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THE ORACLES OF PROLIFERATION
How Experts Maintain a Biased Historical Reading that Limits Policy Innovation

Benoît Pelopidas

By examining via a case study the political authority of US proliferation experts since the 1960s, this article contributes to nuclear weapons proliferation studies and to the growing literature on the role of expertise in democracies. First, it argues that policy choices are determined by an understanding of history and that approaching nuclear history as a history of nuclear weapons proliferation is a presumption shared by both US experts and policy makers. Second, it shows that this understanding of history, relying on the metaphorical use of the term proliferation (which was imported from biology), strongly distorts the facts. Third, the article shows that nuclear experts are plagued by a conservative bias as a result of this use of the proliferation metaphor. Instead of challenging the faulty proliferation narrative, most experts have backed it without question. Fourth, the legitimacy that experts lend to this view of history has important political effects: it provides an authoritative assessment of past policies and limits the possibility of political innovation. Policy initiatives tend to be restricted to changes in speed or intensity. The article suggests three changes that might restore room for informed political innovation in nuclear weapons policies.

KEYWORDS: nuclear weapons; proliferation; disarmament; nuclear history and historians; theory; experts

Experts do matter in nuclear policy. Because of the complexities of nuclear physics and especially rocket science, experts have occupied a privileged place in the nuclear debate. Physicists were the first experts in the nuclear realm during World War II; then came the ''strategists'' and ''economists'' from the RAND Corporation and the University of Chicago whom Fred Kaplan tellingly labeled the ''strategists in power.''[1] This study focuses on nuclear experts in the United States because their influence has been particularly strong. Scholars and experts have been uniquely involved in the shaping of US nuclear policy as well as weapons design since the beginning of the nuclear age. Moreover, in the United States, experts sometimes become policy makers.

One might object that experts have not been successful when they propose dramatic changes in nuclear policy; for example, the Acheson-Lilienthal plan, which issued from the scientists' movement in 1945–46, failed, as did the atomic scientists' proposal advocating a world government.[2]

I shall argue that backing policy makers' pre-existing worldviews should not be seen as a lack of influence. On the contrary, in doing so, nuclear experts provide additional

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legitimacy to past policies; they also miss the opportunity to help policy makers think creatively and suggest that they needn't, and they delegitimize some past policies but limit the realm of choice and the possibility of radical innovation. Changes tend to be conceived of in terms of speed and intensity in the implementation of past policies. In other words, experts keep policy innovation constrained by a view of history that I label the ''proliferation paradigm.''

I borrow the notion of paradigm from the philosopher of science Thomas Kuhn, instead of using the notion of proliferation narrative, for two reasons. First, experts' claim of truth brings them closer to scientists. Second, Kuhn's definition of a paradigm as ''an organizing principle which can govern perception itself'' inside which scientific or experts' ''puzzles'' will be built is helpful in studying the effects of an intellectual framework.[3]

In this article, I will therefore demonstrate four things. First, US experts and policy makers have shared the proliferation paradigm as a view of the nuclear past and future since at least the 1960s. Second, this paradigm has been based on a careless use of the metaphor of proliferation. Third, this metaphor introduces biases in the way people look at the nuclear historical record, overemphasizing certain aspects and hiding others. Finally, once I have established these biases thanks to a systematic evaluation of the historical record, I will show the political effects of this paradigm.[4]

The Proliferation Paradigm as a Widespread Understanding of Nuclear History among US Experts and Policy Makers

As William Potter and Gaukhar Mukhatzhanova write: the ''tendency to view nuclear weapons diffusion in terms of automaticity and contagion is not confined to . . . a particular political or professional orientation. Indeed, it is equally visible among U.S. officials in past and current administrations, international organizations, scholars, nongovernmental analysts and media pundits.''[5]

The major cleavage among analysts of nuclear history shows how this idea of an underlying law of history leading to an increase of nuclear weapon actors over time works as a paradigm as defined above. This idea is the grand framework within which the cleavages are taking place. Thus, the two sides of the central divide between optimists and pessimists, as well as a recent attempt at going beyond these polarities, all share this view of nuclear history, which suggests that the number of actors with nuclear weapons has increased throughout the history of armament, slowly rising from zero in 1945 to the nine known today.[6] Over the last fifteen years or so, scientific research has challenged this view, but it remains nonetheless widely held and continues to inform predictions.[7]

This approach now includes non-state actors, which are imagined to have the inclination and the ability to go for the bomb. Following fears surrounding the security of the former Soviet arsenal, the dismantling of the A.Q. Khan network revealed that technology transfer was easier than had been anticipated.[8] If most analysts agree that nuclear terrorism is the least likely form of weapons of mass destruction terrorism, then the debate among experts has effectively turned away from issues of nuclear capabilities and ambitions in favor of a third matter: namely, that of preventing the acquisition and use of

nuclear weapons.[9] This reveals an implicit belief in the extension to non-state actors of the alleged general principle of an inevitable increase in the number of actors with nuclear weapons.

The concept of an inevitable increase in the number of actors possessing nuclear weapons is maintained by the metaphorical clock, known as the ''Doomsday Clock,'' that has appeared on the cover of the *Bulletin of the Atomic Scientists* since June 1947. Midnight represents nuclear apocalypse, and the clock displays the time yet to elapse (''minutes to midnight'') before that moment arrives; according to this logic, the world is slowly but surely nearing destruction. A rise in the number of actors with nuclear weapons is one of the reasons for which time elapses on the clock in question.[10] Following the end of the Cold War, in 1991 the minute hand of the clock ticked backward, and humanity was said to have moved away from the moment of its own obliteration by eleven symbolic minutes since 1988. In the early 1990s, some members of the governing body of the *Bulletin* suggested that the clock be replaced by a different symbol, but the proposal was rejected. This illustrates the permanence of a desire to imagine a history oriented toward proliferation, even among those who are committed to abolishing nuclear weapons, as has historically been the case of the *Bulletin*.[11]

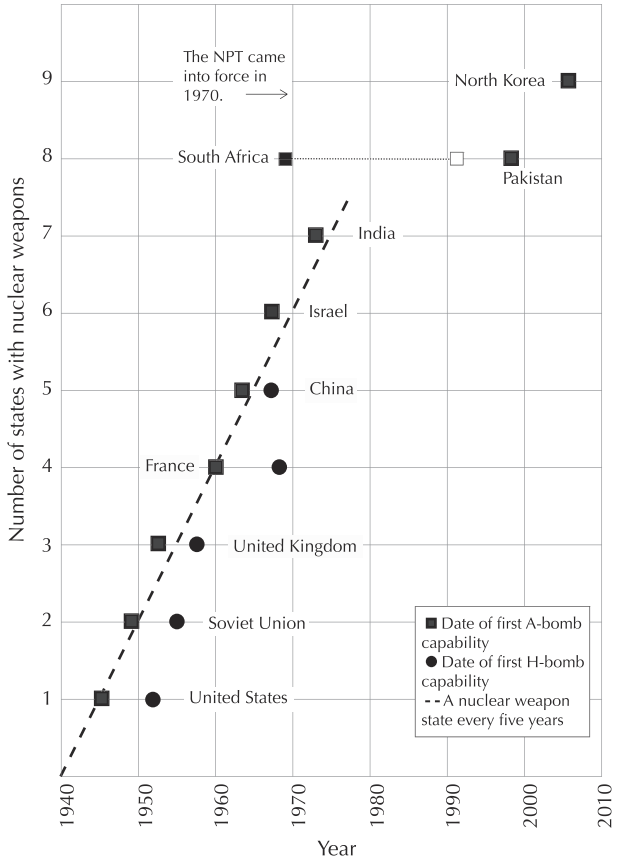
In the late 1950s and early 1960s, a series of National Intelligence Estimates and scholarly works were already focusing on the ''N + 1 country'' problem and trying to identify the relevant candidates. The 1965 Gilpatrick Committee report was another version of this approach, offering one of the earliest mentions of a proliferation ''chain reaction.''[12] This is only the pessimistic version of the proliferation paradigm.

International relations scholar and neorealist Kenneth Waltz and the so-called optimists offer another version based on the assertion that a steady rise in the number of nuclear weapon states increases international security by establishing new situations with mutual deterrents. Waltz considers this trend to be as necessary as its pessimistic counterpart, even though he suggests that the pace will be slow and points out that a general theory of international relations cannot predict a phenomenon as complex as proliferation.[13]

The most radical variant of this analysis of nuclear history, which sees it as being inevitably linear, views the historical trend in terms of speed: only the rate of the increase in the number of nuclear weapon states can be altered, and not the direction of the trend (see Figure 1). This idea is an old one. Thomas Reed and Danny Stillman provide a recent example of that linear understanding of nuclear history in their book *The Nuclear Express* (which received media attention as well as criticism).[14] ''In 1938, the Nuclear Express pulled out of Berlin. For half a century it picked up speed, but never came off the rails,'' wrote Reed and Stillman.[15] ''The Nuclear Express now hurtles into a new century with a boxcar of new technology, a hopper filled with fissile materials, a mail car packed with cash and millions of sleeping passengers. The engineers driving this train seem unconcerned about the safety and well-being of those passengers, even their own children. A massive train wreck, defying all previous human experience, could lie ahead.''[16]

A more moderate—and widespread—variant maintains that the trend is necessary. This variant is less emphatic where its linear development is concerned: it recognizes that there are periods of stagnation and even times when arsenals and the number of nuclear

FIGURE 1
Linear representation of the "proliferation paradigm."



Adapted from Thomas Reed and Danny B. Stillman, *Nuclear Express: A Political History of the Bomb and its Proliferation* (Minneapolis: Zenith Press, 2009), p. 265; with data from Robert S. Norris, senior research associate, Natural Resources Defense Council.

weapon states decrease but sees these as moments of deviation in a wider trend. Advocates of this variant have recourse to a "wave" metaphor in which the size and number of waves that provoke an increase in the number of nuclear weapon states are greater than the size and number of those that do not. This vision therefore points toward a new wave of nuclear proliferation.[17] Triggered by North Korea and Iran, the likes of Japan, Egypt, and Turkey (undoubtedly followed by Indonesia, Australia, Brazil, and Saudi Arabia) are seen as potential near-term nuclear states, which would make a nuclear "swell"—to extend the wave metaphor further—quite likely.

Whether pessimistic or optimistic, linear or nonlinear, the proliferation paradigm also implies retrospective illusion and labeling. Indeed, while the debate about nuclear weapons was not framed in terms of proliferation until the late 1950s or early 1960s, proliferation experts anachronistically label the Soviet decision to go nuclear as "the first case of proliferation" because of their understanding of what would come next.[18] This retrospective illusion also has an impact on the *ex post* understanding of past surprises. It

leads to remembering the unexpected cases of nuclear acquisition while neglecting the numerous surprises of states deciding *not* to go nuclear; the states that gave up their nuclear ambitions or weapons would be forgotten for the same reasons.[19] The persistent excessive pessimism of forecasters in terms of the pace of proliferation as well as the number of actors predicted to cross the nuclear threshold in the years after the assessment suggests that the favorable surprises were far more numerous.[20] Even the exceptional South African case of dismantlement of an existing arsenal took the intelligence services and the experts by surprise. President F.W. de Klerk announced on March 24, 1993 that the South African arsenal had been dismantled, but the intelligence community remained suspicious long after the end of the International Atomic Energy Agency (IAEA) inspections.[21] Similarly, when nuclear weapons were not found in Iraq in 2003, the first reaction of the experts was not to contemplate absence but rather to build scenarios in which the weapons could have been transferred to Syria or destroyed just before the US invasion. Even when these scenarios were considered improbable, the possibility of the weapons being buried somewhere or stolen was often mentioned.[22] These cases show that when an anomaly occurs vis-à-vis the proliferation paradigm, experts tend to deny the anomaly. The reactions in both the Iraqi and South African cases show how hard it is to go against the proliferation paradigm because the absence of evidence can never incontrovertibly become evidence of absence. It therefore seems obvious why Harald Müller and Andreas Schmidt consider ''the story of deproliferation'' as ''little known.''[23]

The consensus surrounding the proliferation paradigm cannot be fully explained by the argument that the individuals who adhere to it are ''problem-solving'' experts, and that members of a more marginal group will do the critical-thinking work.[24] In fact, as seen in the case of the *Bulletin of the Atomic Scientists*, most of those who were advocating disarmament or abolition accepted the proliferation paradigm and used it to complain about the lack of progress.

The Metaphor of Proliferation as a Cognitive Framework for the Proliferation Paradigm

The numerous different versions of that predominant analysis now have to be related to the expert community's systematic use of the metaphor of ''proliferation'' in order to understand how it can lead to the general consensus analyzed in the previous section. Indeed, this use has prevailed at least since policy analyst and strategist Albert Wohlstetter applied the term to nuclear weapons in April 1961 as the cognitive framework through which this interpretation of nuclear history has been imparted.[25] This is all the more important because the strongest biases attached to the proliferation paradigm can be traced to the careless use of this metaphor.

The shift from the term ''dissemination'' to ''proliferation'' establishes the metaphor that will shape the most prevalent interpretation of the phenomenon. The ''problem of the $N + 1$ country,'' as Wohlstetter termed it, began to be addressed in university circles between 1958 and 1962 at the exact time when the term ''proliferation'' was transposed

by Wohlstetter into its new domain.[26] What might have remained a mere simile was concentrated into a metaphor: the increase in the number of actors with nuclear weapons is not *like* proliferation; it *is* proliferation.

Metaphors bring certain attributes to the fore while adding or deleting others; they limit the cognitive framework through which one conceives the phenomenon in question. By describing a battle using terms taken from the vocabulary of chess, for instance, one removes the emotional facet of war.[27] While the legitimacy of using metaphors in scientific discourse has been acknowledged, this requires either that nothing be deduced from the components of the metaphor or that scientists continue to maintain a reflexive relationship with it.[28]

To understand how the metaphor of proliferation lays the foundations for a belief in an inevitable increase in the number of nuclear weapon states, therefore, it is important to examine what exactly can be deduced from it.

First, it is worth addressing the strictly pathological connotations of the term ''proliferation'' as employed in the lexical field of biology, where it has been associated with cancer since the early twentieth century.[29] The process of cellular reproduction is monitored from outside, and when this monitoring fails, degeneration occurs and cancer develops, sometimes to the point of killing the organism in question. The pessimistic version of the paradigm can therefore find a starting point in this aspect of the metaphor; if you want to monitor proliferation, the biological metaphor suggests that an external interuention is necessary. The pathological connotation related to the circulation of weapons then spread to those states that sought to acquire nuclear weapons following the Cold War.[30]

Second, it must be noted that the expression ''proliferation of nuclear weapons'' underlines the element of self-begetting that is present in the phenomenon in question. This meaning appears in English even before the pathological element is introduced; indeed, the Oxford English Dictionary offers the following definition, which first appeared in the 1860s: ''the formation or development of cells by budding or division.''[31] When transposed into the nuclear domain, the term retains the connotation of an automatic process and leaves no room for the political factor, which had no relevance in cellular reproduction. Do the weapons themselves breed more weapons? It seems unlikely, but the metaphor disregards this fact. The biological metaphor of proliferation applied to the nuclear domain therefore results in a purely quantitative approach to the phenomenon and ultimately leads to a type of technological and economic determinism. This reasoning is a major source of the proliferation paradigm and lies behind the fears associated with the notion of ''nuclear latency'' that reemerges in the literature.[32] If one accords the metaphor its full value, then civilian nuclear programs serve as a halfway house in the multiplication of military nuclear arsenals. Such technological and economic teleology can be interpreted in two ways. On the one hand, it could be suggested that this attitude is born of prudence. In this case, since nuclear proliferation was identified on January 31, 1992 by the UN Security Council as a threat to international peace and security, the most reliable policy for achieving nonproliferation is to prevent actors from acquiring the means to build a bomb by erecting technical barriers to that process.[33] This option removes the need to identify the proliferators and to uncover their motives. On the other hand, one

could suggest that the effectiveness of the metaphor of proliferation in the political domain is even greater if it implies that the bomb is seen as intrinsically desirable. However extreme it may seem, the latter interpretation of the metaphor—which is tantamount to asserting that states do not proliferate merely because they are able to do so—is not uncommon.[34] This analysis is compatible with the two main versions of the realist approach, one of which sees the bomb as being thoroughly desirable, while the other recognizes that it has drawbacks as well as advantages. Indeed, as international relations scholar Jacques Hymans has put it, ''soft'' realism can readily become ''hard'' realism to the extent that the security guarantee will always be treated with some degree of suspicion.[35] The economic approach of Dagobert Brito and Michael Intriligator also demonstrates the desirability of the bomb when the authors state that ''as the cost of nuclear weapons falls, . . . there will be new nuclear states unless new policies increase this cost.''[36] A variation on this same theme is found in the widespread belief that chemical and biological weapons are the poor man's atom bomb.[37]

Third, the metaphor also implies a chain reaction. This element seems to be underlined later in the 1960s in the writings of physicist Sir John Cockcroft.[38] Just as cellular proliferation is a phenomenon that continues to occur following an initial division, nuclear proliferation is imagined in terms of a chain reaction once one party crosses the nuclear threshold. This also marks the beginning of a linear approach in terms of speed, which presents a series of waves as periods of temporary acceleration in the phenomenon of proliferation. When a state proliferates, the most widespread analyses argue that other states in the region will do the same in order to maintain a certain strategic balance. Today, most experts subscribe to the image of the ''strategic chain reaction.''[39] Even political science scholar Etel Solingen, who criticizes the approach, occasionally succumbs to the fear of a chain reaction of proliferation in Southeast Asia.[40]

Though it has been established that the proliferation paradigm relies on the careless use of the metaphor of proliferation, this view of history remains to be tested. It is important to note, however, that the argument presented above does not imply that a historical discourse devoid of all metaphor is actually possible. Rather, I need only posit that a reflexive approach to the metaphor in question remains a possibility.

The Proliferation Paradigm in Light of Nuclear History

Before examining the implications of the proliferation paradigm, it is useful to address the deductions arising from the metaphor that leads to that approach. Let me briefly list them: the pathological connotation related to the phenomenon of proliferation and transposed to those entities that represent it; the self-begetting nature of the phenomenon, which ultimately leads to capacity determinism; and, finally, the logic of a chain reaction, which suggests that the bomb represents the most appropriate response to a security threat posed by proliferation on the part of a neighbor.

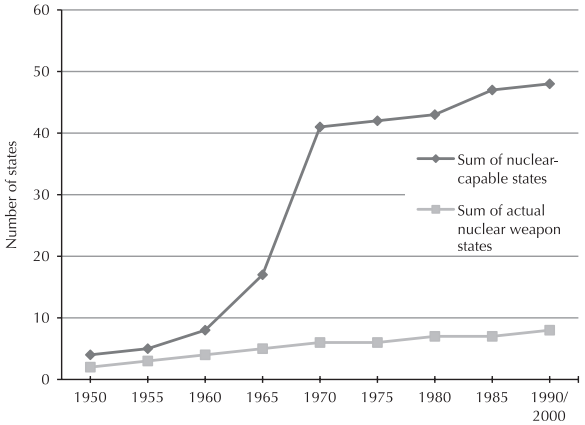
First, proliferating regimes can alter their strategic approach before and after they have crossed the nuclear threshold. This argument throws into relief the limitations of the pathological aspect that the metaphor attributes to the bomb, whereby the proliferators

are the hotbed that allows the disease to spread. The illness, then, can regress. Furthermore, most proliferating states have not succeeded in crossing the nuclear threshold, and South Africa dismantled its entire nuclear arsenal after having built six nuclear bombs and having had a fully operational nuclear weapon at its disposal for ten years.[41] Similarly, three states—Ukraine, Belarus, and Kazakhstan—came into existence with considerable portions of the Soviet arsenal within their borders, and all returned those arsenals to Russia under the Lisbon Protocol, which was signed on May 23, 1992; the arsenals were dismantled by 1996.[42] Even Libya, which supported terrorist groups until the late 1980s and tried to acquire weapons after Muammar Qaddafi came to power in 1969, completely reconsidered its strategy from 1992 onward, when it included its weapons of mass destruction programs in negotiations with Washington and London. After lengthy talks, Libya officially announced that it was renouncing nuclear weapons in December 2003 and that it would dismantle its existing facilities under IAEA control and within a very tight deadline.[43]

Second, the self-begetting nature of proliferation (which is tantamount to the general principle of capacity determinism) maintains that any state able to acquire nuclear weapons will do so. There are at least two versions of this idea. One posits that there is a constant desire to go for the bomb, but that this desire can be tempered by technological barriers. The other agrees that this desire exists, but maintains that the networking of proliferation channels as confirmed by the discovery of the illicit A.Q. Khan nuclear ring considerably reduces the number of technological barriers in existence, so that countries that want to acquire the bomb will always find the financial and human means to take whatever steps will lead them to nuclear technology. In other words, where there is a will, there is a way. The desire for the bomb is present in both of these variants; they diverge only in their stances on the possibility of taking action and limiting it. Yet this pseudo-principle is increasingly undermined by the historical record.

FIGURE 2

Historical comparison of the number of states with the technological capacity to acquire the bomb with the number of states that have done so.



Adapted from Jacques E.C. Hymans, *The Psychology of Nuclear Proliferation: Identity, Emotions, and Foreign Policy* (Cambridge: Cambridge University Press, 2006), p. 4.

If internal political debate sometimes sees the argument of capacity as a means of persuasion for crossing the nuclear threshold, as was the case in India, this does not always have to be the case.[44] Technologically advanced states such as Switzerland and Sweden have engaged in military nuclear activities yet have never crossed the threshold. Japan and Germany also fit into this category, and are even more relevant to this discussion because eminent nuclear experts have predicted that they would go nuclear.[45] Furthermore, if the general principle in question were valid, no nuclear weapon state would have relinquished the bomb, including South Africa. As time goes by, nuclear technology spreads, but contrary to what technological determinism would expect, nuclear weapons projects have increasingly been failing to achieve their ultimate objective, and those that have succeeded in recent years have needed more time than those undertaken in previous decades (see Figure 2).[46] One final argument to submit here is that, of all the states that have engaged in nuclear activity, those that put an end to their nuclear activities after acquiring a research reactor are more numerous than those that did so before acquiring such a facility. In other words, such a considerable technological advance does not make it more likely that a state will cross the nuclear threshold.[47]

Third, the bomb has not necessarily been seen as the most effective security guarantee against a proliferator, which casts the image of the chain reaction in a considerably different light. Egypt serves as a telling example here. In the 1950s, Cairo launched a military nuclear program in order to fend off any potential trouble from Tel Aviv and to establish Egypt as a regional leader.[48] The existence of an Israeli program was not well known at the time, and Egypt's conventional capacity was significantly higher than that of Israel.[49] When, at the beginning of the 1970s, Egypt abandoned its nuclear ambitions, the Israeli program was better known than when Egypt's program had begun, and the balance of conventional capacity had tipped against Egypt: Iran, Iraq, and Libya—all racing against one another for regional leadership—were suspected of proliferation.[50] Finally, Cairo had no security guarantees from Moscow. Some Egyptians believed that the Soviet Union would commit to protecting their country if Israel acquired a deterrent, but other sources flatly deny that such an agreement was in place. In addition, President Gamal Abdel Nasser publicly rejected its existence.[51] If the general principle discussed above held true, the significant degeneration of Egyptian security between the mid-1950s and the 1970s, including its defeat in 1967, should have led Egypt to take steps toward proliferation, had a response to proliferation been necessary at the time. But it did not. Scientifically, however, Egypt was the best equipped of all Arab nations: the desert would have proved an excellent site for testing, and in the 1960s, Egypt's resources were equal or superior to those of Israel or Pakistan when those states began their nuclear programs.[52] The nuclear chain reaction, a recurring tool of the alarmist camp inside the proliferation paradigm since the 1960s, is therefore not supported by much empirical evidence.

The three deductions that can be drawn from the metaphor of proliferation are therefore excessive when one consults nuclear history. Having established above that this metaphor was a cornerstone of the proliferation paradigm, I can now turn to the biases that it introduced in the general understanding of nuclear history.

In general terms, the proliferation paradigm has inspired excessively pessimistic predictions that have not come true. Moreover, the minute hand of the ''Doomsday Clock''

has had to be turned back on several occasions—in 1960, 1963, 1969, 1972, 1988, 1990, 1991, and 2010.[53] If one examines horizontal proliferation, the proliferation paradigm obscures two crucial phenomena in nuclear history.

First, the vast majority of states simply have not tried to acquire nuclear weapons. The most pessimistic studies show that only thirty-nine states have engaged in nuclear activities at one time or another, regardless of any decisions to pursue the bomb.[54] This statistic does little to corroborate any belief in the intrinsic appeal of the bomb. Of the 192 states currently recognized by the United Nations, the most pessimistic figure for the number of states that at one time or another have engaged in nuclear activity stands at 20.3 percent. Naturally, the number of states having crossed the threshold is even lower: 4.7 percent, including North Korea (see Table 1).

Second, the general principle of a linear rise in the number of nuclear weapon states is undermined by the period from 1991 until 1998. During this time, not one state crossed the nuclear threshold, and no new proliferating state came on the scene.[55] This was not merely a period of status quo or nonproliferation, but rather the golden age of deproliferation, if viewed objectively rather than focusing exclusively on states that were acknowledged as having nuclear weapons. From this perspective, South Africa dismantled its nuclear arsenal fully between 1990 and 1991. The new government of Nelson Mandela, which was elected in 1994, chose not to reverse that decision.[56] Similarly, it is worth repeating that Ukraine, Belarus, and Kazakhstan all returned their inherited arsenals to Russia. The fact remains that between 1991 and 1996, when the dismantlement of the arsenals was complete, those three states were, objectively speaking, nuclear; at the time, Ukraine and Kazakhstan had (in purely quantitative terms) the third- and fourth-largest arsenals in the world.[57] In this sense, ten states were effectively said to have nuclear weapons in 1991—the five official states plus Israel, South Africa, and the three former Soviet republics—whereas five years later, that figure had fallen to six. If India is included by virtue of its peaceful test in 1974, the figures are eleven and seven, respectively. Horizontal deproliferation does exist, then, in spite of the efforts of the proliferation metaphor to obscure it, although we must avoid extrapolating it into an irreversible trend, lest we find ourselves embracing a belief that directly counters that which I am examining here.

TABLE 1
Retrospective classification of states' military nuclear status in 2010.

	States	Percentage
States with no history of military nuclear activity	153	79.7%
States with some history of nuclear weapons activity	39	20.3%
States that engaged in nuclear activity or kept arsenals on their soil (before relinquishing or returning them)	28	14.6%
States that engaged in nuclear activity, acquired nuclear weapons, and maintained their arsenals	9	4.7%
States that were probably engaging in military nuclear activity in 2010	2	1%

Both of these factors lead to the acknowledgement that proliferation and abandonment of nuclear activity are twin exceptions in nuclear history. What is more, successful proliferation is less common than abandonment. Indeed, of all the states that have, at one time or another, harbored ambitions to acquire a nuclear weapon, the majority have abandoned them (twenty-eight states)—and very few (only ten) have succeeded in crossing the threshold.

Thus, these inadequacies of the proliferation paradigm required nuclear experts to critically discuss their biases. Quite ironically, US strategist Bernard Brodie foresaw the two main characteristics of the reification process, no later than 1965, in the following terms: ''It is characteristic of our convictions, in strategy as in all affairs in life, that we tend to regard them as natural and inevitable. However, if we examine the history of the ideas contained in those convictions, we usually find that they have evolved in a definitely traceable way.''[58] Beyond the lack of precision in the critical analysis of statesmen's categories and the overall neglect of Brodie's prophetic statement, another failing of the community of US experts stems from the fact that the reification of the proliferation metaphor that took place had strong policy implications that have not always been recognized as such.

Political Effects of the Proliferation Paradigm

The proliferation paradigm influences the type of possible political action, its preferred modalities, and its timing. These consequences result from the reassessment of past practices and policies provided by the proliferation paradigm.

The paradigm discredits disarmament moves as contrary to the ''direction of history,'' claiming that actions in favor of disarmament would just be utopian and therefore impossible. This linear interpretation of history leads to a focus on arms control instead of disarmament, because it only pretends to slow the pace of the movement of history and not to try to reverse it.[59] Indeed, the notion of arms control was introduced in the late 1950s and then strengthened by the generalization of the above-described metaphor of proliferation.[60] One should note that disarmament is considered utopian for today and tomorrow because in this version of nuclear history, it was such in the past. We have previously seen the persisting suspicion with which past cases of disarmament have been considered. Proliferation being the direction of history, all the past nonproliferation policies will be considered as necessary but not sufficient, and should therefore be preserved in spite of their mixed record.

To assess the political implications of the proliferation paradigm in more detail and see how the paradigm leads to a form of conservatism that limits policy change, I will start from the three deductions that can be drawn from the metaphor of proliferation: the self-begetting nature of the phenomenon, the logic of a chain reaction, and the pathological connotation related to the phenomenon and transposed to those entities that represent it.

First, the idea of a self-begetting process leads to policies that aim to fight proliferation by ignoring demand and trying to diminish supply. Expert support for such policies will then be coupled with a critique of past policies of openness and sharing of

nuclear technology as careless actions that speed up the pace of proliferation and a reinterpretation of the NPT as focusing primarily on the goal of nonproliferation.[61] Perhaps the ultimate formulation of this approach was made by an analyst from the Nuclear Suppliers Group who stated that "the technical inability to make weapons seems a more reliable guarantee of nonproliferation than any solemn international commitment."[62] The most striking effect of this approach has been that, over the last twenty years, the mere possession of a "significant quantity" of fissile material has become the criterion bestowing nuclear statehood instead of the actual detonation of a device.[63] Once again, the proliferation paradigm will give the retrospective impression that past policies have been at least partially successful and should therefore be maintained. The failure of policies of denial to prevent poor states like Pakistan and North Korea to get nuclear weapons, as well as the success of China's nuclear program between 1955 and 1964 despite its scarcity of resources, will not be enough to initiate a change in approach, suggesting that it is only the moment of action that can be modified.

Second, the nuclear chain reaction is considered security driven. Therefore, the proliferation paradigm will lead to an emphasis on the past successes of nuclear extended deterrence as a nonproliferation tool, thereby promoting its extension. The proliferation paradigm suggests that this nuclear security guarantee has been a decisive element for states that have not gone nuclear in the past and supposes it will remain so in the future. The cases of France and the United Kingdom, which went nuclear in spite of a nuclear security guarantee, and those of Libya, South Africa, and all the non-nuclear weapon states that do not benefit from such a guarantee, will not cause a change in policy. The conservative implications of the chain reaction argument go beyond that. Indeed, such a view implies that nuclear weapons have been the ultimate security guarantor since their invention and will remain so for the foreseeable future; it implies that the nuclear protector will have to keep more nuclear weapons than it considers necessary for its own security—both in the name of the security of those it protects and in the name of nonproliferation. The only possible change here is limited to the identity of the provider of a nuclear security guarantee.

Third, the pathological connotation fuels the pessimists' and alarmists' arguments and urges action to prevent the spread of nuclear weapons. The proliferation paradigm is supposed to work both for the past and the future, and its incorporation into public speech is supposed to play out as a self-denying prophecy.[64] Acceptance that the proliferation paradigm favors suspicious assumptions and only takes into account surprises with negative outcomes in its understanding of the past is likely to push further the logic of preventive action against the spread of nuclear weapons. This paradigm promotes a suspicious interpretation of uncertainty that leads to scrutiny of states as potential proliferators. Transposing the paradigm to the question of how to anticipate future surprises leads to the consideration that most surprises will be proliferation surprises, some of which are not even conceivable now. Such a position is perfectly reflected by the idea of "unknown unknowns" promoted by Donald Rumsfeld (then the US secretary of defense) in a February 12, 2002 press conference—an idea that included only potentially catastrophic surprises. The pathological connotation rejects the possibility of a change in preferences regarding nuclear weapons and often leads to the

idea that only a shock can stop nuclear ambitions. The shock could be preventive strikes or preventive war. The bombing of the Osirak nuclear reactor by the Israeli Air Force is therefore presented as a success that prevented Iraq from obtaining nuclear weapons before Operation Desert Storm. The paradoxical element here is that, as in the previous cases, even the use of violence appears legitimate because the proliferation paradigm regards it as legitimate in the past. Even measures of shock should then be regarded as conservative measures.[65]

Conclusion: Repoliticizing Policy Makers' View of Nuclear History and Changing Their Expectations of Expert Advice

The proliferation paradigm prevents political innovation and is based on a view of history that strongly overestimates the historical role and appeal of nuclear weapons, leading to ill-conceived policies.[66] It is a fundamentally non-political approach that does not take into account the possibility of change over time in the role and appeal of nuclear weapons.

What needs to be done? In light of the preceding analysis, at least three changes would seem helpful: a reassessment of nuclear history countering the biases of the proliferation paradigm, a reaffirmation of the political dimension of decisions in the realm of nuclear weapons, and a change in what is expected from knowledge providers, be they experts or intelligence agencies.

The first change consists of realizing that nuclear weapons are not, and have never been, intrinsically desirable—and it is wrong to reduce that fact to a lack of capability or security threat. Changing the metaphor and returning to the term ''dissemination'' instead of ''proliferation'' might remind policy makers to be more careful in the way they connect facts. However, this change in terminology is not a magical solution. Indeed, the metaphor was the core of this view of history, but not its only source. Getting rid of the metaphor may help but will not solve the problem. Even Kenneth Waltz, the leading proponent of the optimistic version of the proliferation paradigm, believes that the term proliferation is less than apt.[67]

Second, political responsibility should be reaffirmed. This implies a recognition that political decisions have to be made in a situation of irreducible uncertainty about the intent and the capability of the other; they are bets based on a hierarchy of values and priorities. When questions about whether nations will acquire nuclear weapons are considered, there cannot be an objective answer, even if advisers present their solutions as absolute truths. Policy makers should not try to escape the tragedy of this situation; they should instead start to think that decision makers on the other side are facing the same kinds of dilemmas. The fact that US presidents have subordinated nonproliferation concerns to other policy priorities in the cases of Israel or Pakistan, for example, in the same way that other nuclear powers have, should be considered carefully. Such consideration calls for a political understanding of nuclear history, rather than the supposed irresistible appeal of nuclear weapons, on the side of suspected states.[68] These words might sound very general, but taken seriously, they lead to a realization that worst-

case assumptions and ''speeding conservatism'' are neither the only nor the true answers to a political problem, even if they are often presented as such.

The third move that would prove helpful is to reshape what is expected from the experts. Willingly or unwillingly, their judgments are political because they are driven by an understanding of history that is, most often, the proliferation paradigm. So, instead of expecting from them the truth about what is to be done, policy makers would benefit much more from asking for three specific things: as much factual accuracy as possible, recognition of the limits of what can be known, and a much more challenging attitude vis-à-vis what sounds like consensual truth.[69] Overestimations of what can be known as well as a tendency toward confirmation bias have already been diagnosed as responsible for two major intelligence failures: the absence of weapons of mass destruction in Iraq in 2003 and the lack of anticipation of the attack on Israel in 1973.[70] This last point is not to deny that knowledge informs policy. The point of this article is to say that certainty prevents imagination and creativity in politics and surely prevents any kind of shift from hope to audacity. It is far less sure that this need for certainty coupled with fear and mistrust provides the best guide for prudence.

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NOTES

1. Fred Kaplan, *The Wizards of Armageddon* (New York: Simon & Schuster, 1983), p. 390.
2. Ibid.; Grégoire Mallard, ''Who Shall Keep the Humanity's 'Sacred Trust'? International Liberals, Cosmopolitans and the Problem of Proliferation,'' in Grégoire Mallard, Catherine Paradeise, and Ashveen Perlaye, eds., *Global Science and National Security: Studies in Historical Sociology of Science* (London: Routledge, 2008), pp. 82–119. On the other hand, the post-war scientists' movement was successful in its first major effort, convincing the US Congress to transfer control of the nascent nuclear weapons program from the military to a new civilian agency.
3. Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962), p. 112.
4. This article does not ask *why* the experts stuck to a biased understanding of history. It merely focuses on how and what follows. For an analysis of why, see Benoît Pelopidas, *La séduction de l'impossible. Etude sur le renoncement à l'arme nucléaire et l'autorité politique des experts* [The seduction of the impossible: A study on the renunciation of nuclear weapons and the political authority of experts] (Paris: Sciences Po University Press, forthcoming 2011).
5. William Potter and Gaukhar Mukhatzanova, ''Introduction,'' in William Potter and Gaukhar Mukhatzanova, eds., *Forecasting Nuclear Proliferation in the 21st Century—Volume 1: The Role of Theory* (Palo Alto: Stanford University Press, 2010), p. 2.
6. In his attempt at going beyond optimism and pessimism, Matthew Kroenig focuses on which states will be more affected than others by proliferation and why. In doing so, he remains inside the proliferation paradigm as a direction of history. Matthew Kroenig, ''Beyond Optimism and Pessimism:

The Differential Effects of Nuclear Proliferation,'' Managing the Atom Project, Working Paper 2009-14, November 2009.

7. The most prominent attempts at challenging the proliferation paradigm are Jacques Hymans, *Psychology of Nuclear Proliferation: Identities, Emotions and Foreign Policy* (Cambridge: Cambridge University Press, 2006); Etel Solingen, *Nuclear Logics: Contrasting Paths in East Asia and the Middle East* (Princeton: Princeton University Press, 2007); and Maria Rost Rublee, *Nonproliferation Norms: Why States Choose Nuclear Restraint* (Athens: University of Georgia Press, 2009).
8. The first authoritative study was Gordon Correra, *Shopping for Bombs: Nuclear Proliferation, Global Insecurity, and the Rise and Fall of the A.Q. Khan Network* (Oxford: Oxford University Press, 2006).
9. Among many others, see Charles D. Ferguson and William C. Potter, with Amy Sands, Leonard S. Spector, and Fred L. Wehling, *The Four Faces of Nuclear Terrorism* (London: Routledge, 2005); and Michael Levi, *On Nuclear Terrorism* (Cambridge, MA: Harvard University Press, 2007).
10. This is true to the extent that an increase in the number of actors with nuclear weapons is a factor in the rise in the number of nuclear weapons in the world; separate aspects of nuclear security are climate change and biosecurity. See ''Doomsday Clock Overview,'' *Bulletin of the Atomic Scientists*, undated, <www.thebulletin.org/content/doomsday-clock/overview>.
11. Juha A. Vuori, ''A Timely Prophet? The Doomsday Clock as an Aesthetisation of Securitization Moves with a Global Referent Object,'' paper presented to the Fiftieth Annual Convention of the International Studies Association, New York, February 15–18, 2009, p. 22.
12. Potter and Mukhatzanova, ''Introduction,'' p. 2.
13. The classic statements of Waltz's arguments are Kenneth N. Waltz, *The Spread of Nuclear Weapons: More May Be Better*, Adelphi Paper No. 171 (London: Oxford University Press, 1981); and Kenneth N. Waltz in Kenneth N. Waltz and Scott D. Sagan, eds. *The Spread of Nuclear Weapons: A Debate Renewed* (New York: W.W. Norton, 2002), chapters 1 and 3. His point that a theory of international relations cannot predict proliferation is made in Kenneth N. Waltz, ''A Reply,'' *Security Studies* 4 (1995), p. 803.
14. For an example of criticism, see Robert S. Norris, Jeremy Bernstein, and Peter D. Zimmerman, ''An Uncertain Train of Nuclear Events,'' *Nonproliferation Review* 16 (2009), pp. 293–301.
15. Thomas C. Reed and Danny Stillman, *The Nuclear Express, A Political History of the Bomb and its Proliferation* (New York: Zenith Press, 2009), p. 319.
16. Ibid.
17. For example, see William Langewiesche, *The Atomic Bazaar: The Rise of the Nuclear Poor* (New York: Penguin, 2007); and Sujeet Samaddar, Thinking Proliferation Theoretically,'' *Nonproliferation Review* 12 (November 2005), p. 435.
18. On the origins of the approach in terms of proliferation, see Matthew Woods, ''Inventing Proliferation: The Creation and Preservation of the Inevitable Spread of Nuclear Weapons,'' *Review of International Affairs* 3 (March 2004), p. 419. For the wording of the Soviet effort to build nuclear weapons as ''proliferation,'' see Michael D. Gordin, *Red Cloud at Dawn: Truman, Stalin, and the End of the Atomic Monopoly* (New York: Farrar, Straus, and Giroux, 2009), pp. 64, 186, 275.
19. For a more detailed analysis of this aspect, see Benoît Pelopidas, ''La couleur du cygne sud-africain. Le role des surprises dans l'histoire nucléaire et les effets d'une amnésie partielle'' [The color of the South African swan: The role of surprises in nuclear history and the effects of a partial amnesia], *Annuaire Français des Relations Internationales* [French yearbook of international relations], 2010.
20. For a global assessment of the excessive pessimism of forecasters, see Moeed Yusuf, ''Predicting Proliferation: The History of the Future of Nuclear Weapons,'' Policy Paper 11, Brookings Institution, January 2009.
21. Jeffrey T. Richelson, *Spying on the Bomb: American Nuclear Intelligence from Nazi Germany to Iran and North Korea* (New York: W.W. Norton, 2006), pp. 373–400.
22. Hans Blix, *Disarming Iraq*: *The Search for Weapons of Mass Destruction in Iraq* (New York: Pantheon, 2004), p. 256.
23. Harald Müller and Andreas Schmidt, ''The Little-Known Story of De-Proliferation,'' in *Forecasting Proliferation in the 21st Century–Volume 1: The Role of Theory*, pp. 124–158. On the difficulty for international security experts to adapt their assumptions to contradicting data, see Richard Hermann and Jong Kun Choi, ''From Prediction to Learning: Opening Experts' Minds to Unfolding History,'' *International Security* 31 (Spring 2007).

24. Benoît Pelopidas, ''Critical Thinking about Nuclear Weapons,'' *Nonproliferation Review* 17 (March 2010), pp. 189–96.
25. Albert Wohlstetter, ''Nuclear Sharing: NATO and the N + 1 Country,'' *Foreign Affairs* 39 (April 1961), p. 367.
26. Potter and Mukhatzhanova, ''Introduction,'' p. 2.
27. Max Black, *Models and Metaphors* (New York: Cornell University Press, 1962), pp. 42, 44–45. On the role of metaphors and the way they shape perceptions, see George Lakoff and Mark Johnson, *Metaphors We Live By* (Chicago: University of Chicago Press, 2003). For an early approach to proliferation as a metaphor, see David Mutimer, ''Reimagining Security: The Metaphors of Proliferation,'' in Keith Krause and Michael C. Williams, eds., *Critical Security Studies* (Minneapolis: University of Minnesota Press, 1997); and his further elaboration in David Mutimer, *The Weapons State*: *Proliferation and the Framing of Security* (Boulder, CO: Lynne Rienner, 2000).
28. On metaphors in scientific discourse, see for instance Roger Jones, *Physics as Metaphor* (Minneapolis: University of Minnesota Press, 1982). On the need for a reflexive use of metaphors, see Francois Ascher, ''La métaphore est un transport. Des idées sur le mouvement au mouvement des idées'' [Metaphor is transport: from ideas on movement to movement of ideas], *Cahiers internationaux de sociologie* 63 (January 2005).
29. David Santoro, ''Treating Proliferation: An Oncological Approach to the Spread of Nuclear, Biological and Chemical Weapons,'' PhD diss., McQuarie University, 2008, pp. 4–7.
30. Mutimer, *The Weapons State.*
31. *Oxford English Dictionary*, 1983, p. 1,448.
32. For a critical assessment of the notion, see Scott D. Sagan, ''Nuclear Latency and Nuclear Proliferation,'' in *Forecasting Proliferation in the 21st Century* (Palo Alto, CA: Stanford University Press, 2010), pp. 80–101.
33. United Nations, ''Note by the President of the Security Council,'' S/23500, January 31, 1992, <www.francetnp2010.fr/IMG/pdf/Declaration_CSNU_1992.pdf>.
34. For an analysis and a systematic critique of this view that I label capacity determinism, see Pelopidas, *La seduction de l'impossible* [The seduction of the impossible], ch. 3.
35. Jacques Hymans, ''Theories of Nuclear Proliferation: The State of the Field,'' *Nonproliferation Review* 13 (November 2006), p. 456.
36. Dagobert L. Brito and Michael D. Intriligator, ''The Economic and Political Incentives to Acquire Nuclear Weapons,'' *Security Studies* 2 (1993), p. 301.
37. Mutimer, ''Reimagining Security,'' p. 213.
38. Jim Walsh, ''Bombs Unbuilt: Power, Ideas and Institutions in International Politics,'' PhD diss., MIT, 2001, p. 5.
39. Scott D. Sagan, ''Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb,'' *International Security* 21 (Winter 1996–97), pp. 58–59; Potter and Mukhatzanova, ''Introduction,'' p. 1.
40. Solingen, *Nuclear Logics*, pp. 288–89.
41. Mitchell B. Reiss, *Bridled Ambitions: Why Countries Constrain Their Nuclear Capabilities* (Washington, DC: Woodrow Wilson Center Press, 1995), pp. 8–12, 33–35; Jean DuPreez and Thomas Maettig, ''From Pariah to Nuclear Poster Boy: How Plausible is a Reversal?'' in Potter and Mukhatzanova, eds., *Forecasting Nuclear Proliferation in the 21st Century—Volume 1*.
42. William C. Potter, ''The Politics of Nuclear Renunciation: The Cases of Belarus, Kazakhstan and Ukraine,'' Henry L. Stimson Center, Occasional Paper 22, April 1995; William C. Potter, ''Back to the Future: The Contemporary Relevance of the Nuclear Renunciation Decisions by Belarus, Kazakhstan, and Ukraine,'' Paper delivered to the Nobel Symposium: Oscarborg, June 25–27, 2009; and Nikolai Sokov, ''Ukraine: A Post-Nuclear Country,'' in Potter and Mukhatzanova, *Forecasting Nuclear Proliferation in the 21st Century—Volume 1*.
43. On Libya's attempts to get nuclear weapons under Qaddafi, see Malfrid Braut-Hegghammer, ''Libya's Nuclear Turnabout: Perspectives from Tripoli,'' *Middle East Journal* 62 (Spring 2008), pp. 58–63; Rublee, *Nonproliferation Norms*, p. 152; and Solingen, *Nuclear Logics*, p. 213. On the importance of 1992 as a turning point, see Braut-Hegghammer, ''Libya's Nuclear Turnabout''; Wyn. Q. Bowen, *Libya and Nuclear Proliferation: Stepping Back from the Brink* (London: Oxford University Press, 2006), ch. 3; and Harald Müller, ''The Exceptional End to the Extraordinary Libyan Nuclear Quest,'' in Morten Bremer Maerli and Sverre Lodgaard, eds., *Nuclear Proliferation and International Security* (London: Routledge, 2007), p. 77.

On how quick and verifiable the Libyan dismantlement was, see Bowen, *Libya and Nuclear Proliferation*, ch. 4; Joseph Cirincione, Jon B. Wolfsthal, and Miriam Rajkumar, *Deadly Arsenals* (Washington, DC: Carnegie Endowment for International Peace, 2005), p. 317.

44. Peter Lavoy, ''Nuclear Proliferation over the Next Decade: Causes, Warning Signs, and Policy-Responses,'' *Nonproliferation Review* 13 (November 2006), p. 440.

45. On Germany, see John Mearsheimer, ''Back to the Future: Instability in Europe after the Cold War,'' *International Security* 15 (1990), p. 38; on, Japan, see Christopher Layne, ''The Unipolar Illusion: Why New Great Powers Will Rise,'' *International Security* 17 (Spring 1993), p. 37.

46. For an in-depth analysis of this puzzle, see Jacques Hymans, *Implementing Nuclear Ambitions: Politics, Profossionalism, and Technical Achievement* (Cambridge: Cambridge University Press, forthcoming).

47. Harald Müller and Andreas Schmidt, ''The Little-Known Story of De-Proliferation: Why States Give Up Nuclear Weapons Activities,'' paper presented to the Forty-Ninth Annual Convention of the International Studies Association, San Francisco, 2008, p. 25.

48. Solingen, *Nuclear Logics,* ch. 11; Rublee, *Nonproliferation Norms*, ch. 4.

49. Prime Minister David Ben-Gurion and Shimon Peres had made up their minds earlier, but formal Israeli decisions to go for the bomb were only taken in 1957–58. Avner Cohen, *Israel and the Bomb* (New York: Columbia University Press, 1998), p. 137.

50. Rublee, *Nonproliferation Norms*, p. 108; Solingen, *Nuclear Logics,* p. 234.

51. Solingen, *Nuclear Logics,* p. 233–34.

52. Rublee, *Nonproliferation Norms*, pp. 107, 112.

53. The ''Doomsday Clock'' displays nuclear risk in general, but I have assumed that proliferation is an essential component in such risk.

54. Ariel Levite identifies thirty-eight proliferators, if the four that he lists as ambiguous are included. See Ariel Levite, ''Never Say Never Again: Nuclear Reversal Revisited,'' *International Security* 27 (Winter 2002–3), p. 62. The states are: Algeria, Argentina, Australia, Belarus, Brazil, Canada, China, Egypt, Finland, France, Germany, Greece, India, Indonesia, Iran, Iraq, Israel, Italy, Japan, Kazakhstan, Libya, the Netherlands, North Korea, Norway, Pakistan, Romania, South Africa, South Korea, the Soviet Union/Russia, Spain, Sweden, Switzerland, Taiwan, Turkey, Ukraine, the United Kingdom, the United States, and Yugoslavia. I add Syria, in light of the suspicion surrounding the facility that Israel bombed on September 6, 2007. I am reluctant to label Ukraine, Belarus, and Kazakhstan as proliferating states because they were not independent when a portion of the Soviet arsenals was set up within their borders. The fact that all three states have had separate seats at the UN General Assembly does not seem sufficient grounds on which to cancel out this fact. These states inherited arsenals that had seen nuclear activity, but they are not proliferators. Harald Müller and Andreas Schmidt, meanwhile, maintain that thirty-six states have undertaken nuclear activities at some point in history, regardless of which states had or had not explicitly decided to make a bomb (see Müller and Schmidt, ''The Little-Known Story of De-Proliferation''). It is important to note that some studies put forward a significantly lower total of proliferating states, but Müller and Schmidt argue convincingly against those studies.

55. Müller and Schmidt, ''The Little-Known Story of De-Proliferation,'' p. 8. They make no mention of Syria, whose military aims remain open to doubt. In the absence of any conclusive evidence, I do not consider Syria to have been a new proliferator during the period in question. Furthermore, some sources suggest that Damascus launched a nuclear program in 1979; that is to say, prior to the period being examined. See ''Syria Profile: Nuclear Overview,'' Nuclear Threat Initiative, July 2009, <www.nti.org/e_research/profiles/Syria/Nuclear/index.html>. This point however needs to be qualified further. Indeed, the fact that Pakistan could react to the Indian tests by detonating six of its own devices within two weeks leads one to wonder whether Pakistan had its weapons ready before its 1998 test. Thanks to Sverre Lodgaard for this remark.

56. Helen Purkitt and Stephen Burgess, *South Africa's Weapons of Mass Destruction* (Bloomington: Indiana University Press, 2005), chs. 6, 7, and 8.

57. Two questions have yet to be discussed, though I do not have space to go into them in detail here: the matter of launch codes and that of testing sites. Indeed, in order for Ukraine to have been able to acquire a truly independent arsenal, it would have needed access to the launch codes for its missiles and would have had to become able to change the targets of that same arsenal. (Interview with Robert C. Nurick of the James Martin Center for Nonproliferation Studies, Washington, DC, on April 4, 2008.) Ukraine had neither an independent satellite system to monitor missiles nor a testing site.

Christopher Stevens argues, on the contrary, that nuclear warheads had lifetimes that did not expire until at least 2010; in this case, computerized tests could have been carried out. He also relies upon Reiss, *Bridled Ambitions*, p. 105; and John Mearsheimer, ''The Case for a Ukrainian Nuclear Deterrent,'' *Foreign Affairs* 72 (Summer 1993), pp. 62–63, to point out that US and Russian experts believed that the Ukrainians had the capacity required to ensure the security of nuclear warheads. Christopher Stevens, ''Identity Politics and Nuclear Disarmament: The Case of Ukraine,'' *Nonproliferation Review* 15 (January 2008).

58. Bernard Brodie, *Strategy in the Missile Age* (Princeton: Princeton University Press, 1959), p. 19.

59. Neil Cooper, ''Putting Disarmament Back in the Frame,'' *Review of International Studies* 32 (Summer 2006), pp. 353–57.

60. Emanuel Adler, ''The Emergence of Cooperation: National Epistemic Communities and the International Evolution of the Idea of Nuclear Arms Control,'' *International Organization* 46 (Winter 1992), p. 101.

61. Henry Sokolski is a prominent voice of this critique of nuclear technology sharing in the name of proliferation concerns. Henry Sokolski, ''Towards an NPT-Restrained World that Makes Economic Sense,'' *International Affairs* 83 (May 2007), pp. 531–48; and Henry Sokolski, ed., *Falling Behind: International Scrutiny of the Peaceful Atom* (Carlisle, PA: US Army War College Strategic Studies Institute, 2008).

62. Lauren Mayros, ''Multilateral Export Control Regimes: Tools for Non-Proliferation or Instruments of Economic Influence?'' in Grégory Boutherin, ed., *Europe Facing Nuclear Weapons Challenges* (Brussels: Bruylant, 2008), p. 222.

63. Jacques Hymans, ''When Does A State Become a 'Nuclear Weapon State'? An Exercise in Measurement Validation,'' *Nonproliferation Review* 17 (March 2010), pp. 161–80.

64. Lewis Dunn, ''Non-Proliferation Epidemiology,'' in Paul Bracken, Ian Bremmer, and David Gordon, eds., *Managing Strategic Surprises: Lessons from Risk Management and Risk Assessment* (Cambridge: Cambridge University Press, 2008), p. 79, fn. 79.

65. Rigorously, one should add a policy of inaction waiting for the sudden death of the head of the regime and father of the nuclear program as relying on a shock as the only factor of change. For more on this understanding of the supposed role of a shock as a nonproliferation policy, including the need to wait for the shock caused by the death of a ruler associated with the program, see Pelopidas, *La séduction de l'impossible* [The seduction of the impossible], ch. 4.

66. For a critical reassessment, see notably Ken Berry, Patricia Lewis, Benoît Pelopidas, Nikolai Sokov, and Ward Wilson, ''Delegitimizing Nuclear Weapons: Assessing the Validity of Nuclear Deterrence,'' James Martin Center for Nonproliferation Studies, August 2010, <cns.miis.edu/opapers/pdfs/delegitimizing_nuclear_weapons_may_2010.pdf>.

67. Kenneth N. Waltz in Richard K. Betts, Scott D. Sagan, and Kenneth N. Waltz, ''A Nuclear Iran: Promoting Stability or Courting Disaster?'' *Journal of International Affairs* 60 (February 2007), p. 136.

68. On the US policy vis-à-vis the nuclearization of Pakistan, see notably Adrian Levy and Catherine Scott-Clark, *Deception: Pakistan, the United States and the Secret Trade in Nuclear Weapons* (New York: Walker and Company, 2007); and Gerald Smith and Helena Corban, ''A Blind Eye to Nuclear Proliferation,'' *Foreign Affairs* 68 (Summer 1989). On the US relationship with the Israeli nuclear program, see Seymour Hersh, *The Samson Option: Israel's Nuclear Arsenal and American Foreign Policy* (New York: Random House, 1991); Cohen, *Israel and the Bomb*, ch. 7, on the role of the John F. Kennedy administration; and Avner Cohen, *The Worst-Kept Secret: Israel's Bargain with the Bomb* (New York: Columbia University Press, 2010).

69. This implies that policy makers should be open to much less certainty, and we know this is really rarely the case. On this issue, see Robert Jervis, *Why Intelligence Fails: Lessons from the Iranian Revolution and the Iraq War* (Ithaca: Cornell University Press, 2010), ch. 4.

70. Stating that the Iraqi case was a failure of intelligence does not necessitate a decision on whether the political outcome would have been different with better intelligence. Even the leading proponents of the idea that intelligence did not matter recognize that there was a failure due to ''too much certainty,'' ''no alternatives considered,'' and ''lack of imagination.'' See Jervis, *Why Intelligence Fails*, ch. 3. On the Israeli case, see Isaac Ben-Israël, *Philosophie du renseignement, logique et morale de l'espionnage* [Philosophy of intelligence: logic and morals of espionage] (Paris: Éditions de l'éclat, 2004).