborations between communication professional, communication scholar, and climate scientist<sup>46</sup>.

I subscribe to this idea, but also think that the dependency on the climate scientist is perhaps smaller than on the communication professional and communication scholar. Prompted by these two, the climate scientist takes on a role; is an actor. More a spokesperson of the field than an individual. The IPCC reports are so comprehensive, and the consensus among climate scientists is so large, that most climate communication is not very different from undergraduate teaching. All climate scientists can do it.

When I worked in Sydney, I participated in a climate communication traineeship organized by the Climate Council. Back then, the climate debate in the media in Australia was very hostile. There was much denialism, likely fueled by the powerful mining industry. In order to protect climate scientists from personal attacks by the deniers, the Climate Council wanted to broaden the pool of climate scientists that were comfortable to speak to the media. The more voices for climate science there are, the more difficult it is to get personal Australian oceanographers, meteorologists, paleoclimatologists and other climate scientists had made a front. They are exchangeable.

And that is important to realize, because it touches upon the question of scope of expertise. Many academics will have experienced 'expertise creep' when they engaged in science communication. How do you answer a media question that is beyond your own expertise? How even can you define the limits of your expertise?

Ask my oceanography colleagues and they will say that my expertise is Lagrangian oceanography, how ocean currents move 'stuff' around. Ask my students and they will say my expertise is physical oceanography, the topic of the courses I teach. Ask my friends and family and they will say my expertise is climate physics, the topic of my MSc degree.

We let our expertise be defined by others, and that can lead to uneasiness. When I am interviewed by for example the NOS on a topic that I haven't published in for the last three years, I am more worried about the responses of my direct colleagues than by that of my mother. In a field where we need as many voices as possible to communicate the dire state of our climate, that is not a healthy situation.

Of course, it depends a bit on the type of media, but my own working definition of my expertise is roughly any topic that I'd feel comfortable to lecture about in an undergraduate class.

### The activist academic

So back to the question of whether climate scientists should take on the hero-role. I can't deny that it would be awesome to 'come in and save the day'. But I don't know many climate scientists who actually see themselves as heroes, and I don't either: the problem is that I don't have a silver bullet solution. When Aike Vonk in my team recently analysed the roles of scientists in press releases about oceanographic research<sup>47</sup>, the role that was mostly used was that of 'warner'. Oceanographers position themselves as the proverbial canaries in the coalmine.

But then it becomes really interesting. Because it's only a small step from warner to activist. There are many definitions of what activism is in academia<sup>48</sup>, but for now, let's assume that an academic is activist when their goal is to reduce the number of policy options by advocating for one policy option over another. For example, advocating for a radical reduction in greenhouse emissions versus advocating for uncurbed growth.

Is activism a necessary part of taking on a warner role? No. An academic can in principle only warn about the climate crisis, and refrain from promoting certain

policies. Many academics in fact think that this is the ethical way to engage, and it is what is meant<sup>49</sup> with the role 'Honest broker of policy options'.

Others state that it is near-impossible for academics to refrain from advocacy<sup>50</sup>; even the act of submitting a competitive grant proposal could be seen as activist since the outcome of any competitive call is for tax money to be steered towards a few research projects, necessarily then diverting funds away from other research projects.

But of course, academics can still choose to be more, or less, activist in their public engagement and science communication. The research question I'm interested in, is whether it is effective to be activist. Does engaging activist hurt the credibility and trust of climate scientists? You may intuitively think it does, since activism essentially means choosing sides. But there is empirical evidence that it doesn't need to be that way. In fact, the public may even expect climate scientists to be activist.

This is suggested for example by an experiment in 2017 where they assessed how people rated the credibility of a climate scientist's statements in a variety of press releases<sup>51</sup>. They found that the credibility, at 5.2 on a scale from 1 to 7, was independent of the amount of activism that the climate scientist put in his press releases, whether the climate scientist only talked about the results of a latest study or called for specific policies to reduce carbon dioxide emissions.

And this is not the only evidence that trust and credibility are not affected by activism. In a 2020 survey of German and US citizens<sup>52</sup>, and found that the majority support policy advocacy by climate researchers and expect political engagement. And so did the majority of climate scientists, by the way. There's no data for The Netherlands yet, but I'm very keen to find out if that also holds here.

In the meantime, I will work under the hypothesis that the public expects me and my fellow climate scientists to scream as loud as we can if we see anything in our data that society should be alarmed about. That is what why society invests in climate scientists.

And speaking of worrying about climate change... Perhaps this is a good moment to reveal the results of our *KlimaatStemming*. This was the experiment you all participated in, which I developed with Frank Goethals from Studio Tegenwind, Karlijn van den Broek from the Copernicus institute and the *KlimaatHelpdesk*. We asked everyone to provide answers to two questions: How worried are you about climate change? And how worried do you think the others at this inaugural lecture are? We did this because we want to measure whether people have an accurate

idea about the level of climate anxiety among their peers. So let's see what the outcomes are...

When we premiered the KlimaatStemming at the Betweter festival last October, we found that most visitors expected their peers to be quite worried but that most of them were actually extremely worried themselves. I spent an hour at the end of the Betweter festival discussing these results with visitors, as they passed the unveiled Klimaatstemming when they left TivoliVredenburg around midnight. And, as we anticipated, the outcome provided some comfort to many people. They were not alone in their climate anxiety. One person told me she would sleep better knowing that so many others are worried too. I hope that the results this afternoon can also provide you support if you need it.

### Showing emotion in climate communication

But what then for those colleagues who feel uncomfortable about the activist stance? Well, activism doesn't need to be angry and explicit.

In a 2007 paper titled "Nonpersuasive Communication about Matters of Greatest Urgency"<sup>53</sup>, decision scientist Baruch Fischhoff ended with a beautiful paragraph that is right on point: "Scientists who avoid science advocacy can still engage in value advocacy by speaking about the things that they cherish. As seen in the success of science films and centers, the passions of scientists often matter to nonscientists. Like artists, scientists have a special sense for the uniquely meaningful features of the world around them, enabling them to speak with an authenticity that goes beyond technical estimates of the costs and benefits of climate-related decisions."

Fischhoff is right that the roles and opportunities for academics are similar to those of artists. In fact, art can be a very powerful conduit for science communication<sup>54</sup>.

It is not sufficient to communicate scientific facts. Science communicators should also use the emotional doors to the hearts of their audience. Artists know much better how to do that.

I must confess I'm not much of an artist myself, but I do often get touched by art. You may have recognised the music that Jaap Jan Steensma played on the organ when the cortege entered, and which he will again play when we soon leave. It's "Beds are Burning" by the Australian band Midnight Oil. I chose this song because back in 2009, when I finished my PhD, it served as a protest song for climate justice and the climate movement. Originally written by Midnight Oil to support the emancipation of the Aboriginals, the text of the Chorus is "How can we dance



when our earth is turning? How do we sleep while our beds are burning?" The song is an expression of rage and anger about climate injustice.

It can be scary, but powerful, to incorporate emotions in science communication. One of my most memorable climate communication moments was when I gave a lecture about the impacts of climate change on the ocean to a group of Master students in the Marine Science program three years ago.

An hour into the lecture, after showing dozens of figures detailing the many dangers of climate change for ocean ecosystems, I couldn't take it anymore. I broke. I started crying. I had to stop the class and left the classroom.

I don't think I've ever given a more impactful lecture than that one three years ago. I expect it made a lasting impact on many of the students. It surely made a lasting impact on me. It made me realize that the scientific cognitive message needs to be aligned with the emotional message, for it to be understood by the audience. A mismatch between emotional and scientific message creates cognitive dissonance. So climate scientists in the room, please don't smile when you discuss the climate crisis. The audience won't understand it.

On the other hand, anger is such a negative emotion. For my own sanity, I therefore try to use more positive emotions. Reflecting on Fischhoff's observation that "the passions of scientists often matter to nonscientists", I'm settling on 'Passion'. I hope I have conveyed mine, and I look forward to learning about your passion at the reception.

*Ik heb gezegd.*

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