Misunderestimation: Explaining US Failures to Predict Nuclear Weapons Programs[·]

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Abstract

Various policy options have been proposed for slowing or halting the spread of nuclear weapons; yet all rely on sound intelligence about the progress of nuclear aspirants. Historically, the United States has had an uneven record of estimating weapons programs, overestimating the progress made by some proliferators while underestimating others. This paper seeks to catalogue and evaluate the intelligence work surrounding sixteen of the twenty-five states that are thought to have pursued nuclear weapons and to derive conclusions about the causes of distorted nuclear proliferation intelligence estimations. In particular, we evaluate twelve specific hypotheses related to policy, culture, bureaucracy, and organizational culture. We find that the US has overestimated nuclear programs more frequently than it has underestimated or correctly estimated them, and that most mistaken estimates founder on similar grounds.

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Introduction

In recent years, nuclear proliferation has become an urgent, if not necessarily a primary, concern of international politics. Many policy options have been proposed for slowing or halting the spread of nuclear weapons, ranging from security guarantees and economic incentives to economic and diplomatic sanctions, blockades, sabotage, and regime change. Each approach has its disadvantages, but all rely on sound intelligence about the sophistication, location, and capability of nuclear facilities or the structure of proliferation networks that provide technical components to aspiring states.

Yet the overestimation of Iraq's nuclear program is not the only case of US intelligence estimates being grossly wrong. Before the Persian Gulf War, US intelligence agencies made the opposite mistake, regarding Iraq's nuclear program to be almost a decade away from constructing a nuclear weapon when in fact fissile material could have been ready within a couple of years.[1] Iran's nuclear program has consistently been overestimated: warnings that Iran would develop nuclear weapons within three to five years have been consistently issued (and consistently wrong) since the mid-1980s.[2] Yet the US underestimated the speed with which states such as the Soviet Union, Israel, and Taiwan would progress toward a preliminary nuclear capability.

Until recently, there has been no systematic public account of US intelligence experience with regard to nuclear weapons programs. Understanding when (and why) US intelligence estimates have been skewed is crucial to improving intelligence estimates, preventing unnecessary conflicts, and broadening public and academic knowledge of intelligence capabilities. While the recent failure in Iraq has been accompanied by a great deal of conflicting analyses,[3] such explanations are limited by a lack of historical context. Without understanding the history of US intelligence estimates of nuclear programs, it is difficult to identify whether the factors that led to the Iraqi estimate are structural or circumstantial, habitual or aberrant.[4]

With the publication of *Spying on the Bomb*, Jeffrey Richelson has provided an extensive historical overview of US intelligence on 13 states (Nazi Germany, the Soviet Union, China, France, India, Israel, South Africa, Taiwan, Iraq, North Korea, Libya, Pakistan, and Iran).[5] However, Richelson's work is primarily historical, seeking to catalogue the US intelligence programs rather than to subject them to evaluation and analysis. Consequently, in order to systematically study the causes of US nuclear intelligence failures, we draw from and extend Richelson's canonical work, providing original research on three additional states (Argentina, Brazil, and South Korea) and viewing estimates of all sixteen states' capabilities and intent through the literature on intelligence distortions and forecasting.

We take our overall universe of cases–countries that have at least explored a nuclear option–by combining the cases listed by Singh and Way with Jo and Gartzke for a total of 25 states.[6] The

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[1] Compare the estimate in Director of Central Intelligence 1991, p. 3, which suggests the "late 1990s," with Albright, Berkhout and Walker 1997, p. 327.
[2] See Appendix.
[3] See, for example, Cirincione, et al. 2004, Silberman and Robb 2005.
[4] Russell 2005, in a brief survey, argues that they are structural.
[5] Richelson 2006.
[6] Singh and Way 2004 code 23 countries between 1945 and the present, separating them in to

ten 'successful' states who are known to have or are suspected of having obtained nuclear explosive capability are the United States, the United Kingdom, the Soviet Union, France, China, Israel, India, South Africa, Pakistan, and North Korea. The first two are omitted from the study as US intelligence estimates were unnecessary. We include a number of states that, according to Singh and Way, have seriously pursued at least a nuclear weapons option: South Korea, Libya, Brazil, Argentina, Iraq, and Iran. We omit most of the states that they classify as having only explored weapons due to a lack of declassified information on intelligence estimates or on the programs themselves: Switzerland, Sweden, Yugoslavia, Australia, Algeria, and Romania. However, we include Taiwan, coded by Singh and Way as exploratory, since good estimates are available. Imperial Japan and Nazi Germany had active programs during World War II; due to similar informational requirements, the latter is included while the former omitted. Other states are suspected of having had nuclear programs, but little hard evidence exists of an independent effort.[7] Finally, Belarus, Kazakhstan, and the Ukraine may have briefly had physical possession of weapons, though since they were "born nuclear" they do not warrant inclusion.

Table 1: Scope of the Study

State	Programs	Our Analysis	Upper Limit
Germany	1941–1945	1941–1945	End of World War II
Soviet Union	1943–	1945–1949	Test
France	1954–	1946–1960	Test
China	1956–	1955–1964	Test
Israel	1955–	1957–1969	Meir/Nixon meeting
India	1964–1974	1958–1974	Test
Taiwan	1967–1976, 1987–1988	1965–1988	End of Program
South Africa	1971–1990	1969–1990	End of Program
South Korea	1971–1975	1970–1975	End of Program
Libya	1970–2003	1970–2003	End of Program
Pakistan	1972–	1974–1998	Test
Argentina	1976–1990	1974–1990	End of Program
Brazil	1978–1990	1975–1990	End of Program
North Korea	1982–	1982–2006	Test
Iran	1984–	1984–2007	2007 NIE
Iraq(1)	1973–1991	1981–1991	End of Persian Gulf War
Iraq(2)	1991–2003	1991–2003	End of Operation Iraqi Freedom

We start our analysis for each program from its beginning or from the first available estimate of the program, whichever is earlier. Our analysis ends when a subject state tests a nuclear explosive or conducts a decisive test that gives them sufficient confidence in their designs (most cases), is

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"exploring" and "pursuing"; Nazi Germany and Imperial Japan add two. Jo and Gartzke 2007 code 21 between 1941 and 2002, excluding Libya, Switzerland, Australia, and Algeria due to a lack of a top-level decision to produce (rather than procure) weapons. See Montgomery and Sagan 2009 on coding differences.

[7] Levite includes additional countries in the "tried but gave up" category: Egypt, Italy, postwar Germany and Japan, Canada, the Netherlands, and Norway. He also notes that there have been assertions, but no data, on Finland, Greece, Spain, and Turkey. Levite 2002/2003, p. 62.

invaded (Germany and the two Iraq cases), a program is ended (Taiwan, South Africa, South Korea, Libya, Argentina, Brazil), a program is believed to have been divulged to the United States (Israel, in the Meir/Nixon meeting) or the last NIE regarding a program has been published (Iran). The approximate dates for each program are from Jo and Gartzke; the years covered by our analysis are displayed in Table 1.[8] We divide the Iraqi program into two observations, the first ending with the first Gulf War in 1991, the second with Operation Iraqi Freedom in 2003, giving us a total of seventeen observational periods. We omit a second potential period for India (1974–1998) as capability had already been achieved, and a potential first period for Iran (1974–1979) due to a lack of data.

In the following section, we generate twelve hypotheses contributing to intelligence distortion based on a review of the intelligence literature. We then discuss two of our sixteen states, identifying key estimates and evaluating whether they were under, over, or correct. Israel and North Korea were chosen so as to demonstrate each of the distortions we found to be operative in the universe of cases; they also provide a helpful contrast between sources of error about allies and those about rogue states. For each, we evaluate our hypotheses as fully as possible given the limitations of our data. We then conclude with policy and research implications.

Hypotheses: Sources of Distortion in Intelligence Estimates

Even beyond the usual difficulties associated with forecasting in international relations, national intelligence estimation is a difficult process. The analysts charged with monitoring the political and technical events that comprise foreign nuclear weapons programs must navigate many pressures that threaten to distort assessments. Analysts must balance between relevance and objectivity, urgency and alarmism, conservatism and uncertainty in the face of rapidly changing demands and targets. In this section, we catalog political, cultural, bureaucratic, and organizational effects, organizing these sources of distortion into hypotheses. These hypotheses are not an exhaustive list of possible sources of intelligence failure, for two reasons. First, it emits most of the psychological sources of estimation distortion in order to focus on distinctively political processes. Second, this list is tailored to estimates of clandestine nuclear programs, to which some hypothesized sources of intelligence failures do not pertain.[9] The sources of distortion are summarized in Table 2 below.

[8] Except Libya and India, for which we use the Singh and Way pursuit coding, and Taiwan's second attempt, for which we use the Singh and Way explore coding.

[9] For a similar, more general endeavor, see George 2010.

Table 2: Intelligence Distortion Hypotheses

Type	Distortion	Literature
Political	1. The ideology of the executive may encourage or promote those estimates that conform to the desired view. a. Members of the executive branch select preferred primary intelligence. b. Requests to agencies may be suggestive, leading, or constraining. c. Certain leaders may marginalize or ignore agencies. d. The choice of DCI may affect the environment of political neutrality. e. Standards of proof may be raised prohibitively if they contradict preferences.	(Bar-Joseph 1995) a: (Ransom 1985, p. 26) b: (Lowenthal 2000, p. 124) c: (Lowenthal 2000, p. 123) d: (Ransom 1985, p. 43)
	2. Policy initiatives, past, present and future, can affect estimates a. Existing policy in an area makes difficult or precludes objective analysis, whether logistically or psychologically b. Not enough importance attached to an area of geography or analysis, collection failure c. Likelihood of major action resulting from estimate	a: (Ransom 1985) (Lowenthal 1985) b: (Wohlstetter 1981) c: (Bar-Joseph 1995) (Hastedt 1987)
	3. Likelihood of disclosure / politicization of estimate. A function of the level of consensus regarding a given action in the domestic policy arena.	(Hastedt 1985) (Hastedt 1987) (Ransom 1985)
Cultural	4. Cultural biases create mistaken assumptions of capabilities.	(Ford 1993) (Lowenthal 1985) (Ascher 1978)
	5. Misestimating intent / motives / resolve of subject state.	(Handel 2003) (Booth 1979)
	6. Analysts misinterpret the involvement of outside sources	
Bureaucratic	7. Multiple advocacy among agencies causes a. compromise b. domination	(Bar-Joseph 1995) (Handel 2003, pp. 28, 44) (Lowenthal 2000, p. 122)
	8. A fragmented bureaucracy stalls the dissemination and aggregation of useful data.	(Handel 2003, p. 35)
Organizational	9. Data overwhelms the analytic system, signals not separated from noise.	(Wohlstetter 1981) (Lowenthal 1985, p. 49)
	10. Preference for secret over open sources	(Hastedt 1985, p. 143) (Turner 1985, pp. 116-117)
	11. Recent experience with intelligence failures	
	12. Mistaken induction / conceptual rigidity: assumptions derived from historical experiences may not apply	(George 2004) (Ascher 1978) (Choucri and Robinson 1978) (Kuhns 2003, p. 90)

Political

The intelligence producer-consumer relationship is a delicate one. An intelligence agency must continually mediate between serving the needs of its consumers and maintaining objectivity. Intelligence must balance between concerted support for decided policy and maintaining objective estimation about developing future threats and most regions of the world. This tension is exacerbated by policymakers' general dissatisfaction with intelligence estimates generally, which tend to question deeply-held ideologies and detract from treasured policy initiatives. As Betts writes, "intelligence cannot live with politicization, but policy cannot live without it."[10]

[10] Betts 2003.

The early Director of the Office of National Estimates (ONE) Sherman Kent argued that credibility, not influence, should be the goal of intelligence producers.[11] Ford has shown how Kent's doctrine, combined with a move to Langley, changing leadership style in the White House, and a general decline in the quality of ONE staff in the 1950s, led to a separation of intelligence estimating from policymakers.[12] Subsequent decades have seen a trend toward more 'activist,' politicized relationships as "the need to successfully gain the decisionmakers' attention detaches [analysts] from [Kent's] ethic."[13] This approach is not without its advocates: Hastedt suggests that the intelligence-policy relationship is necessarily politicized, and argues that "rather than try to improve the quality of estimates by depoliticizing the estimating process, attention must be given to holding in check the potential for corruption."[14]

Whether due to the nature of the nature of the relationship or the pecurliarities of specific policymakers, intelligence consumers may issue leading requests for estimates that put distortionary pressure on competing intelligence agencies and analysts, or cause selection of preferred estimates from between these agencies.[15] While express evidence of executive ideological politicization is difficult if not impossible to attain from classified or open sources alike, the possibility is clearly real.[16] Hypothesis 1 evaluates these propositions for each case, considering five possible mechanisms of politicization. First (a.), members of the executive branch may overtly select from preferred primary or finished intelligence sources in order to craft a picture that supports their desired policy, discarding or ignoring contrary information.[17] Second (b.), requests to agencies may be suggestive, leading, or constraining of objective analysis and tacitly encourage analysts to adhere to the preferred line.[18] Third (c.), the perspective that certain leaders hold toward intelligence generally may serve to marginalize or ignore agencies that endeavor to produce policy-relevant intelligence.[19] Fourth (d.), the appointment of intelligence chief (formerly the DCI, now DNI) may affect the environment of political neutrality in subtle and circuitous ways relating to their sense of their role, their view of the intelligence community generally, their relationship with the executive, and so on.[20] Fifth (e.), policymakers may raise or lower evidentiary standards for intelligence based on their views of the issue area. For example, Ellis and Keefer discuss President Clinton's experience with intelligence on Sino-Pakistani missile transfers in spite of the Arms Export Control Act: "Flexibility was seen as key to the Clinton team's foreign policy…[which] led to conflict with the intelligence community and with key members of Congress over the standards of evidence for missile technology transfers."[21] Goodman describes a more general—but equally distortionary—process: "As a result of

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[11] Kent 1968, p. 34.
[12] Ford 1993.
[13] Bar-Joseph 1995, p. 11.
[14] Hastedt 1987, p. 8. Corruption, for Hastedt, is a function of "personalities, closed and rigid belief systems, ulterior political motives," and the allowance of secrecy for analysts.
[15] For a recent example, see Mazzetti 2006.
[16] An excellent general discussion of ideological politicization can be found in Bar-Joseph 1995.
[17] Ransom 1985, p. 26.
[18] Lowenthal 2000, p. 124.
[19] Lowenthal 2000, p. 123. For an excellent summary of the changing executive-intelligence relationships (and also executive-DCI relationships) , see Andrew 1996.
[20] Ransom 1985, p. 43.
[21] Ellis and Kiefer 2007, pp. 51-55.

considerable policy pressure, the intelligence community in 1998-1999 began to lower its standards for judging strategic threats, describing known missile programs [in North Korea, Iran, and Iraq] as more immediate threats than did previous assessments."[22]

However, direct executive politicization does not exhaust the possibilities for ideological estimative distortion. For instance, the broader course of policy initiatives, past, present, and planned, can affect the estimation process in at least three ways. Less a problem of corruption than selective attention, Hypothesis 2 suggests that relatively rare collection failures can have political causes. By necessity "national interest…determines intelligence priorities,"[23] but variations in how the national interest is to be pursued are likely to influence intelligence requests and corresponding adjustments in collection capabilities are often viscous.[24] There are three possibilities. First (a.), existing policy in an area makes difficult or precludes objective analysis, whether logistically or psychologically.[25] Second (b.), politicians may privilege or slight certain regions or issues depending on their expertise, campaign promises, or a host of other strategically arbitrary motivations, and these vicissitudes may influence agencies' ability to collect constant and sound intelligence.[26] Third (c.), the likelihood of major action resulting from an estimate may affect that estimate in two ways: the prospect of major military or diplomatic action may skew determinations, while a sense that little can be done regardless of the intelligence gathered may discourage collection of data.[27]

Lastly, there is good reason to think that the likelihood of disclosure or the public politicization of an estimate may temper the conclusions reached in that estimate. Hastedt notes that since the 1970s declining trust in government and extended executive and legislative control of the bureaucracy have created more public consumers of intelligence than ever before, with corresponding effects on transparency in intelligence agencies and scrutiny of estimates and estimators.[28] The years since Hastedt wrote have only amplified this trend, and added to it a contemporary proclivity to disclose executive summaries of NIEs when so doing would promote policy initiatives.[29] Ransom notes that the likelihood of disclosure and politicization is inversely related to the level of consensus among the public and policy communities: the more consensus, the less likely disclosure and politicization are likely to occur.[30] Hypothesis 3 asserts that the possibility of disclosure alters the contents of an estimate and, secondarily, that the level of

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[22] Goodman 2008, p. 123.
[23] Lowenthal 1985, p. 47.
[24] Hulnick 2006 reminds us that human intelligence assets take years to recruit and implant—but even satellite telemetry cannot always be reprogrammed easily.
[25] Ransom 1985, p. 26, Lowenthal 1985. The primary case here is the U.S.'s agreement not to maintain operations in the Shah's Iran led to surprise at his collapse.
[26] Wohlstetter 1981.
[27] Bar-Joseph 1995, Hastedt 1987.
[28] Hastedt 1985, p. 148.
[29] See Andrew 1996 for some history of disclosures. Note that a complex game has evolved in which disclosures may come from the executive or intelligence agencies themselves. The affects on the content of estimates would vary with either possibility.
[30] Ransom 1985, p. 43.

domestic consensus regarding a given action correlates negatively with this possibility.[31]

Cultural

Ascher, in his treatise on economic forecasting, tends in a different direction: his analysis pays little attention to institutional makeup and maintains that estimative methodology is less important than the assumptions the analyst applies to the task.[32] In international relations estimating, invalid assumptions can result from biases and misinformation about other states and cultures. These assumptions can affect estimates of a state's capabilities, intent, motives, or resolve. As long as "human perceptions are ethnocentric,"[33] "mirror-imaging" in intelligence estimating will remain a problem and will cause inaccurate estimates based on misperceived or overly rational motivations.[34] Hypothesis 4 evaluates assumptions of technical capabilities, asking whether estimates of manufacturing capacity or the abilities of scientific communities are skewed by cultural biases. This category need not be limited to cultural or racial biases: failure to properly calculate potential output, for instance, may fall under this category if it resulted from a failure to understand an economic system.

Hypothesis 5 covers assumptions of the political intent, motives, or resolve of the subject state. The decision to pursue, assemble, and test nuclear weapons is always a political one and so a proper estimate requires estimating the likelihood of those decisions. This mechanism is indicated when the historical evidence suggests a mistaken appraisal of the target country's interests at stake in the nuclear program, or from a failure to adequately understand the leadership's thinking on nuclear matters.[35]

Hypothesis 6 serves to evaluate the impact of outside sources on a nuclear weapons program, whether from allied third party states, nuclear proliferation rings, or other established nuclear countries by espionage. Seeking international assistance is a common practice in the pursuit of nuclear weapons, and appears to be accelerating. Many states–including all of the original "nuclear five"–have pursued nuclear weapons while receiving help from outside their borders, whether in the form of data from others' programs (whether willingly or not), scientists brought from abroad, or parts manufactured in other countries, although the extent to which this assistance has been useful is debated.[36] The recent rise of clandestine nuclear networks only

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[31] Also Hastedt 1987, p. 48, Ransom 1985, p. 43, Betts 2003. For a more recent example, see Spector and Cohen 2008. The authors surmise that the White House overruled a previous agreement among intelligence agencies not to release the contents of the critical 2007 Iran NIE, and so the subsequent release had biased and unintended affects.

[32] Ascher 1978, p. 199.

[33] Handel, quoted in Ford 1993, p. 74.

[34] Lowenthal 1985, p. 49.

[35] Handel 2003, pp. 12-14, Booth 1979. Because the decision to build a nuclear weapon represents a failure of general deterrence, much of the work on that subject is informative here. For more on the importance of accurately appraising interest and intent, see George and Smoke 1974 and Morgan 2003.

[36] Recent quantitative studies have attempted to evaluate the extent to which assistance has affected states' nuclear programs. Fuhrmann 2009 and Kroenig 2009 have argued that civilian and sensitive assistance respectively have accelerated nuclear weapons programs; for a

increases this trend, although again how effective these networks are is contested.[37] In the instances where substantial outside assistance did take place, the effect of this assistance ranged widely, from sporadic nudging to close collaboration. Determining the extent of this assistance and estimating its effect presents a special difficulty for intelligence analysts.

Bureaucratic

Another class of distortions derives from the internal bureaucratic politics and institutional organization of the intelligence community. With components of the nuclear intelligence effort spread between the CIA, the military intelligence organizations and the Departments of State and Energy, inter-organizational politics are critical, especially when producing consensus documents like a national intelligence estimate (NIE).[38] While this multiple advocacy can promote analytical pluralism, it also creates serious difficulties for the estimating process.[39]

Hypothesis 7 holds that the politicization of inter-organizational estimation can lead to two types of distortion of the substance of intelligence estimates: (a.) multiple advocacy can lead to compromise behavior (most famously in CIA and General Westmoreland's estimates of Vietcong strength during the Vietnam War); or (b.) an imbalance of resources or favor could cause some agencies' preferred forecasts to dominate others (for example, in the CIA's interpretation of Iraq's aluminum tube purchases over the correct Department of Energy analysis).[40]

Relatedly, a fragmented bureaucracy may stall the dissemination and aggregation of useful data as agencies in competition defend their scarce information for advantages over their peers.[41] Hypothesis 8 is coded as operative when these dynamics substantively affect the estimation process.

Organizational

Organizational models of domestic politics refer to those that deal with a culture or set of practices that inhere in certain organizations or agencies.[42] Hypotheses 9-12 give the most important such practices for the estimation of nuclear weapons programs.

Hypothesis 9 tests Roberta Wohlstetter's classic account of the inchoate intelligence

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counterpoint, see Montgomery 2010.

[37] Braun and Chyba 2004, Montgomery 2005.

[38] Hastedt notes additionally that the internal structure of an organization can cause distortion; these are omitted from the study as too difficult for an outsider to evaluate. He writes: "hierarchy, specialization, and centralization can be identified as the major sources of distortion" in the organizational sphere. Hastedt 1985, p. 141.

[39] Handel 2003, p. 42.

[40] Authors who have discussed the compromise and domination dynamics include Bar-Joseph 1995, Handel 2003, pp. 28, 44, and Lowenthal 2000, p. 122.

[41] Handel 2003, p. 35.

[42] A general account of these dynamics can be found in Wilson 1989. While this study explicitly eschews psychological explanations of estimative distortion, when these dynamics are encouraged by organizational culture in an aggregate sense, these effects might be classified as organizational.

community's failure to predict Pearl Harbor as an inability to separate the crucial informational signals from the ambient noise.[43]

Hypothesis 10 draws upon an organizational bias that Director of Central Intelligence Stansfield Turner thought he had identified in intelligence agencies: an "excessive emphasis on the use of secret data as opposed to open information." He points out that the latter might well be better disposed than secret intelligence to "the long-range forecasting of political, economic, and military trends."[44] This hypothesis is to some extent implicitly present whenever outside academics or analysts are not consulted, but is considered be operative here when specific, valuable open sources go unanalyzed and unincorporated into estimates.

We might think that recent experience with intelligence failures on this or other issues might well distort analysts' propensities to make conservative or assertive claims. Unwilling to be caught off guard again, analysts may overstate their evidence to emphasize alarming trends.[45] Handel, however, argues that the process tends to operate more often in the inverse: "intelligence organizations tend to err in the direction of excessive caution and underutilization of information."[46] This may be especially true after overestimating a critical case. Hypothesis 11 tests this possibility.

Hypothesis 12 takes on the what is perhaps the most difficult issue of social forecasting: [47] the problem of mistaken induction from past trends onto future possibilities. The issue of determining the proximity and character of a discontinuity in prior political trends is a fundamental, irreducible one in social and political analysis and can never be solved completely. However, it is clear that unreflective "conceptual rigidity"[48] can be damaging to proper intelligence estimation and that some steps can be taken to identify and confront mistaken or unfounded assumptions in specific issue areas.[49] Imaginative or "surprise-sensitive forecasting" might well serve to identify threatening possibilities that might otherwise go unconsidered.[50]

US Intelligence on Nuclear Programs

In Table 3, we list and evaluate the decisive estimates of each of the 17 time periods made by the US intelligence community. While community knowledge of a program is reflected in a constellation of documents, memos, articles, and interviews, the table concentrates on concrete verifiable estimates of overall capabilities and intentions. Below we discuss two case studies, Israel (1957-1969) and North Korea (1982-2006), between which all but one of the hypotheses (Hypothesis 10, preference for secret over open sources) can be observed in practice.

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[43] Lowenthal 1985, p. 49, Wohlstetter 1981
[44] Turner 1985, pp. 116-117, Hastedt 1985, p. 143. Note that in Turner's formulation this bias might well be bound up with Hypothesis 5.
[45] Jervis 2006 discusses this bias in relation to the estimates on the Iraqi program.
[46] Handel 2003, p. 41.
[47] On the issue of forecasting intelligence, see George 2004, Lefebvre 2004, p. 243, Handel 2003, p. 43, Kuhns 2003, p. 90; in international politics generally, see Doran 1999, Choucri and Robinson 1978; for a treatise on economic forecasting, see Ascher 1978.
[48] Handel 2003, p. 45.
[49] Kuhns 2003, p. 88.
[50] Ascher 1978, pp. 202, 211.

Table 3: Estimate Accuracy

State	Date	Evidence	Accuracy	Estimate	Actual
Germany	1943	Compton, *Situation in Germany*	Correct	lack of censorship indicates reactor work	no large scale project
	1944	Furman, *Report on Enemy Activities*	Over	pretense of work as usual	work as usual
Soviet Union	1946	ORE 3/1	Under	between 1950-53	August-49
	1947	ORE *Soviet Capabilities…*	Under	No working reactor	Lab 2 reactor operational
	1948	JCS JIC *Estimate of the Status…*	Under	mid-1950 earliest, mid-1953 probable	August-49
	1949	DCI to Truman	Under	mid-1949 earliest, mid-1953 probable	August-49
France	1956	OSI, *Nuclear Energy Activities…*	Over	Plutonium ready by 1957	Test would occur in Feb. 1960
	1957	NIE 100-6-57	Over	Plutonium available, weapon possible 1958	Test would occur in Feb. 1960
	1958	CIWS *French Nuclear…*	Over	A test could occur at any time	Test would occur in Feb. 1960
	1959	OSI French Nuclear Weapons..	Over	Test possible by Nov. 1959	Test would occur in Feb. 1960
China	1956	NIE 13-56	Correct	A primitive nuclear research capability	Most capacity would be developed in subsequent years
	1957	NIE 13-57	Under	Independent program unlikely before 1961	Soviet support withdrawn by 1959
	1957	NIE 100-57	Under	Chicoms unwilling to divert resources	Necessary commitments were made
	1959	NIE 13-59	Under	No production capacity before 1963	Most elements were in place by 1963
	1960	NIE 13-2-60	Correct	1963 most probable with Soviet support	This date correct without Soviet support
	1962	NIE 13-2-62	Correct	Test possible 1963, likely delayed	Test delayed a year
	1963	SNIE 13-2-63	Correct	Test likely in 1964	Test in 1964, though not for the right reasons
	1964	SNIE 13-4-64	Under	Next few months possible, likely next year	Test a few months later
Israel	1960	SNIE 00-8-60	Under	Primary complex was not detected	Dimona was discovered shortly after
	1961	NIE 4-3-61	Correct	Plutonium by 1965-6, weapon by 1966-7	This is accurate to the best of our knowledge
	1969	*Assessments*	Under	Organizations conclude a weapon	Capability was probably attained some years earlier
India	1961	NIE 4-3-61	Over	Weapon possible in 1968-9, unlikely	Test of nondeliverable device in 1974
	1964	NIE 4-2-64	Over	12 bombs are possible by 1970	Test of nondeliverable device in 1974
	1965	SNIE 31-1-65	Over	A test could occur within months	Test of nondeliverable device in 1974
	1966	NIE 4-66	Over	Within a year of decision, next few years	Test of nondeliverable device in 1974
Taiwan	1964	NIE 43-64	Under	CHICOM test would probably not affect Taiwan	Nuclear program in 1965
	1966	NIE 4-66	Under	Only India likely to undertake a program	Nuclear program in 1965
	1974	NIC-M-85-10001	Correct	Taiwan conducts a program w/NW in mind	Nuclear program in progress
	1987	Albright 1998	Correct	Taiwan seeking a reprocessing plant	Reprocessing program restarted
South Africa	1971	OSI *Atomic Energy Activities…*	Correct	No material, no design, y-plant discussed	only lab-scale uranium enriched
	1974	CIA *Surveyor* article	Under	Lacks all facilities but enrichment	Somchem lab designed & tested a scale model that year
	1974	SNIE *Prospects for Further…*	Under	judges no serious threat to S.A.	threat was used as rationale for bomb
	1976	CIA *Surveyor* article	Under	Sees no evidence of bomb development	A scale model has been tested
	1977	CIA *S.A.'s Uranium Enrichment…*	Over	Several devices worth of HEU/yr.	Really one every 12–18mo.
	1984	NIE *Trends in…*	Over	Enough HEU/yr. for two to four devices	Really one every 12–18mo.

State	Date	Evidence	Accuracy	Estimate	Actual
Pakistan	1974	SNIE *Prospects for Further…*	Correct	At least a decade away	Capability probably attained in 1986
	1975	INR *Pakistan and the Non-…*	Over	Earliest weapon in 1980	Capability probably attained in 1986
	1978	CIA *Untitled*	Correct	Weapon possible early 80s, likely later	Capability probably attained in 1986
	1983	INR	Correct	Weapon possible 1985-6	Correct, but with pu instead of heu
	1986	SNIE -classified-	Correct	Concludes a bomb could be ready	Correct
South Korea	1974	DCI NIO 1945-74	Under	Needs at least a decade	Work under way
	1975	Gilette *U. S. Squelched Apparent…*	Correct	Moving rapidly towards a nuclear weapon	Reprocessing plant one of last few items needed
Argentina	1974	DCI NIO 1945-74	Over	Nuclear weapons capability in early 1980s	Problematic enrichment by 1983, no full capability
	1983	Kessler and Knapik 1983	Under	No knowledge of enrichment efforts	Enrichment plant announcement
	1985	NIC-M-85-10001	Correct	Constrained by economics, domestic politics	No intent to develop nuclear weapons
Brazil	1975	NIE 93-1-75	Correct	No decision to make nuclear weapons	Accurate
	1983	SNIE 93-83	Under	mid-1990s to produce HEU	early 1990s
	1985	NIC-M-85-10001	Correct	Constrained by economics, domestic politics	No intent to develop nuclear weapons
Libya	1975	CIA *Qadhafi's Nuclear Weapons Aims*	Correct	Domestic crash program; ten years	Mostly attempting to buy a weapon, but 10 years correct
	1985	CIA *The Libyan Nuclear Program*	Correct	Rudimentary, highly unlikely within 10 years	Major problems
	1988	CIA *Middle East-South Asia*	Correct	Goal cannot be reached for at least a decade	Little effort being made
	1996	CIA *Section 721*	Under	No mention of nuclear program	Assistance from A.Q. Khan
	2001	CIA *Section 721*	Correct	Efforts to obtain dual-use technologies	Assistance from A.Q. Khan
	2002	CIA	Over	Enough HEU for a weapon by 2007	9-centrifuge cascade
North Korea	1985	NIC-M-85-10001	Under	Plutonium from the reactor by 1990	Reactor started in 1986
	1992	DCI Gates 1992	Over	A few months to a couple of years	Reprocessing plant not finished by 1992
	1998	DIA 1998 (Sanger)	Over	New nuclear complex at Kumchang-ni	Empty tunnels
	2001	CIA *Section 721*	Correct	North Korea centrifuge enrichment program	Acquiring components
Iran	1988	CIA NESA 88-10027X	Correct	Iran will eventually try to develop a capability	Long-term plans laid
	1992	DCI Gates 1992	Over	Iran could have a weapon by 2000	Enrichment not until 2006
	1995	SOS Christopher 1995	Over	Iran has a crash effort	Very little effort
	1997	ACDA director 1997	Over	Iran could not produce fissile material until 2005-6	Enrichment not until 2006
	2000	CIA *Assessment* 2000	Over	Cannot rule out Iranian acquisition	No source of fissile materials
	2002	DCI Tenet	Correct	Iran could have a weapon by 2010	Possible, if worst-case estimate
Iraq (1)	1983	CIA *Iraqi Nuclear Program…*	Under	Does not identify program, design	They're there
	1983	CIA *Iraqi Nuclear Program…*	Under	Focussed on plutonium	A robust enrichment program by this point
	1983	CIA *Iraqi Nuclear Program…*	Correct	Not enough material before 1990s	Material could have been ready by 1992
	1991	NIE	Under	HEU by late 1990s	Albright estimates by 1992
	1991	NIE	Over	Crash bomb six months to a year	Inspectors estimate over a year
Iraq (2)	1993	CIA *Senate testimony*	Over	Without inspection, five to seven years	Much infrastructure was lost, unlikely in five to seven
	1999	JAEIC *Reconstitution of…*	Over	Gradual program, five to seven years	Much infrastructure was lost, unlikely in five to seven
	2002	NIE *Iraq's Continuing Program.*	Over	Program begun: five to seven years	Program had not begun

Note: Sources for this table can be found in the Appendix.

Israel, 1957-1969

U.S. intelligence estimates of Israel's nuclear program were late and of poor quality. Though Israel began producing the sensitive materials necessary to start nuclear research in 1950[51] and began close cooperation with French nuclear scientists in 1956, it was not until 1960 that American policymakers were made aware of Israel's progress toward a bomb. Had any number of pieces of information been examined in those four years, U.S. policymakers would have had knowledge about the program sooner. In 1957, the year Israel broke ground on the Dimona reactor complex in the Negev desert, Israel also abandoned its request for an American 10 MWth reactor and accepted instead a small Soreq research reactor. This did not arouse suspicion at the CIA.[52] Israel accepted this shift because it had received the nuclear assistance it needed from France in the form of a 18 MWth thermal research reactor and plutonium separation technology the same year. French contractors would later assist with construction at Dimona. In 1958, U.S. analysts received U-2 imagery of Israel's primary nuclear facility at Dimona in the Negev desert, two years after the construction was started. This same year, the intelligence community urged U.S. Atomic Energy Commission and the Department of States to step up collection efforts against countries seeking nuclear weapons, but Israel was not included as a country of interest.[53]

In March and April 1958, State Department officials conducted a series of interviews with Dr. Ernst Bergmann, the head of the Israel Atomic Energy Commission and major proponent of the bomb program at the behest of U.S. intelligence agencies. He seems to have been uniformly taken at his word, except for his admission that his country was planning to build a research reactor (which these agencies assumed meant the U.S. reactor).[54] In mid-1959, information on the Dimona complex was furnished to the CIA by human intelligence sources "but was discounted because the other information in the item was demonstrably untrue."[55] Between August and December 1960, a broad range of information finally became available to U.S. intelligence agencies. The decisive piece of information came when University of Michigan nuclear scientist Henry Gomberg was debriefed at the State Department in December about a recent trip to Israel during which he gleaned enough information to guess accurately at the contours and intent of the Israeli program.[56]

Though the Israeli leadership intended to maintain strict secrecy regarding the program a relatively large quantity of information leaked out all the same, which was mostly ignored by U.S. intelligence agencies. Had they launched a concerted collection effort, more surely could have been shaken loose and the program could have been discovered earlier. The failure is doubly grave considering the fact that U.S. intelligence agencies were tracking French nuclear

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[51] In 1956, Israel requested 10 tons of heavy water from the AEC but later abandoned the request; this information was not transmitted to the intelligence community. Director of Central Intelligence 1961b, p. 8.
[52] Cohen 1998, p. 81.
[53] Director of Central Intelligence 1961b, p. 7.
[54] Director of Central Intelligence 1961b, p. 10.
[55] Director of Central Intelligence 1961b**,** p. 8.
[56] Cohen 1998, p. 87.

scientists in the run-up to that country's 1960 test in the Sahara.[57]

After 1960, both the Israeli nuclear program and US estimates of it were increasingly enveloped in secrecy. However, we know enough to posit that Israel achieved preliminary nuclear capability in November of 1966 when nuclear scientists recorded the successful completion of a 'decisive test'–possibly a zero-yield trial.[58] Israel may have cemented this by assembling one or more weapons following Egypt's attack during the Six-Day War. Whether or not this account is to be accepted as accurate, the American apprehension of the program is somewhat confused. In September of 1961, nine months after a post-mortem was completed on the American failure to discover the program sooner and an alarmed President Kennedy demanded information, the intelligence community included Israel in a National Intelligence Estimate that surveyed the nuclear capabilities of non-Soviet countries. This accurately concluded that Israel could assemble an explosive device in 1965-66.[59] In fact, there is reason to believe that American intelligence continued to underestimate Dimona's capacity even after discovering the facility, though the incomplete body of the best current open-source knowledge cannot allow us to be sure. NIE 4-3-61 accepted French and Israeli statements at face value and assessed the Dimona reactor as a 26 MWth heavy water unit. Open source data cannot decisively reject this hypothesis, but it also offers very strong reasons to believe that Dimona was at least a 40 MWth reactor from the start. The evidence for the higher estimate comes from debriefed French contractors who noticed both reactor power and cooling ducts several times too large for a 24 MWth reactor. Information on plutonium output from the defector Mordechai Vanunu and other sources suggests that the reactor had been running at 70 MWth for its entire lifetime. Looking at all the available open-source information, Albright, Berkhout, and Walker conclude that 40-70 MWth is the likeliest option.[60]

Following this and pressure from the Kennedy administration, Ben Gurion agreed to allow American inspectors to visit Dimona in the week of May 15, 1961. These visits were relatively informal, cordial, conducted by AEC scientists without access to intelligence, and so were unsurprisingly uninformative.[61] Seven more inspections over the next decade revealed similar results.[62] Most official estimates from this period remain classified; there is some anecdotal evidence to suggest that formal estimates during this period and after were eschewed due of the sensitivity of the subject in favor of informal conversations between JAEIC members.[63] This almost certainly did nothing to satisfy the post-mortem's recommendation of diminished viscosity of shared information.

By the time Nixon came to office, ambiguity remained regarding both America's knowledge of the Israeli program and its policy toward it. Johnson's tacit opposition to the program had not carried the weight of Kennedy's disapproval, who once threatened Ben Gurion that further stonewalling on the issue would "jeopardize American commitment to Israel's security and well

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[57] Office of Strategic Intelligence 1956, pp. 39-43.
[58] Cohen 1998, pp. 231-232.
[59] Director of Central Intelligence 1961a, p.2.
[60] Albright, Berkhout, and Walker 1997, pp. 257-262.
[61] Cohen 1998, p. 107.
[62] Cohen 1998, pp. 175-194.
[63] Richelson 2006, p. 265.

being."[64] A 1968 State Department memo still asserted that Israel had "not embarked on a program to produce a nuclear weapon."[65] National Security Advsior Henry Kissinger convened NSSM 40, a policy planning board—though without the input of the Arms Control and Disarmament Agency (ACDA) and the Atomic Energy Commission (AEC)—to recommend to the president a position on Israeli nuclear weapons. Howver, by the time Nixon met with Israeli Foreign Minister Golda Meir in the Oval Office in September 1969, preparatory estimates from all sources had assessed the nuclear-capable Jericho missiles and the Plumbat uranium affair and concluded that a bomb had likely already been produced. It seems likely that Meir and Nixon discussed the program openly at that meeting, though its contents have never been divulged.[66] It should be noted that many observers think that American intelligence estimates afterward did not improve and that Mordechai Vanunu's assertions of Dimona's upgrade and increased production caught many in the intelligence community by surprise, though the present level of declassification cannot verify this and in any case these estimates fall beyond the scope of this study.

The CIA's failure in the late 1950s to properly identify Israel's reactor complex at Dimona resulted, like most intelligence failures, from multiple overlapping distortions. The primary problem was that intelligence agencies attached too little importance attached to evaluating and aggregating data about Dimona and Israel's program more generally. The overwhelming quantity of information that became available to the Joint Atomic Energy Intelligence Committee (JAEIC) in the second and third weeks of December 1960 suggests that had similar attention been devoted to the Dimona installation at an earlier period in its development, many of these clues would have become apparent.[67] Israel was not prominently discussed in a 1957 NIE of nuclear proliferation and was only listed in the lowest possible priority for intelligence collection the year before; a year later, Israel's program was raised to Second Category. This meant that as late as 1961 all analysis on the Israeli program was "performed on a part-time basis by one intelligence analyst… who is responsible for corresponding coverage of over forty Bloc and Non-Bloc countries."[68] The CIA's own post-mortem on its Special National Intelligence Estimate of 1960 declared that "the second priority status of Israel tended to reduce the effort and urgency attributed to this program."[69] Instead, the accidental discovery of the site by U-2 in 1958 was not confirmed until two years after the fact.

The close relations of the Israeli and American governments was likely a major impediment to accurate analysis and probably contributed to a failure to fully appreciate the warning signs at every level of government. Political will therefore crucially important: it is hard to imagine Kennedy exhibiting a reaction similar to Eisenhower's apathy at being shown preliminary imagery of the site;[70] and a demand for further information could have led to the site's discovery two years earlier. Furthermore, there is some evidence that analysts and policymakers alike assumed that the program could not be completed without US knowledge or assistance; French

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[64] Cohen 1998, p. 193.
[65] Cohen and Burr 2006, p. 2.
[66] Cohen and Burr 2006.
[67] Director of Central Intelligence 1961b, pp. 7-8.
[68] Director of Central Intelligence 1961b, p. 5.
[69] Director of Central Intelligence 1961b, p. 2.
[70] Cohen 1998, p. 84.

and Israeli statements regarding their collaboration were accepted at face value, a lenience that would have been inconceivable in evaluating Sino-Soviet interactions.[71] The result of these conditions was that positive data was not recognized in the usual data noise, particularly because reports were rarely distributed adequately. (H2)

The US experience with the Israeli program is unique in a number of ways; this is reflected in six other operative hypotheses. Especially after 1961 and during the NSSM 40 process, the close bilateral relationship uniquely hindered the estimating process, as fear of disclosure prevented the production of formal or interagency NIEs (H3). Next, analysts underestimated Israeli technical capabilities, as it was believed that Dimona could not be completed without US or French assistance (H4). The SNIE noted that "the belief that any such aid would be readily known to the US led to a tendency to discount rumors of Israeli reactor construction and French collaboration…"[72] Early complacency led to a major underestimation of Israeli intent and resolve (H5). As noted, French assistance to the program was much more extensive than expected by US estimates, as statements were taken more or less at face value (H6). While the US community possessed much of the data that could have warned policymakers of Dimona's existence years earlier, much of it went unappreciated and unanalyzed as the result of insufficient transmission or recognition of importance (H8, H9).[73]

North Korea, 1982-2006

The current Yongbyon site where the bulk of North Korea's nuclear infrastructure sits was started in 1962, when the Soviet Union agreed to supply the Democratic Republic of Korea (DPRK) with a small (2 MWth) IRT-2000 research reactor. In the 1970s; North Korea separated a small amount of plutonium from the fuel rods of this research reactor.[74] North Korea joined the International Atomic Energy Agency in 1974, and placed this research reactor under safeguards in 1978.[75]

In the late 1970s, North Korea began planning to build a 5 MWe graphite-moderated reactor at Yongbyon, which went critical in the mid-1980s. In the mid- to late-1980s, construction was started on a second (50 MWe) graphite-moderated reactor and a plutonium reprocessing facility at the same site; in 1989, construction on a third (200 MWe) graphite-moderated reactor located in another location (Taechon) also began. Additional facilities are known to exist. A reprocessing facility, also located at Yongbyon, was begun in the late 1980s; an earlier pilot facility may have also existed. This facility was intended to have two process lines sufficiently large to reprocess spent fuel for all of North Korea's reactors; at the time of the Agreed Framework in October 1994, one of the lines was almost complete.[76]

In December 1985, the Soviet Union agreed to supply four light-water nuclear power reactors if

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[71] Director of Central Intelligence 1961b, p. 2.
[72] Director of Central Intelligence 1961b, p. 2-3.
[73] Cohen 1988, p. 84.
[74] See Hibbs 1992 and Albright and O'Neill 2000 on this separation, which the North Koreans later admitted.
[75] On the North Korean program from 1945–1980, see Mazarr 1995.
[76] Albright and O'Neill 2000, Bermudez Jr. 1994, Bermudez Jr. 1999a, Bermudez Jr. 1999b, Bermudez Jr. 2002.

North Korea joined the Nonproliferation Treaty (NPT). North Korea signed the NPT, but failed to submit a safeguards inspection agreement with the IAEA by the extended deadline of December 1988. In 1989, the DPRK shut down the 5MWe reactor for about 70 days, removing and reprocessing some of the fuel rods and extracting the plutonium. While North Korea claims that it only removed a few damaged fuel rods and reprocessed about 90 g of plutonium, they could have extracted up to several kilograms, depending upon how many fuel rods they removed and the efficiency of the extraction process.[77] In parallel, the DPRK is rumored to have conducted a series of high explosive tests between about 1983 and 1991;[78] further tests were rumored to have occurred between 1991 and 1994.[79]

In 1994, the DPRK again shut down the 5MWe reactor and withdrew the fuel rods from the core. The history of the reactor was partially destroyed by removing the rods without noting where in the core they were placed, making it difficult to reconstruct the operating history of the reactor and therefore the number of fuel rods that the DPRK had withdrawn in 1989. After the threat of economic sanctions and a face-saving trip by former President Jimmy Carter, the US negotiated the Agreed Framework with the North Koreans, shutting down the reactor and preventing reprocessing of the fuel rods removed from it.

The CIA first noted the construction of the 5MWe reactor in 1982, but noted that it "is not designed to produce the quantities of plutonium needed for a nuclear weapons program," and in a separate assessment noted that "We have no basis for believing that the North Koreans have either the facilities or materials necessary to develop and test nuclear weapons." In 1984, the CIA revisited the reactor, judging that it would take at least three more years before it would be complete.[80] In 1985, a general estimate noted that the reactor was capable of producing "significant quantities of plutonium by 1990."[81] Two years later, the CIA issued a report entitled "North Korea: Potential for Nuclear Weapon Development," that called North Korea's efforts "a considerable developing capability." North Korea issued a denial of its weapons aims in 1989.[82] Satellite imagery showed that North Korea was building what appeared to be a reprocessing plant in June 1989.[83] The State Department estimated in 1991 that North Korea would not be able to develop a nuclear weapon until mid-decade,while the Pentagon and the DIA estimated three to five years, and experts at the DOE labs several more.[84]

In February 1992, CIA director Robert Gates estimated that North Korea had only a few months to a couple of years before they would have a nuclear bomb, while the director of the State Department's intelligence arm (INR) Toby Gati argued that North Korea would need two or more years; this difference was attributed by an administration official to the need for the CIA to project worst-case estimates after their underestimation of Iraq, while the official attributed the

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[77] On the operating history of the 5MWe reactor and estimates of the plutonium extracted, see Albright and O'Neill 2000.
[78] Nuclear Threat Initiative 2005.
[79] Yu 1996.
[80] Wampler 2003, Documents 1, 2, 4.
[81] Director of Central Intelligence 1985, p. 17.
[82] Wampler 2003, Document 7.
[83] Richelson 2006, p. 357.
[84] Wampler 2003, Document 15, Mack 1991.

State Department's focus on diplomacy to its inclination to say that there was still time to solve the problem. Gates' replacement, James Woolsey, stated that North Korea "could have enough nuclear material" for one or maybe two weapons.[85] A separate estimate assessed that "there was more than a 50 percent chance that the country might already possess a very small nuclear arsenal, consisting of one or two bombs,"[86] while the State Department argued that due to reprocessing inefficiencies, the material was likely to be less than what is required for a single weapon. However, the State department had earlier accepted that the reprocessing plant was actually a manufacturing plant. After the Agreed Framework was signed, the DIA argued that North Korea would operate a covert program regardless of agreements, while the INR argued that the North was looking for improved relations.[87]

The variability in intelligence estimates was not simply limited to agency differences. As Pollack notes, most of the CIA estimates were consistent with each other through the 1990s, but in 2001 the intelligence estimates rewrote the past, stating that "[t]he Intelligence Community judged in the mid-1990s that North Korea had produced one, possibly two, nuclear weapons," then that "the US . . . has assessed since the early 1990s that the North has one or possibly two [nuclear] weapons using plutonium it produced prior to 1992."[88]

Unfortunately, these estimates cannot be properly assessed. While the assessment of plutonium production and separation is still up for debate, with the differing estimates of the CIA, DIA, and the INR, someone must be wrong. The INR was clearly wrong about the reprocessing plant, but arguments have been made that they were correct about the North's intent in general; while the North did eventually start a HEU program, it was small in scale until at least 2000.[89] Nonetheless, the evidence is somewhat ambiguous.

However, US officials did turn out to be incorrect about one particular suspected facility at Kumchang-ri, where satellite imagery seemed to indicate by the summer of 1998 a major tunneling operation, suspected to be nuclear-related. After negotiations and threats, a team inspected the site in May 1999 and found no indications of nuclear activity; a follow-up visit in 2000 found nothing additional.[90]

Finally, estimates concerning the DPRK HEU program and transfers to and from Pakistan were more-or-less correct. The Clinton administration reportedly learned of transfers between North Korea and Pakistan in 1998 or 1999, according to the Congressional Research Service (CRS).[91] The CIA first mentioned seeking components for uranium enrichment specifically until the latter half of 2001, when it reported that "the North has been seeking centrifuge-related materials in large quantities to support a uranium enrichment program. It also obtained equipment suitable for

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[85] Quoted in Richelson 2006, p. 522
[86] Richelson 2006, p. 523
[87] Richelson 2006, pp. 522-524.
[88] Central Intelligence Agency Nonproliferation Center 2002, National Intelligence Council 2001, p. 9, Pollack 2003, p. 12.
[89] Montgomery 2005.
[90] Richelson 2006, pp. 527-529.
[91] Niksch 2005.

use in uranium feed and withdrawal systems."[92]

In October 2002, Assistant Secretary of State James Kelly visited North Korea and accused the regime of conducting a clandestine HEU program based on intelligence that indicated that North Korea had sought parts from Russia and had acquired aluminum tubes sufficient for 2600 P2 centrifuge casings, although the latter intelligence did not become publicly available until 2005.[93] A special, untitled report by the CIA, released on November 19, 2002, stated "we assess that North Korea embarked on the effort to develop a centrifuge-based uranium enrichment program about two years ago."[94]

These estimates seemed to be publicly confirmed when a shipment of 214 6000-grade aluminum tubes were intercepted on April 12, 2003, as a French ship sailed through the Suez Canal on their way to North Korea via China. These tubes, unlike the Iraqi tubes, fit very closely dimensions of centrifuge plans that the A.Q. Khan network passed on to North Korea.[95] Musharraf verified in 2005 that A.Q. Khan had passed "probably a dozen" centrifuges to North Korea.[96] Yet, as David Albright has argued, extrapolating the size or even existence of a program from a set of tubes is highly dubious; moreover, an unnamed CIA official in 2004 stated that the CIA was not even certain whether that such a plant existed.[97]

Since North Korea ejected IAEA inspectors in late 2002, other than the interception of the aluminum tubes in 2003, no further solid evidence has emerged that could confirm any other estimates regarding North Korea's nuclear capabilities. No specific site has been identified, and CIA estimates remained static, arguing that North Korea "has pursued a uranium enrichment capability at last in the past."[98]

The 2006 North Korean nuclear test is not a satisfactory test of US intelligence simply due to the North Korean decision to announce on October 3 that it would test, followed by the actual test on October 9. The uncertainty that preceded the test as to the location of the potential test site before the test seemed to indicate a lack of sources outside of defectors and satellite imagery, although in the end the site at which vehicle movement and cable reels were spotted (near P'unggye-yok) was correct. Additionally, in 2005 some intelligence officials leaked information to the New York Times regarding preparations being made for a test, which turned out to be false.[99]

The changes noted by Pollack in 2001 and 2002 that re-wrote the history of intelligence estimates potentially indicate (along with the Iraq and Libyan cases) an influence of executive ideology (H1). The HEU intelligence may have been influenced by policy initiatives (H2a); North Korea by October 2002 had already been placed in the Axis of Evil, the Nuclear Posture Review, and

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[92] Central Intelligence Agency Nonproliferation Center 2001.
[93] International Herald Tribune 2005b, Robbins and Hussain 2002.
[94] Central Intelligence Agency Nonproliferation Center 2002.
[95] Warrick 2003.
[96] Agence France Presse 2005a.
[97] Albright 2007.
[98] Central Intelligence Agency Nonproliferation Center 2008, p. 6.
[99] http://www.armscontrolwonk.com/index.php?id=698.

the National Security Strategy, all of which characterized North Korea as a belligerent state.[100] Indeed, estimates seem to track policy closely, since the characterization of North Korea's HEU program has been walked back over time in step with a renewed commitment to the Six-Party Talks. Poor ability to penetrate North Korea led to wildly varying estimates from different agencies, at least some of which must be wrong; in particular, as one unnamed administration official noted, State Department estimates seemed to be biased due to their focus on diplomacy (H2b,c). By contrast, the DIA consistently assumed that North Korea would cheat on any agreement, leading to an overestimation of their likely capabilities in the mid-1990s, and to leaks regarding DPRK tests in 2005 (H5). With the high degree of disagreement between the different intelligence agencies, worst-case estimates seemed to prevail at the level of the DCI/DNI (H7). The failure to predict Iraq may have influenced estimates of North Korean capabilities, leading to the overestimation by the DCI of North Korean capabilities in 1992, as the same unnamed official noted (H11).

Discussion

The US intelligence agencies' experience with foreign nuclear weapons programs has been poor. Out of seventeen observation periods, the general trends across estimates is not good: nine were overestimated, five were underestimated, and only two were correct, with varying levels of accuracy (see Table 4). Of seven foreign weapon tests, intelligence agencies provided US policymakers with definite and timely warning nearly as many times as they failed to do so; removing the announced North Korean test, the US intelligence record is only 50%. Both intelligence collection and analysis varied in quality and nearly all proposed distortions were found to be operative in one way or another. The historical pattern of intelligence failures implicitly offers suggestions for analysts of current and future programs.

The primary finding is that the state of policy toward a country affects analytic determinations (H2 – found in 15/17 cases). In all but two of the cases, existing policy precluded accurate analysis, whether by logistically, diplomatically, or psychologically limiting analytic or collection efforts. The persistence of the distortion suggests that analysts should distance themselves and their efforts from the prevailing policy environment and evaluate data as objectively as possible, without regard for the consequences of their findings.[101] On the other hand, this finding implies that it may be rational for a state to construct or alter its policy toward a nuclear country in such a way as to facilitate the collection of accurate information regarding the target's activities. This is especially plausible when dealing with nuclear proliferators, where the stakes are high, successful policy hinges on having good information, and policy predicated on mistaken assumptions can be dangerous. Breaking this pattern will be crucial to halting nuclear proliferation in coming years, as the next proliferators are likely to be American allies or in regions the U.S. has not traditionally considered to be in its vital interest. The case studies selected for inclusion here provide some evidence of this. The different pattern of distortions present in estimates of the Israeli program versus those of the North Korea's are largely attributable to the fact that the United States enjoyed a close relationship only with the former.

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[100] Bush 2002, Department of Defense 2001, National Security Council 2002.

[101] Similar recommendations result from the findings that cultural predispositions irrationally biased estimates of technical capabilities: where possible, analysts should undertake a complete evaluation of manufacturing and design capacities regardless of predispositions (H4).

Table 4: Overview of Findings

State	Estimate	Warn?	1	2	3	4	5	6	7	8	9	10	11	12
Germany	Over	-		1		1	1		1					
Soviet Union	Under	no		1			1	1			1			1
France	Over	yes		1		1								1
China	*	yes	1	1		1	1	1						1
Israel	Under	-		1	1	1	1	1		1	1			
India	Over	no		1						1				1
Taiwan	Under	-		1			1			1				
South Africa	Over	no		1			1							
Pakistan	Correct	yes					1	1						
South Korea	Under	-		1			1							1
Argentina	Over	-		1			1							
Brazil	Correct	-		1			1							
Libya	Over	-	1			1		1						1
North Korea	Over	yes	1	1			1		1				1	
Iran	Over	-	1	1			1	1						
Iraq(1)	Under	-		1		1	1	1						1
Iraq(2)	Over	-	1	1			1	1	1	1	1		1	1
	5u/2c/9o	4y/3n	5	15	1	6	14	8	3	4	3	0	2	8

**Correct timing, but for the wrong reason.* [102]

The second finding suggests the analytic process would be improved by investing more effort in political and psychological profiles[103] of the countries and leaders in question to better predict intent, motives, and resolve. (H5 – 14/17) A 1985 CIA analysis of previous estimates of nuclear programs notes that while most estimates acknowledge political factors, they nevertheless exhibit "a tendency to focus on predicting when countries will become technically capable of producing a nuclear explosion."[104] Better political analysis, while notoriously difficult, could have helped to alleviate the confusion regarding, for instance, Indian and Israeli programs. The report found that "in virtually every case the decision to build an explosive device...have been a gut-level reaction by the top political leader at the time" and, furthermore, "in the broader political arena, nuclear matters have become much more subject to the normal pull and tug of domestic politics."[105] These findings strongly recommend putting more emphasis on serious political collection and analysis.

A third major finding recommends analytic creativity and also vigilance among analysts against unwarranted or obsolete assumptions. (H12 – 8/17) In about half of the cases, mistaken induction

[102] The estimate on China defies the over/under typology: the estimate was accurate and analysts were able to provide the political leadership with warning, but the data gathered did not warrant an accurate assessment, which was achieved purely by chance.
[103] Hymans 2006.
[104] Director of Central Intelligence 1985, p. 7.
[105] Director of Central Intelligence 1985, pp. 12-13.

or conceptual rigidity of the kind Kuhns deplored served to distort crucial findings. A partial solution would be to condition estimators to be more stringent regarding the assumptions they implicitly or explicitly adopt as they parse and evaluate data and more sensitive to changing trends. Agencies may benefit from cautiously considering the recommendations of William Ascher's "surprise-sensitive forecasting," which endeavors to allow for analysts to come to "startling, dangerous conditions"—though this would almost certainly be done at an increased risk of implausibility.[106] Practices that assign analysts to make an alternative analysis challenging conventional wisdom[107] are only a partial and artificial palliative for a phenomenon so ingrained in the analytic psychology.

The fourth and final major finding is that US intelligence has been relatively poor at evaluating the effect of outside assistance. (H6 – 8/17) Earlier programs tended to work in close collaboration with allied states. This form of assistance is no longer practiced in the modern day, but the role of proliferation networks has increased, although their influence on nuclear programs is debated.[108] Accordingly, the estimates of Pakistan and Iraqi programs hinged on an accurate tracking of technical components from countries in industrialized nations as well as between proliferators. Few nuclear programs have ever conducted their work alone. Counterproliferation and counterintelligence efforts are exceptionally difficult to carry out successfully, but these findings suggest that successfully limiting the supply of assistance may be a factor in preventing nuclear proliferation. Properly understanding and tracking such assistance is important for monitoring the progress (or lack thereof) for nuclear programs.

Other hypotheses varied in importance. Contrary to Stansfield Turner's assertion, little evidence was found to suggest declassified sources are underutilized, though this is partially the result of analyzing a subject deliberately shrouded in the strictest secrecy. However, it should be noted that increased consultation of academics or outside experts could serve to improve political analyses as well as human intelligence collection. Also, the dissemination of data through the intelligence bureaucracy has been and remains a particularly intransigent problem and is exacerbated by continued interagency competition (H8 – 4/17).

Our analysis also suggests that much of the variation in prediction accuracy can be explained without recourse to some of the most common views of intelligence failure—the tendency of bureaucracies to hoard rather than share critical intelligence, and psychological bias. While each can undoubtedly be important,[109] the history of U.S. estimations on nuclear weapons programs at least suggests that other factors were decisive in causing intelligence failure. Hypothesis 8, which evaluated the dissemination of data through the intelligence bureaucracy, was present in four of seventeen cases. The case of Israel, included here, demonstrates this perennial problem but also adds a cautionary note: strongly suggestive data on the Dimona complex did not circulate properly within the intelligence community—but other data did, which was widely ignored. Furthermore, the low priority attached to such intelligence prior to and after 1960 meant that the most important data about Dimona was never collected. The factors we have classified as political appear to be a prior consideration to dissemination of information that was collected.

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[106] Ascher 1978, p. 211.
[107] George 2004.
[108] Braun and Chyba 2004, Montgomery 2005.
[109] On the first, see Kean, et al. 2004, pp. 416-19.

The study of psychological biases among intelligence analysts has a long and distinguished history.[110] To some extent, these biases can never be resolved completely; but for the psychological biases of analysts to prevent accurate estimation it seems that potential political, bureaucratic, and organizational errors must first be silent. A psychological bias cannot have a decisive effect if the analyst is never permitted to do her job in the first place.

Distortion that results from the executive branch ideology is a particularly alarming topic lately and, interestingly, an historical analysis suggests that this alarm is more warranted in recent years than in the past (H1 – 5/17). While nearly impossible to identify conclusively, the evidence suggests that ideological pressures may have played a role in estimates of the Chinese case in the early 1960s under Kennedy, and in four recent estimates: Libya, North Korea, Iran, and Iraq following the withdrawal of UNSCOM inspectors in 1998. While this relationship had been theorized extensively and warned against in the 1980s,[111] it appears that this particular strain of politicization of intelligence has become worse in recent years.

Most importantly, these particular results should not cause us to lose sight of the broader point: containing the spread of nuclear weapons requires excellent intelligence under difficult circumstances. In most of the advanced nuclear weapons programs, U.S. intelligence analysts were unable to provide American policymakers with accurate assessments. Inaccurate or incomplete information about the capacities and locations of clandestine installations can seriously constrain a sensitive policymaking process. Every effort should be made to improve the quality of this information, but given the historical record, policymakers ought to maintain a healthy skepticism regarding the quality of information they are being offered and calibrate policy accordingly.

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[110] Heuer 1999.

[111] Bar-Joseph 1995, Ransom 1985, p. 12.

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