Gender, Race & Equitable Participation: Engaging Diversity in Public Deliberation

Methods
6 Calif. Deliberative workshops 2009
Diversity ~ reflect US population
• Small groups, 4.5 hours, single session
• Pre-/Posttests—risk & benefit perceptions

Sequence
• Discussion of cultural domains (energy, environment & technology)
• Introduce nanotechnologies
• Self select articles to read
• World Cafés (small groups)
• Final dialogue

Main Findings: Bases for Gendered Risk Perception in Social Risk and Technological Uncertainty

• Gender and race/ethnicity differences strong, with women highly uncertain at pretest; deliberation participation has much stronger effect on women’s views than men’s
• Fairness is a key dimension in forming risk views—re: distribution of risks and benefits; re: procedures and opportunities for participation
• Mistrust of corporations/industry greatest source of uncertainty and ambivalence; spillover on others for collusion with industry
• Economic conditions and lack of job creation also factors
• Scientific uncertainty about risks, calls for labeling and precautionary principle

Early Warnings for Nanotechnology Risk Communication: Benefit Tenacity or Risk Betrayal?

- Acceptability ratings shift as information changes
- Change is greater when benefit or safety info is given 1st & risk info 2nd (p=.03)
- Differences are explained by two reactions: stronger 2-step movement from benefit to risk info; and lesser (1-step) movement from risk to benefit.
- Findings imply risk & benefit judgments are malleable so far but risk only information will likely backfire given stronger response to R-B order.

Data from 2008 US national survey (n=1100).

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**Problem:** How will information about nanotechnology research and development be encountered and perceived given variations in the attributes of information, and given the attitudes and social experience of perceivers (whether they see the world as just, or not; and whether they experience themselves as vulnerable in the world, or not)? Two experiments in risk messaging were conducted to assess how new technologies are taken up by social groups that vary by experiences of vulnerability and attitudes towards environmental justice.

### Method:

- **an experimental U.S. national telephone survey** (N= 1,100) conducted in 2008. Vulnerability and Environmental Justice scales constructed from six survey items.

### Findings:

1. Comparative analyses of different examples of nanotechnology applications demonstrated heightened ambivalence across acceptability when risk versus benefit information was provided with application descriptions (described in short vignettes as compared to the general category “nanotechnology,” absent of risk or benefit information).

2. Experimental narrative analyses, using longer more comprehensive descriptive passages, show how assessments of risks and benefits are tied to the systematically manipulated psychometric qualities of the application (its invasiveness and controllability), risk messaging from scientists, and the social implications of the technology as concerns justice.

### Comparative Analysis of Nanotechnology Applications with Risk and Safety Correctives

<table>
<thead>
<tr>
<th>Nanotechnology Applications</th>
<th>TINY Nano Silver Particles Can Be Used in Bandages to Stop Infections by Killing Bacteria. But Nano Silver is Considered a Water Pollutant; If It Turns Up in Our Rivers or Oceans, Fish and other Marine Life May Be Irreversibly Damaged.</th>
<th>Nano Technologies Are Used to Create Small Radio Transmitters That Can Send Medical Diagnoses and Records From Remote Areas By Internet or Cell Phone. As the Information Is Sent, However, Leaks in Privacy May Be Unstoppable or Irreversible.</th>
<th>TINY Instruments Known as Nanorobots Can Be Used to Repair Damaged Cells and Organ in Water Birds Damaged by Oil Spills. This New Technology and How To Control It Is Now Well Understood By Scientists.</th>
<th>TINY Nanoparticles Are Being Developed for Targeted Delivery of Medicine at the Cellular Level, a Process That Means That Chemotherapy Will Only Kill Diseased Cells. This New Technology Will Be Available For the Poor or Those With Limited or No Healthcare.</th>
<th>Nano Technology Can Be Used to Make a Very Small Device for Easy Use and Medical Diagnoses in Remote Areas of the World. They Are Being Tested in Poor Countries at the Request of People There In Areas Where Few Medical Services Exist.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vulnerability</td>
<td>- .21 ** (0.07)</td>
<td>- .24 ** (0.06)</td>
<td>- .19 ** (0.07)</td>
<td>- .08 (0.06)</td>
<td>- .23 ** (0.07)</td>
</tr>
<tr>
<td>Environmental Justice</td>
<td>- .21 ** (0.07)</td>
<td>- .24 ** (0.06)</td>
<td>- .03 (0.07)</td>
<td>.03 (0.06)</td>
<td>-.10 (0.07)</td>
</tr>
<tr>
<td>Pseudo R² (Nagelkerke)</td>
<td>.09 (0.07)</td>
<td>.08 (0.06)</td>
<td>.03 (0.07)</td>
<td>.07 (0.06)</td>
<td>.06 (0.07)</td>
</tr>
<tr>
<td>Model X²</td>
<td>223.49</td>
<td>294.71</td>
<td>322.80</td>
<td>261.01</td>
<td>305.35</td>
</tr>
<tr>
<td></td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.02</td>
<td>.48</td>
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<td></td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.002</td>
<td>.002</td>
</tr>
</tbody>
</table>

Participants (four sub-samples of approximately N = 275) were asked to provide ratings of acceptability for a range of specific nano-applications, each described in short vignette form. All vignettes began with a statement of the purpose of the technology and its benefits; three of these were accompanied by clear safety messages, and three were followed by counterpart risk message. For vulnerability and environmental justice, a high number indicates strong disagreement. Standard errors are in parentheses. * p < .05; ** p < .01; *** p < .001.
Key findings need for regulation, education

• Only 46% of participants reported having a nano-specific EHS program.
• More (61%) cited “lack of information” as an impediment to implementing nano-specific EHS practices than any other obstacle.
• Participants reported high levels of uncertainty about ENM risks
• Despite reported lack of information and uncertainty about ENM risk, a majority of participants believes ‘industry knows best’

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.

Problem. Risks and benefits of different technologies are often compared to one another. Comparisons can have unexpected consequences, however. Comparison may trigger anchoring effect, in which people unconsciously associate two objects as being similar despite the intention of the comparison to create contrast. Or, comparisons can trigger a sense of contrast, pushing beliefs about the unknown risk away from the known one.

In this study, based on an experimental survey with 809 subjects, we examine how comparisons among technologies shape peoples' attitudes.

Question 1. Do comparisons with landline phones or X-ray radiation affect beliefs about cell phone safety?  
**Result:** Subjects who are first asked to compare cell phones with landline phones believe cell phones are more dangerous than people not making a comparison. Comparison with X-rays has no effect.

Question 2. Do comparisons with further reliance on foreign oil or wind & solar power affect attitudes toward nano fuel additives?  
**Result:** Subjects who compare with wind & solar power are less positive toward nano fuel additives than people not asked to compare; comparison with foreign oil has no effect.

Question 3. Do comparisons with eating organic food or eating fast food affect attitudes toward nano-packaging for food?  
**Result:** There are no differences between subjects in the reference and treatment conditions.

<table>
<thead>
<tr>
<th>Target Issue</th>
<th>Condition 1</th>
<th>Condition 2</th>
<th>Ref. Condition</th>
<th>Mean/Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Comparison</td>
<td>Mean</td>
<td>Diff.</td>
<td>Mean</td>
<td>Diff.</td>
</tr>
<tr>
<td>Nano Food Packaging</td>
<td>Organic Food</td>
<td>3.39</td>
<td>-0.01</td>
<td>Fast Food</td>
</tr>
<tr>
<td>Nano Fuel Additive</td>
<td>Wind &amp; Solar</td>
<td>3.09</td>
<td>-0.20*</td>
<td>Foreign Oil</td>
</tr>
<tr>
<td>Cell Phones</td>
<td>Landline Phone</td>
<td>3.03</td>
<td>-0.38*</td>
<td>Radiation</td>
</tr>
</tbody>
</table>

*= p < .01

Interpretation. Some comparisons among technologies are subject to contrast effects, in which a comparison with a benign, familiar object makes an unknown technology look worse than when no comparison is made.

- contingent on the specific technologies;
- stronger in less ideological people;
- and stronger in more cognitively sophisticated people.

Affective-Trust and Asymmetry in Nanotechnology Regulation

- Studying public perceptions of nanotechnology under conditions of low awareness and apriori any stigmatizing risk events necessitates relying on known predictors of risk. Two well-known predictors of risk perception are measures of trust and affect. The former includes trust judgments about reports on different management practices whereas the latter [affect] refers to rapid pre-conscious or pre-analytic judgments expressing strong or weak feelings about the “goodness” or “badness” of an object [nano].

- Reporting on a nationally representative phone survey of U.S. residents (N=1,100), participants were asked (1) their affective response to nanotechnology and (2) their trust judgments of different risk management practices. Management scenarios were intentionally balanced from extremely positive to extremely negative. Findings illuminate the fact that affective ratings largely enhance the principle of trust asymmetry – that trust is easier to destroy than gain. Enhancing trust (blue bars) is more difficult to achieve than the reverse (red bars), and even in the best scenarios those who offered negative affective judgments were not converted to trusting positions in the face of trust-enhancing events.

Satterfield, T.; Conti, J.; Pidgeon, N; Harthorn, B.H. *in preparation*, ES&T
INTRODUCTION
The goal of this project was to investigate the multiple studies of perceived risks of nanotechnologies to identify challenges posed for health and safety regulators, and to understand emerging trends in public judgments of both benefit and risk.

We conducted a meta-analysis of all quantitative surveys of nanotechnology risk perceptions and attitudes published from their first appearance in 2000 through to January 2009.

RESULTS
• most people see benefits as outweighing risks; there is little evidence for risk aversion toward nanotechnologies per se
  • a very large number of respondents across studies (average of 39%) have reserved or declined judgment (that is, they refuse to acknowledge risk or benefit)
  • more positive judgments of nanotechnology are driven by both familiarity and knowledge of the technologies, which is itself a limited subset of most representative samples
  • few studies have examined in depth the ideas that have most characterized studies of risk including those on the social attenuation and amplification of risk through media and other social institutions, as well as the role of intuitions about toxicology and their influence of judgments of risk and benefit.

INTRODUCTION
Anticipating public response is difficult, given limited public knowledge of nanotechnology and the complex relationships between perceived benefits and risks, emotional and symbolic characteristics of nanotechnology, and the trust or lack of trust placed in those managing this new class of technology.

One concern amongst regulators as well as the scientific community is the emergence of stigma, a measure of avoidance once an object has become ‘marked’ – often by a risk event and/or the positive or negative news stories that can follow. Figure 4 shows a correlation between risk aversion (a kind of ‘stigma susceptibility’ score) versus risk tolerance score, both of which effect acceptability scores.

RESULTS
• Stigma measures (figure to the right) indicated that judgments might easily change as a result of how this plays out in the media and/or should a controversial stigmatizing event occur.

Figure 4: Stigma and acceptability of various nanotechnologies.
Unpacking benefit judgments - the Nanotechnology Case

We examined how people change their judgments when provided benefit and then risk information for the same nanotechnology applications.

Currently, the majority of surveys report that people regard benefit as outweighing or equal to risks. The above figure indicates that it is also the case that as familiarity with nanotechnology increases, the proportion of participants judging that benefits will exceed risks increases significantly. Benefit judgments in this sense can be said to be a function of knowledge or familiarity and not a knowledge deficit per se.

However, one concern is that the current mood of technological optimism or benefit centrism might be quickly reversed in the event of a risk event. To explore this we offered people two forms of information: Benefit information first followed by risk information and the reverse (2nd figure).

When information is initially positive, followed by a risk message, the reversal of the first judgment is much stronger (and more significant) than the reverse order. For example, across risk to benefit scenarios, initial judgments were reversed on average by 28.24 percentage points, while in benefit to risk scenarios the average change score across vignettes was 45.01 percent. This indicates high sensitivity in this judgment forming ‘upstream’ moment, whereby any sense of surprise in the face of unanticipated risk information could produce a betrayal-like effect and hence strong reversals of acceptability.

Terre Satterfield, Joe Conti, Barbara Herr Harthorn, Nick Pidgeon, in preparation for Journal of Nanoparticle Research
Vulnerability and Environmental Justice as Factors in Emergent US Nanotechnology Risk Perceptions

Introduction
The question generally posed by social scientists interested in perceived risk is: How might current growth in nanotechnology research and development be viewed by different publics and will the products and capacities derived from nanomaterials be met with optimism or aversion? Will nanotechnologies be the subject of controversy? Or, will benefit appreciation prevail over risk aversion and if so, why?

Results
• When the distribution of risks and benefits from nanotechnologies is perceived as unfair, concerns for social justice lead to heightened perception of the nanotechnologies as risky (see figure 1)
• Experiences of vulnerability also amplify perceptions of risk associated with nanotechnologies.
• There is significant variation in risk perception between application domains.

Recognizing the embeddedness of technological innovation in social contexts, including experiences of vulnerability and normative evaluations related to social justice, extends the conventional foci of risk perception research and demonstrates how justice has thus far been under-recognized as a factor in perceptions of risk.

Figure 1. Risk judgments from respondents who acknowledge environmental inequality (blue) significantly differ from those that do not (green) on 14 of 18 items, including all non-nano risk objects.

Joe Conti, Terre Satterfield, Barbara Herr Harthorn, under review, Risk Analysis.
The Impact of Testing Costs on the Regulation of Nanoparticles

Costs of testing the toxicity of nanoparticles are important for determining how nanoparticles might be regulated. Here we analyze whether testing costs might reasonably be borne by industry.

Based on publicly available information we estimate that there are 265 distinct nanoparticle types for sale in the US. Testing costs vary from $70,000 (Level 1 – physical characterization) to $4.48 million (Level IV – in-vivo animal models) depending on level of testing. Four scenarios assumed different proportions (“distribution”) of nanomaterials that are tested at different levels. In the optimistic scenario only 10% of nanoparticles will need the full range of tests, while in the precautionary approach all nanoparticles need testing at all levels. Costs of testing range from $249 million (Optimistic) to $ 1.18 billion (Precautionary) At current levels of R&D spending on nanomaterial toxicity this translates into between 11 and 43 years for testing currently existing nanoparticles.

New approaches that increase the efficiency of testing are needed, especially as the numbers of nanoparticle types increase.

While several US federal regulations are expected to apply to emerging nanomaterials, questions remain as to whether current regulatory frameworks are sufficient for managing risks that may emerge. This work investigates the federal health, safety, and environmental regulations that apply over the life cycle of a typical nanomaterial to determine whether novel properties and high uncertainty over risks significantly challenge the current regulatory system.

While existing regulations are widely considered to provide adequate authority to regulate nanomaterials, novel properties, low production volumes, sparse data, and a lack of standards and protocols severely challenge the applicability of regulations. Furthermore, a shortage of resources and inadequate authority to require testing or recalls severely limit regulators’ effectiveness in managing risk. Many nano-products as a result will go largely unregulated along their life cycle, while others may fall through gaps in regulation as they move from one stage of their life to the next. Overall, improvements in authority to require testing of a wider range of products, a systems approach to regulation that better engages stakeholders in risk management, and improvements in regulatory oversight at the ‘use’ stage are recommended.

Figure 1. Federal health, safety, and environmental regulations that apply along the life cycle of a typical nanomaterial. Dashed boxes denote the life cycle stages at which each regulation’s primary regulatory mechanisms are in effect.
Deliberating Nanotechnologies in the US: Gendered Beliefs about Benefits and Risks as Factors in Emerging Perception and Participation

2009/2010 Study: Gender, Risk, and Equitable Participation

Six deliberative workshops were conducted in Fall 2009 in Santa Barbara, CA. Workshops focused on dialogues about nanotechnology in (1) energy and other environmental applications, and (2) health and human enhancement applications. The workshops varied gender composition systematically to allow for a comparative analysis of gender and risk perception.

Preliminary Results:

• Similar findings to 2007 study: greater perceived benefits over risks, but dependent upon application context.
• Strong gender effects, with women more cautious than men about forming risk vs. benefit judgments.
• Concern about equal access, fairness, and distribution.
• Concern about governance: distrust in U.S. government and corporations to responsibly manage nanotechnology.
• Strong interest in “informed public consent” of nanotechnology usage.

2009/2010 Study: Methods

• Formal and self-directed learning were incorporated through Powerpoint presentations and World Café-style small group discussions.
• Participants were selected to match local demographics.
• Two co-facilitators, plus one “expert” CNS science fellow moderated the discussion and facilitated the world cafés.

• Small group size suitable for focused discussion-based interaction (n=9-13)
• Pre-tests and post-tests to measure attitude change and changes to risk perception, pre and post-workshop.

Comparative Analysis to 2007 Study

Comparative analysis with our 2007 US workshops will allow depth analysis of changing views about benefits and risk.
• Four parallel deliberative workshops were conducted in February 2007, two in the US and two in the UK. Workshops focused on dialogues about nanotechnology applications in either energy or health & enhancement.
