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Memetic Engineering and Public Acceptance

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Current popular perception of nuclear power is characterized as a meme. Recognition of this condition leads to insight regarding the most useful approaches to changing current perceptions. Some current approaches considered to be counter-productive are examined, particularly in the communication of risks regarding low-level radiation exposure.

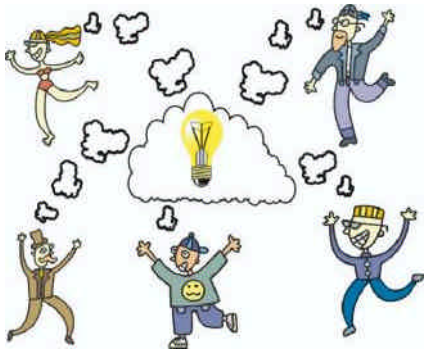
The Nuclear Meme

It is well-recognized that public opposition to nuclear power is largely based upon an irrational response to real or imagined risks. Efforts to alleviate this through education and communication have met with some success, but inevitably encounter a barrier that some have called the "Dread Syndrome": a deep and almost visceral fear initiating an immediate negative response, independent of external stimuli. The response is subconscious, and therefore unlike public concern for many other technologies. A successful approach to dealing with this response will likewise be unlike that used with many other technologies.

Others have written extensively on the origin and evolution of nuclear power's perception problem, as well as the various factors affecting popular risk perception (see, for example: Darby, 1999; Sims, 1990; Morone, 1989). The finger is unanimously pointed at Hiroshima and Nagasaki for introducing nuclear energy as an agent of unprecedented violence and death, bred in secrecy and unleashed without warning. The Cold War perpetuated the public fear and loathing, and in this macabre environment a civilian electric power technology was created.

The decades since then have entrenched matters. The science of nuclear power remains intimidating to the public, the technology remote from common experience, and the public discourse hampered by mutual suspicion. In the latter half of nuclear power's five-decade existence, subconscious response – the Dread Syndrome – has prevailed over rational thought. The public has developed an instinctive mistrust which rapidly amplifies any nuclear accident to spectacular proportions. This is despite their overall infrequency and reduced public health effect, relative to other industrial accidents.

The "deep and almost visceral" nature of this reaction is, as mentioned, independent of external stimuli. It is coded into the sociocultural fabric that modifies behaviour globally. Thus, the words "nuclear", "radiation", and "plutonium" have immediate popular associations, much like the words "Nazism", "atheism", "sex", "Christmas", and "cancer". The anathema "nuclear" often erased from official terminology without technical justification, as in the well-known alteration of "Nuclear Magnetic Resonance Imaging" to simply "Magnetic Resonance Imaging" (Meaney, 1984).



Understanding the basis of the public reaction is key to understanding how to deal with it. The current popular perception of nuclear power can be

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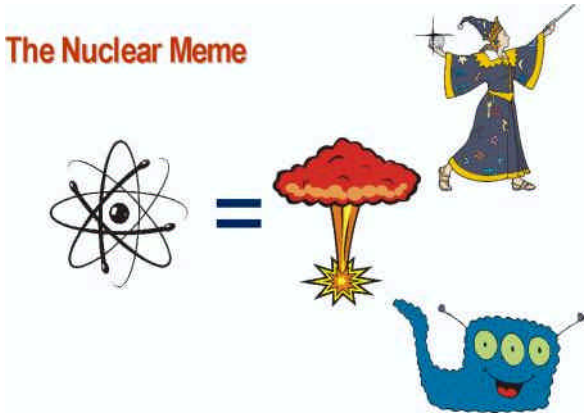
characterized as a "meme". A meme, as coined by Oxford zoologist Richard Dawkins in his 1976 book *The Selfish Gene*, is a fundamental unit of thought that drives cultural evolution, in much the same manner that genes drive biological evolution (Dawkins, 1976). An entire field of "memetics" has developed around this theme (Blackmore, 1999; Bloom, 1997; Brodie, 1995; Lynch, 1999; Rushkoff, 1996).



Nuclear power's perception displays classic memetic traits in that it is contagious, replicating, mutable, and has significantly affected sociocultural evolution since its first "infection" of the collective public consciousness. That it is a particularly strong and resilient meme, and therefore one that experiences increasing rates of growth, is self-evident.

A meme programs its own transmission through its host. Memes propagate through communication – in books, movies, television shows, media reports, songs, paintings, and in simple conversation. As with genes, a meme need not be necessarily "good" to survive; it is sufficient that it be strong and replicate quickly. A meme that satisfies this requirement will tend to appeal to the senses, or reinforce a fundamental desire, instinct, or bias. It will self-generate and spread exponentially, once introduced into a fertile medium.

Memetic replication is infinitely more rapid, of course, than its genetic analog, since the generation time is that of a single thought. This has two implications, both sobering: (1) a single individual can have a profound and rapid effect upon sociocultural evolution in his/her lifetime; and (2) the evolutionary pressure from competing memes is immediate and constant.

A prominent figure in the Canadian and global nuclear community, Dr. W.B. Lewis, recognized the memetic nature of nuclear-phobic sentiments shortly after Dawkins' introduction of the terminology (Lewis, 1978). Lewis was quick to note the superior nature of the nuclear-phobic meme, primarily due to its basis in fear. "Memes for fears," he writes, "gain added strength until they intoxicate the minds of those who indulge them."

Lewis rightly suggested that pro-nuclear memes, while inherently weaker, are worthy of cultivation: contrary to natural pressures, "bad" memes should be actively suppressed in order to preserve a "good" idea. Unfortunately, Lewis offered no insight as to how this might be accomplished, but he took the first step in recognizing the memetic roots of anti-nuclear perception.

What Doesn't Work

Recognition can be liberating. The fact that subconscious nuclear-phobia is robust and self-replicating means that the past is somewhat irrelevant. Nothing practical is achieved in debating the origins of the anti-nuclear meme; it suffices to know that it exists and has a life of its own.

Recognition also leads to an effective discussion of countermeasures. The main reason for the mediocre success of past education and communication efforts is that memes are immune to reason. People do not fear nuclear technology because of rational concern for the health effect of radiation; otherwise there would be widespread enthusiasm to reduce indoor radon concentrations and time spent in the sun. Quite the opposite, despite ample information on the realities of exposure to radon progeny and sunlight, people show little concern. There is, in fact, widespread enthusiasm to conserve energy by tightly sealing residences, and thus increasing radon exposure. Outdoor summer activity has not been curtailed; instead, the population appears content to rationally approach sunlight's dangers with protective lotions and clothing.

When the radiation emanates from a nuclear reactor, however, the response is disproportionately opposite. Unfortunately, therefore, recent initiatives to raise public awareness of the realistic risks of low-level radiation exposure are probably doomed to failure as a mechanism for turning around public opinion. This is simply not the root of public apprehension.

More aggressive is the movement to directly counter the radio-phobic meme with what is essentially a "counter-meme"; namely, the notion that science has proven the zero or positive health effect of exposure to low-level radiation. This virile meme has replicated widely in the pro-nuclear community, for obvious reasons. It reinforces preconceptions based upon years of casual observation, it provides an alluring response to anti-nuclear propaganda, and it is supported (or, more accurately, not contradicted) by a growing body of evidence. The power of this meme drives scientists to proclaim its validity with almost impatient zeal, and to cast aspersions on the scientific integrity of colleagues who speak otherwise (Rockwell, 1997; Pollycove, 1998; Jaworowski, 1999; Higson, 2000).

This effect within the realm of science underscores the potency of memes. In truth, the facts of this matter have not changed the basis for adopting the so-called Linear No-Threshold (LNT) hypothesis in the first place. The LNT concept remains an administrative tool for the practical application of low-level radiation protection policy, in the *absence* of observable evidence for any health effect. Epidemiological studies of ever-increasing statistical power which fail to find evidence of a health effect do not prove the non-existence of a health effect; they only prove that if any effect exists, it is small.

This reality is reflected in the continuing policy of national and international agencies that set radiation protection guidelines, and is espoused by experts in the field (NEA, 1999; Gentner, 1998). Moreover, statistical analysis using the known limits of radiation risk suggest that the likelihood of finding such evidence is small (Goss, 1975).

Beyond the question of scientific accuracy, however, there is valid concern for the likelihood of success of this tactic. Can the radio-phobic meme, replicating in the public consciousness for decades, be turned around by a direct counter-attack? Will a declaration about the harmlessness (or benefit) of low-level radiation, even if scientifically sound, have a noticeable impact on public perception? This does not seem likely, and it is probable that such a declaration would be met with increased suspicion.

Unfortunately, the most obvious result of this internal challenge so far has been to divert attention from practical issues like the disproportionate spending allocated to low-level radiation protection, the misuse of the LNT model for predicting widespread health effects in large populations, and the cost-benefit arguments against the ALARA principle. These are valid issues at the root of nuclear power's economic and public perception woes, and they deserve greater consideration.

What Might Work

If direct, frontal attacks raise concern, one might wonder if an effective tactic against the nuclear-phobia meme even exists. The effort to find one is certainly worthwhile, as long as a compelling argument can continue to be made for the continuation and expansion of nuclear technology (Rhodes, 2000).

A more subtle approach would be to employ the nuclear-phobia meme's own ability to survive and replicate in an indirect campaign against itself. An analogy can be made to genetic engineering ("memetic engineering"), from which strategies may be borrowed .

One example is "meme-splicing" – the insertion of a foreign, but compatible, pro-nuclear meme amongst existing memes known to possess favourable replication characteristics. The controversial topic of Global Climate Change is one such meme, and efforts have been made to include nuclear power in the discussion of amelioration strategies. Unlike the direct approach, which in this case might involve a unilateral declaration of nuclear power's environmental benefits, insertion into the Climate Change "vector" is subtly effective, and no less truthful. Participants otherwise indisposed to accept isolated positive statements about nuclear power, might allow its inclusion in a list of valid strategies.

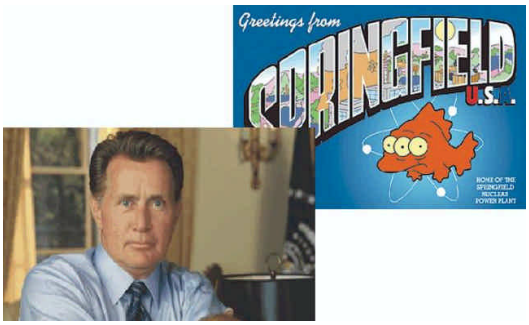
Despite the exclusion of nuclear technology from two key export mechanisms of the Kyoto Protocol (United Nations, 2001), with time it appears that nuclear power might be retained on the agenda.

Much of genetic therapy involves the delivery of "corrected" genes into cells known to contain mutated versions of the same gene. From the viewpoint of public perception, memes involving popular exaggerations of the truth may be considered in this category. For example, that Chernobyl was a horrendous accident caused by foolishness and leading to death, is a truthful meme spread globally. That Chernobyl caused thousands of deaths, is a mutant form of this meme, as is the misconception that the accident could easily happen again anywhere in the world. Candid and factual recognition of Chernobyl's after-effects, however ugly, will avoid leaving a void for the ever-present hyperbole memes to fill.

Likewise, the scientific community should challenge the widely publicized but misguided motives for bringing the so-called "Children of Chernobyl" to North America each year. At the same time, it should be emphasized that a significant health benefit does result from this activity, but one that is probably not related to excess radiation exposure.

Regarding the generic issue of low-level radiation exposure, it is preferable to simply state what is known – that no effects have been observed below a certain exposure level. This is a straightforward and powerful message which all sides of the debate can agree to. People accept the observation-threshold argument for a host of other toxins, because they understand the implications. This avoids asking ordinary people to accept dose-risk models, and concepts of relative risk.

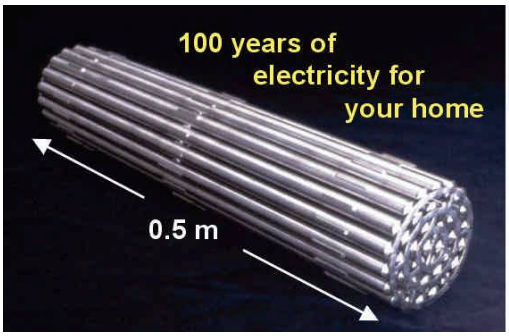
The trick is in the delivery – usually achieved in genetic therapy though the attachment of corrected genes to a modified virus capable of entering cells and integrating its own genetic information with that of the cell's chromosomes. One looks for analogous transport mechanisms in the case of "memetic therapy". Celebrity endorsements and television shows are perfect examples, but probably unrealistic. Well-publicized statements by respected scientific authorities (professors, Nobel laureates, etc.) might suffice. Bumper-stickers have been spreading memes for decades, suggesting another conduit for understated, positive nuclear slogans ("Another Environmentalist for Nuclear Energy" has been used in the past).



The memetic significance of imagery should not be underestimated. A well-rooted meme like nuclear-phobia requires minimal stimuli for proportionally large expression. Thus, although it is tempting to dismiss "Blinky", the three-eyed fish living near the nuclear plant on the FOX TV show "The Simpsons", as harmless humour, the popular resonance of this one image can have long-lasting socio-economic implications. Likewise, much more than entertainment motivated a recent episode of NBC's "The West Wing" involving the crash of a truck bearing uranium fuel. "Memetic Resonance Imaging", if you will, is a fundamental tool of the entertainment and media industry.

In the application of memetic engineering to the nuclear field, the one-on-one approach may be best: for example, nuclear professionals should be encouraged to join environmental groups that reflect shared concerns. The members of such groups are ideal "vectors" for introducing corrected memes about nuclear power into the rest of society. Letters to newspapers, op-ed pieces, and informative websites are other options. This approach is traditionally thought to be less effective than large "market-penetration" campaigns, such as national media advertising, and this is certainly true in the short term. If the memetic model is valid, however, then returns on individual (or fractionated) effort can be

widespread, and ordinary engineers, scientists, students, teacher, etc., become empowered in the field of broad public awareness.



The metaphorical application of genetic therapy to public acceptance of nuclear power is useful for gaining insight into the dilemma, as well as for solving it. We may speak of "causal" versus "susceptible" memes: techno-phobia and feelings of scientific inferiority are precursor memes that make one susceptible to a host of social perceptions, including nuclear-phobia. Increased awareness of science and technology, especially during one's formative education, helps to address this susceptibility.

We may think of "weaker" or "down-regulated" memes requiring higher "expression": most college-level students in the US are known to support nuclear power, but incorrectly perceive that they are in the minority (Howard, 1999). This suggests that an information campaign publicizing the level of support for nuclear power might encourage more people to speak out in its favour.

Summary

It is suggested that "memetic engineering" has a higher potential for success than more direct methods currently practiced. The price is the requirement for more patience, subtlety, and time for implementation. Literal analogs from the world of genetic engineering are naturally impossible, but several insights and strategies are suggested.

The overwhelming benefit of nuclear technology to society justifies continued vigilance in raising its public acceptance level. This may require a renewed approach based on novel or unfamiliar concepts. The underlying theme is *subtlety*: this characterizes the fundamental perception problem, and this must characterize the solution.

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