CNS-UCSB
Center for Nanotechnology in Society

SES 0938099
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Evidence-Based Risk Perception and Communication for Ethical & Socially Sustainable Nanotechnology

NSF NSE meeting, Arlington, VA Dec 4-6, 2013

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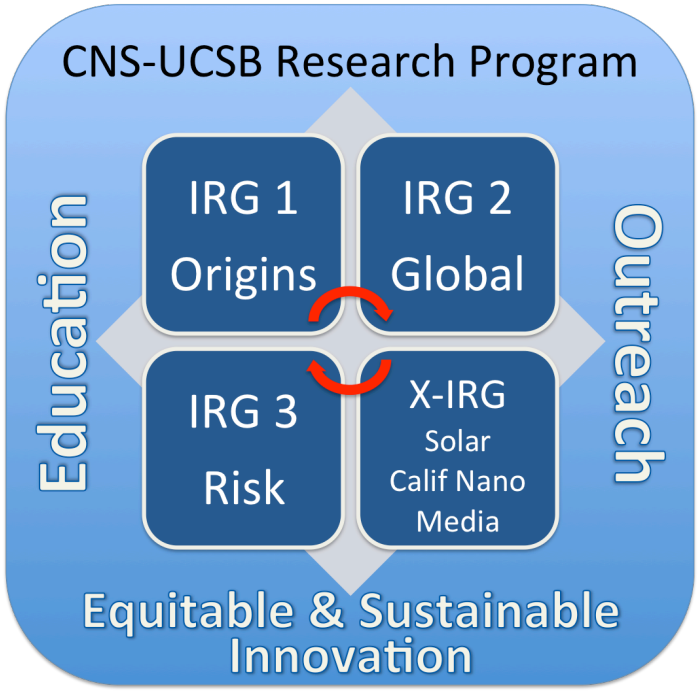
Mission: Nanotechnology Origins, Innovations, and Perceptions in a Global Society

CNS is dedicated to understanding the relationship between technological innovation and social change and to advancing an ***integrative role for the social sciences*** in promoting the development of equitable and sustainable technological innovation around the world.



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IRG 3: Risk Perception and Social Response

Views on Nano's risks & benefits are key to societal outcomes

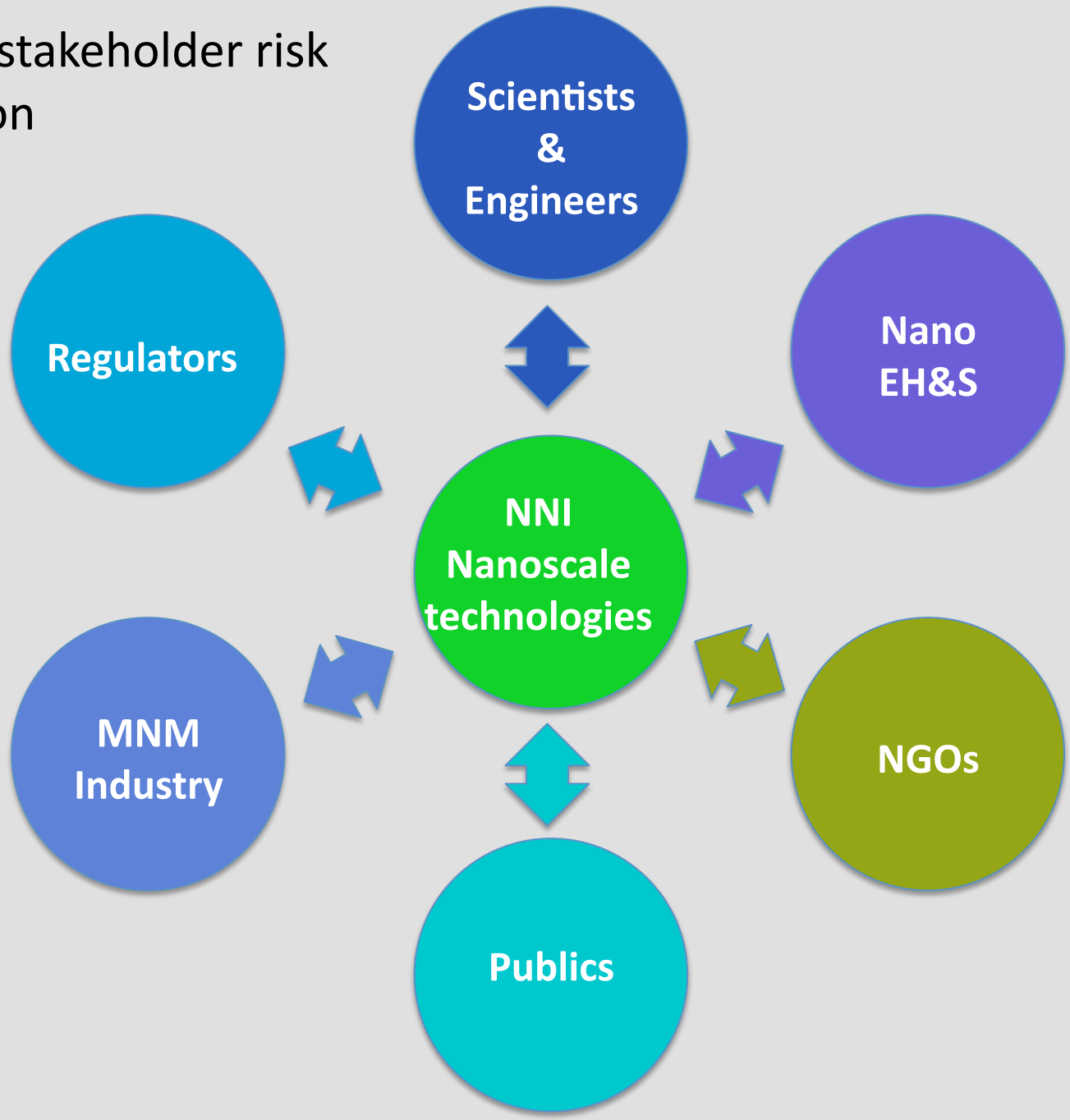
Understanding publics' and experts' perceptions, beliefs, concerns, views on nanotechnologies, social amplification and attenuation of risk, and methods for effective, equitable public engagement and deliberation.

Nature 29 Aug 2012: Nanotechnology: Armed resistance

Understanding the societal context for new technology reception includes:

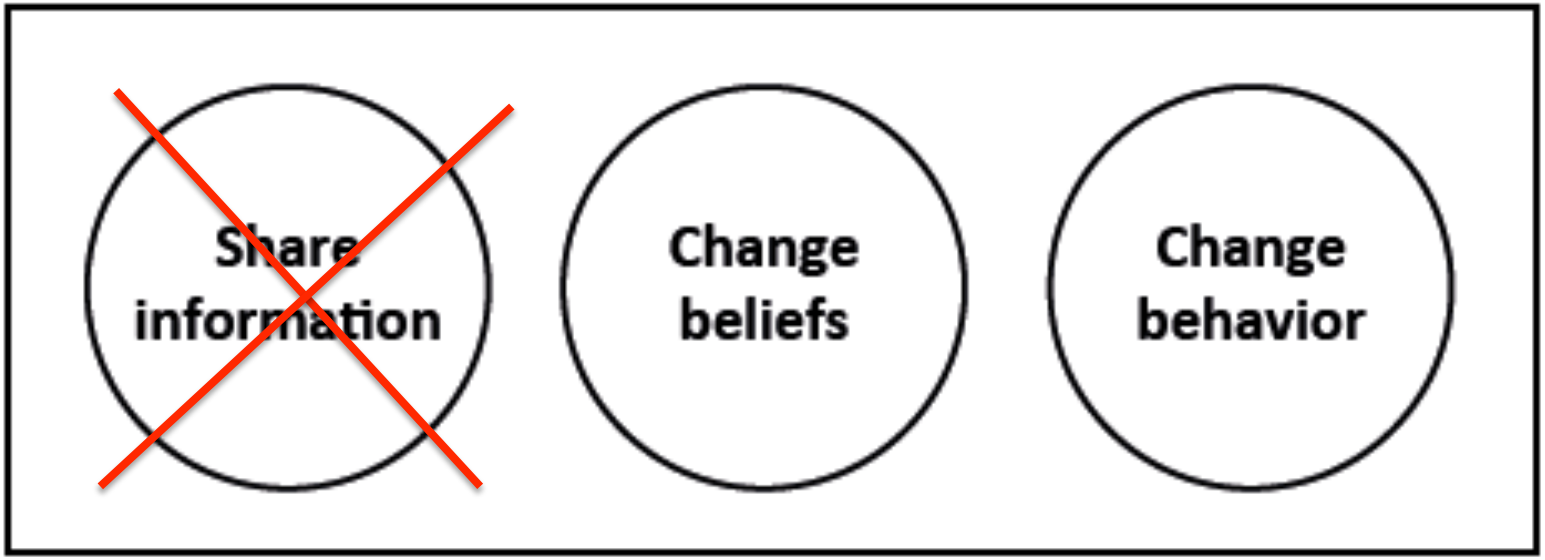
- Scientists' views on risk & responsibility
- Public & NGO perceptions of benefit & risk, acceptability, NGO actions
- Industry's approach to safety and stewardship
- Regulator views and system capacities
- Distributive and procedural justice

Multiple stakeholder risk perception



Evidence-based Risk (and Benefit) Communication – goals come first

Three potential goals of risk communication



Source: Fischhoff et al. 2011

Normative Bases for Risk Communication

- Duty to inform/informed consent
  - Contains info needed for effective decision making
  - Users can access the info
  - Users can understand what they access

- Uncertainty → construction of preference; more stable preferences produced when provide:
  - Alternative perspectives
  - Range of possible outcomes
  - No hidden values (biases) embedded in choices (e.g., must achieve acceptance)
  - Quantify risks, quantify benefits

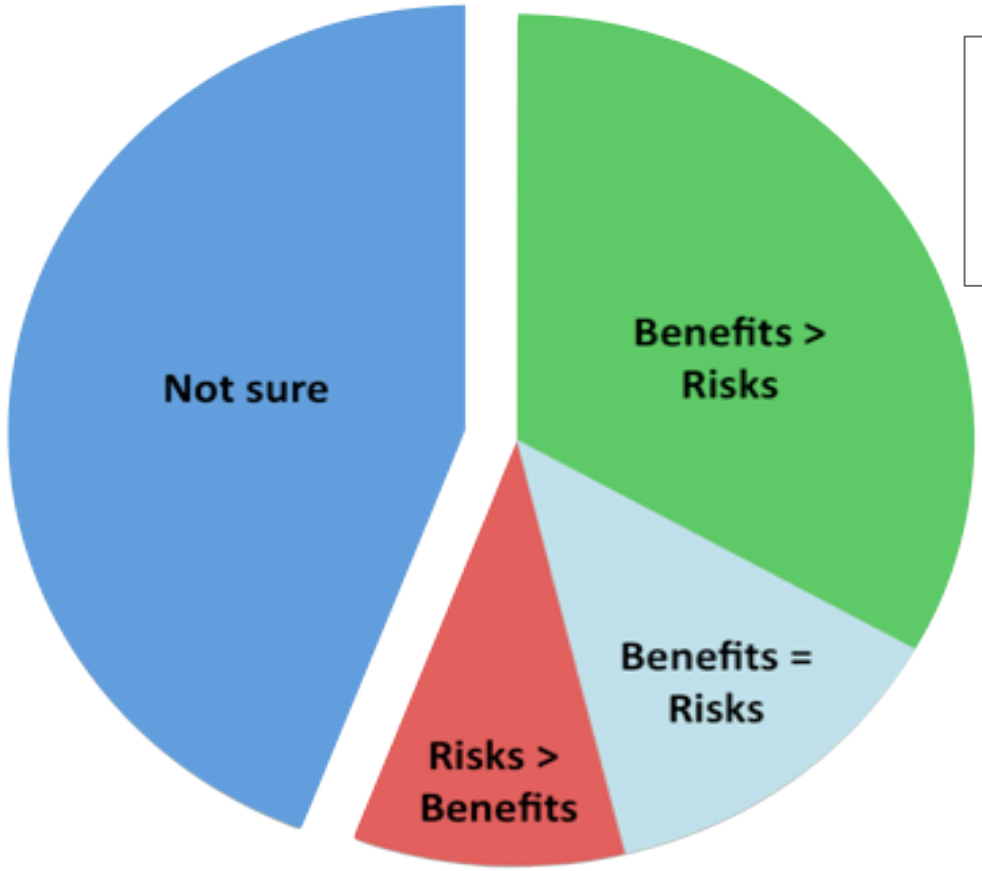
Evidence (not intuition) needed at every level for effective risk communication practices

- Information needs to **fit needs/concerns of people** whose beliefs or behaviors you're trying to change (e.g., publics, but also policymakers)
- We should **expect a mismatch** between values and needs/concerns of experts, policymakers, and publics, so need to study them
- Context(s) drive risk perceptions, so need to characterize
- Effective communication process requires research/ evaluation

→ **'Evidence-based guesses about best practices'** (cf. Fischhoff 2011)

Examples of Nano Risk (and Benefit) Evidence for Communication

Public perceptions of nanotechnology risks and benefits: Benefit centric, but high uncertainty and potential malleability



Based on quantitative metaanalysis of 22 studies 2002-2009 in N Am, Europe, and Japan

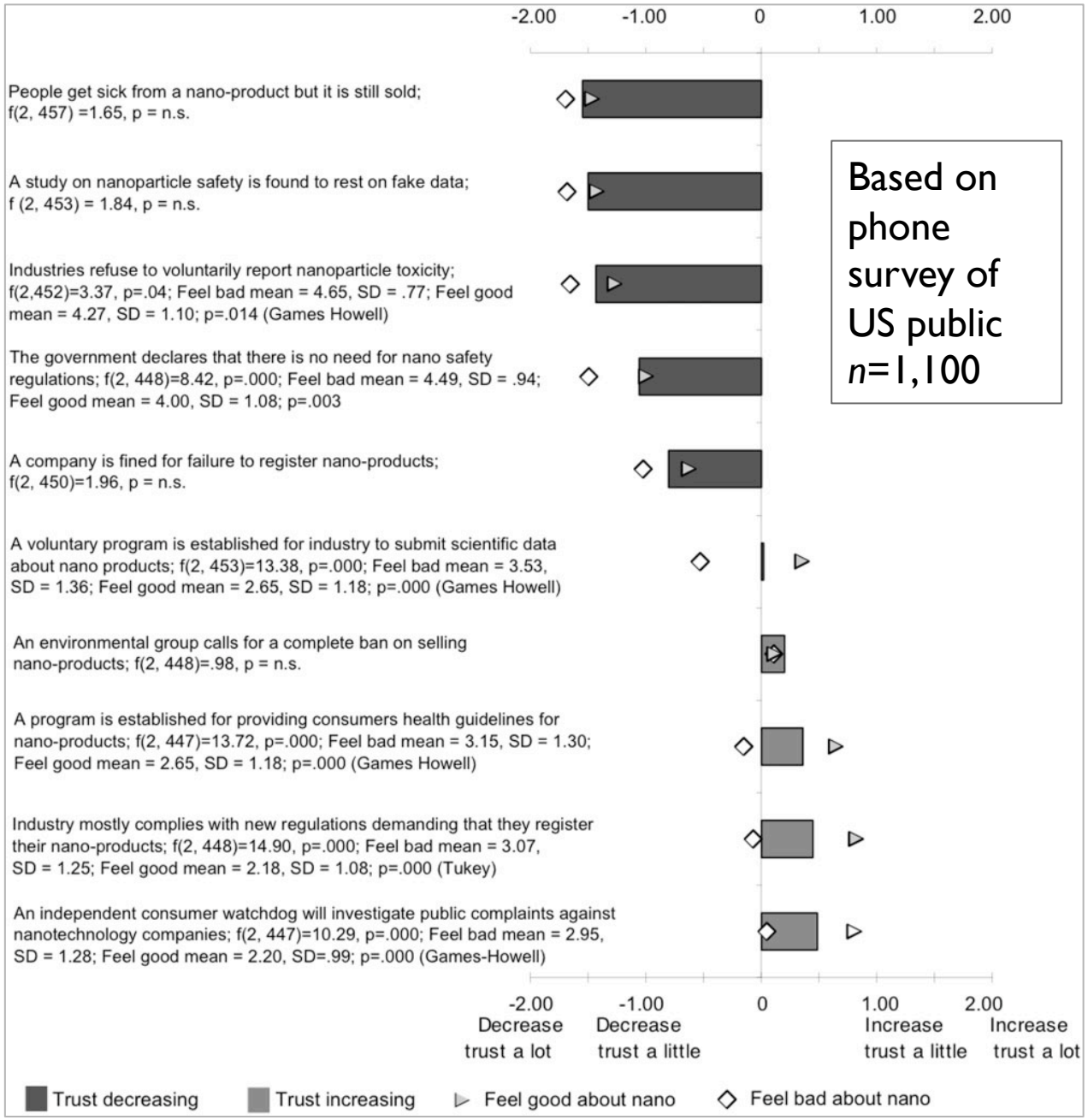
Slide courtesy of C. Beaudrie

Source: Satterfield, T. et al. 2009 Anticipating the perceived risk of nanotechnologies. Nature Nano 4: 752–758.

Nano Risk and Institutional Responsibility

Experimental risk comm effects:

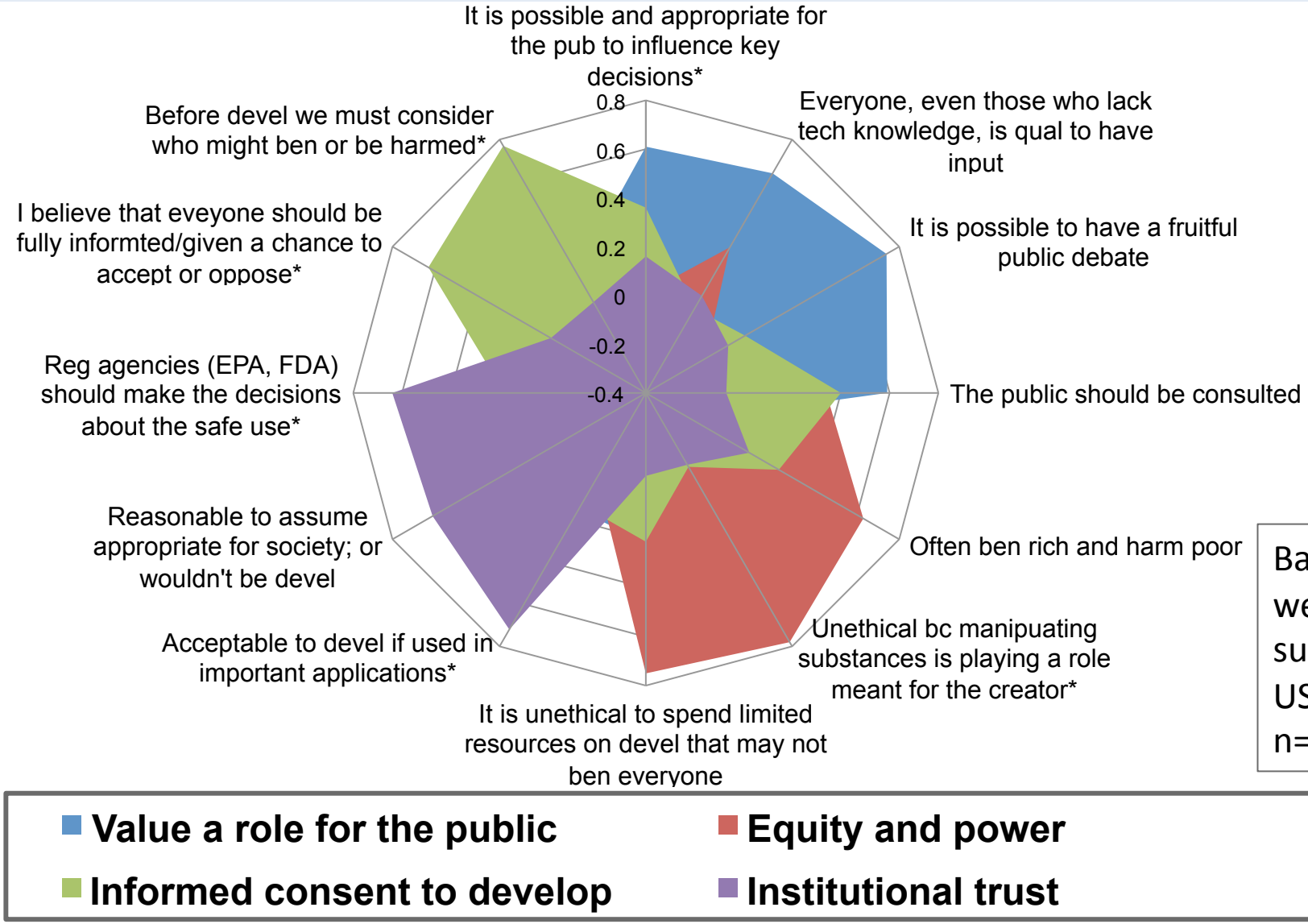
- Trust asymmetry prevails—easier to lose than gain trust
- Communicating regulatory action/ caution increases trust
- Involving NGOs increases trust
- Mobility of views likely in the face of news
- More mobility of views when bad news follows good —**benefit only communication risky!**



Based on phone survey of US public *n*=1,100

Source: Satterfield et al. 2012 Sci & Public Policy: 1-14

Publics' views on upstream ethics, **incl. risk communication ethics**, linked to environmental acceptability of nanotechnologies



Based on web survey of US public n=697

- **Value a role for the public**
- **Equity and power**
- **Informed consent to develop**
- **Institutional trust**

UCCEIN

Collins, Hanna, Satterfield & Harthorn, 2013 in preparation

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

Risk Perception survey with shorter and longer experimental narrative vignettes (N=1,100)

***4 control variables*: scientists' risk judgments, controllability, bodily invasion, justice**

***3 Applications*: NANOFOOD, NANOPILL, NANOFUEL**

***Example*: NANFOOD8 (most positive form)**

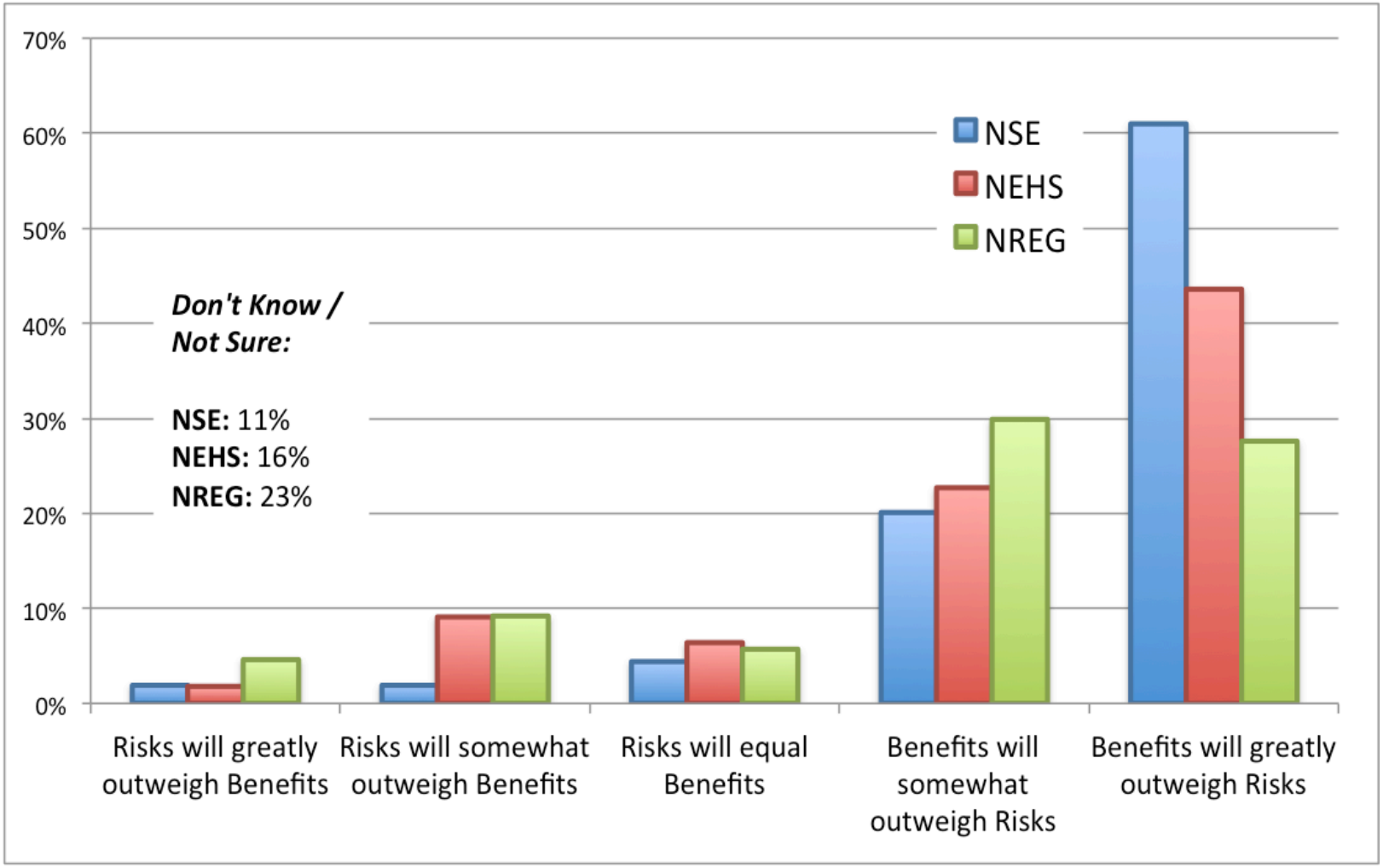
> Nanotechnology may be used in food to improve its taste and nutritional value. Scientists are positive about the benefits of this. Even though these materials are small, they cannot be absorbed into the bloodstream through the intestines. They are designed to expel quickly through sweating or urination. Currently, the production of nanofoods is occurring in both poor and well-off neighborhoods. How acceptable is this on a scale between 1 and 7, where 1 is strongly support it, 4 is neutral, and 7 is strongly oppose it?

Results:

All nanofood applications were unsupported, incl. entirely positive condition. In other 2 domains (nanopill, nanofuel), some scenarios were supported. In general, respondents to longer narratives were less positive (more risk averse) than to the shorter RvB ratings in other studies.

Conti, Satterfield & Harthorn. 2011. *Risk Analysis 31(11):1734-1748.*

Scientists' and Regulators' ENM Risk vs. Benefit Perceptions—Benefits outweigh the risks, but notable group differences

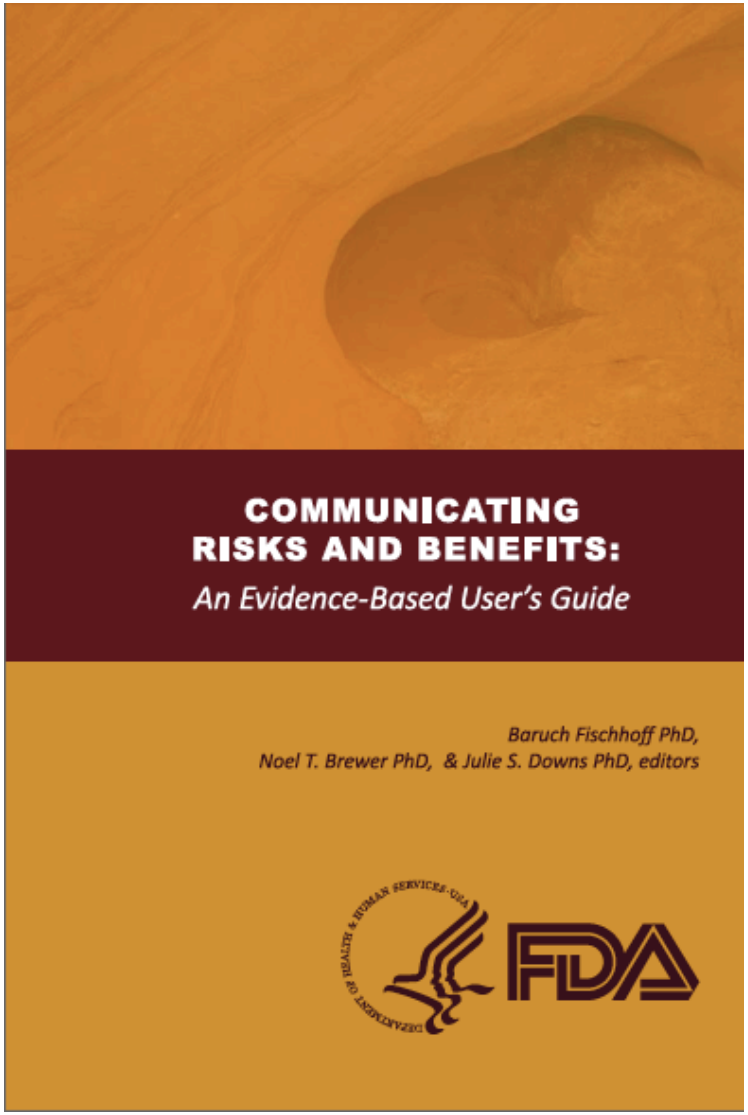


Source: Beaudrie, Satterfield, Kandlikar, & Harthorn 2013 PLOS One

Main points/issues/questions

- Responsible, ethical risk analysis, management and communication are key parts of responsible development
- Depend on good evidence about risks, *and about society*
- Emerging ***evidence*** from systematic social scientific research on key stakeholder groups' beliefs, values, preferences and perceptions; much research on experimental risk and benefit communication
- **Risk Communication Paradox**: just at the moment when the need for nano environmental risk communication is on the rise, social scientific research essential to it has already peaked in funding and centrality

Implementing Evidence-based Nano Risk (and Benefit) Communication



How useful would a comparable document be, synthesizing nano societal data, and tailored for, nanomaterials and nanotechnologies?

Thank you!

- Research participants in all these different communities
- Lead collaborators: Terre Satterfield at University of British Columbia and Nick Pidgeon at Cardiff Univ, UK
- Colleagues, collaborators, students, and postdocs in the CNS-UCSB and UC CEIN, in particular: Milind Kandlikar & Christian Beaudrie (UBC), Paul Slovic & Robin Gregory (Decision Research), Shannon Hanna (NIST), Joseph Conti (U Wisc-Madison), Mary Collins (UMD), Patricia Holden & Cassandra Engeman (UCSB), and Hilary Godwin & Andre Nel (UCLA).
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When it comes to safeguarding the environment, human health, and community livelihoods from the impacts of new technologies, where does the role of the government end and that of nongovernmental organizations (NGOs) begin? This question will be the focus of a multidisciplinary, global conference to be hosted by the CNS at University of California at Santa Barbara, Nov 13-15 2014

http://www.cns.ucsb.edu/demtech2014/welcome

Public views re: nano food and drugs

Table V. Fractional-Factorial Analysis of Nano-Applications

Domain	Dimensions	Sum of Squares	df	F	Partial n^2
Nanofood	Scientists' risk judgments	3.07	1	1.09	0.003
	Control	0.77	1	0.27	0.001
	Bodily invasion	20.47	1	7.26**	0.02
	Justice	11.67	1	4.14*	0.01
	Error	908.10	322		
	Corrected total	944.11	326		
Nanopill	Scientists' risk judgments	7.03	1	2.16	0.007
	Control	1.29	1	0.4	0.001
	Bodily invasion	45.29	1	13.92***	0.04
	Justice	49.77	1	15.30***	0.05
	Error	1018.28	313		
	Corrected total	1112.78	317		
Nanofuel	Scientists' risk judgments	52.49	1	17.01***	0.05
	Control	8.86	1	2.87	0.009
	Bodily invasion	55.71	1	18.06***	0.06
	Justice	55.06	1	17.84***	0.05
	Error	956.57	310		
	Corrected total	8670.00	314		
All Applications	Scientists' risk judgments	51.41	1	16.17***	0.02
	Control	1.06	1	0.33	0.000
	Bodily invasion	135.75	1	42.71***	0.04
	Justice	126.94	1	39.93***	0.04
	Error	3175.56	999		
	Corrected total	3480.16	1003		

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
Notes: No risk = 1, expert concern for risk = 0; ability to control = 1, inability to control = 0; impossibility of bodily invasion = 1, bodily invasion = 0; socially just = 1, unjust = 0.

Conti Satterfield & Harthorn. 2011. *Risk Analysis 31(11):1734-1748.*