



NSF
Center for
Nanotechnology
in Society
at **UCSB**

Public Participation in Nanotechnology Risk Governance: Best Practices for Best Outcomes

Barbara Herr Harthorn, PI & Director, CNS-UCSB
IRG 7 leader, UC CEIN



CNS-UCSB
Center for Nanotechnology in Society

CNS-UCSB Mission: Nanotechnology Origins, Innovations, and Perceptions in a Global Society

CNS-UCSB challenge: How can nanotechnology mature into a transformative technology, in our rapidly changing international economic, political & cultural environment?

- Social and environmental sustainability, 'responsible development'
- Requires many methods, new approaches
- Demonstrate value to the S&T enterprise of understanding and engaging with social issues

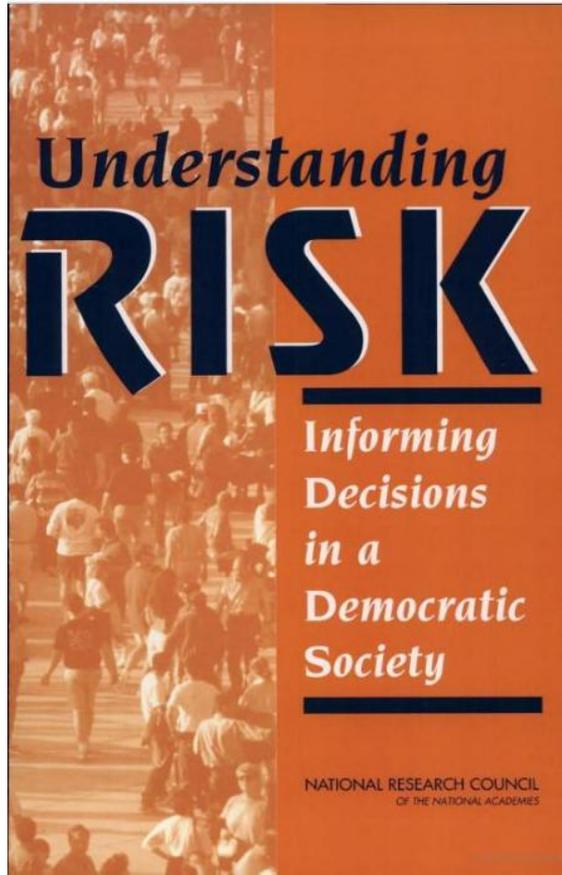
Key factors we focus on:

- Global nano-enterprise (E.Asia, N. Europe, & Latin America focus)
- **Multiple party risk perception**
- **Modes of dialogue with the public**
- Historical contexts for S&T development

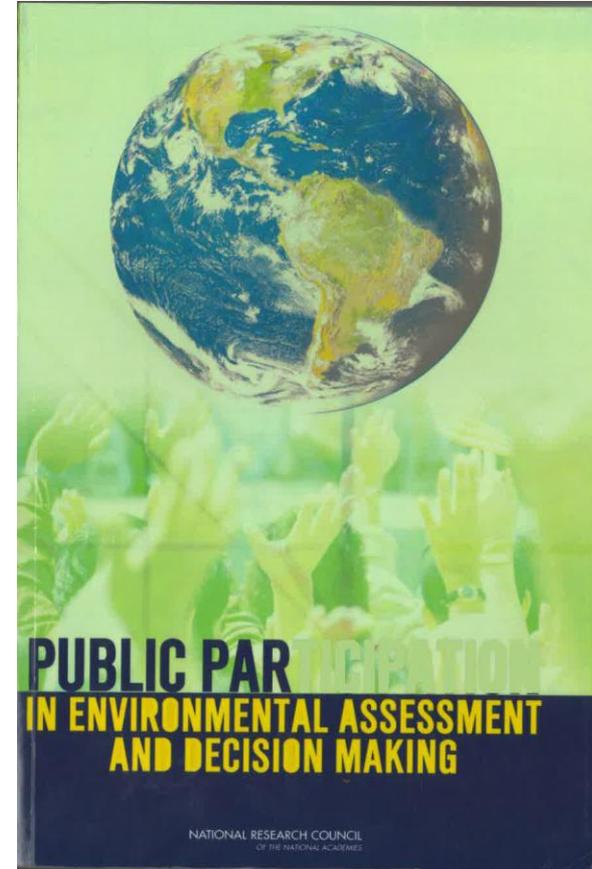
Why public participation in governance?

- ▶ Should Technology Assessment be participatory?
 - ▶ Right thing to do—those affected should share in decision-making (see *21st Century Nanotech R&D Act*)
 - ▶ Useful thing to do--equitability and substantive input are good for outcomes

Engaging diverse publics: Part of much broader deliberative turn in US and abroad



NRC: Stern & Fineberg (1996)



NRC: Dietz & Stern (2008)

Key aspects of successful public participation:

- ▶ “early and often”
- ▶ procedural fairness
- ▶ well managed process
- ▶ implementation that includes breadth, intensity, and integration of scientific expertise

Aims:

- ▶ addresses needs and concerns of publics
- ▶ reduces mistrust between stakeholders
- ▶ results in all participants (including scientists) being better informed about the issues *and* about one another

Who are the relevant public(s)?

- ▶ Democratic participation:
 - ▶ Self selected (e.g., GM Nation--worried; NISEnet—interested science museum)
 - ▶ “Invited public” (UCSB and ASU deliberative research)
 - ▶ Representative research sample (UCSB/UBC/Cardiff, ASU/UW-M, others)
 - ▶ NGOs-activated for a reason (environmental, consumer safety, *local* issues)

When to do public participation?

- ▶ Downstream (conventional) vs. upstream (radical?)

When affects What forms participation can take

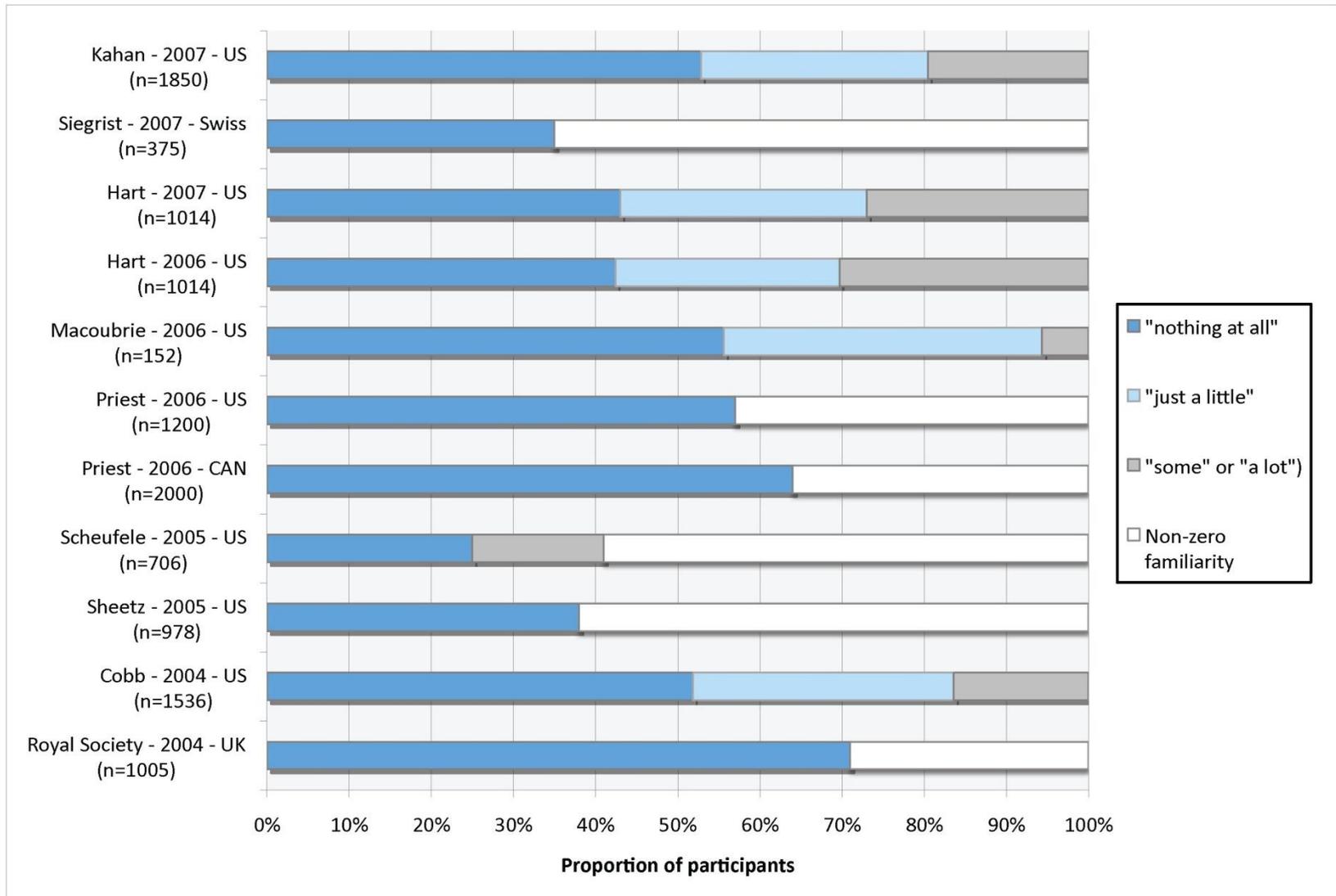
Downstream focus → Consequences (risk)

Upstream focus → Critical reflection/social
progress

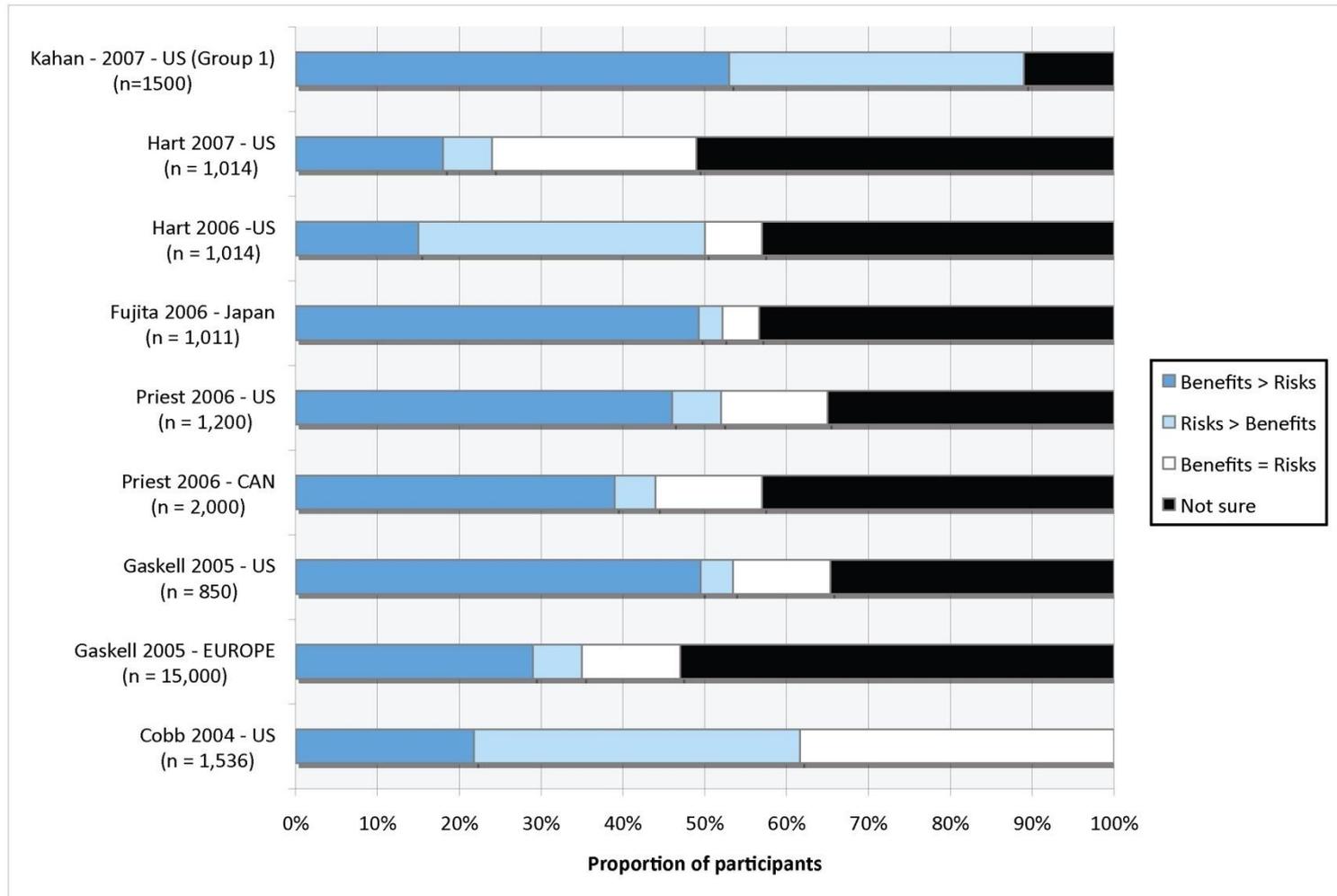
Nanotechnology Perceptions: The Emerging Evidence

- ▶ Survey and Experimental Research
- ▶ Qualitative / Deliberative Fora
 - ▶ [→ different results; surveys more optimistic; qual more mixed]

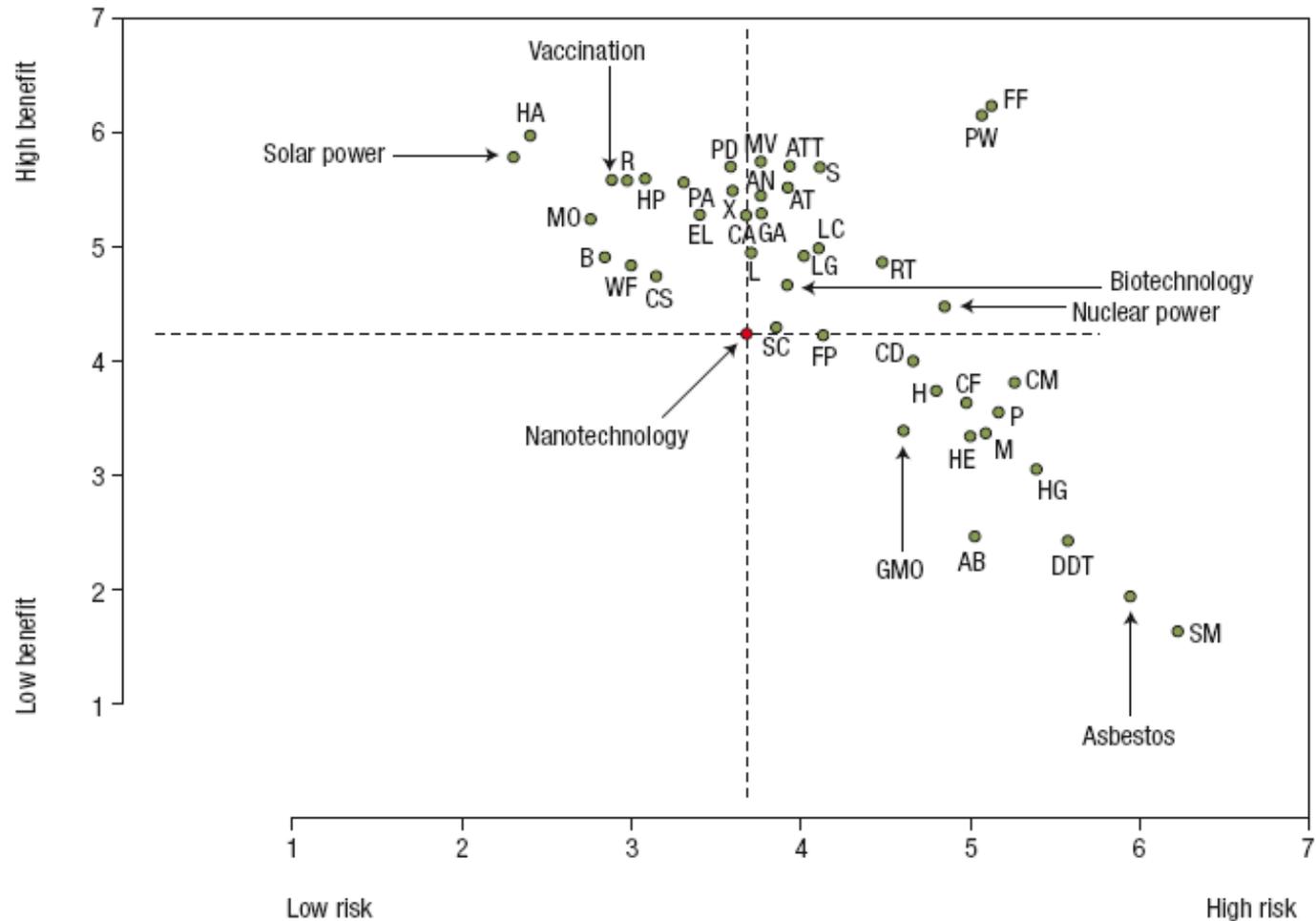
Awareness of nanotechnology



Judgment of Nanotechnology Risks and Benefits

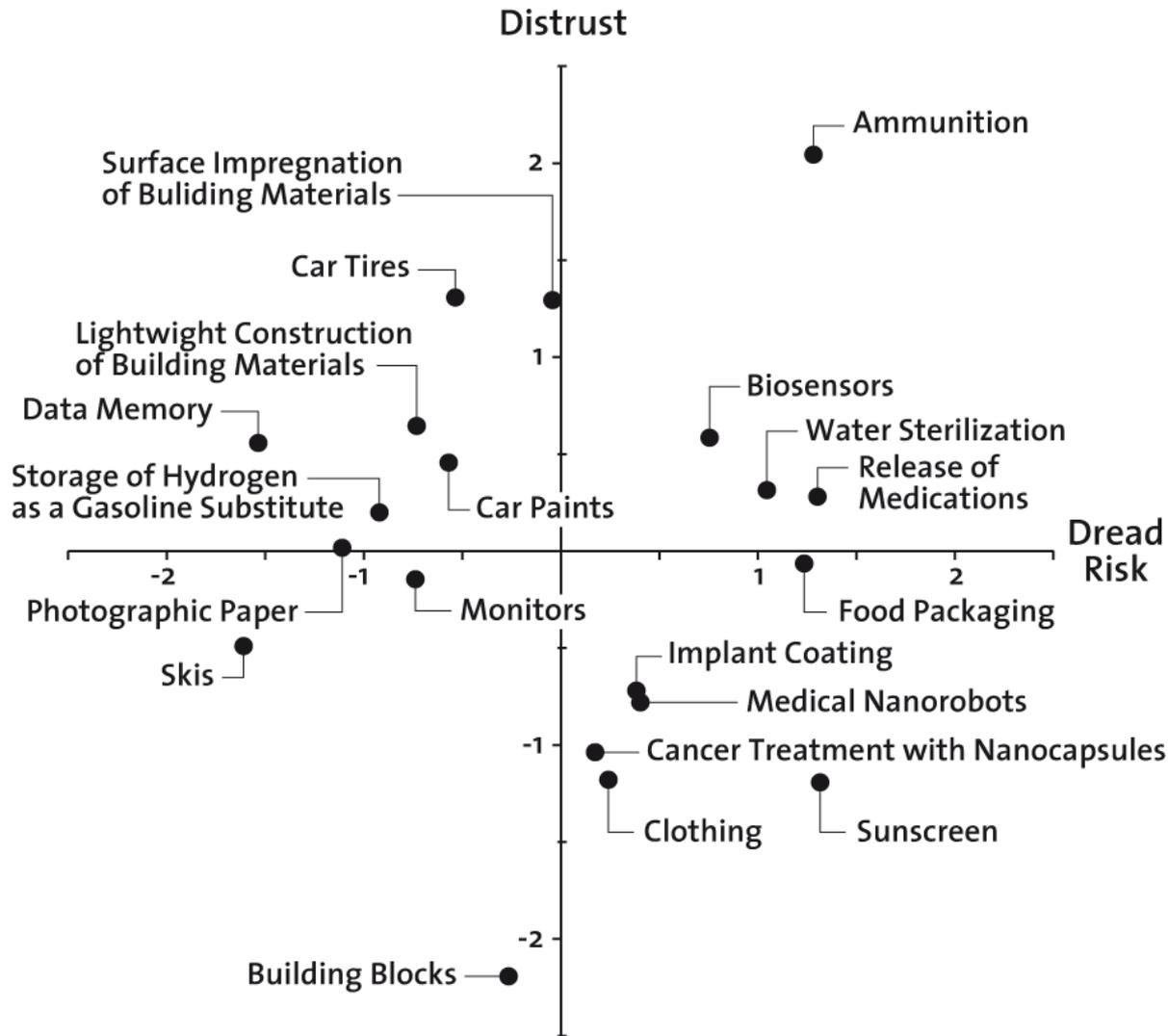


Nanotechnology Risk/Benefit Perceptions Compared to Other Issues



Source: Currall et al (2006) *Nature Nanotechnology*, 1, 153-155.; US, n=503)

Distribution of Perceptions for Different Nanotechnology Applications – Switzerland



(Source: Siegrist et al, 2007, *Risk Analysis*, v27, 59-70, n=375 Switzerland)

Special Issue:
Nanotechnology Risk Perceptions and Communication

Risk Analysis



Nanotechnology involves the fabrication, manipulation and control of materials at the atomic level and may also bring novel uncertainties and risks. Potential parallels with other controversial technologies means there is a need to develop a comprehensive understanding of processes of public perception of nanotechnology uncertainties, risks and benefits, alongside related communication issues. Taken as a whole the papers in this special collection add to a new and exciting body of literature within risk research.

In this issue:

Introduction

Nick Pidgeon, Barbara Herr Harthorn, and Terre Satterfield

A Longitudinal Study of Newspaper and Wire Service Coverage of Nanotechnology Risks

Sharon M. Friedman and Brenda P. Egoif

Envisioning Emerging Nanotechnologies: A Three-Year Panel Study of South Carolina Citizens

Susanna Priest, Thomas Lane, Ted Greenhalgh, Lindsey Jo Hand, and Victoria Kramer

Vulnerability and Social Justice as Factors in Emergent U.S. Nanotechnology Risk Perceptions

Joseph Conti, Terre Satterfield, and Barbara Herr Harthorn

Fairness and Nanotechnology Concern

Katherine A. McComas and John C. Besley

Labeling of Nanotechnology Consumer Products Can Influence Risk and Benefit Perceptions

Michael Siegrist and Carmen Keller

Evidence Maps: Communicating Risk Assessments in Societal Controversies: The Case of Engineered Nanoparticles

Peter Wiedemann, Holger Schütz, Albena Spangenberg, and Harald F. Krug

About Risk Analysis: Published on behalf of the Society for Risk Analysis, *Risk Analysis* is designed to meet the need for organization, integration, and communication and provide a focal point for new developments in the field. The analysis of risk is being increasingly viewed as a field in itself, and the demand for a more orderly and formal treatment of risk is great. This international journal is committed to publishing critical empirical research, conference proceedings, and commentaries dealing with risk issues.

wileyonlinelibrary.com/journal/RISK



Examples of Qualitative / Deliberative Approaches

UK

- ▶ Royal Society (2004)
- ▶ Nanotechnology Risk and Sustainability (2004/5)
- ▶ NanoJury UK (2005)
- ▶ Nanodialogues (2005/6)
- ▶ Smalltalk (2005/6)
- ▶ 'Which' Citizen NanoSummit (07)
- ▶ Deepen (2008-9)

Continental Europe

- ▶ Various (Netherlands, Switzerland, France, Germany, Portugal)

USA

- ▶ Macoubrie/Woodrow Wilson (2005)
- ▶ Madison Area Citizens' Consensus Conference (2005)
- ▶ National Citizen Forum (2008)
- ▶ **UCSB Gender Deliberation** (2009)

USA/UK

- ▶ **Santa Barbara/Cardiff Workshops** (2007)

New Zealand

- ▶ McDarmid Inst (2005)

Gendered aspects of talk in US nano deliberation

- Men speak more than women and use more intrusive interruptions in deliberations on nano
- Whites use more intrusive interruptions than people of color
- Women speak more, use more backchannels/cooperative overlaps, and use more self-disclosure when discussing **health and human enhancement applications vs. energy/environment applications**
- Men's patterns of talk do not vary across applications

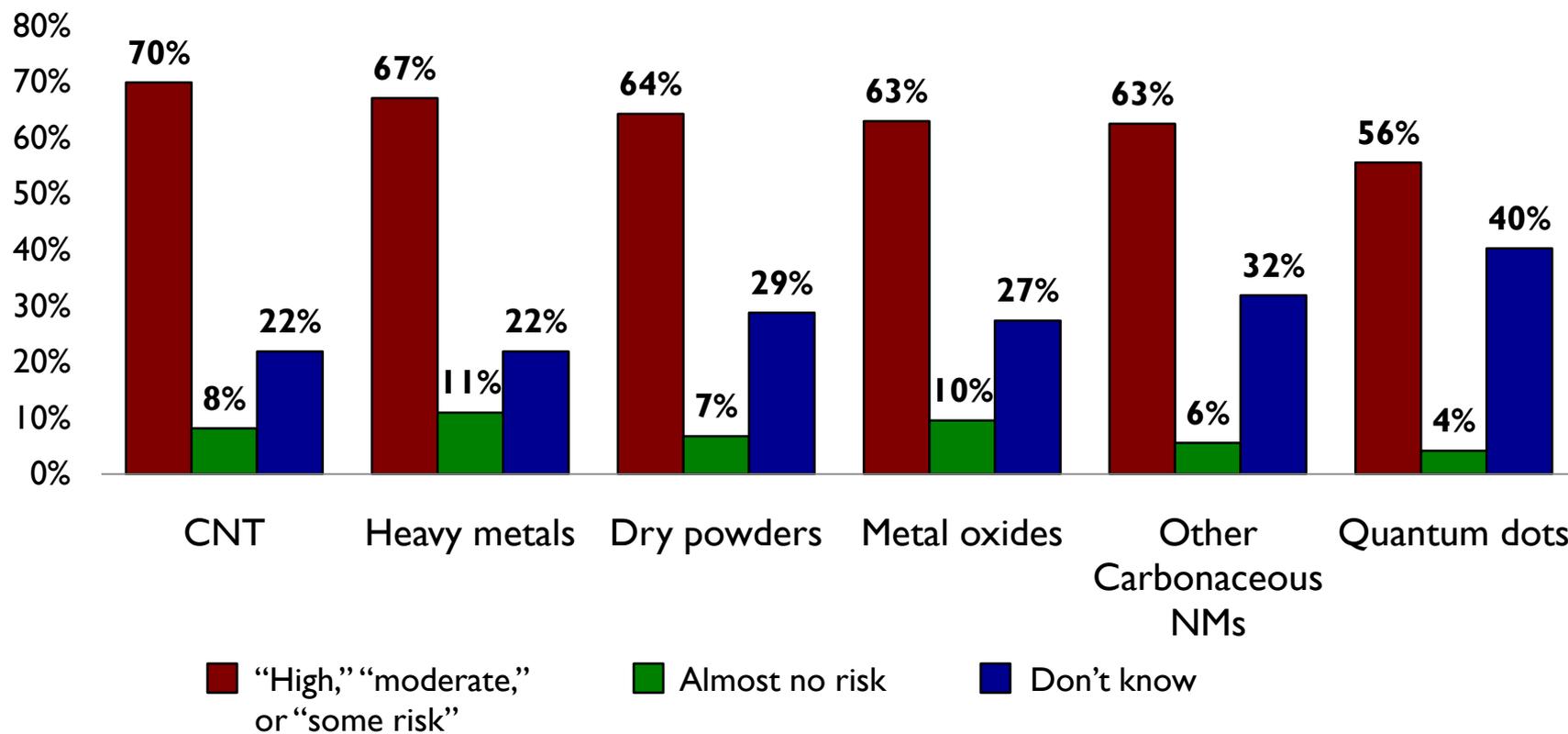
Implications: subtle and overt group dynamics play a major role in deliberative settings, largely unexamined thus far

Nano-focused Non-Governmental Organizations (NGO's)

Organization	Description	Funding	Action	Target	Goal
	<p>Erosion, Technology, and Concentration Group</p> <ul style="list-style-type: none"> •Issues: Consumer Safety & Equitable Dev. •Represent: Public 	Donations	Publications	International Governments	Moratorium
	<p>Greenpeace</p> <ul style="list-style-type: none"> •Issues: Environmental •Represent: Environment 	Members	Publications	Nanotech Industry	Moratorium
	<p>Environmental Defense Fund</p> <ul style="list-style-type: none"> •Issues: Environmental and Consumer H&S •Represent: Environment & Public 	Members	Publications & Partnerships	U.S. Government & Industry	Regulatory Change
	<p>Friends of the Earth</p> <ul style="list-style-type: none"> •Issues: Public and Environmental H&S •Represent: Environment & Public 	Members	Publications	Government & Industry	More EHS Research

What about other key stakeholders? Will they open their doors to public participation?

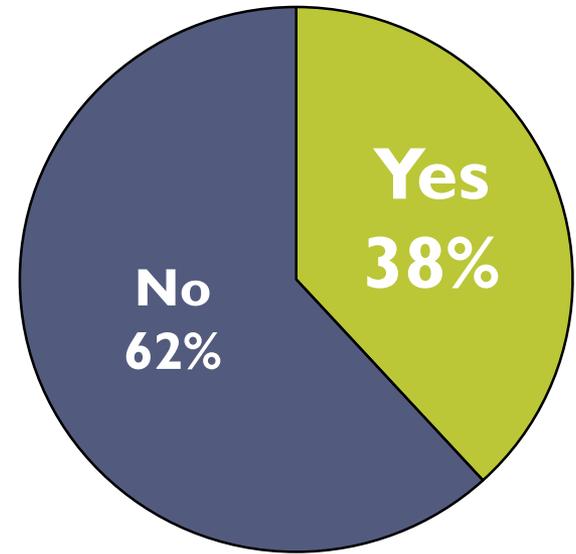
ENM Industry views on risk across six of nanomaterials



International survey of ENM companies, n=78 companies, 2009-2010; Engeman, Holden, Satterfield, and Harthorn. Under review.

Reported practices did not consistently follow government guidance

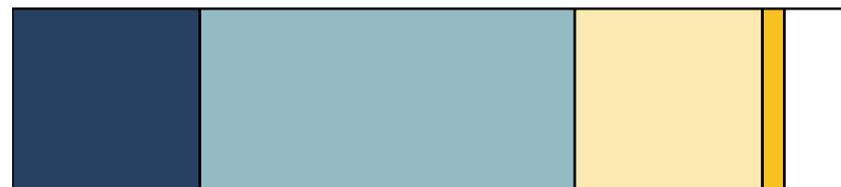
Does your company monitor the workplace for nanoparticles?
(n = 76)



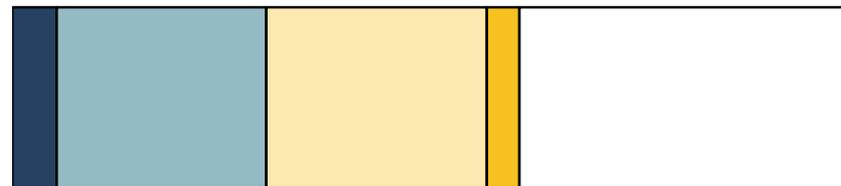
N=71

Company participants' concern over potential public response

1. In my company, we worry that nanotechnologies may encounter **unwarranted public backlash** such as that which accompanied genetically modified foods in Europe (**59% agree**).



2. **Insurers** in my industry are increasingly **concerned** about nano-specific risks (34 % agree; **40% don't know**; 30% disagree).



3. **Direct involvement of citizens in policy decisions** about research and development of new technologies is **beneficial** (**55% disagree**).



0% 20% 40% 60% 80% 100%

Strongly agree
 Agree
 Disagree
 Strongly disagree
 Don't know

Modes of Public participation in (non-linear) innovation

Standard Linear (Expert Driven)	Lyon Model (Bottom-up)
Curiosity-driven research goals	Expression of widespread social need
(Incremental) public funding	Targeted “moonshots” – 10x / 100x
Expert-driven research	Public / expert cogeneration of research
Precompetitive transactions (\$ <-> IP)	Open source research communities
Invention disclosure	Invention disclosure
Property transactions: patent, license	Negotiated hybrids of proprietary & open
Industry development	Industry and community development
Inter-firm competition	Continuous user inputs
Modest government bridging	Government partnerships
Market demand	Social narratives about goals of use, success
Innovative product in marketplace	Continuous dialogue-based improvement

Newfield, C. & D. Boudreaux, book in preparation: ***Can Rich Countries Still Innovate? Towards a New Model of Nanoscale and Emerging Technology***; based on CNS-UCSB conference held in Lyon, France, April 2010

Commentary – Future Nanotechnology Perceptions?

- ▶ The current situation ~ risk attenuation – Why?
 - ▶ low awareness, threats only to core values, lack of alternative technology pathways, risks restricted to the marginalised?
 - ▶ plus (constructed or real) benefits
 - ▶ absence of large interactive amplification/stigma events, or politics?
- ▶ What will happen with more contentious nano-applications (e.g. food, synbio, some geoeng)?
- ▶ Implications for trust in the upstream (emphasize care, competence or consensual values?)



Discussion

- ▶ Participation is essential to nano governance ('early and often')
- ▶ NSF's support of societal research is providing useful insights into upstream perceptions and attitudes
- ▶ Critical issues:
 - ▶ (mis)trust of governance
 - ▶ social and historical context
 - ▶ institutional performance
 - ▶ social amplification effects (e.g. media, NGO activity)
- ▶ Upstream opportunity is
..... slipping away



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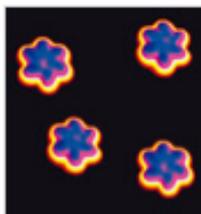
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Focus

Public perceptions of nanotechnology



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Since it was launched in October 2006, *Nature Nanotechnology* has published papers on a wide range of topics within nanoscience and technology. This web focus brings together all the papers we have published in four particularly active areas — DNA nanotechnology, graphene, nanopores and nanotoxicology — along with articles on the public perceptions of nanotechnology.

Research into public perceptions of nanotechnology is becoming more rigorous with social scientists developing and testing increasingly complex theoretical models. Researchers have explored, among other things, how the public's reaction to nanotechnology depends on cultural predispositions, religiosity and the specific application of the new technology.

It is clear that increased public awareness of nanotechnology will not, on its own, automatically lead to widespread public acceptance. This page brings together all the articles that *Nature Nanotechnology* has published on this topic.

Meta-analysis

[top](#)

Article:

Anticipating the perceived risk of nanotechnologies **FREE**

Terre Satterfield, Milind Kandlikar, Christian E. H. Beaudrie, Joseph Conti & Barbara Herr Harthorn

doi:10.1038/nnano.2009.265

[Abstract](#) | [Full text](#) | [PDF \(444 KB\)](#) | [Supplementary information](#)

- ▶ <http://www.cns.ucsb.edu/SNet2011>
- ▶ Outgrowth of Network for Nano in Society (NSF)
- ▶ Co-hosted, CNS-ASU & CNS-UCSB
- ▶ Robust international community of societal researchers, n= ~200 presenters from around the world



S.NET 2011
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Society for the Study of
Nanoscience and Emerging
Technologies**

November 7-10, 2011

Tempe, Arizona / Tempe Mission Palms Resort & Hotel

Thank you.

- ▶ Many people to acknowledge: Faculty researchers: Nick Pidgeon, Terre Satterfield, Edwina Barvosa, Bruce Bimber, Karl Bryant, Joseph Conti, Sharon Friedman, Hillary Haldane, Milind Kandlikar; postdocs: Gwen D’Arcangelis, Adam Corner, Anton Pitts, Jennifer Rogers, and Christine Shearer; grads Rachel Cranfill, Amanda Denes, Cassandra Engeman, Shannon Hanna, Indy Hurt, Tyronne Martin; undergrad: Julie Whirlow.
- ▶ This work is funded by NSF through cooperative agreements # SES 0531184 and #0938099 to the Center for Nanotechnology in Society at UCSB; and grant # SES-0824024 to PI Harthorn. Also funded by NSF & EPA through cooperative agreement #DBI 0830117 to the UC Center for Environmental Implications of Nanotechnology. Views expressed here are those of the author and do not necessarily reflect the views of the NSF or EPA



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2020 Science

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HOME ABOUT PERSPECTIVES ON TECH INNOVATION

Public participation in nanotechnology – should we care?

by BARBARA HERR HARTHORN on MAY 4, 2010

A guest blog by [Barbara Herr Harthorn](#), Director of the [Center for Nanotechnology in Society](#) at the University of California Santa Barbara.

7

tweets

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A couple of weeks back, my colleague David Guston wrote here about [engaging the public on nanotechnology](#). In his piece he gave an excellent overview of the US government's activities – or relative lack of them – on public engagement in this area. But I also felt that some questions on why we should encourage public participation in nanotechnology in the first place – and how the government should think about approaching this – were left unanswered. So to continue where

David left off, I would like to explore these questions a little further.

To start with, why do public deliberation on nanotechnology? The simplest answers are because it's the right thing to do, and because it's a useful thing to do.

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Engagement Methods— Generic Difficulties (from ‘Downstream’ experience)

- ▶ Who represents the public?
- ▶ Clarifying objectives (communication, decision-making, legitimation and trust?)
- ▶ Lack of impact on real decisions may lead to stakeholder fatigue
- ▶ Reconciling public debate with other evidence streams?

Other perceived risks?

- Consumer backlash
- U.S. falling behind as an economic/technological leader
- Government regulation
- Greater public participation in science and technology decisions – i.e. investment and regulation
- Government participation in science and technology investment and research decisions

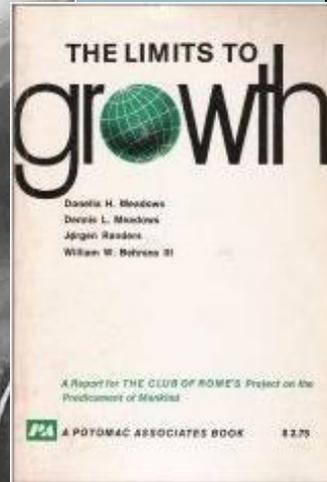


Summary of Findings

- Men speak more than women in deliberations on nano
- Whites and nonwhites do not vary in the amount they speak in deliberations on nano
- Men use more intrusive interruptions during the deliberations than women
- Whites use more intrusive interruptions during the deliberations than nonwhites
- Women speak more, use more backchannels/cooperative overlaps, and use more self-disclosure when discussing health and human enhancement than energy/environment applications of nano
- Men's patterns of talk do not vary across applications
- Individuals who move towards a benefit stance use more backchannels than individuals who do not change their stance
- Individuals who move towards a risk stance do not vary in their patterns of talk from individuals who do not change

Limitless: From Space Colonies to Nanotechnologies in Pursuit of the Future

W. Patrick McCray, forthcoming in 2012, Princeton University Press



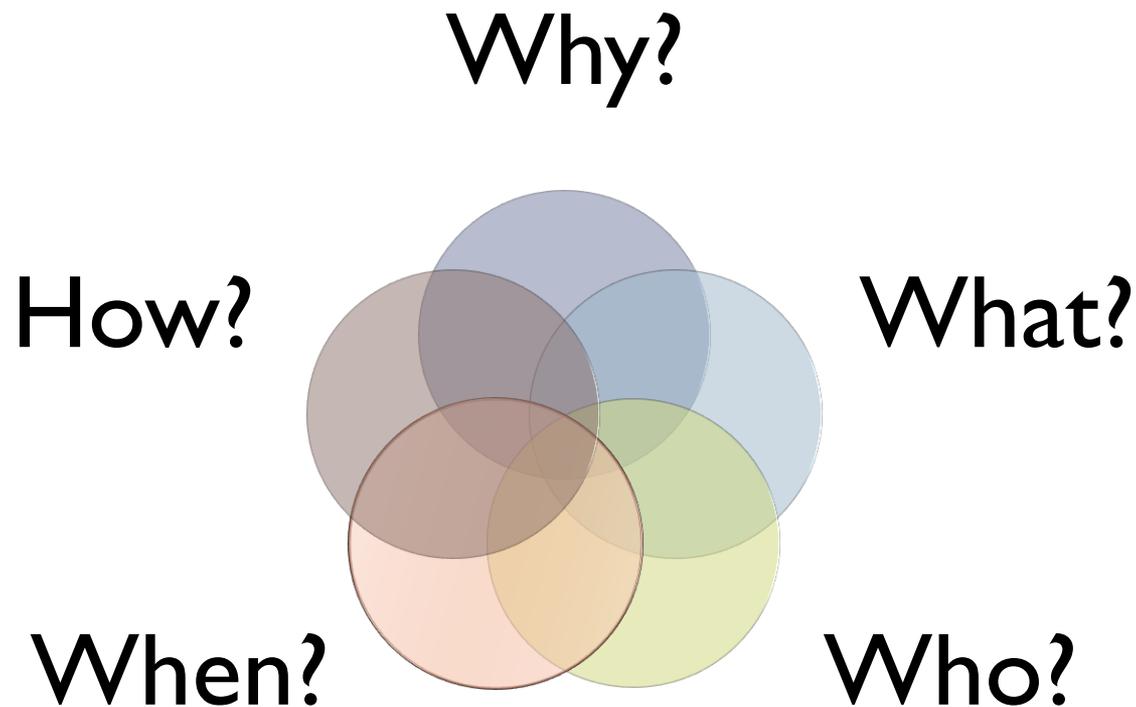
(Left to right) Physicist Gerard O'Neill with space colony (1976);
1972 book *Limits to Growth*;
Eric Drexler with model of “nano-assembler” (1990)



stevenson

"I think we're beginning to chip away at the stigma."

Public participation in nano governance



Nanotechnologies Qualitative Findings (in aggregate)

- ▶ Initial difficulties engaging with the topic (no simple analogies / few familiar products)
- ▶ Increased confidence with time and support
- ▶ Views on risks and benefits more mixed than surveys (context of use matters). Hence method matters, particularly with emerging issues, especially framing of materials and procedures
- ▶ Enthusiasm tempered by concerns about long-term unknowns
- ▶ Trust – who can be trusted to ultimately control and regulate nanotechnology (opening Pandora's Box)?

Media Triggers

A possible risk to public health is likely to become a major media story to the extent it involves:

- ▶ Questions of Blame
- ▶ Alleged Secrets and Cover-ups
- ▶ Human Interest
- ▶ Links with High Profile Issues/Persons

- ▶ Conflict
- ▶ Signal Value
- ▶ Many People Exposed
- ▶ Strong Visual Impact
- ▶ Links to Sex or Crime

A (UK) Framework for Responsible Innovation

The 'Oxford' Principles for Governance of Geoengineering Research:

- ▶ Regulation as a Matter of Public Interest (“public good”)
- ▶ Public Participation in Decisions
- ▶ Open Access to Results
- ▶ Independent Assessment of Impacts
- ▶ Governance Before Deployment

(Rayner et al. 13 Jan 2010, and 18 Mar 2010 House of Commons report)

Issues for 'Upstream' Public Engagement with Emerging Technologies?

- ▶ Engagement over what? With what methods?
- ▶ 'Setting the record straight' vs. genuine dialogue with people
- ▶ Lack of awareness and ready analogies sets a major challenge (and dangers of pre-framing)
- ▶ Unintended consequences – research constructs the 'risk object'?
- ▶ Need to ask different questions: Why this technology? Who needs it? Who owns it? Who will take responsibility?

Nanophobia-phobia?

The New York Times

Fashion & Style

WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH SPORTS OPINION

AUTOS

FASHION & STYLE DINING & WINE HOME & GARDEN WEDDINGS/CELE

SKIN DEEP

New Products Bring Side Effect: Nanophobia

By NATASHA SINGER
Published: December 3, 2008

IT sounds like a plot straight out of a science-fiction novel by [Michael Crichton](#). Toiletry companies formulate new cutting-edge creams and lotions that contain tiny components designed to work

muscle building blocks have an ability to penetrate the skin, swarm to clog and attack internal organs like the liver.

Humans have long lived in dread of such nightmare scenarios in which swarms of creatures attack. [Alfred Hitchcock](#) envisioned menacing flocks in "The Birds." In the 1990 film "Arachnophobia" a killer spider arrives in the United States, where it attacks and multiplies.

And now comes nanophobia, the fear that tiny

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nature International weekly journal of science

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Published online 9 December 2008 | Nature | doi:10.1038/news.2008.1290

News

Fearing the fear of nanotechnology

Hard data could help dispel scientists' preconceptions about the public, argues Richard Jones.

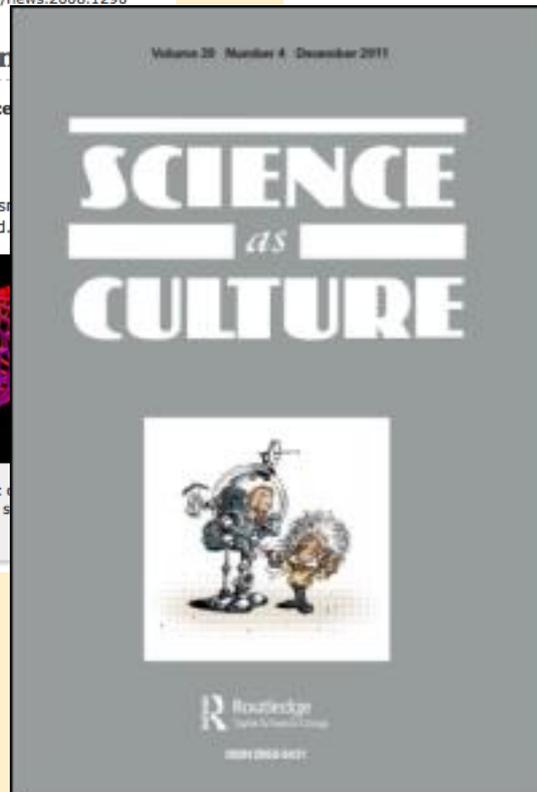
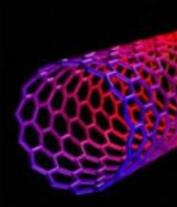
Richard Jones

Nanoscience has always had a degree of nervousness about the way that public opinion of their science might unfold.

This unease is underpinned by a set of preconceptions about people's reactions to new technologies in general. Some of these assumptions have now been tested by three studies published in *Nature Nanotechnology*, which survey public attitudes to the science^{1,2,3}.

All too often, scientists treat the public as an

The reasons for public concern about nanotechnology often s



Risk Controversies Arise From:

- ▶ Social and historical context
- ▶ Institutional performance
- ▶ Social 'amplification effects' (e.g. media, NGO activity)
- ▶ (dis)Trust of Governance

IRG 3 projects

Risk perception & public deliberation team

UCSB, Cardiff (UK), UBC (CA)

- 1) Multiple party risk perception—public, NSE, toxicologists, regulators, industry
- 2) Public participation/deliberation

Media team UCSB, Lehigh, (U of A)

- 3) Media coverage of societal issues
- 4) Web networks of nano advocacy and protest groups

Theoretical framework-SARF

- Social amplification and attenuation of risk
- Risk amplification and technological stigmatization
- Framing of nano by media and advocacy groups



1. It is reasonable to assume that industries working with nanomaterials will adapt or alter their safe-handling practices when new hazards are discovered.



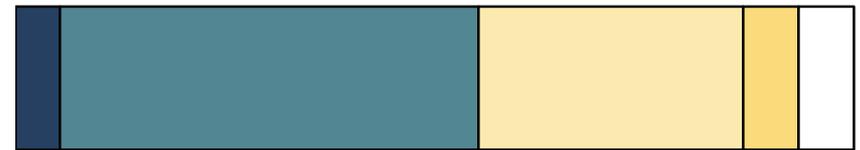
2. Businesses are better informed about their own workplace safety needs than are government agencies.



3. Industries working with nanomaterials can be trusted to regulate the safe-handling of these materials.



4. Voluntary reporting approaches for risk management are effective for protecting human health and the environment.



5. Employees are ultimately responsible for their own safety at work.



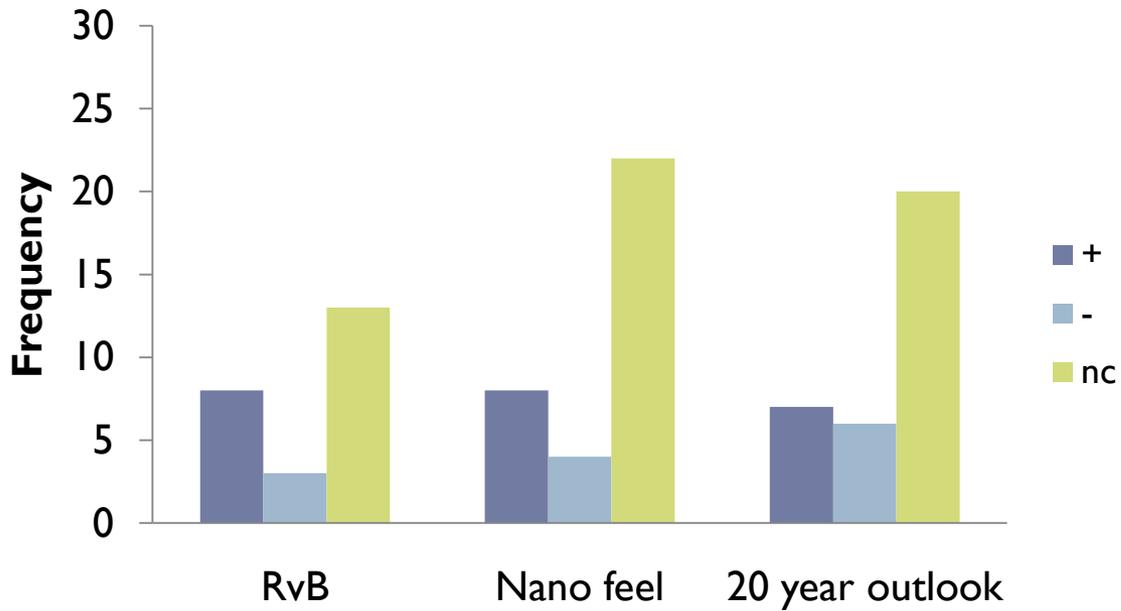
0% 20% 40% 60% 80% 100%

Strongly agree Agree Disagree Strongly disagree Don't know

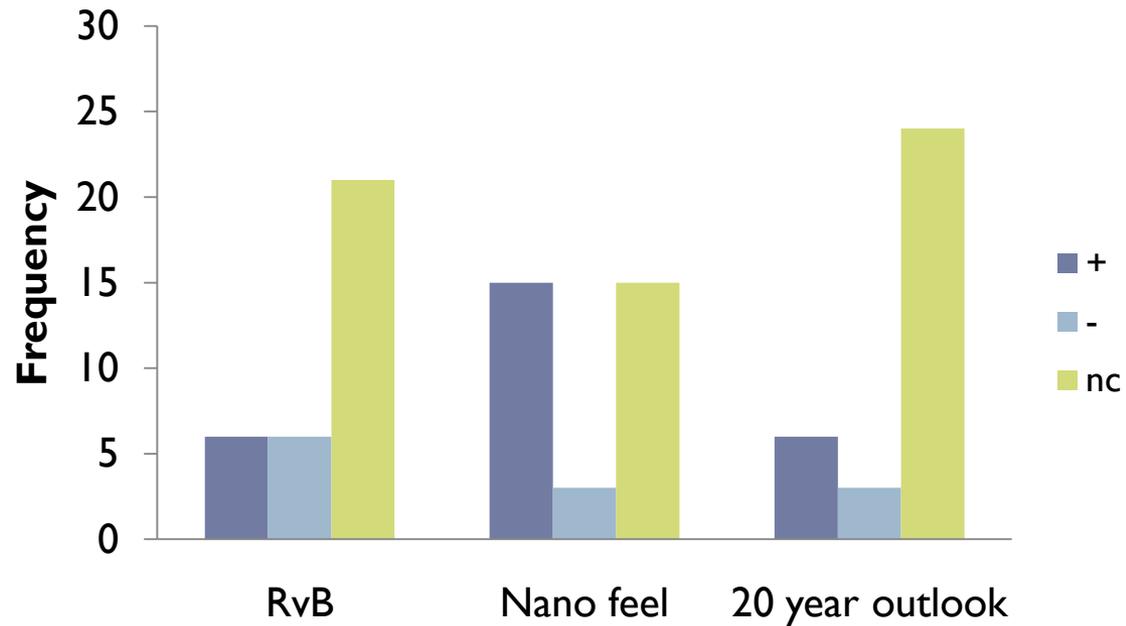


How are people changed by participation in deliberation?

Women change in opinion



Men change in opinion



Satterfield et al., *Nature Nanotechnology* (2009):

- ▶ Familiarity with nanotechnology remains low (may not be changing much over time, 2002-08)
- ▶ People (in ratio of 3:1) continue to think benefits will outweigh risks but many remain unsure (may be changing: cf Priest, 2010)
- ▶ Reported familiarity with nanotechnology positively correlated with higher perception of benefit outweighing risks
- ▶ Other variables (gender, trust, science optimism, worldviews) also important in some studies.
- ▶ But – nano (crucially) has no obvious history of crisis (yet!)