The Ambivalence of Nuclear Histories

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ABSTRACT

This chapter argues that a discourse of "control," authored by the overlapping narratives of academic proliferation studies and U.S. anti-proliferation policy, has come to dominate our understanding of nuclear histories. This discourse, with its primary purpose of seeking to predict which countries are likely to build nuclear weapons and thereby to threaten the prevailing military-strategic status quo, has narrowed the gaze of nuclear historians. Among its effects has been to *minimize* the importance of the discovery of atomic fission as a "world historical" event and to *impoverish* our recognition of the fluidity of international affairs in the decade following the end of the Second World War. This chapter concerns the tendency to see nuclear histories as, above all, *national* histories and to privilege concerns about the development of nuclear *weapons* over a fuller and more nuanced understanding of what nuclear *programs* mean and why they matter. Paying attention to the scientific-technological underpinnings of nuclear programs offers an alternative path, opening up new archives and insights into the making of "national" nuclear programs that might have important other, even nonbelligerent, ends. This chapter points to the varieties and importance of international collaboration in the making of "national" programs, and shows how weapons building is by no means a universal end of all nuclear programs.

"GOING" NUCLEAR

There can be little disagreement that the development and use of nuclear weapons by the United States in 1945 changed the nature of the international system, and the academic study of international relations, fundamentally.[1] Even though the firebombing of Tokyo using conventional munitions a few months before the nuclear destruction of Hiroshima and Nagasaki may have been approximately on the same scale in terms of destruction to place, property, and persons, from the moment of their first use there was near universal appreciation of the massive destructive power of these new weapons.[2] The first thermonuclear tests, eight years later, only strengthened this feeling, especially as they were conducted aboveground with relatively large numbers of onlookers. The complete disintegration of an entire Pacific island from the test of a hydrogen bomb and the widely reported death of a Japanese crew member from radioactive

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[1] Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca, 1989).

[2] Richard Rhodes, *The Making of the Atomic Bomb* (New York, 1986), 599, 734, 740–1.

exposure on the unfortunate tuna boat *Lucky Dragon Five* made it vividly clear that the world had never seen the destructive equal of this class of weapon. Reflecting the new awareness was nuclear strategist Bernard Brodie's pithy assertion that "[t]hus far the chief purpose of our military establishment has been to win wars. From now on its chief purpose must be to prevent them. It can have almost no other useful purpose."[3]

In January 1946, the young United Nations created an Atomic Energy Commission. A few months later, members made the first proposals seeking collectively to manage the spread of fissile materials and nuclear weapons. The U.S. proposals (the Acheson-Lilienthal/Baruch plans) were soon followed by the Soviet response presented by Andrei A. Gromyko. The former sought to create an international body that would control fissionable materials, the latter to ban the "stockpiling, production and use" of nuclear weapons altogether.[4] As early as 1950, there was debate at the highest level of the U.S. government on whether the conflict in Korea justified the use of nuclear weapons.[5] In other words, within the first decade of the start of the nuclear age, questions of international control and the potential use of nuclear weapons were openly considered and debated. Fifty years later, these two themes—control and use—are still very much with us, marking an ongoing and widespread concern with the *ends* of nuclear programs. What is surprising, however, is how little agreement exists on a foundational question we might have thought would precede a discussion of ends: Why do states develop nuclear weapons in the first place?

Political scientist Scott Sagan offers us the most comprehensive statement on why states "go" nuclear.[6] Sagan posits that there are three primary models explaining nuclear acquisition: a "security," or realist, model, which argues that states build weapons for security and because others do; a "domestic politics" model, which sees nuclear weapons development as the outcome of actions by powerful coalitions within states that seek institutional power via this end; and, finally, a "norms" model, which argues that "weapons acquisition, or restraint in weapons development, provides an important normative symbol of the state's modernity and identity."[7] Sagan's article argues in conclusion that both "[n]uclear weapons proliferation and nuclear restraint have occurred in the past, and can occur in the future, for more than one reason: *different historical cases are best explained by different causal models.*"[8] In an important rejoinder to positivist approaches to international relations, Sagan argues that parsimony in explanation is unlikely to grasp the full range of the "proliferation" problem, a conclusion with important policy implications.

This is an important finding, but it may leave other scholars of nuclear affairs a little puzzled about its significance. Scholars of foreign policy, national security strategy,

[3] Bernard Brodie, ed., *The Absolute Weapon: Atomic Power and World Order* (New York, 1946), 76, cited in Jervis, *Meaning of the Nuclear Revolution* (cit. n. 1), 7.

[4] David Holloway, *Stalin and the Bomb: The Soviet Union and Atomic Energy, 1939–1956* (New Haven, 1994), 154–66, on 161.

[5] John Lewis Gaddis, *What We Now Know: Rethinking Cold War History* (New York, 1997), 103–7.

[6] Scott D. Sagan, "Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb," *International Security* 21 (Winter 1996/97): 73–85. See also Stephen M. Meyer, *The Dynamics of Nuclear Proliferation* (Chicago, 1984); Bradley A. Thayer, "The Causes of Nuclear Proliferation and the Utility of the Nuclear Non-Proliferation Regime," *Security Studies* 4 (1995): 463–519; Tanya Ogilvie-White, "Is There a Theory of Nuclear Proliferation?" *Nonproliferation Review* 4 (Fall 1996): 43–60.

[7] Sagan, "Why Do States Build Nuclear Weapons?" (cit. n. 6), 55. It should be noted that Sagan uses the term "norms" in three distinct ways: as an ideational-symbolic form, as a form of international mimicry, and as a reflexive constraint on autonomous actions.

[8] Ibid., 85 (my italics).

and international relations have long identified the moment states "go" nuclear—a techno-political event involving the planned (and hopefully controlled) explosive release of nuclear energy—as a moment of the greatest importance. Whether identified as a "bomb," a "test," a "peaceful nuclear explosion," or a "demonstration," this event is of primary significance in setting analytic calendars in these fields as it is seen to mark the unambiguous moment when a country has crossed over a particular set of political and technological boundaries. The nuclear explosion is taken to mark a shift in the international distribution of power, leading to new scales of international threat and casting into question existing regimes of nuclear control. It is easy to see why, for realist analysts of foreign policy and for governmental policy makers, this event matters.

However, is trying to understand why countries conduct their first nuclear tests the same as explaining why countries begin nuclear programs? By identifying the first nuclear test as the moment when a threshold has been crossed—the historic moment—analysts have effectively reduced the variety of histories of any nuclear program to the path that led to this particular outcome. The multiple meanings of nuclear power are shrunk into one register—the desire to produce weapons—an analytic shortcoming with both real world and conceptual implications. From a practical standpoint, this approach highlights the prevailing bias that countries seeking to develop nuclear weapons are of primary interest to scholars, thereby conflating scholarly interests with those of policy makers who necessarily have to be worried about new weapons. Taking this assumption as a starting point reinforces the particular aura of nuclear weapons as objects to be coveted and desired, the very opposite effect sought by policy makers concerned with nuclear proliferation.

The intent of this chapter is threefold. First is to explore how the language of nuclear "control"[9] has helped to narrow our analytic vision. Due to the substantial overlap of two streams of analysis[10]—academic studies of nuclear proliferation and U.S. anti-proliferation policy measures seeking to reduce the spread of nuclear weapons worldwide—a discourse of "control" has come to dominate our understanding of nuclear issues. By examining two key concepts in nuclear proliferation studies, we come to realize how a singular focus on a single techno-political event, the nuclear explosion, distorts our understanding of the course of nuclear programs; an alternative approach is suggested. Second, to set the study of nuclear histories on a more productive path, this approach draws on a concept derived from colonial discourse studies—ambivalence—to show that there are remarkable and largely unacknowledged similarities between all the "early" nuclear states. Finally, this paper argues that nuclear programs are best understood as one of a larger family of public technology projects, not all of which are weapons related or have destructive ends. The larger point here is to propose that without a careful appreciation of the political and historical context within which decisions are made to develop nuclear *programs,* it is not possible to get closer to understanding the desire for, likelihood of potential use of, and possibility of international control of nuclear *weapons.*

[9] Using "control" rather than the more common "proliferation" reflects our understanding of proliferation as "political language." "Proliferation" indexes an international-legal discourse in which five countries are given a special status as "nuclear weapon states" and the intent of the law is to prevent other states from acquiring the same *de jure* status. For other examples, see Murray Edelman, *Political Language: Words That Succeed and Policies That Fail* (New York, 1977).

[10] Steve Smith, "The United States and the Discipline of International Relations: 'Hegemonic Country, Hegemonic Discipline,'" *International Studies Review* 4 (Summer 2002): 67–85.

OPACITY, AMBIGUITY, AND INDIA'S "PEACEFUL NUCLEAR EXPLOSION"

The centrality and, by extension, the limits of the first nuclear test in analytically determining the "true" course of a country's nuclear program is best appreciated by considering two concepts central to proliferation studies: ambiguity and opacity. India tested a "peaceful nuclear explosion" (PNE) in 1974. The PNE was officially termed a "demonstration," a word that recurs in Indian technological history.[11] Once India had tested, based on the experience of every other country that had conducted a nuclear test since 1945, it could be considered a nuclear power. But was it? India "did nothing" for the next twenty-four years, that is, it didn't test again or overtly weaponize until 1998. This "expected absence" came to be called a state of "nuclear ambiguity."

Nuclear ambiguity is usually defined as uncertainty in the presence of suspicion about the existence of a nuclear weapons program. However, the term "nuclear ambiguity," as Frankel and Cohen point, out "is [itself] ambiguous": it could either mean a lack of clarity on the part of others' knowledge of the extent and abilities of a country's nuclear program—do they have a weapons program or not?—or could mean a multiplicity of views on the part of a country's leadership about the utility, efficacy, and morality of nuclear weapons possession.[12] The conceptual weakness of this term is clear when we realize that when taken to the limit, all nuclear-capable countries could be said to be in a state of ambiguity until they explode a nuclear device. Ambiguity, however, is to be distinguished from "opacity."

Avner Cohen defines opacity as a "situation in which the existence of a state's nuclear weapons has not been acknowledged by the state's leaders, but in which the evidence for the weapons' existence is strong enough to influence other nations' perceptions and actions."[13] The best example of this case is Israel, which has not officially declared its possession of nuclear weapons but has institutionalized opacity at the highest level of national strategy. Ambiguity, in other words, is about uncertainty and lack of knowledge for the outsider; by this definition, so is opacity, but here the uncertainty is "actionable" from a policy point of view.

Opacity can be understood variously as the outcome of (a) indecision at the highest levels of political decision-making (e.g., India), (b) a deliberate strategy of information denial (e.g., Israel), or (c) an effort to finesse executive authority via calculated deception by a government agency or coalition of agencies (e.g., Fourth Republic France). Nuclear opacity on both sides of a dyadic rivalry might even lead to an equilibrium state of mutual tacit (nuclear) deterrence (e.g., India and Pakistan from the late 1980s). We realize that the only possible resolutions to this uncertainty are a nuclear explosion or the public dismantling of the program, à la South Africa. Given the small likelihood of the latter in most cases, ambiguity and opacity become threshold terms describing a liminal stage between intention and a yet-to-happen event, the long moment between the Fall and the Second Coming. In the case of nuclear ambiguity, a nuclear test is taken to mean that the technical means to do so has been converted

[11] That a techno-political event is only a "demonstration" is an official hedge. It should be taken to mean a technical capability to do something that (a) stops short of defining national policy and (b) provides cover to the technologists in case of failure. Central to the meaning of the word are the various audiences—domestic and foreign—who are presumed to be seeking unambiguous meaning from this event.

[12] Avner Cohen and Benjamin Frankel, "Opaque Nuclear Proliferation," in *Opaque Nuclear Proliferation: Methodological and Policy Implications,* ed. Benjamin Frankel (London, 1991), 14–44.

[13] Avner Cohen, *Israel and the Bomb* (New York, 1998), ix.

into formal ability—whether expected by analysts or not; in the case of opacity, a test is taken to show that the decision has been made to "come out of the nuclear closet" and openly declare a nuclear power. Given these shades of meaning, there is little surprise that analysts turn to the material proof of a nuclear test to confirm their concerns about the direction of a country's nuclear program; by the same token, once a test has taken place ambiguity and opacity are no longer meaningful categories.

The narrowing of vision embodied in these terms, built around the expectation that an explosion is inevitable and forthcoming, reinforces the idea of how limited the purposes and meaning of a nuclear program are assumed to be and how devalued is the importance of the political processes that ultimately make these decisions. Yet if it is important to establish when a country has decided to develop nuclear weapons, the moment of a nuclear explosion is convenient but may not necessarily be meaningful. If the counterexample of Israel—a country recognized as having a nuclear weapons program but which has never openly tested a nuclear device—is not sufficient, and we seek to establish whether a country has a "real" nuclear weapons program, an alternative approach might be based on a closer examination of the technical means to nuclear explosive potential. Under this approach, however, the evidence of a single test is neither necessary nor sufficient.

It is not unreasonable to think of a country's first nuclear test explosion as very much an experiment, with all the uncertainties that term implies. Although the feasibility of the fission process has been known for more than half a century, setting off a first explosive device anywhere is still an act of scientific ability, combined with considerable engineering skills, involving trial and error, chance and luck—and not inconsiderable means. To successfully produce a single nuclear explosive device requires, at the minimum, the following expertise: mathematical and statistical modeling skills, the means to obtain sufficient amounts of fissile material, sophisticated materials handling abilities, expertise in conventional explosives, electronics and instrumentation abilities, and the organizational skills to bring all these different elements together effectively. Needed also are adequate finances and a place to explode the device.

However, for this first test to translate into a weapons program and a nuclear arsenal that can be used at will, two things must happen. First, a political decision to proceed has to be made, and second, ad hoc scientific procedures have to be replaced with an organized, ends-oriented technological process. The technologization of the nuclear explosive building process is a discrete step necessary to convert a latent scientific ability to make nuclear explosives into a tangible and reliable process. Every step of the process—fissile material extraction, weapon design and testing, and delivery—has to be converted into an industrial process, built around repetition, with uncertainty minimized, in which laboratory practices are converted into industrial routines, and safety codes and internal security practices are regularized and institutionalized. It may not always be possible for the same organization that produced the first explosive device as a one-off scientific event to industrialize the process. Certainly, new forms of industrial and organizational management have to be employed and the process routinized sufficiently to reduce levels of error to those at which the explosive device meets the standards of military reliability. In other words, if you want to build a reliable nuclear weapons program, a number of tangible, material, organizational objectives have to be put into place, and these can be observed.

How do these clarifications help us better understand India's nuclear history?

Volumes have been written about the 1998 tests, seeking above all to explain why India did what it did, when it did.[14] To many, the still unresolved question is why, following the 1974 PNE, India did "nothing" until 1998, when it set off five more explosions and proclaimed itself a nuclear power. Of course, India didn't actually "do nothing" for twenty-four years. Under five different prime ministers, a very high-level and public debate went on about the larger purpose of the country's nuclear program, the costs of nuclear power versus other sources of energy, the threat to the world from nuclear weapons, the likelihood of global and limited disarmament, the significance and implications of the Non-Proliferation and Comprehensive Test Ban treaties, and finally, whether to build a nuclear weapons arsenal.[15] In 1998, a newly elected government, operating in great secrecy, and, as in 1974, ahead of a political consensus that this was necessary for India's security, decided India should "go" nuclear. It should be noted, however, that this decision was by no means predetermined, nor are 1974 and 1998 necessarily the dates that best reflect the changed status of India's nuclear capabilities.

Based on the technological criteria referred to above, India probably became a nuclear "power" around 1986, when Rajiv Gandhi was prime minister. From this point onward, India was certainly capable of using nuclear weapons in war and could be considered to have an effective, if crude, nuclear deterrent capability vis-à-vis Pakistan.[16] Considerable evidence now exists that there were at least two attempts to test before 1998, though these were stymied by internal political disagreements and U.S. pressure.[17] Certainly, India's nuclear scientific establishment had been keen to push ahead with more tests for some time, but the political leaders had not made up their minds about the value of doing so. It was not until the ascent to power of the right-wing Bharatiya Janata Party (BJP), a radically new political dispensation in government, that the political decision to "out" India's capabilities was reached, well after conditions on the ground existed. While the decision to test again was the outcome of particular political changes, the siren song of a nationalist government finally in power, for all practical purposes India was already a nuclear power. Previous governments, quite unlike the BJP nationalists ideologically, had ensured that India had converted a latent ability into a viable weapons option a decade before. Crossing the test threshold, however, was symbolically significant *as it sought to signal identity with dominant international norms of nuclear meaning.*

In other words, I argue that framing the decision behind the May 1998 tests was

[14] Most important, Praful Bidwai and Achin Vanaik, *South Asia on a Short Fuse* (Delhi, 2000); M. V. Ramana and C. Rammanohar Reddy, eds., *Prisoners of the Nuclear Dream* (Delhi, 2002); George Perkovich, *India's Nuclear Bomb* (Berkeley, 1999); Raj Chengappa, *Weapons of Peace: The Secret Story of India's Quest to be a Nuclear Power* (Delhi, 2000).

[15] Perkovich, *India's Nuclear Bomb* (cit. n. 14), 226–433.

[16] Chengappa, *Weapons of Peace,* 291–305; Perkovich, *India's Nuclear Bomb,* 293–9. (Both cit. n. 14.) Both countries recognized each other's nuclear capabilities no later than December 1988. This date marks the signing of the first bilateral agreement between India and Pakistan not to attack each other's nuclear facilities.

[17] Ashok Kapur in *Pokhran and Beyond* (Delhi, 2002) asserts that Indira Gandhi wanted to test in 1982, but as Perkovich notes, other than the formal request by the nuclear scientists, the rest of the story (Gandhi's agreement to go ahead that was rescinded after twenty-four hours) has never been fully corroborated. *India's Nuclear Bomb* (cit. n. 14), 242–4. More reliably, Raj Chengappa in *Weapons of Peace* (cit. n. 14), 390–5, reports that in 1995 Prime Minister Narasimha Rao ordered a series of tests that were canceled following internal disagreements and U.S. pressure. Of his two successors, Atal Behari Vajpayee also ordered tests, but his government fell in thirteen days, while H. D. Deve Gowda felt that other matters were more pressing than nuclear tests, even though the test site was ready and explosives were in place. Perkovich, *India's Nuclear Bomb,* 375–6.

the desire to reduce the multiple meanings of a "peaceful" nuclear program, to force nuclear ambivalence into a more familiar register. The desire to discipline these excesses of meaning—via nuclear explosions—comes from the intersection of the discourse of control with that of the domestic nuclear scientist seeking "sweet" solutions, more resources, and intellectual bravura in the name of national pride. Each nuclear explosion sought to reduce further the range of meanings of the Indian nuclear program, bringing it closer into line with received interpretations of what a "typical" nuclear program does. In its rejection of postcolonial difference, this event mimicked the simultaneous transformation of India's unique state-led economic development model into a more familiar path, the now orthodox global model of neoliberal, private sector–led economic growth.

NUCLEAR AMBIVALENCE

However, even once a state has "gone" nuclear, seemingly setting to rest doubts whether it is a proliferator, the meaning of what has emerged continues to be unstable. Are these weapons for deterrence, for waging war, for arms control? Do they work? Earlier meanings of the nuclear revolution—atoms for peace and for electricity—do not disappear; they can even gather new force. In what follows, we see the expression of ambivalence in more than one setting, seemingly in contradictory fashion, but only if we consider the expression of polysemic forms a violation of our preferred epistemology.

Scholarly interest in weapons production is usually located within a conceptual framework that isolates the nuclear industry from the larger political economy of the state—occluding the family resemblances of a class of modern technologies both destructive and nondestructive—and that prevents us from appreciating the flow of ideas, rules, procedures, and techniques between the nuclear industry and the rest of the state apparatus.[18] This tendency to isolate individual states and to examine their unique motives for going nuclear prevents us from giving due importance to the varieties of international collaboration that were common and indispensable to all early developers of nuclear programs (and which, by extension, gives us another history of nuclearism). Focusing on the reasons behind the acquisition of nuclear weapons reduces the number of cases that might be part of our analytic universe by focusing primarily on the bomb makers. It also reduces the search for the multiple factors that influence why countries develop nuclear programs by narrowing analytic gaze to the causes underlying weapons acquisition.[19] Putting these together, one can appreciate why there is still little agreement on the far more vexing question of why countries that could "go" nuclear *don't* or, as suggested below, appear not to.

Rather than forcing the analysis down one path exclusively, I prefer to use the term "ambivalence" to discuss the nuclear condition, in order to highlight the simultaneous presence of more than one meaning of nuclear practices, whether during the stage of ambiguity, before, or after. Ambivalence is a permanent feature of the nuclear

[18] One example of these flows is the adoption of highly restrictive procedures originally developed for the Manhattan Project to guard institutional secrets in a variety of settings quite removed from U.S. national security. See Daniel Patrick Moynihan, *Secrecy: The American Experience* (New Haven, 1998), 154–77.

[19] This issue is explicitly recognized but not fully addressed in Benjamin Frankel and Zachary S. Davis, "Nuclear Weapons Proliferation: Theory and Policy," in *The Proliferation Puzzle: Why Nuclear Weapons Spread (And What Results),* ed. Zachary S. Davis and Benjamin Frankel (London, 1993), 2.

condition, not simply a question of narrow political choice. This semantic excess is not a sign of conceptual weakness, but a recognition of the inability to wholly control the meaning of nuclear events. As the postcolonial cultural critic Homi K. Bhabha puts it (in the context of colonial discourse), ambivalence does not emerge from "the contestation of contradictories [or] the antagonism of dialectical opposition."[20] Ambivalence is rather a "splitting" of discourse, a denial of the possibility of either one or the other side of familiar binaries (e.g., security/insecurity, war/peace), resulting in "multiple and contradictory belief"; splitting is a "strategy for articulating contradictory and co-eval statements of belief."[21] The "strategy" of ambivalence, as Bhabha uses it, is not an instrument of policy under the control of the proliferating state, to be used to deceive or confuse, but rather an effect of the inability of discourse to fix itself unambiguously on one or another nuclear meaning. "Splitting" the discourse of nuclear control is crucial if we are to open up calcified nuclear histories to see what else they can tell us.

One way of doing this is by closer examination of two related and familiar thematics[22] in the telling of nuclear histories: nuclear programs as *national* programs, and the choice of *either destructive or peaceful ends* as natural objectives of all nuclear programs. By demonstrating that no national program can claim to be truly so, and by showing that both war and peace are always present in the meanings attributed to nuclear programs, the discussion opens up nuclear history to explore its intimate relation with the state project of legitimacy in the modern era.

ORIGINS

One of the most enduring tropes of nuclear histories is the idea that atomic energy programs are always *national* programs. The close relation between nuclear power and national power has led to the assumption that, for reasons of security especially, nuclear programs must be uniquely identified with particular countries. Official histories and scientists encourage this belief, for obvious parochial reasons, but it is rarely true. No atomic program anywhere in the world has ever been purely indigenous, nor is it sensible to attribute singular national origins to the scientific efforts to create nuclear fission in laboratories. Given the continental scale of nuclear physics research in prewar years, when scientists from a dozen countries worked together in four or five different countries, it is difficult, and indeed intellectually pointless, to attribute either origins or original successes to one country over another. The scientific importance of nuclear-related discoveries all through the 1930s, in England, in Italy, in Soviet Russia, in Denmark, and in Germany, which culminated in the discovery of nuclear fission by Otto Hahn and Fritz Strassman in December 1938 (published in 1939), guaranteed a wide interest in the latest news from nuclear physics among physicists around the world.[23]

The first effort to create a "national" atomic energy program, the U.S. atomic en-

[20] Homi K. Bhabha, *The Location of Culture* (London, 1994), 131.

[21] Ibid., 132

[22] Another amazing parallel across practically all national narratives of nuclear energy (not developed here) is the figure of the "Father of the [put country name here] Nuclear Program"—a male scientist-bureaucrat-politician who is able to achieve great success in all three domains.

[23] See Atomic Scientists of Chicago, *The Atomic Bomb: Facts and Implications* (Chicago, 1946), 18, for a list of the key publications announcing the discovery of fission and the diverse nationalities of their authors.

ergy bomb project, was inherently a multinational project, with important contributions from British, Canadian, French, and Italian scientists, not to mention the extensive efforts of expatriate German refugees.[24] The Canadian and British atomic energy projects, the latter of which began with the loan of French uranium oxide, derived some of their legitimacy and expertise from experiences gained in the multinational U.S. program. John Lewis and Xue Litai remind us that Chinese scientists worked with Max Born in Edinburgh, in the Joliot-Curies' lab in Paris, and at Pasadena's Jet Propulsion Lab during the war years and, after returning to China, helped build the Chinese nuclear program.[25] The Chinese program began with Soviet help, and scores of Chinese engineers were trained in the schools and labs of the Soviet Union before relations between the two countries broke down. In the early years of their program, the French approached both the Norwegians and the Canadians for help.[26] The Soviet program was built largely through the indigenous efforts of Russian scientists, supplemented by the clandestine work of British and American spies working in the U.S. program.[27] The Norwegians supplied the Israeli program with heavy water and worked closely with the French and the Swedes in the early postwar years and later with the Dutch, a relationship that would lead to the formation of the European nuclear consortium, Urenco, in 1970.[28] The Israeli program was closely tied to the French and Norwegian efforts,[29] and all this before the formation of the International Atomic Energy Agency and a legal regime governing multilateral traffic in nuclear knowledge and materials. It cannot be denied that to some extent international collaboration, especially for the French, was a self-help strategy driven by the legal exclusions of the postwar American nuclear program, notwithstanding the many contributions of non-Americans in its creation.[30]

In 1951, India and France signed an agreement to collaborate, but the agreement did not lead to much by way of practical accomplishments. A few years later, India's nuclear scientists, facing increasing political pressure at home for their lack of manifest achievements, turned, at Sir John Cockcroft's suggestion, to a British swimming pool reactor design that had been published in the trade magazine *Nucleonics.* In addition to design and engineering details, enriched uranium fuel rods were also supplied by the United Kingdom.[31] India's second reactor, the CIRUS (Canada-India-U.S.), was based on a Canadian design, moderated by heavy water supplied by the U.S. Atomic Energy Commission. In India, however, this multinational history would remain largely invisible. At the inauguration of the swimming pool reactor Apsara in January 1957, Nehru would say:

> We are told, and I am prepared to believe it on Dr. [Homi Jehangir] Bhabha's word, that this is the first atomic reactor in Asia, except possibly [in] the Soviet areas. In this sense,

[24] Rhodes, *Making of the Atomic Bomb* (cit. n. 2).
[25] John Wilson Lewis and Xue Litai, *China Builds the Bomb* (Stanford, 1988), 44–5
[26] Lawrence S. Scheinman, *Atomic Energy Policy in France Under the Fourth Republic* (Princeton, 1965).
[27] Holloway, *Stalin and the Bomb* (cit. n. 4).
[28] Astrid Forland, "Norway's Nuclear Odyssey: From Optimistic Proponent to Nonproliferator," *The Nonproliferation Review* 4 (Winter 1997): 1–16.
[29] Cohen, *Israel and the Bomb* (cit. n. 13).
[30] Margaret Gowing, *Independence and Deterrence,* vol. 1, *Policy Making* (New York, 1974).
[31] Itty Abraham, *Making of the Indian Atomic Bomb: Science, Secrecy, and the Postcolonial State* (London, 1998), 84–5.

> this represents a certain historic moment in India and in Asia. . . . We are not reluctant in the slightest degree to take advice and help from other countries. We are grateful to them for the help which they have given—and which we hope to get in future—because of their longer experience. *But it is to be remembered that this Swimming Pool reactor in front of you is the work, almost entirely, of our young Indian scientists and builders.*[32]

A local product, in other words, "almost entirely." The Indian Atomic Energy Commission press release following reactor criticality had Cockcroft grumbling to his colleagues, "Did you see the press release from Delhi? . . . [This characterization of India's achievement] seems rather ungracious in view of the advice and help we have given and are asked to give. Presumably, detailed plant designs and drawings do not constitute outside help!"[33] Why was it so important to insist on the purely national origins of atomic energy?

Modern technology, especially in the postcolony, was always marked with the trace of the foreign. Yet true independence required self-reliance and indigeneity, especially in relation to technology. Seeking approval to set up an atomic energy commission in 1948, Nehru would remind the Constituent Assembly of India that in spite of "its many virtues," India had become a "backward" country and "a slave country" because it had missed earlier technological revolutions, namely those of steam and electricity.[34] This approach defined technological achievement as one of the primary meanings of national independence and elevated the idea of self-reliance to the highest levels of national strategy. In spite of this considerable ideological need for the local and the indigenous, India's large technological projects were almost always the outcome of international collaboration, exchange, aid, and technology transfer. Recognizing the limits of Indian resources and means, Nehru turned to the world for help in building modern India. No matter what the public thought, or was told, the technology being harnessed to transform India was almost always produced in collaboration with foreign countries. No cold war blocs here—the Soviet Union, the United Kingdom, France, West Germany, Poland, and the United States all contributed directly to the building of independent India's dams, steel mills, fertilizer factories, engineering colleges, and cities. Atomic energy was no exception. Even considering that this was the one technology that, given the overwhelming concern with security, one might have expected to be the most privileged and restricted—in a word, nationalized—the Indian atomic energy project was from the outset built in collaboration with multiple foreign partners.

ENDS

Those responsible for the Indian nuclear program had long been aware of the possibility of atomic energy being used to build weapons. In yet another example of the intertwined histories of nuclearization across many sites, we find that both Indian and Soviet scientists became aware of the Manhattan Project before Hiroshima.

David Holloway, in his authoritative study of the Soviet nuclear program, writes:

[32] Nehru, "Apsara," from *Jawaharlal Nehru's Speeches,* vol. 3, *March 1953–August 1957* (Delhi, 1958), 504–5.

[33] Internal memo, n.d., File AB6/1250, Public Records Office, U.K.

[34] *Constituent Assembly of India (Legislative) Debates,* 2nd sess., vol. 5 (Delhi, 1948), 3319–20.

> Early in 1942 Lieutenant [nuclear physicist Georgii] Flerov's unit was stationed in Voronezh, close to the front line. The university in Voronezh had been evacuated, but the library was still there. "The American physics journals, in spite of the war, were in the library and they above all interested me," Flerov wrote later. "In them I hoped to look through the latest papers on the fission of uranium, to find references to our work on spontaneous fission." When Flerov looked through the journals he found that not only had there been no response to the discovery that he and [Konstantin] Petrzhak had made, but that there were no articles on nuclear fission [at all]. Nor did it seem that the leading nuclear physicists [in the West] had switched to other lines of research, for they too were missing from the journals.[35]

Flerov, Holloway reports, concluded that "the Americans were working to build a nuclear weapon."[36] The story told by Flerov, of the "dog that didn't bark," finds an uncanny parallel in India. Govind Swarup, the radio astronomer, reported in an interview some years ago that Homi Jehangir Bhabha, a Cambridge-trained physicist who would become the founder of the Indian nuclear program, had told him that, by 1944, Bhabha, too, had become convinced that the Americans had started a nuclear weapons program.[37] Bhabha's reasoning was similar to Flerov's. He had been in close contact with a number of physicists around the world, largely by letter, through the war years, when he was stuck in India, unable to travel. Letters from colleagues in the United States, always slow because of distance, and made worse by the war, had practically dried up by 1943. Bhabha thought little of it at the time, assuming that the obvious reasons, distance and war, had slowed his mail down. In 1944, still not having heard from his colleagues in spite of a number of letters written by him, Bhabha sat down and made a list of the people who would be likely candidates for a nuclear program. He then made a list of his silent correspondents—the two lists were almost exactly the same.

The near-simultaneous realization by Flerov and Bhabha (and undoubtedly others) that the United States was engaged in a highly secret process to build an atomic weapon should come as no surprise. The potential military implications of these discoveries were also no secret to anyone who had a basic understanding of the fission process, though there was less than unanimity on the exact outcome of a process of nuclear fission.[38] The nuclear physics community in the interwar years was small, close-knit, and multinational. New discoveries were emerging from a relatively small numbers of labs in Europe and the United States and communicated immediately via letter and travel to a transnational epistemic community that eagerly discussed the implications of each new finding.[39]

In the unsettled first decade after Hiroshima, with Europe divided and a hot war breaking out in Korea, many feared that nuclear weapons would be used again. The horror of nuclear weapons led the UN General Assembly to express its "earnest desire," in a resolution introduced by India in 1953, to urge the "Powers principally involved" to sit down and thrash out a means to "eliminate and prohibit" weapons of

[35] Holloway, *Stalin and the Bomb* (cit. n. 4), 78.
[36] Ibid., 48.
[37] Govind Swarup, interview by author, Washington, D.C., Oct. 15, 1995.
[38] Spencer R. Weart, *Nuclear Fear: A History of Images* (Cambridge, Mass., 1988), 77–102.
[39] Daniel J. Kevles, *The Physicists: The History of a Scientific Community in Modern America* (1971; repr., Cambridge, Mass., 1995), 200–86.

"war and mass destruction." Lester Pearson, the influential foreign minister of Canada, spoke for many when he noted: "A third world war accompanied by the possible devastation by new atomic and chemical weapons would destroy civilization."[40] The need to restrain the superpowers, seeing them as the primary source of world insecurity, became for many, aligned and nonaligned alike, the driving consideration of international affairs in the 1950s.

The use of nuclear weapons in Japan had a considerable impact on Indian elites. Mahatma Gandhi, of course, denounced it in no uncertain terms. Responding in typical fashion to the suggestion that atomic weapons were so horrific that they would end war, he wrote:

> This is like a man glutting himself with dainties to the point of nausea and turning away from them only to return after the effect of nausea is well over. Precisely in the same manner will the world return to violence with renewed zeal after the effect of disgust is worn out. . . . The atom bomb . . . destroy[ed] the soul of Japan. What has happened to the soul of the destroying nation is yet too early to see . . . A slaveholder cannot hold a slave without putting himself or his deputy in the cage holding the slave.[41]

The widespread public revulsion against nuclear weapons, especially once the effects of the hydrogen bomb became more widely known, and a desperate need to consider new roads to international peace and development helped shift the discourse around nuclear power. Only a short decade after average Americans polled in a 1946 survey glumly confirmed that "atomic energy means the atomic bomb,"[42] the combination of Atoms for Peace (1953), the first UN-sponsored conference on the peaceful uses of nuclear energy (1955), the Plowshares project, an effort to develop peaceful uses of nuclear explosions, and international competition in the sale of nuclear reactors broke the link between nuclear power and nuclear weapons, at least temporarily. What we should be surprised about is in spite of the intense and repeated association of the nuclear revolution with the use of ever-greater forces of destruction, a divergent but parallel discourse of nuclear power for development and economic growth did emerge. While few questioned the nostrum that the nature of war was now substantially altered as a result of the destructive potential of these weapons, weapons acquisition did not become the only or even primary consideration for countries now facing the real possibility of a global holocaust.

Even countries that began nuclear programs with an explicit intent to develop nuclear weapons, the United States and the Soviet Union in particular, sought to expand the scope of these programs beyond narrowly defined military ends after the war. In both cases, "civilian" technologies were borrowed directly from the military effort. The transfer of technology from the U.S. nuclear submarine project led to the building of civilian, private sector, light water reactors, while Soviet electric power reactors were based on designs taken from a military reactor designed to maximize the availability of plutonium. Not surprisingly, these new civilian programs struggled with their redefinition due to the weight of existing popular sentiments about the destructiveness of atomic power. In David Nye's discussion of the American "techno-

[40] Quoted in Nehru, "The Hydrogen Bomb," in *Speeches* (cit. n. 32), 248.

[41] Mohandas Karamchand Gandhi, "The Atom Bomb, America, and Japan," originally published in *Harijan,* July 7, 1946. Reprinted in *The Gandhi Reader: A Source Book of His Life and Writings,* ed. Homer A. Jack (New York, 1956), 349–50.

[42] Weart, *Nuclear Fear* (cit. n. 37),162.

logical sublime," he develops a genealogy of American technological development that links the U.S. space program with the nuclear program. Nye notes dryly that "[c]onvincing the public that atomic energy was friendly proved difficult, but the space program was popular."[43]

To make the difficult case that nuclear power could be used for peaceful ends, it was necessary to utilize the discursive mediation of other modern technological marvels. Spencer Weart reminds us of some of the remarkable possibilities offered by the peaceful use of atomic power, including "new lands flowing with milk and honey," transforming Africa into "another Europe," and deserts into irrigated land, which led "some Americans [to look] forward to a government operated civilian atomic energy program, an 'atomic TVA' . . . After all, projects already underway, such as the monumental dams of the Tennessee Valley Authority, were scarcely less astonishing."[44] These linkages were not merely rhetorical flourishes: *wunderkind* head of the TVA, David Lilienthal, would be appointed the first chairman of the U.S. Atomic Energy Commission in 1946. Who better to combine, as Weart puts it, the "White City of technology with the green hills of Arcadia"?[45] The Soviets, too, had begun to believe in the possibilities of nuclear power for nonmilitary ends. Given a history of promoting the virtues of Communism through modern technology projects, including "the most ambitious programs in hydro-electric power and canal building in the 20th century, as well as the largest nuclear power plants ever built,"[46] the Soviets discussed using nuclear explosions to change the course of major rivers for irrigation and electricity-generating purposes. "Along with Marxism, a fierce national pride urged Russians to stand second to none in modern technological projects; huge reactors would join huge dams, rockets and steel mills as proofs of [international] pre-eminence."[47] Even in a country where security imperatives would seem to override all others, Israel, atomic energy was more than just that. Avner Cohen quotes Shimon Peres as saying: "Ben Gurion believed that Science could compensate us for what Nature has denied us," and "Ben Gurion's romantic, even mystical faith in science and technology sustained his utopian vision of a blossoming Negev desert and the use of nuclear power to desalinate sea water."[48]

Contradictions abounded. Even as international demands to control nuclear weapons grew, led by countries with large civilian nuclear programs such as Canada and India, the same countries sought to affirm their own national sovereignty and atomic autonomy. Nehru would say:

> [T]he use of atomic energy for peaceful purposes is far more important for a country like India whose power resources are limited, than for a country like France, an industrially advanced country. Take the United States of America, which already has vast power resources of other kinds. To have an additional source of power like atomic energy does not mean very much for them. No doubt they can use it; but it is not so indispensable for them as for a power starved or power hungry country like India or like most of the other countries in Asia and Africa. I say that because it may be to the advantage of countries which have adequate power resources to restrain and restrict the use of atomic power because

[43] David E. Nye, *American Technological Sublime* (Cambridge, Mass., 1994), 225.
[44] Weart, *Nuclear Fear* (cit. n. 37), 158–9.
[45] Ibid., 160.
[46] Loren R. Graham, *Science in Russia and the Soviet Union* (Cambridge, Mass., 1993), 166.
[47] Weart, *Nuclear Fear* (cit. n. 37), 165.
[48] Cohen, *Israel and the Bomb* (cit. n. 13), 11, 353 n. 9.

> they do not need that power. It would be to the disadvantage of a country like India if that is restricted or stopped.[49]

Nehru's ambivalence, expressed through the simultaneous demands for international control over nuclear weapons and domestic sovereignty over India's nuclear development, would be resolved by a discursive shift in the meaning of nuclear energy, aligning it not with destruction but the history of technology and India's colonial past.

> Often our people fail to realise what the modern world is all about. How did Europe and the United States of America advance? Why were they able to conquer us? It is because they had science through which their wealth and economic and military strength grew. Now they have even produced the atom bomb. All these things stem from science and if India is to progress and become a strong nation, second to none, we must build up our science.[50]

NUCLEAR POWER

The ambivalence of the meaning of atomic energy in postcolonial India is demonstrated by the inability to represent this object in terms of either war or peace. Even though India appeared to argue for a peaceful orientation to this new technology, in contrast to the belligerent views present elsewhere, atomic energy was neither one nor the other, "but something else besides." Seeing atomic energy as a necessary means for preventing recolonization and setting newly gained independence on a solid foundation was much more than parliamentary rhetoric to get the 1948 Atomic Energy Act passed. For Nehru and the Indian elite, the central political problem, postindependence, was to create a new basis for Indian nationalism, to project India's strength, and to be taken seriously on the international stage: *to create political legitimacy for the postcolonial state.*

The closest parallel to the Indian program with regard to the larger national-technological meaning of atomic power is probably the French program. Gabrielle Hecht reminds us that "[t]he fundamental premise of discussions about a future technological France was that, in the postwar world, technological achievements defined geopolitical power." She goes on to quote de Gaulle as saying, "A State does not count if it does not bring something to the world that contributes to the technological progress of the world."[51] Both to recapture the "radiance" of France and to offset American dominance in postwar Europe and the world, France needed technology, especially nuclear technology. In the discussion of the first French Five Year Plan, atomic energy was justified by noting the country's lack of traditional energy sources (coal, oil, hydroelectric power). The planners noted: "there is no doubt that in a few years the energy sources put at the disposition of people would so profoundly and radically transform their economic activity that the nations that do not have it will appear as helpless as the most backward nations of the world today appear in the face of modern nations."[52] Given the French image of themselves, what choice did France have?

[49] Nehru, "Control of Nuclear Energy," Speech in the Lok Sabha, May 10, 1954, *Speeches* (cit. n. 32), 255.
[50] Nehru, *Selected Works of Jawaharlal Nehru,* 2nd ser., vol. 28, *1 Feb.–31 May 1955* (Delhi, 2001), 31.
[51] Gabrielle Hecht, *The Radiance of France* (Cambridge, Mass., 1998), 39.
[52] Scheinman, *Atomic Energy Policy in France* (cit. n. 26), 75.

Establishing the base for an Indian atomic energy program was much more than a scheme for building weapons. The urgent political need for national development and state legitimation was intimately wrapped up in the technological success of atomic energy, defined in terms of national strength, uniqueness, and security. "So what should our role be in this dangerous and fast changing world? It is obvious that the first thing is to make ourselves strong and better off to face any danger."[53] The constant iteration of themes of self-reliance, autonomy, independence make it impossible to separate atomic energy from a host of other techno-political projects also begun by the Indian state soon after independence. These included the building of large-scale electricity-generating, flood control, and irrigation management systems, congealed into the sign of the high dam; the urgent creation of a modern industrial base, including a capital-intensive heavy goods industry, steel mills, and iron ore extraction and milling plants, all positively reinforced by repeated images of industrial furnaces and billowing smoke stacks generated by the Ministry of Information and Broadcasting.[54]

The centrality of monumentality and novelty in the representation of these techno-political projects points to their legitimation function for the postcolonial state. Note the similarity in the rhetorical tropes used in Nehru's speeches inaugurating two seemingly very different postindependence technology projects: the massive Bhakra Nangal hydroelectric dam project and the new planned city of Chandigarh, designed by the French architect, Le Corbusier:

> *I do not think that there is any project on such a grand scale being undertaken anywhere else in the world.* The leading countries of the world have many huge schemes, but a project as gigantic and difficult as Bhakra-Nangal is not being undertaken anywhere else. . . . It is a symbol of a nation which is alive and on the move. . . . [T]he biggest advantage is that in the process of accomplishing them, the nation gains vastly in strength.[55]

Speaking in Chandigarh in 1955, Nehru said:

> When you see a new city coming up, you wonder what shape it will take, for no city can be a mere collection of buildings made of brick and mortar. There has to be something more. *It gives a hint of the shape a society will likely take in the future.* So I was especially interested in Chandigarh. I am happy that the people of Punjab did not make the mistake of putting some old city as their capital. It would have been a great mistake and foolishness. . . . If you had chosen an old city as the capital, Punjab would have become a mentally stagnant, backward state.[56]

Taken together, Bhakra Nangal and Chandigarh, the dam and the city, constitute a techno-political genus, more related to each other than their immediate physical surroundings. This family of artifacts was the technological expression of a new form of secular reason (modern technology), dedicated to massive change (national development), authored by the sovereign independent state, epitomizing the desired future in the mundane present. State power and legitimacy was expressed through these techno-political artifacts, representing the means by which social transformation would take place as well as the ends of that change.

[53] Nehru, *Selected Works* (cit. n. 50), 30.
[54] Abraham, *Making of the Indian Atomic Bomb* (cit. n. 31).
[55] Nehru, *Selected Works* (cit. n. 50), 29 (my italics).
[56] Ibid., 26 (my italics).

CONCLUSION

This chapter has argued that a discourse of "control," authored by the overlapping narratives of academic proliferation studies and U.S. antiproliferation policy, has come to dominate contemporary understandings of nuclear histories. This discourse, with its primary purpose of seeking to predict which countries are likely to build nuclear weapons and thereby to threaten the prevailing military-strategic status quo, has narrowed the analytic optic of nuclear historians considerably. Among the effects of this discourse has been to bury important historical details, minimize the importance of the discovery of atomic fission as a "world historical" event, and impoverish recognition of the fluidity of international affairs in the decade following the end of the Second World War. The discursive means that have led to these outcomes are the tendencies to see nuclear histories as, above all, *national* histories and to privilege concerns about the development of nuclear *weapons* over a fuller and more nuanced understanding of what nuclear programs mean and why they matter. Paying attention to the scientific-technological underpinnings of nuclear programs is another analytical path to follow, offering new archives and insights into the making of "national" nuclear programs that might have other, even nonbelligerent, ends. Such an approach recognizes the varieties and importance of international collaboration in the making of "national" programs and shows how weapons building is by no means the only or even the most common end of all nuclear programs.

Returning now to a question that has not received a complete answer: Why don't all countries that could build nuclear weapons do so? My answer: they only appear not to.

The discussion above elaborated the multiplicity of meanings encompassed by the nuclear condition, meanings that might be in contradiction with each other but that continue to be available to different audiences *at the same time.* In particular, it pointed to the familial identity of nuclear programs with other kinds of state-led public technology projects. New cities, enormous dams, soaring skyscrapers, ballistic missiles, space programs, and nuclear power are universal techno-political means by which modern states seek to visualize their power and express their authority. Put simply, modern states have always sought popular legitimacy through massive technology projects: nuclear programs are one of the prime sites for the expression of that desired political relationship.

By exploring the history of the Indian nuclear program, atypical from the vantage point of the first countries to build nuclear weapons, the United States and the Soviet Union, we see the simultaneous presence of "military" and "civilian" programs, arguably from the inception of the nuclear program in the late 1940s. While the political decision to come "out of the nuclear closet" and create a nuclear arsenal in 1998 had a number of proximate causes, it was also importantly influenced by the power of the discourse of control. It is extremely important to postcolonial decision makers not to (be seen to) lose autonomy over this program for all the other meanings signified by nuclear prowess—at the very least, national sovereignty and a claim to universal modernity. If not losing autonomy meant making a decision that would reduce the level of uncertainty of what this program meant, to outside observers and in relation to the prevailing discourse about nuclear programs, it was worth the immediate and corresponding decline in the country's net security. Nuclear explosions may not tell us whether a country is developing a nuclear weapons program, but they do signal a desired dialogue with dominant discourses.

If nuclear programs carry this ideological weight, at the same time as they may (or may not) be a means to produce weapons, then a policy that seeks to reduce the spread of nuclear weapons—counterproliferation—must take that "fact" seriously. If reasons of national sovereignty and the desire to make a unique claim to modernity help us understand why Malaysia builds the Petronas Towers, why Taiwan and China follow suit with even taller buildings, why Japan has a space program, why Brazil, Ghana, and Indonesia, each, at various points in their respective national histories, claimed to be building the largest dam in the world, why China wants to host the Olympics, why countries as different as Brazil, Pakistan, and Nigeria all built expensive, new, technologically sophisticated (if unaesthetic and antisocial) capital cities, why France identifies her atomic reactors in genealogical relation to the Eiffel Tower and why Sydney's Opera House is much more than a building in which to see *Tosca,* then we can see why getting rid of a nuclear program is extremely difficult.

In the 1950s and 1960s, when the discourse of control was far less determinate (and determined) than it is today, countries such as Australia, Norway, and Sweden could decide to close down their fledgling nuclear weapons programs with little ideological pain. Other technological marvels could take their place. Today, it takes a radical reformation of the state—the end of the Soviet Union, the end of white racist rule, and the end of two decades of military rule—for Ukraine, Kazakhstan, South Africa, and Brazil and Argentina, respectively, to give up their nuclear weapons and weapons-building programs. The degree of reformation gives us clues as well to the likelihood of reversibility, to wit, recent stories about the possible return of Brazil to the nuclear ranks.

What countries are giving up, especially democratic ones, when they dismantle their nuclear programs is a claim to a form of national modernity that they once took pride in and took for granted. Little wonder that nuclear "control" is so difficult, especially when the unevenness of the demand to dismantle is as visible as it is today. If there needed to be another reason given as to why the process of global disarmament needs to begin from the top—from those who have the most weapons—it is because the country with the greatest access to the highest forms of modernity is also the best starting point to disabuse the world of the common sense of the relation between nuclear weapons and international prestige.