Responsible Research and Innovation:
From theory to practice to integration

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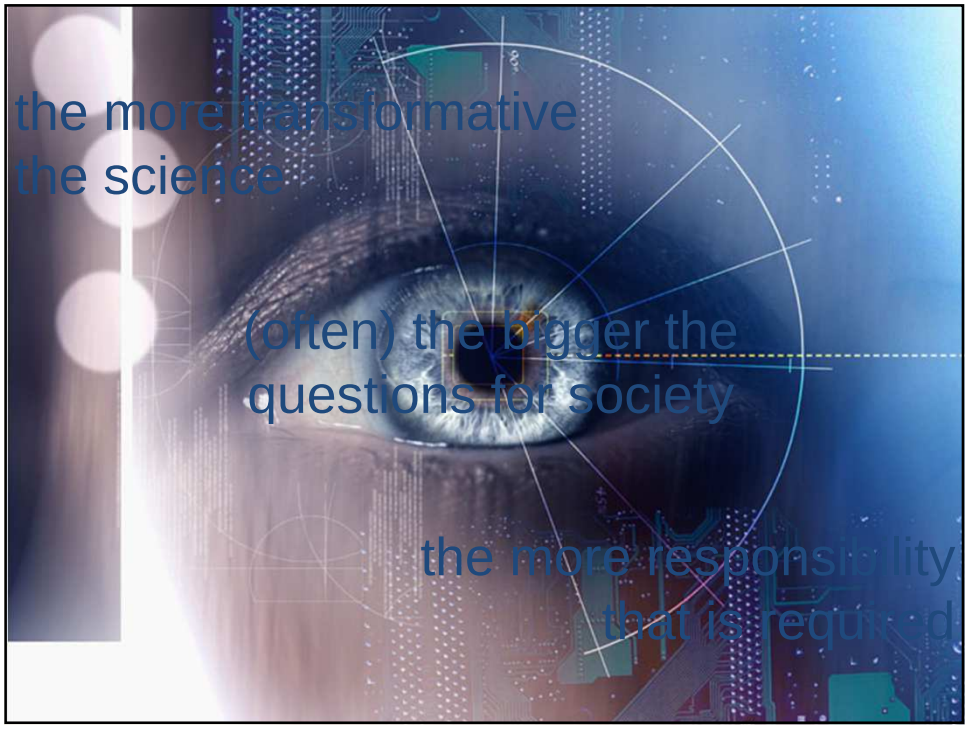
Professor of Technology and International Development

WAGENINGEN UR
For quality of life



Responsible (research and) innovation: what is it?

- (How) can we steer the development of science and technology so that it meets widely shared societal goals?
- An old idea – but set within a new science and innovation policy context

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

EPSRC Engineering and Physical Sciences Research Council

1. What is 'responsible innovation' – and what is different about it?
2. Why is it important – and why now?
3. Implications for UK research councils?



Defining Responsible Innovation

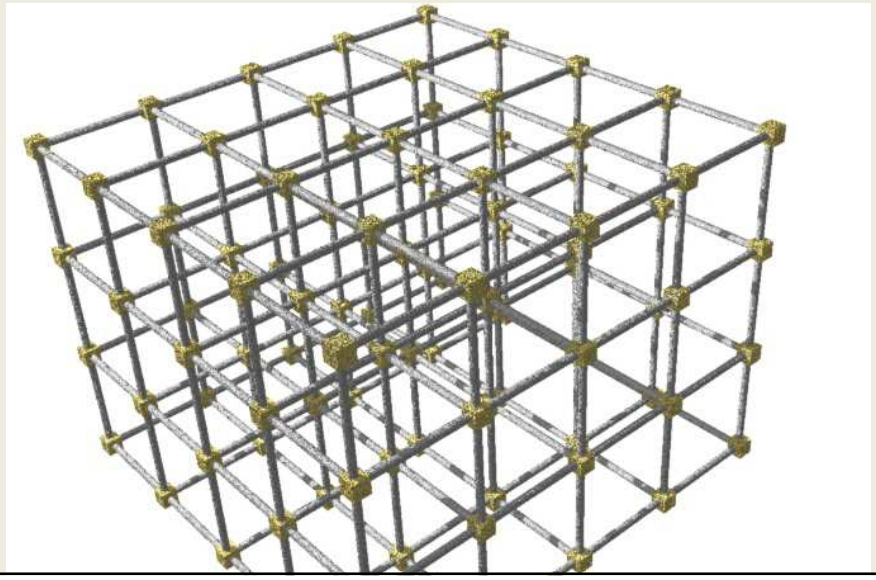
"Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)"

(von Schomberg, 2011)

"taking care of the future through collective stewardship of science and innovation in the present"

(Stilgoe, Owen and Macnaghten 2012)

Objective: to build a framework for responsible science governance



Our approach:

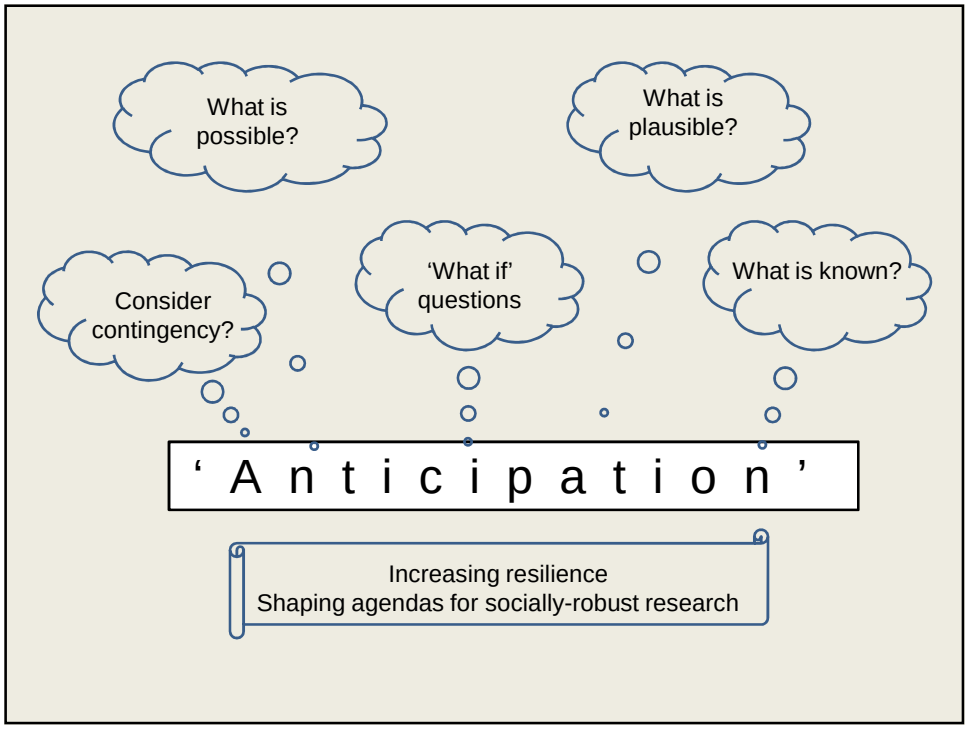
Responsible innovation needs to respond to kinds of questions that publics typically ask of scientists and innovators, or would like to see scientists ask of themselves

a. Purposes
b. Trust
c. Inclusion
d. Speed and direction
e. Ethics and trade-offs

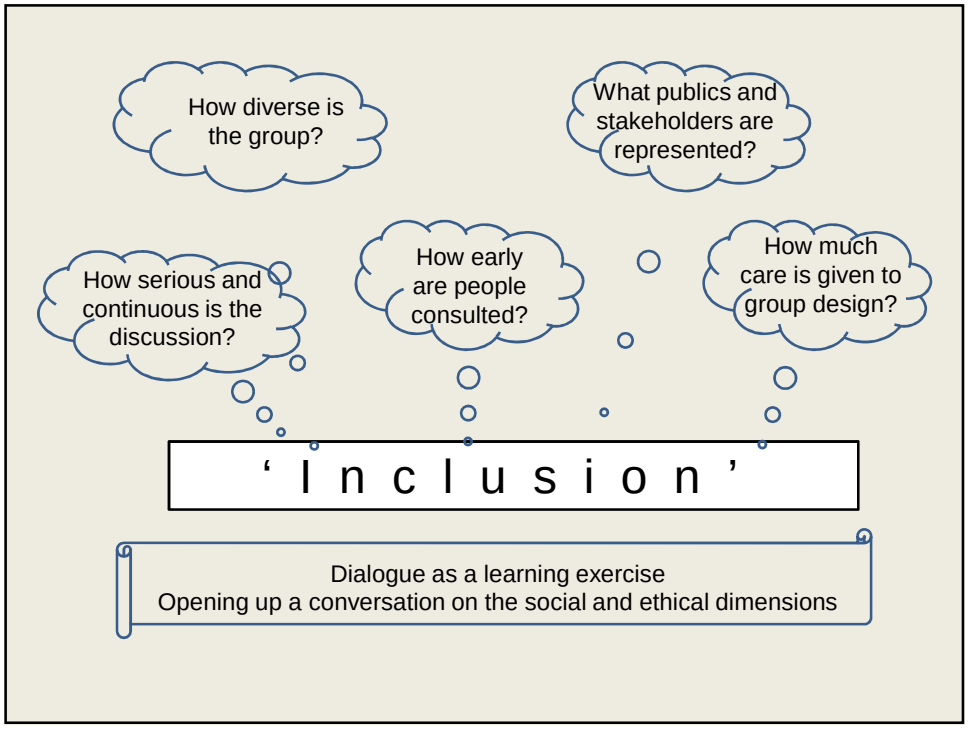
Lines of questioning on responsibility (derived from public dialogue on synthetic biology)

Product questions	*Process questions*	*Purpose questions*
What are the likely risks and benefits ?	How should research and innovation take place?	Why should this research be undertaken?
How will the risks and benefits be distributed ?	How should standards be drawn up and applied?	Why are researchers doing it?
What other impacts can we anticipate?	How should risks and benefits be defined and measured?	Are these motivations transparent and in the public interest?
How might these change in the future?	Who is in control?	Who will benefit?
What don't we know about?	Who is taking part?	What are they going to gain?
What might we never know about?	Who will take responsibility if things go wrong?	What are the alternatives?
	How do we know we are right?	

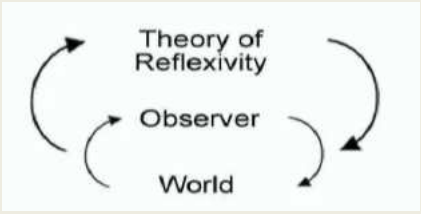
Anticipation!

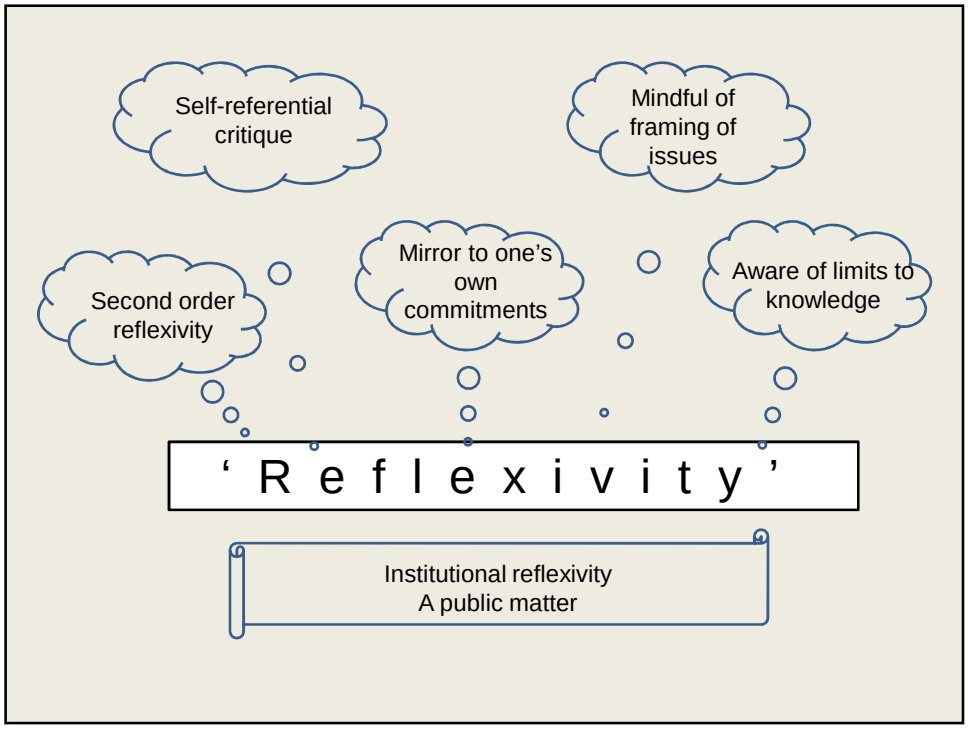


Dimension	Indicative techniques and approaches	Factors affecting implementation
Anticipation	Foresight	Engaging with existing imaginaries
	Technology assessment	Participation rather than prediction
	Horizon scanning	Plausibility
	Scenarios	Investment in scenario-building
	Vision assessment	Scientific autonomy and reluctance to
	Socio-literary techniques	anticipate



Dimension	Indicative techniques and approaches	Factors affecting implementation
Inclusion	Consensus conferences Citizens’ juries and panels Focus groups Science shops Deliberative mapping Deliberative polling Lay membership of expert bodies User-centred design Open innovation	Questionable legitimacy of deliberative exercises Need for clarity about, purposes of and motivation for dialogue Deliberation on framing assumptions Ability to consider power imbalances Ability to interrogate the social and ethical stakes associated with new science and technology Quality of dialogue as a learning exercise

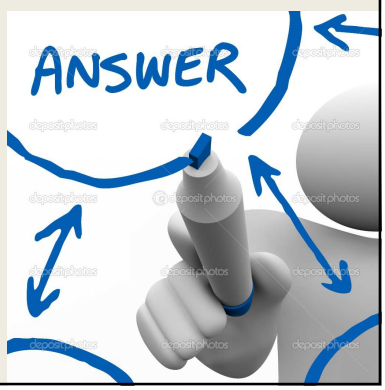

Theory of Reflexivity
Observer
World

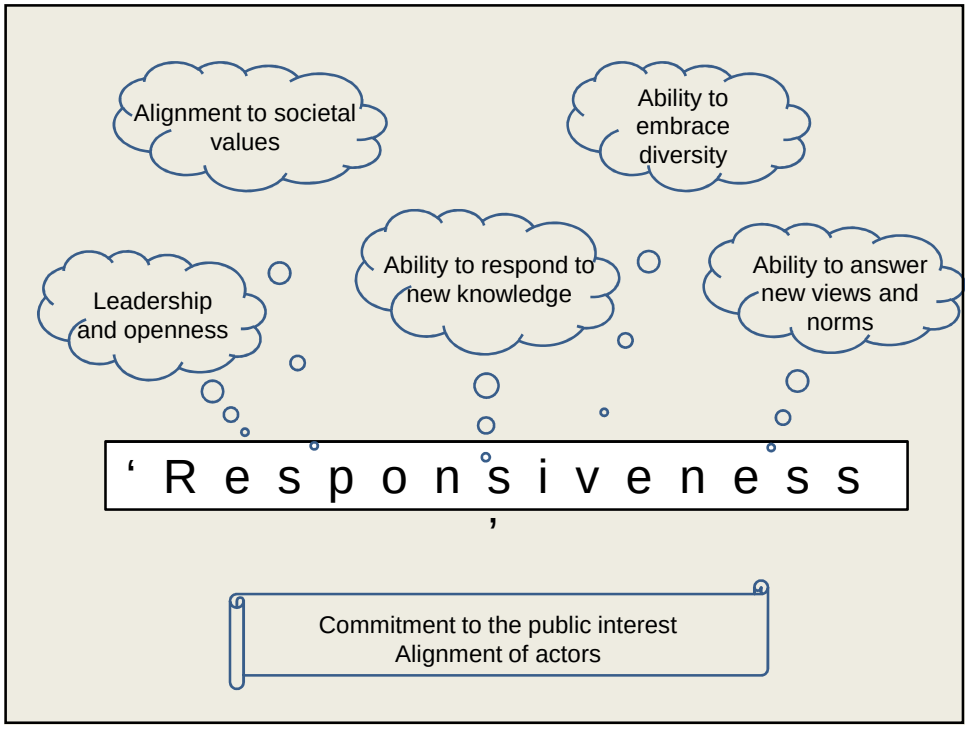

Self-referential critique
Mindful of framing of issues
Second order reflexivity
Mirror to one's own commitments
Aware of limits to knowledge
'Reflexivity'
Institutional reflexivity
A public matter

Dimension	Indicative techniques and approaches	Factors affecting implementation
Reflexivity	Multidisciplinary collaboration and training Embedded social scientists and ethicists in laboratories Ethical technology assessment Codes of conduct Moratoriums	Rethinking moral division of labour Enlarging or redefining role responsibilities Reflexive capacity among scientists and within institutions Connections made between research practice and governance

RESPONSIVENESS

react

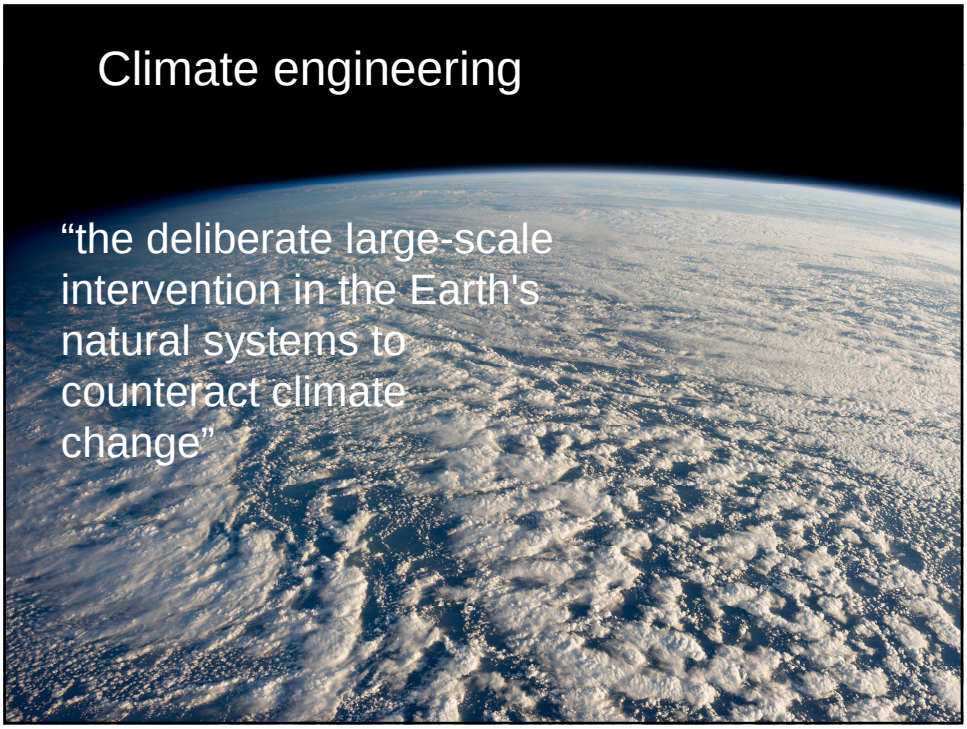




Dimension	Indicative techniques and approaches	Factors affecting implementation
Responsiveness	Constitution of grand challenges and thematic research programmes	Strategic policies and technology ‘roadmaps’
	Regulation	Science-policy culture
	Standards	Institutional structures
	Open access and other mechanisms of transparency	Institutional cultures
		Institutional leadership
	Niche management	Openness and transparency
	Value-sensitive design	Intellectual property regimes
	Provision of information	Technological standards
	Labelling	
	Moratoriums	
	Stage-gates	
	Alternative intellectual property regimes	
	New institutional structures and norms	

Responsible innovation in action

Climate engineering



Climate Engineering:

CO_2 removal & Solar Radiation Management Approaches

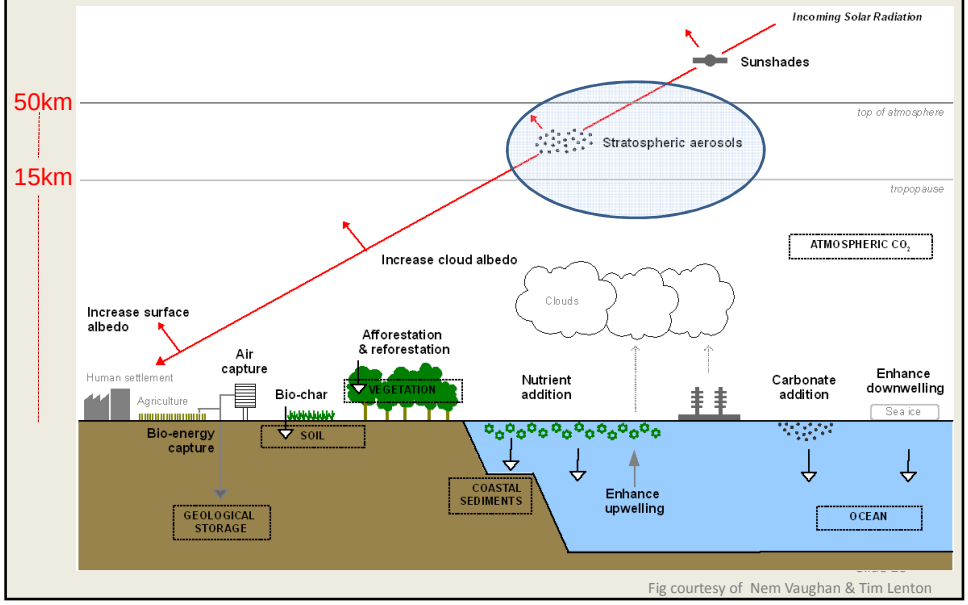


Fig courtesy of Nem Vaughan & Tim Lenton

SPICE project: Stratospheric Particle Injection for Climate Engineering

EPSRC, NERC, STFC funding

Objective: to investigate the effectiveness of reflecting heat & light back into space using stratospheric particles.

Evaluating candidate particles: what would be an 'ideal' particle to inject into the stratosphere (maximizing solar radiation scattering while having minimal impact on climate, weather, ecosystems and human health).

Delivery Systems: feasibility and design of using a tethered-balloon to inject particles into the stratosphere. Use data from **the 1km high test-bed project** in computer models to investigate how a full-scale system might work at an altitude of 20km.

Climate and environmental modelling:
what can be learned from past volcanic eruptions. Also modelling the potential impact on ozone layer concentrations, regional precipitation changes and atmospheric chemistry.

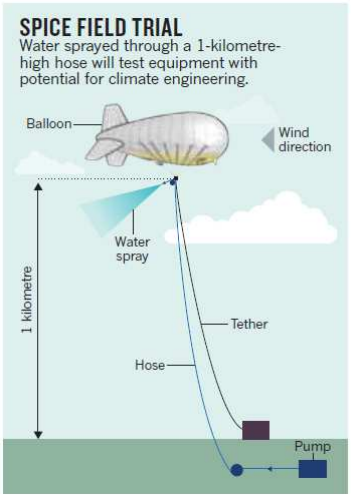


Figure Macnaghten and Owen, 2011

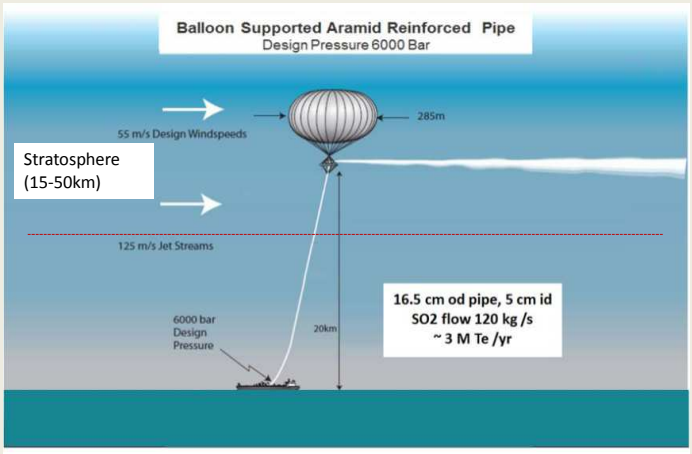


Fig courtesy of SPICE project team

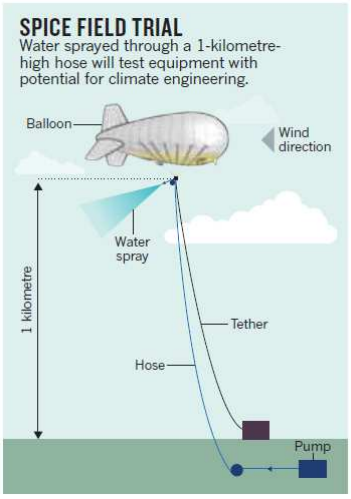


Figure Macnaghten and Owen, 2011

The Stakes:

A balloon 1 km high spraying water over Cambridgeshire

or

UK's 1st field trial of climate-engineering technology

EPSRC's Societal Issues Panel (approx. 2010)

The oversight panel

- Aerospace engineer
- Atmospheric scientist
- Civil society actor
- 2 social scientists

Stage Gate responsible innovation criteria

1. (Dimension: ***reflexivity*)**
- The field test deployment is safe, the principal risks have been identified and managed, and are deemed acceptable.
2. (Dimensions: ***reflexivity***)
- The field test deployment is compliant with relevant regulations.
3. (Dimension: ***reflexivity, inclusion***)
- The framing of the project (nature, purpose) for external communication is clear and advice regarding this has been obtained
4. (Dimensions: ***anticipation, reflexivity***)
- Future potential application(s) and associated impact(s) have been described and mechanisms put in place to review these as significant information emerges.
5. (Dimension: ***inclusion, reflexivity***)
- Mechanisms have been identified to understand wider public and stakeholder views regarding these envisaged applications and impacts.

ETC Group
News release
27 September 2011
www.etcgroup.org
www.econexus.info

SAY NO TO THE "TROJAN HOSE" :
NO SPICE IN OUR SKIES, SAY ENVIRONMENTAL JUSTICE GROUPS

Over 50 concerned groups from around the world are calling on people to sign an open letter (link) asking the UK Government and Research Councils to scrap the controversial SPICE experiment designed to test hardware for deployment of stratospheric aerosol injections as a way to artificially cool the planet. The SPICE project (Stratospheric Particle Injection for Climate Engineering) involves four universities, three research councils, several government departments along with private company Marshall Aerospace.

Groups signing the letter to Environment Minister Chris Huhne and the UK Research Councils hope it will gather enough support before the test to get authorities to reconsider allowing the controversial experiment to go ahead. The experiment, which involves spraying water from a kilometre-long hose suspended by a giant balloon, is scheduled to take place on a disused military airstrip in Sculthorpe, in Norfolk, UK between October 6 and 23rd. Groups objecting to the test say it will send the wrong signal to the international community, which adopted a moratorium on geoengineering activities last October at the Convention on Biological Diversity (CBD) in Nagoya, Japan.

"On the one hand, our government is involved in negotiations around geoengineering and biodiversity by funding, chairing and actively participating in discussions at the CBD. On the other hand, it is preparing the hardware for deployment of a potentially very dangerous geoengineering technology. Such tests should certainly not be allowed to proceed before there is an international decision to go down that path," says Helena Paul of Econexus, one the NGOs involved in the CBD talks and in the open letter.

Diana Bronson of ETC Group, an international technology watchdog says: "This is a Trojan Hose -- our objection is not that they want to spray water but that they are preparing the technology that can shoot sulfates into the stratosphere to try to block sunlight from reaching the earth. This so-called Solar Radiation Management could have devastating consequences -- altering precipitation patterns, threatening food supplies and public health, destroying ozone and diminishing the effectiveness of solar power, in addition to many other known and unknown impacts."

Organizers invite people opposed to carrying out geoengineering field trials in the absence of international agreement to signal their opposition here: handsoffmotherearth.org

For more information:

Helena Paul, Econexus in London: cell: + 44 (0)7724 711183
h.paul@gn.apc.org

Diana Bronson, in Montreal: +1 514 629 9236
diana@etcgroup.org

News

Want to mimic a volcano to combat global warming? Launch a Wembley-size balloon

Monster blimp would fire water into atmosphere

Scientists hope droplets can reflect the sun's heat

John Vidal
Environment editor

It sounds barmy, audacious or sci-fi: a tethered balloon the size of Wembley stadium suspended 20km above Earth, linked to the ground by a giant garden hose pumping hundreds of tonnes of minute chemical particles a day into the thin stratospheric air to reflect sunlight and cool the planet.

But a team of British academics will later this month formally announce the first step towards creating an artificial volcano by going ahead with the world's first major "geo-engineering" field test in the next few months. The ultimate aim is to mimic the cooling effect volcanoes have when they inject particles into the stratosphere that bounce some of the sun's energy back into space, so preventing it from warming the Earth and diminishing the effects of man-made climate change.

Before the full-sized system can be deployed, the research team will test a scaled-down version of the balloon-and-hose design. Backed by a £1.6m government grant and the Royal Society, the team will send a balloon to a height of 1km over an undisclosed location. It will pump nothing more than water into the air, but it will allow climate scientists and engineers to gauge the feasibility of the plan. Ultimately, they aim to test the impact of sulphates and other aerosol particles sprayed directly into the stratosphere.

If the technical problems posed by con-

Scientists hope to replicate the

So imagine how big a helium balloon you need to hold several double-decker buses

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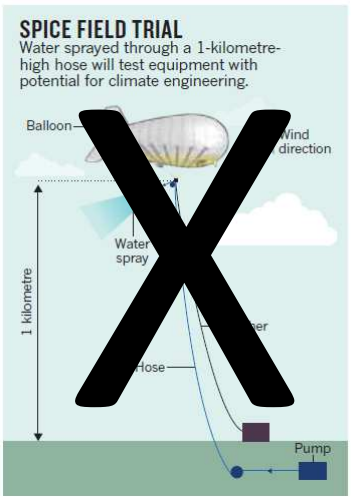

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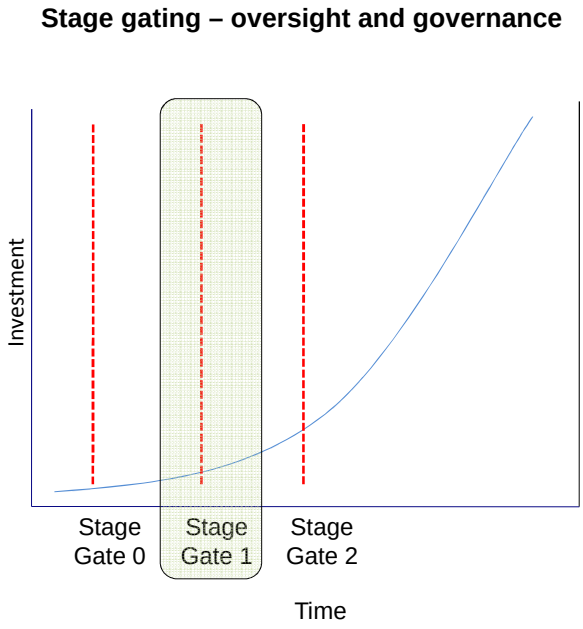


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FRAMEWORK FOR RESPONSIBLE INNOVATION
EPSRC is committed to develop and promote Responsible Innovation. This site reaffirms our own commitment and sets out our expectations for the researchers we fund and their research organisations.
INTRODUCTION
Responsible Innovation is a process that seeks to promote creativity and opportunities for science and innovation that are socially desirable and undertaken in the public interest. Responsible Innovation acknowledges, that innovation can raise questions and dilemmas, is often ambiguous in terms of purposes and motivations and unpredictable in terms of impacts, beneficial or otherwise. Responsible Innovation creates spaces and processes to explore these aspects of innovation in an open, inclusive and timely way. This is a collective responsibility, where funders, researchers, stakeholders and the public all have an important role to play. It includes, but goes beyond, considerations of risk and regulation, important though these are.
As a public funder of research, we have a responsibility to ensure that our activities and the research we fund, are aligned with the principles of Responsible Innovation, creating value for society in an ethical and responsible way. EPSRC does not wish to be prescriptive about how Responsible Innovation is embedded in the research and innovation process. We recognise that some researchers are already well engaged


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ANTICIPATE, REFLECT, ENGAGE AND ACT (AREA)
A Responsible Innovation approach should be one that continuously seeks to:
Anticipate – describing and analysing the impacts, intended or otherwise, (e.g. economic, social, environmental) that might arise. This does not seek to predict but rather to support an exploration of possible impacts and implications that may otherwise remain uncovered and little discussed.
Reflect – reflecting on the purposes of, motivations for and potential implications of the research, and the associated uncertainties, areas of ignorance, assumptions, framings, questions, dilemmas and social transformations these may bring.
Engage – opening up such visions, impacts and questioning to broader deliberation, dialogue, engagement and debate in an inclusive way.
Act – using these processes to influence the direction and trajectory of the research and innovation process itself.

EPSRC
Engineering and Physical Sciences Research Council

EPSRC Centres for Doctoral Training

Call type: Invitation for outlines

Closing date: 16.00 hrs 4 April 2013

Related themes: All

Responsible innovation

Science and innovation not only produces understanding, knowledge and value, but it can result in unintended impacts, questions, and ethical dilemmas and, at times, unexpected transformations in social life. In EPSRC we recognise that we have a duty of care to promote approaches to "responsible innovation" which will initiate ongoing reflection about the potential ethical and societal implications of the research that we sponsor on behalf of the taxpayer and to encourage and train our research community to do likewise.

As a research sponsor, our aim is to build capacity within our research community to discuss and consider social and ethical questions. A key element in building awareness and capacity will be through appropriate multi-disciplinary training embracing aspects such as social science and ethics. However, we feel we should not be prescriptive about such training but rather students and their supervisors should be allowed to be imaginative and develop and discuss what is appropriate within a broad framework.

EPSRC would like to encourage training around the concepts of responsible innovation. In doing so you may wish to seek to consult and work with others outside of the EPS sphere e.g. social scientists, ethicists and public engagement experts.

Responsible innovation is not

Responsible innovation is not

Responsible innovation is not

Scientists

Social scientists & ethicists

Responsible innovation is not

Embedding these kinds of questions into scientific practice

Product questions	*Process questions*	*Purpose questions*
What are the likely risks and benefits ?	How should research and innovation take place?	Why should this research be undertaken?
How will the risks and benefits be distributed ?	How should standards be drawn up and applied?	Why are researchers doing it?
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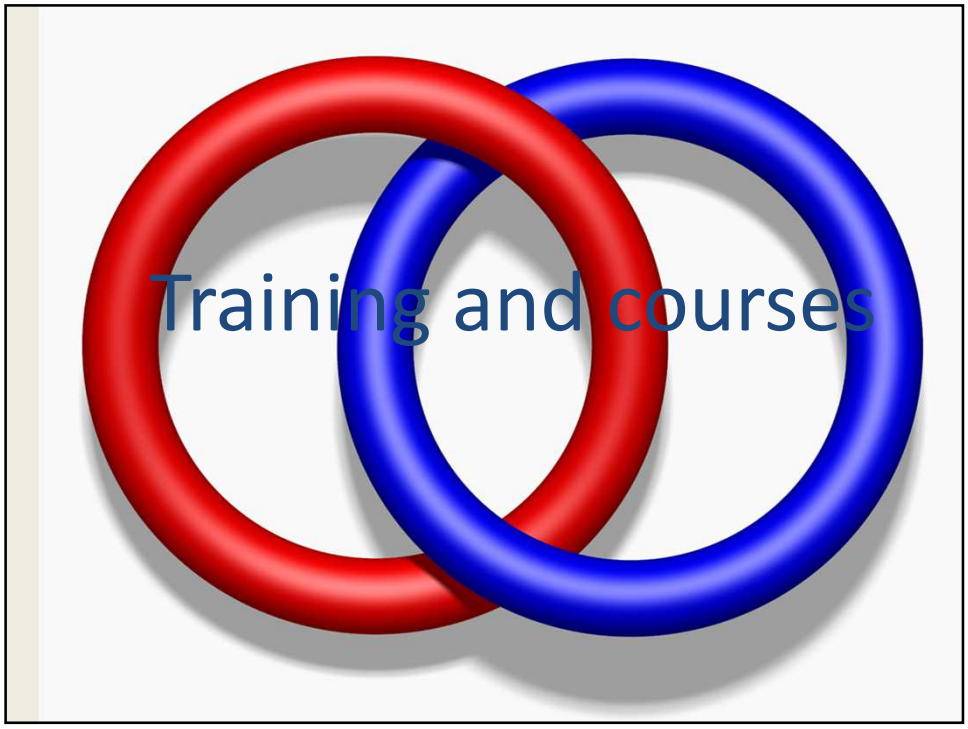
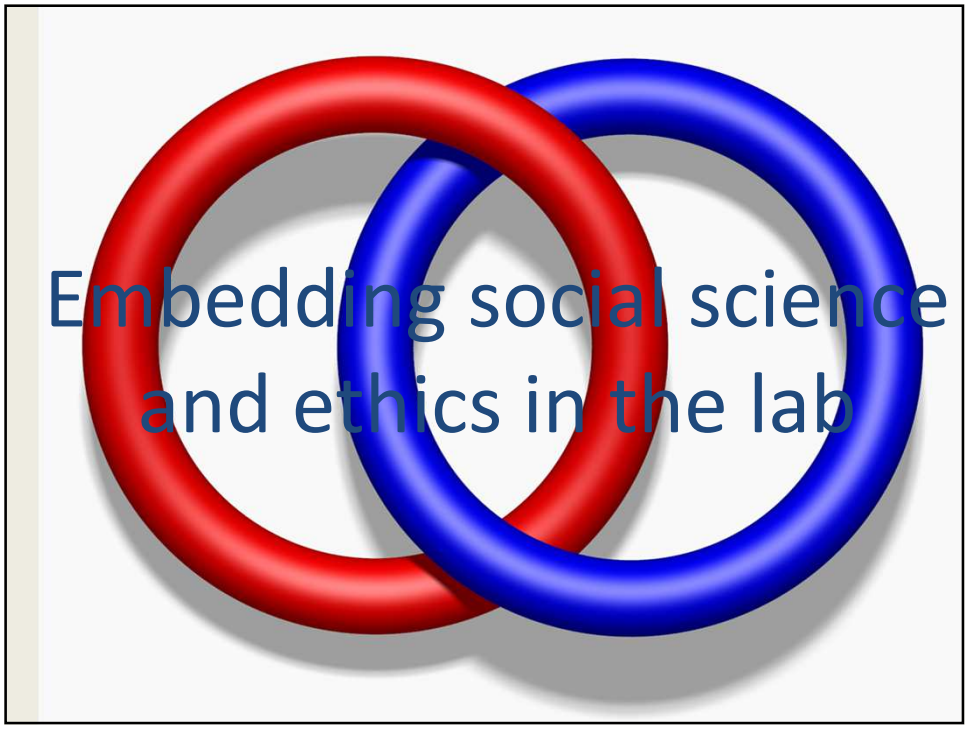
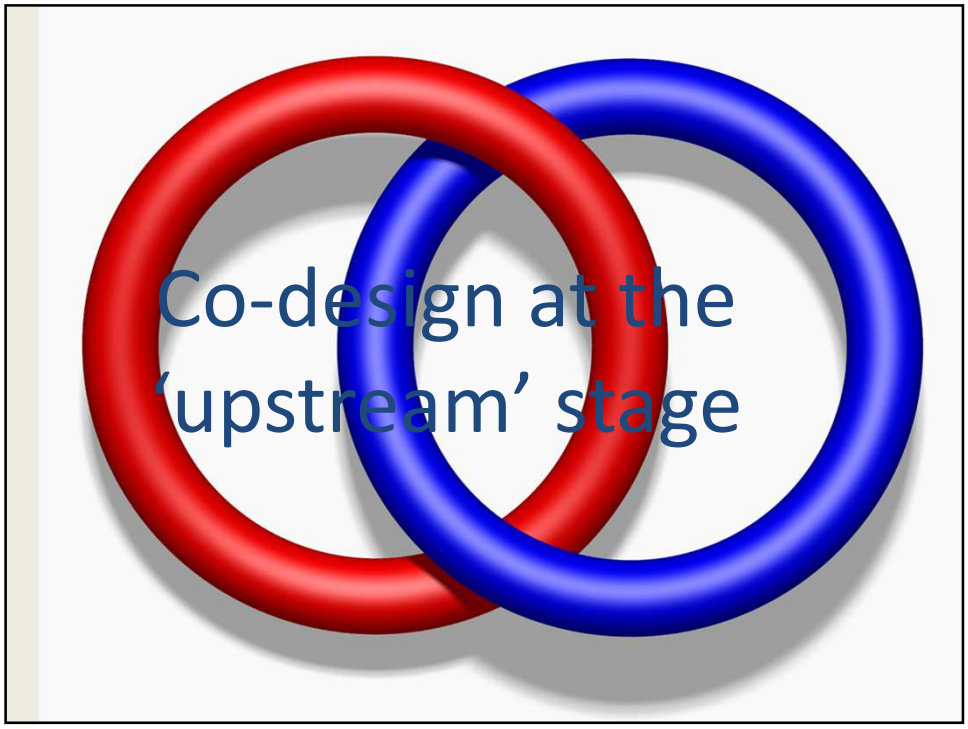
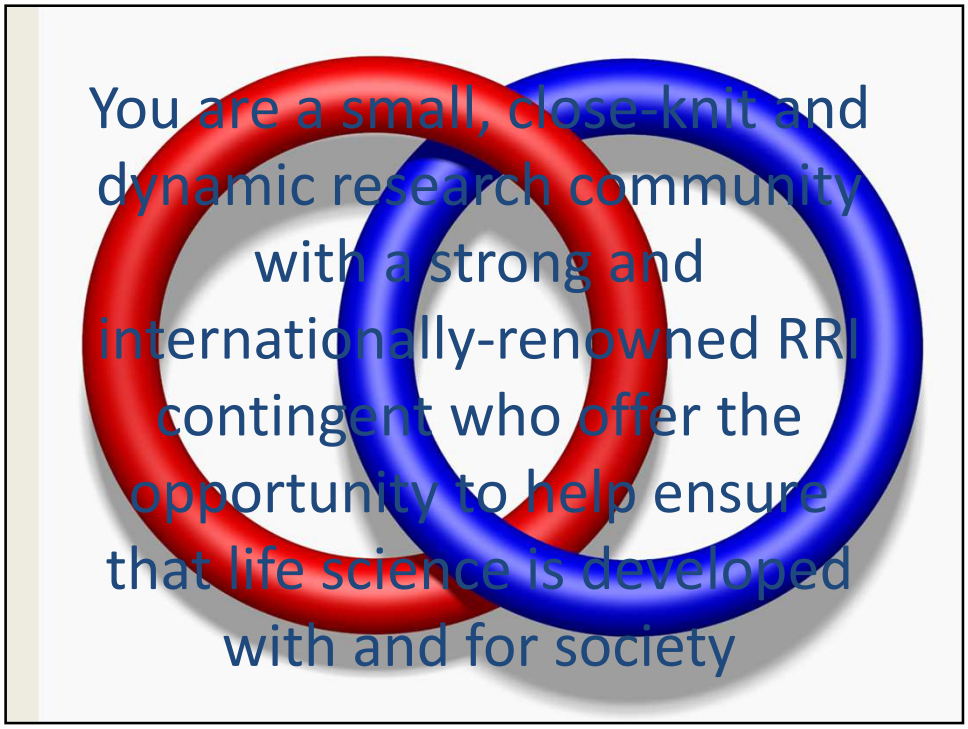

Training and courses


Embedding social science
and ethics in the lab


Co-design at the
'upstream' stage


You are a small, close-knit and dynamic research community with a strong and internationally-renowned RRI contingent who offer the opportunity to help ensure that life science is developed with and for society

Thank you!