

## Why Nano Fear Will Not Disappear

David Rejeski  
Director, Project on Emerging Nanotechnologies  
Woodrow Wilson International Center for Scholars

Over the past year, the nanotechnology debate has been characterized by battles between those who have sought to reassure us about the technology and those who have raised concerns about possible impacts, environmental and otherwise. Sound familiar? Though fears about the impacts may be exaggerated, the pro-technology forces will not be able to eradicate them because with each passing day nanotechnology becomes more and more integrated into the collective narrative we share about technology and its place in our lives.

Narrative is one of the most fundamental and powerful elements of human cognition. We are, as a species, storytellers, and the stories we tell – either personal ones that shape our perception of ourselves, or collective ones that shape social interactions – are an enduring part of human behavior. People trying to make sense of an emerging technology will fall back on narratives long before they pick up a physics or biology book and try to understand the science. This is obviously frustrating to scientists who have spent years writing these tomes, but that's life in a world where fables can outlive facts.

Narratives emerge from direct experience with the world, from mediated experiences, or both. Mediated experience, from books, movies, television, video games, and the Internet, play a powerful role in shaping our perceptions. The power of mediated experience will likely increase with each new generation of technologies and with growing global connectivity.

The key to understanding public response to nanotechnology is not to be found in the latest peer-reviewed journal or yesterday's headlines but in decades of collective narratives mixed with new storylines, often from mediated sources. This is not new. Think back to the messages about nuclear power that were embedded in post-World War II comics like *Captain Marvel and the World of Mr. Atom*. These largely revolved around the failure of government to control new technologies, which inevitably fall into the hands of various evildoers. What has changed are the number of mediated channels available to the public and the variety and intensity of the messages that must be sorted out and understood. And frankly, who has the time to sort fact from fiction? In our information economy, the most valuable commodity is attention, and in the battle for peoples' attention, the scientific community may loose to reality TV. So it is the enduring narratives in our lives that stick and matter.



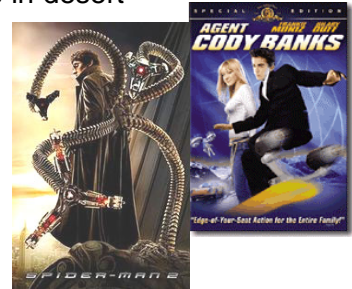
Let's explore one example. Rachel Carson's 1962 book, *Silent Spring*, helped launch our modern environmental movement. It was an enthralling story at two levels. The first, about the effects of the pesticide DDT on our ecosystem, involved a fascinating bit of scientific detective work. The story however went much further, and from a psychological level, much deeper. One chapter of the book, entitled "A Fable for Tomorrow," described a town where all life forms had been impacted by DDT. This fable moved beyond the science to a dystopian vision of the future and may have been the book's most powerful section. In the end, the take away story for people who could not pronounce "dichlorodiphenyltrichloroethane" was that the release of persistent toxics into

the environment can come back to haunt you. This narrative was then repeatedly reinforced by a continuous string of environmental headlines involving substances that looked good on the surface, but turned out to have negative long-term effects, including ozone-depleting chemicals, tetraethyl lead (gasoline additive), asbestos, PCB's, bromided fire retardants, and, recently MTBE (another gasoline additive). One of the primary legacies of this narrative was a healthy dose of consumer skepticism concerning chemical remedies.

Given this background, it should not be surprising that a recent University of North Carolina study of public attitudes towards nanotechnology using experimental issue groups identified "long-term effects" as a high-level concern. Releases of nano-engineered particles or substances into the environment will likely trigger a series of associations to this deeper cultural concern.

Here are three common narratives that shape popular perception of science and technology. Interestingly, links between these narratives and nanotechnology have already been established.

*Dr. Strangelove:* The first narrative involves the corruption or manipulation of science for evil purposes, a narrative that has provided gist for the story mill for decades. This is obviously a real concern in the case of nuclear material walking across former Soviet borders in the hands of corrupt scientists. It also appears in the concerns of survivalists and other worrywarts who fantasize about secrete military projects in desert bunkers gone bad. This narrative is applied skillfully in the recent film *Agent Cody Banks*. This film, aimed largely at pre-teens, involves a scientist who developed nanotechnology for noble environmental purposes and is coerced into creating a weapon of mass destruction. In the recent blockbuster, *Spiderman II*, viewers are introduced to a nano-based neural implant that plays a role as good scientist Dr. Octavius turns into villain Doc Ock and terrorizes New York City.



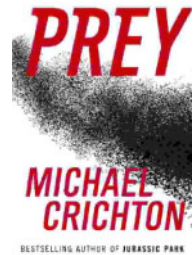
*The Trojan Horse:* In this narrative, we accept innovations into our lives and learn later that we made a mistake. "Technology bites back," as Princeton historian Ed Tenner has observed. Most people have learned this lesson in numerous and painful ways throughout their lives and it has been a favorite theme of filmmakers for decades (remember Charlie Chaplin in *Modern Times*). The Trojan Horse scenario is played out with great effect in a new video game called *NanoBreaker* developed by Konami Digital Entertainment for the PlayStation 2. In this game, nanotechnology originally developed to enrich peoples' lives goes terribly awry and the game player must defeat the wayward nanomachines to save an island nation.



*It's Out:* The narrative involves the accidental release of harmful substances, often due to technological and/or human failure (or with evil intent, tying this to the Dr. Strangelove narrative). The narrative has real roots in the Bhopal catastrophe and the accidents at Chernobyl and Three Mile Island and is used with masterful results in Michael Crichton's new thriller *Prey*, where a swarm of animated nanoparticles gets out of an isolated research lab and threatens humankind. Whether the public considers such occurrences

as aberrations in our highly complex technological society or whether they are becoming what sociologist Charles Perrow once termed “normal accidents” is an open question.

In all these cases, the mediated narrative, though often exaggerated for cinematic effect, links to actual occurrences, increasing its believability. The reach of these narratives is immense. In contrast to *Silent Spring*, which was originally serialized in *The New Yorker* and reached a few hundred thousand readers at best, a film version of *Prey* could easily be seen by 20 million people within the first week of its release (*Spiderman II* exceeded this number in its first three days). Videogames are now played by well over a hundred million people in the United States alone, reaching a prime population cohort between 18 and 35 years of age.



These narratives are played out on the larger cultural stage, which can attenuate or increase their impact and affect their interpretation. Today, the daily headlines and terrorist alerts (Is it orange today?) have large segments of the U.S. population in a state of constant and heightened agitation. Undifferentiated anxiety with no focus is like a gun with no target. We have millions of people who need something to worry about. Their focus will not necessarily be on the benefits of nanotechnology, despite the inherent technological optimism of the American populace. Historically, a sphere of public interest around technology tends to emerge in response to threat more than promise. Most people in our society take the benefits of technological innovation for granted, while the downsides stick in their minds (this is also where the popular press has focused much of its attention in regard to nanotechnology).

To address the risks, we must address the narratives. The scientific community can provide little counterweight to these storylines because the narratives imply failures inherent in our larger society – ethical failures, failures to anticipate, and failures to develop adequate controls for complex technological systems. Corporations are even less capable of changing the storylines than scientists. Recent surveys indicate a low level of trust in business leaders within the nanotechnology industry to protect the public from potential risks. This leaves government. If the public loses faith in government, in the ability of government to regulate and respond effectively to future threats and risks, the enterprise of science is undermined, often in irreparable ways. When the ozone hole burst onto the scene, the science was long over and immediate and coordinated action by the policy community was required. Ditto for a host of other environmental and public health problems.

If nanotechnology fails to live up to its promises, it will be due to a failure of government, not a failure of science. Government can rewrite the narratives or at least change the plot but that requires vision and engagement, not false assurances. The public must believe that effective regulation, technology assessment, and public engagement are part of our science policy, not an afterthought. If the science of nanotechnology outpaces our ability to thoughtfully assess its impacts and ensure public confidence, the next narrative may unfortunately be the same as the last.

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David Rejeski directs the Project on Emerging Nanotechnologies at the Woodrow Wilson International Center for Scholars, a partnership with the Pew Charitable Trusts. He can be reached at: rejeskidw@si.edu