

## NANOTECHNOLOGY AS A MORAL ISSUE? RELIGION AND SCIENCE IN THE U.S.

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Nanotechnology is one of the fastest-growing areas of research, with federal funding in the U.S. having almost quadrupled since 2001. And the Wilson Center's Project on Emerging Nanotechnologies already tracks over 500 commercial applications that are currently on the market, including waterproof sunscreen, stain-resistant clothing, and high-performance sports equipment. When forming attitudes about nanotechnology, the U.S. public, at least for now, seems to focus mostly on these novel applications and their potential benefits and is not particularly interested in or concerned about the potential risks of the new technology [1].

Things have not changed much in the last few years. As part of two separate grants from the National Science Foundation (NSF), we have been tracking public attitudes and information on nanotechnology since 2004 with colleagues at Penn State, Cornell, and Arizona State. Those tracking surveys showed that the U.S. public remains largely unaware of nanotechnology, and that levels of information – measured on a battery of true/false questions – stayed at consistently low levels.

Uninformed publics, of course, are a phenomenon that comes as no surprise to most social scientists. In fact, study after study in political science has shown that a majority of the U.S. electorate is similarly ignorant about candidate issue stances and the political process. And emerging technologies, such as nanotechnology and stem cell research, are inherently political issues. They get their own sections in federal budget proposals; they receive significant attention from regulators; and they have social and ethical implications that transcend the technical aspects of the science behind them.

What is surprising, however, is how little effort is currently spent on understanding the dynamics of opinion formation in a systematic, data-driven fashion. While the NSF has funded a significant number of studies on understanding the ethical, legal, and social implications (ELSI) surrounding nanotechnology, the latest budget for the National Nanotechnology Initiative (NNI) devotes less than four percent of all nano-related spending to projects with a major focus on ELSI issues.

This may be shortsighted for two reasons: noticeable gaps in some risk perceptions between the general public and leading nano scientists; and an increasing number of

studies highlighting the importance of personal beliefs and values among members of the general public when they form attitudes about nanotechnology [2];[3].

A communication gap between scientists and the public. The first phenomenon emerged when we compared attitudes from a sample of the leading U.S. nano scientists to a representative survey of the U.S. population, both collected with colleagues at the Center for Nanotechnology in Society at Arizona State University [4]. Not surprisingly, nano scientists were overall more optimistic about the potential of nanotechnology to bring about positive societal change, and less pessimistic about the potential risks of nanotechnology. In two areas, however, they expressed significantly higher concerns than the general public: environmental impacts, including pollution; and dangers to human health. These higher levels of concerns were somewhat surprising, given the generally more optimistic outlook of scientists for emerging technologies in the past. At the same time, however, the concerns among scientists simply mirror an emerging debate among corporations, interest groups, regulatory agencies, and academe about necessary steps for researching and regulating nano risks in these two areas.

The emergence of moral concerns? In the most recent iteration of our tracking surveys on public attitudes on nanotechnology, we also designed a battery of questions that paralleled the wording of questions in recent Eurobarometer surveys about public attitudes toward nanotechnology. This provided us with data from over 30 countries on attitudes toward nanotechnology and nano regulations [5].

First comparisons showed many similarities between the U.S. and key players in Europe in terms of overall attitudes toward and awareness of nanotechnology. There was, however, one striking difference between Europe and the U.S. Respondents in the U.S. were significantly less likely to agree that “nanotechnology is morally acceptable” than respondents in most European countries. At first glance, of course, this finding seems somewhat puzzling. Why would consumers and citizens have moral qualms about a technology they know little about?

In order to make more sense of this finding, we first looked at the World Values Survey, an extremely rich data set with data from over 75 countries on religious views, values, media use, demographics and other variables. And the pattern was not surprising. On a ten-point scale, U.S. respondents scored between 8 and 9 on average when indicating how much guidance God provided in their daily lives. European respondents in Germany, France, and the U.K., in contrast, consistently scored below 5.

These differences are at least consistent with the idea that religiosity may play more of a role among the U.S. public than European audiences when it comes to nanotechnology. At the same time, however, comparing aggregate level data from different data sources can suggest a potential explanation, but provides no conclusive evidence. Some of that individual-level data, however, can be found in a forthcoming study we conducted with colleagues at Wisconsin and Cornell [2]. In that study, we found a weak link between religiosity and attitudes toward nanotech and nano funding. And that most likely reflects a general reservation toward science among religious respondents. More importantly,

however, our data showed that religiosity also serves as an important "filter" for certain publics when they make sense of nano.

This idea of "religious filters," of course, is not just about a simple correlation between religiosity and attitudes toward science, which is important in its own right. But in this case, we are talking about a link between benefit perceptions and attitudes that varies depending on respondents' levels of religiosity. In other words, seeing the benefits of nanotechnology is consistently linked to more positive attitudes – at least among less religious respondents. For more religious respondents, in contrast, that effect is significantly weaker, and seeing the benefits of nano does not necessarily translate into support for the technology or future funding.

**The ethics of focusing on elite audiences.** Putting information out there, of course, continues to be an important goal for all science communication. But we also need to realize that different publics have different informational needs, react very differently to information, and -- most importantly -- are looking for answers to questions that often have very little to do with the scientific issues surrounding emerging technologies. As the data from our forthcoming articles show, fitting the moral implications of nano breakthroughs into their existing belief or value systems is much more important for some groups in society at the moment than understanding the science behind it.

Relying on research and strategic communication in order to reach uninvolved or hard-to-reach audiences and help them make sense of scientific information may raise some ethical concerns. Is it appropriate to use strategic communication in order to make scientific issues more relevant to a general public? And should we take advantage of communication tools that can also be used to spread what some would call "misinformation"?

The answer to the first question is a clear "yes." In fact, the more successful communicators are at tailoring their message to specific audiences, the more effectively they can get the scientific side of things heard in public debate. Global warming in the U.S. is a good example. The U.N.'s Intergovernmental Panel on Climate Change (IPCC) was founded about two decades ago as an objective source of information about climate change. But "An Inconvenient Truth" and the subsequent Nobel Prize did more to raise awareness of the issue and force it on the political agenda than almost 20 years of science-based campaigning by the IPCC.

More importantly, the notion that we should not use all tools at our disposal in order to reach broad audiences is unethical in itself. Many traditional outreach efforts, such as town hall meetings, museum exhibits, or science sections of newspapers, often fail to reach minority populations and citizens of lower socioeconomic status. It is therefore critical to find ways to successfully engage and target these groups using what we know from systematic communication research. In fact, it would be unethical if we did not develop ways of reaching beyond traditional elite audiences.

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