Separating isotope facts from fallacies: nuclear weapons proliferation in the eyes of three intelligence communities

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ABSTRACT

Separating Isotope Facts from Fallacies compares how intelligence agencies have performed in assessing the nuclear proliferation intentions of other countries. Using original archival and declassified documents from the Cold War era, the study appraises the accuracy of American, British, and West German intelligence proliferation assessments of India and Argentina. Contrary to pervasive scepticism, the available historical documentation shows that intelligence agencies did not habitually inflate their assessments of proliferation risks unless they anticipated arms race dynamics. Second, target state attitudes toward the nonproliferation regime provide essential clues to their nuclear intent. Third, more information about intentions did not inherently improve accuracy.

The belief that another country is pursuing nuclear weapons can determine whether a state wages war, signs a treaty, or builds its own arsenal. Governments crafting policies to influence the nuclear choices of others through normative, economic, or military pressures prize accurate and timely proliferation assessments.[1] For example, counter-proliferation strikes and sanctions are most effective when directed against a programme's early stages.[2] Export controls also rely on intelligence assessments of the end use.[3]

From the beginning of the nuclear age, governments have erred in assessing the scope and purpose of other countries' programmes.[4] Public evidence is scarce, limiting knowledge about the frequency and causes of nuclear misestimation. Individual episodes of one intelligence agency tracking a sole nuclear programme have been scrutinised, usually seeking to explain an 'intelligence failure'.[5] More recent work has examined US intelligence analysts' performance in tracking multiple nuclear programmes over time.[6]

Despite the United States government being only one of many employers of proliferation trackers, few researchers have systematically studied the assessment performance of multiple intelligence agencies tracking the same nuclear programmes.[7] This article provides such an international comparison, making it possible to contrast their accuracy and test for recurring patterns that are not idiosyncratic to individual intelligence assessments.

In more than seven decades of intelligence scholarship, no general theories have emerged.[8] However, the intelligence literature has produced bountiful insights on the institutional and psychological processes that can bias intelligence assessment.[9] Less attention has been directed at how the assessed country's behaviour and external environment affect its perception by intelligence analysts.

Because the international relations (IR) literature dedicates itself to the above-mentioned dynamics, this article distils three generalisable propositions from various orientations of IR theory on the accuracy of proliferation assessments. Drawing from three levels of analysis, these propositions are not hypotheses intended to compete directly. Instead, they probe the power of these theoretical schools to reveal useful generalisations about the work of intelligence assessors.

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These propositions will be tested on efforts by the American, British, and West German intelligence services to assess the Indian and Argentinian nuclear programmes for signs of weapons intent from the 1960s through the 1980s. After presenting the theoretical foundations of these propositions, this article describes each nuclear programme's evolution. It scores the relevant intelligence agencies' assessments of that programme, followed by an evaluation of whether the above IR-derived propositions explain a portion of the variation in analytic accuracy and how they compare to findings in the intelligence studies literature.

Propositions on proliferation predictions

Some structural IR theories predict that governments overestimate most dangers as part of a general paranoid pattern that animates interstate phenomena like the security dilemma and the 'spiral model'.[10] The difficulty of judging other states' intentions and capabilities has long occupied grand theoretical investigations of interstate phenomena like alliance behaviour and war.[11]

In 'presupposing eternal rivalry and potential conflict', the perennial challenges of intelligence analysis are compatible with many realist approaches.[12] In this tradition, states compensate for dangerous uncertainty by erring on the side of overestimation because making worst-case assumptions about each other's intentions and capabilities amounts to 'prudent insurance'.[13] For conventional armaments, this impulse might be tempered by geographic distance or other signs that a foreign state is non-threatening. However, the destructive power of nuclear weapons makes even their potential acquisition by faraway governments a global security event.[14]

Consistent with these theoretical predictions, previous empirical investigations of nuclear proliferation forecasting by US intelligence indeed have found an overestimation trend interspersed with instances of underestimation.[15]

Which structural circumstances make overestimation more likely? Realism's defensive varietals suggest that suspicion is more likely to target states perceived to be in a nuclear-tinged security competition within this paradigm. If a state is seen to be pursuing nuclear arms, its rivals would fear the effect on the balance of power – or even their use as an offensive capability – and be expected to follow suit. This can be illustrated with a prominent example: US assessments of Iraq's unconventional weapons programmes before the 2003 invasion were most likely influenced by the latter country's policy of deliberate obfuscation to deter Iran.[16]

Evidence of this alarmist tendency would be found in intelligence assessments of proliferation. If intelligence analysts believe in a security model for the spread of nuclear weapons, they would be expected to overestimate states' propensity to fight proliferation with proliferation.[17] The construct of proliferation as a biological process of contagion – in which states respond to nuclear programmes of rivals by developing weapons – has deep roots in nuclear thought.[18] This suggests the first proposition:

Proposition 1. Intelligence analysts overestimate states that they perceive as having a proliferating rival.

Despite the systemic incentives for paranoia, liberal institutional theories aim to explain why some cooperation nevertheless takes place between states.[19] This approach is useful in testing whether any of the international institutions that have been built to deal with a problem particular to nuclear weapons: Nuclear infrastructure and technology are inherently dual use, and the 'line between safe and dangerous activities' is ever-changing.[20] Even states seeking nuclear weapons are incentivised to claim peaceful intent. This makes it difficult to discern which states are pursuing weapons by tracking capabilities, raising the relative importance of accurately understanding governments' intentions.[21]

States seeking to assure others that their nuclear development poses no threat can signal their non-aggressive intent by creating and joining diplomatic commitments and constraints, often in the form of international institutions.[22] These commitments are not ironclad, although violating them risks consequences – if only to a state's reputation. Verification provisions may also serve as 'a means to cull the sincere from the insincere' when states promise to limit their nuclear capability.[23]

Nonproliferation commitments should aid intelligence analysts in at least three ways. The first of these is screening: While rife with potential for misuse, signing a declaration of non-weapons intent is a potentially resource-saving heuristic of where *not* to direct attention. Second, the difference between what documents states will sign and those they refuse could be rich in information. This includes diplomatic postures as treaties and other nonproliferation agreements that are negotiated with the target country's input. Lastly, assessors may acquire information through cooperative monitoring mechanisms that would be costly or impossible to collect on their own. Possible clandestine proliferators will know this, so a state with nuclear weapons intent is less likely to agree to formal limitations and thereby reinforces the screening logic.[24]

Returning to the Iraq example provides cause for scepticism. The country had previously successfully misled IAEA inspectors about its nuclear programme, was cooperating inadequately with international inspectors, and 'US intelligence (was) unable and/or unwilling to grasp the reality that the inspections … had succeeded'.[25]

The NPT is the principal vehicle for states to record their nuclear armament intentions.[26] From safeguards on nuclear energy installations to treaties prohibiting nuclear testing, many other agreements have accumulated into a 'nonproliferation regime' with which governments can signal their nuclear intent for intelligence analysts to interpret.[27]

Proposition 2. Nonproliferation commitments aid intelligence assessors.

The third proposition draws upon rationalist models with a tradition of explaining nuclear behaviour. Conspicuously, theories of deterrence among nuclear-armed competitors involve intelligence interpretations of other states' capabilities and intentions.[28] These models of state perception are optimistic about states' abilities to update their assessment of external threats with new information.[29] After all, an intelligence advantage should be a decision advantage.[30] Rational states should invest in intelligence accuracy in proportion to its value for making policy decisions.[31] These models also predict a linear relationship between information availability and assessment accuracy: 'the more that it invests in intelligence, the less likely it is to be mistaken in its estimate', if all else is equal.[32]

An important reason for variation in the information available to assessors would be their intelligence collection capability.[33] For example, overhead imagery to locate and analyse clandestine facilities is not available to every intelligence service. The target's difficulty, such as counterintelligence competence or its society's general informational openness is another factor. In this perspective, any intelligence community assessing the same information should arrive at identical conclusions about a country's proliferation risk and additional information should improve accuracy.

Proposition 3. Assessment accuracy is a function of collected information.

IR theories subscribing to a model of states as smooth information processors diverge from the results of much work in the intelligence literature, which grapples with key analytical challenges like tradecraft, organisational knowledge management, and the effects of domestic politics on analysis.[34] The misestimation of Iraq's WMD intentions and capabilities by US intelligence has become synonymous with flawed analysis, including integrating 'technical and political analysis sufficiently'.[35]

Testing these three propositions against the historical record requires variation in the assessed countries' (1) presence of proliferating rivals and (2) relationship to the nonproliferation regime, as well as the assessing country's (3) intelligence collection capacity. The next section creates that variation by tracing three intelligence communities' assessments of two nuclear programmes.

Comparing proliferation assessment accuracy

German, US, and UK assessments of India and Argentina were selected as case studies for the abundance of ambiguous and non-linear variation in their nuclear programmes' intentions and capabilities over time. Argentina did not develop nuclear arms and likely never intended to do so, even if some government elements pushed for the creation of a weapon option that may have shaped the pursuit of an independent and full nuclear fuel cycle. On the surface, India shared several similarities: interest in peaceful nuclear explosions, antipathy towards the global nonproliferation regime, and regional security competition. The main difference was that it eventually chose to construct a nuclear arsenal.

The criteria for inclusion as a proliferation assessment were that comprehensive analytical findings about a country's proximity to nuclear weapons possession were presented to high-level decision-makers as a complete analysis for internal use.[36] They had to be 'corporately authored' by intelligence services or other government bodies.[37] The United States has produced National Intelligence Estimates (NIE) to capture the entire intelligence community's views since 1950, which warrants their inclusion.[38] The Joint Intelligence Committee's (JIC) reports serve a similar function in the UK.[39] Reports from individual intelligence services or other government offices were only included if they fulfilled these criteria, which excludes the vast majority of regular intelligence reporting on individual events or developments. West Germany had a single foreign intelligence service, so any assessments by the Bundesnachrichtendienst (BND) transmitted to the country's political leadership were included. The evaluation of the propositions draws upon a broader range of government documents relevant to the analytical process.

This comparative research design is based on original archival research, formal declassification requests, and previously released intelligence assessments from Germany, Great Britain, and the United States.[40] Reflecting greater document availability, the respective countries' interest in tracking proliferation, and their collection capability, the United States intelligence community generated the most individual assessments. Argentina received less attention than India.

Assessments of India's winding path to weaponisation

Projecting ambiguity throughout, India took a circuitous path to building a nuclear arsenal.[41] Its nuclear programme was born with a covert interest in weapons applications in 1948, when the country secretly established a nuclear commission that was publicly directed to begin work on 'peaceful' nuclear explosives (PNE) in 1964.[42] The project was shut the same year, and India did not advance its nuclear explosive capabilities. After this time, 'New Delhi's proliferation drift was sealed by mid-to-late 1967'.[43] Scientists were authorised to conduct theoretical work on explosive designs and formally restarted work on nuclear devices in 1972.[44] The project produced a detonation in May 1974, which India described as a PNE. India did not undertake to convert its nuclear explosive capability into one that could be weaponised and delivered as a warhead, working instead more broadly on its nuclear capabilities for the rest of the 1970s. In 1980, India seems to have become committed to pursuing non-peaceful nuclear explosives and decided on an arsenal in 1989.[45] The ability to deliver weapons likely appeared around 1990.[46]

Britain observes a former colony

British foreign policy had a persistent high-level interest in the possibility of proliferation in South Asia. For instance, the cabinet discussed creating a joint nuclear deterrent force in the Pacific region to dissuade India from arming in response to China's bomb in 1965.[47] The next year, it was proposed that India be dissuaded from contemplating the construction of an arsenal by sharing the high costs of British proliferation.[48] As a US-allied permanent member of the UN Security Council, interest in China and Pakistan motivated British regional policies throughout the Cold War. With its nuclear weapons status codified by the NPT, Britain sought to prevent other states from acquiring these arms.

At first, the British government tracked the early stages of India's nuclear development as an energy and scientific matter, relying on open sources.[49] Formal British nuclear intelligence assessments of India began in 1961, when the JIC reported that India was developing the preconditions for a weapons programme and that 'a government decision to make a weapon would inevitably be affected by' China's nuclear policy.[50] This first superficial assessment, probably based on open sources, accurately reflected the state of the Indian programme; the same applies to a September 1963 update that deemed it 'unlikely that the country has yet committed itself to producing nuclear weapons, but the wide scope of the nuclear programme and her evident aversion to being tied to outside sources involving safeguards suggest that the possibility of weapons production has been kept in mind'.[51]

This cautious tone fell away in the next assessment of July 1965, which overstated that 'India could rapidly develop nuclear weapons, and could test an initial device based on plutonium within 12–18 months of making the decision to do so'.[52] Following India's summer war with Pakistan, an October 1965 JIC report indicated that it was on the way to developing a technical nuclear capability but the government had not decided whether to activate that option: 'India also has the capability to manufacture a nuclear weapon within twelve to eighteen months of a decision (which as far as we know has not yet been taken)'.[53] Coming a few months before India's governmental interest in developing its nuclear technology towards non-peaceful uses, in going from 'an initial device' to 'a nuclear weapon', the JIC overestimated the former British colony's capability.[54]

A 1969 JIC report predicted that India would not 'develop a nuclear capability' over the next five years.[55] Taken literally, the prediction was correct: India's nuclear test took place five years and four months after this estimate. While the report acknowledged that India's position on the NPT might in part reflect the desire to maintain a weapons option, exercising the option was deemed unlikely. The test later demonstrated that India wanted to exercise its weapons option.

Later that year, the JIC presented a deeper investigation of the country's nuclear capabilities and concluded that it was 'unlikely that India has decided to start a nuclear weapons programme, or that she will do so over the next five years, unless she has reason to expect large-scale Chinese military hostilities'.[56] British intelligence had detected no signs of test preparations, promising policymakers that they could provide them with 'six months' warning of an atmospheric test and a longer warning of a full-scale underground test'.[57] But if the explosion were 'only to demonstrate an Indian ability to detonate a nuclear device, it could be carried out at short notice and the preparations probably concealed for some time'.[58] The six months' warning was not given when India detonated its first nuclear device less than five years later. Arguably, the PNE fell under the 'demonstration' caveat. However, the assessment's assurance that policymakers need not worry about an Indian nuclear weapons was unfounded.

The possibility of a test under the guise of peaceful applications was at the heart of a 1971 analysis, concluding that India had 'rejected the option of producing nuclear weapons, it has preserved the option of developing the capability to produce them and, in order to do so, has reserved the option of conducting nuclear explosions for peaceful purposes'.[59] The analysis predicted that a successful PNE would generate 'domestic pressures for developing nuclear weapons'.[60]

This Foreign Office memorandum moved the British understanding of Indian policy close to its later manifestation, although the delay between the first test and weaponisation suggest that whatever domestic pressures emerged were not the main force behind that development.

In late December 1973, the JIC wrote presciently:

> India is very well placed to make a simple device and to conduct initial nuclear tests and could develop nuclear weapons suitable for her bombers well within the period. A decision actually to develop weapons is unlikely unless there is evidence of Chinese long-term intentions to launch a full-scale attack on her or of practical steps by Pakistan to develop nuclear weapons. But India may develop nuclear explosives for peaceful purposes, which would certainly imply that she could produce similar devices for military purposes.[61]

After the May 1974 test, the JIC assessed that India had been 'mainly (though not exclusively) concerned with developing a nuclear weapons capability' and would 'not be able to catch up with even the least advanced of the 5 existing nuclear powers in the foreseeable future'.[62] British intelligence understood that India would not be sprinting to field a nuclear arsenal.

The next assessment appeared in the archives in 1979, reporting the absence of 'evidence of a nuclear weapon or explosive programme'.[63] Refraining from predictions, the assessment focused on the options that the country's technical capabilities provided and the role that Pakistan's nuclear decisions would play in Indian policy. The same year, a survey of proliferation trends identified India and Pakistan as the most likely candidates for weapons acquisition. A 'determined Pakistani nuclear weapons' effort could trigger an arms race.[64] A Pakistani programme was underway and, by one account, 'Pakistan's nuclear program was the biggest provocation for India to go nuclear'.[65]

The last available declassified JIC assessment was dated February 1982. It warned that if relations with Pakistan did not stabilise, 'India might also decide to resume (PNEs), an option which Mrs Gandhi has never foreclosed'.[66] While relations with Pakistan improve, India did not resume explosive testing until 1998. Indira Gandhi reluctantly and briefly authorised a more advanced PNE shortly after this assessment.[67] The assessors offered no forewarning regarding India's establishment of a ballistic missile programme in the following year.[68]

Nonproliferation and nonalignment challenges to US intelligence

Cold War American policy aimed to prevent other countries from acquiring nuclear arms.[69] India, whose feared nuclear armament was a primary US motivation for creating the NPT – although bilateral efforts to that end lacked determination and strategy in the key years of the 1960s.[70] After the country's PNE, the US objective was to inhibit the development of an overt arsenal, which was often cast as the primary aim in Indo-American diplomatic meetings.[71] The broader relationship was frequently troubled over matters like US support for Pakistan and India's efforts at Cold War nonalignment.

While Indian attitudes towards nuclear weapons were explored in preparing the first global proliferation overview in 1957, the final version did not include the country.[72] In a follow-on study of the next year, India was deemed deeply opposed to weapons development in the absence of Chinese acquisition.[73] The possibility of an Indian nuclear arsenal received more attention from American assessors in 1960, resulting in a vague warning that 'the government might decide to undertake a nuclear weapons program (especially if) Nehru has been succeeded by a less neutralist government'.[74] A full assessment arrived in a November 1961 NIE that evaluated global nuclear proliferation possibilities. Domestic and ideological factors were seen to work against a weapons intention, while Chinese nuclear development would push in the opposite direction.[75] The assessment reflected contemporary Indian thinking about its nuclear weapons option while being too optimistic about its technical capability.

A 1963 NIE reported that a weapons decision had not been reached and that it was 'unlikely that such a program will be authorised so long as Nehru remains in power' despite ongoing tensions with China.[76] For the analysts, indications were clear 'that India (was) actively improving its overall

capabilities in the nuclear field, possibly in anticipation that a future decision to develop an operational nuclear capability may be required'.[77] International safeguards constrained the country's capabilities, but it 'could reach a position of independence from present controls in about two years, after which it would take another two or three years for India to produce its first nuclear device'.[78] The assumption that India would formally break its international agreements before using materials produced under its safeguards agreements with supplier countries would be disproven a decade later.

A year later, the State Department's Bureau of Intelligence and Research (INR) reported the community-wide consensus that 'India has the capability of producing and testing a first nuclear device in one to three years after a decision to do so'.[79] The assessment concluded that current policy was 'to use nuclear energy for peaceful purposes only' but deemed it likely 'that this policy will be kept under review during the months ahead'.[80] This underplayed Indian willingness to develop a PNE capability and the technical difficulties it would face.

Circulated days after China's first test, an October 1964 NIE assessed that 'the chances are better than even that India will decide to develop nuclear weapons within the next few years'.[81] By 1970, India could produce 'about a dozen weapons in the 20 KT range' for air delivery.[82] Such an arsenal did not appear for another two decades, although the analysis foresaw that India would not rush into production. With the dust of the Chinese test settled, a December 1964 Central Intelligence Agency (CIA) proliferation overview announced that there was 'a good chance that India will embark on a weapons program during the next few years'.[83] The State Department's intelligence bureau (INR) contributed a memorandum to accompany NPT negotiations in July 1965: 'New Delhi has so arranged its peaceful uses nuclear research program as to keep open the option of diverting it to weapons research and development'.[84] Both assessments were correct.

An April 1966 NIE assessed the totality of the Indian nuclear policy. On the technical side, it declared that 'India has the capability to produce nuclear weapons', erroneously asserting that the country 'could test a first device within a year of a decision'.[85] According to the assessors, India's intent was more complicated. The decision to abandon its anti-nuclear position would involve India's relationship with the United States, China, and Pakistan. This assessment was vague but accurate when Indian policy was 'an option on the option'.[86]

After more Chinese nuclear tests later that year, an INR memorandum assessed that the Indian government would not follow domestic public opinion in favour of nuclear weapons' development, but that it would likely not be able to 'hold the line' indefinitely.[87] State Department intelligence again addressed reports of Indian nuclear test preparations in January 1972, even if American intelligence collectors had not detected direct physical evidence.[88] The INR report assessed 'that India could proceed rapidly and with little difficulty to establish a modest nuclear weapons program', exaggerating the rapidity of India's eventual arsenal development.[89]

In August 1972, a Special NIE (SNIE) on India's nuclear programme shortened the time between a decision to conduct a test explosion and the detonation to 'a few days to a year'.[90] The likelihood of such a decision was 'roughly even that India will conduct a test in the next several years and label it a peaceful explosion'.[91] In the event of a test, India would 'probably go ahead to make a small number of devices – which could be used as weapons'.[92] The PNE became a reality; the small weaponised arsenal did not.[93]

US intelligence attention then drifted from the Indian program, providing no warning of the May 1974 PNE. In late October, an SNIE surmised that 'India has had all of the essential materials and facilities for production of plutonium weapons for about a decade'.[94] The assessors now deemed Indian nuclear armament more likely than not – and that it may have been underway.[95] The SNIE provided guidance on what India's next technical steps would mean for its weapons intentions, overestimating India's future nuclear weaponisation in the process.[96]

The publicly accessible record does not include another post-1974 assessment of India's nuclear programme until June 1981. An INR analysis led with the finding that 'India and Pakistan have decided to keep the option of developing nuclear weapons, and signs of preparation for

underground nuclear tests have been identified in both countries'.[97] Despite these concrete indicators, the assessors foresaw preparations to maintain an option without offering predictions of likely developments.

The following July, an NIE expanded the theme of Indian nuclear policy being driven more by Pakistan than China: 'Pakistani nuclear activities have caused India to activate its own nuclear explosive development capabilities, which heretofore have been viewed by New Delhi primarily as capabilities for developing a nuclear deterrent against China'.[98] The observation appears accurate in retrospect.

West Germany's hesitant judgment

West German policy towards India aimed to support nonproliferation principles without restricting nuclear exports.[99] Export interests tended to outweigh proliferation concerns, producing frequent friction with the United States, including over India.[100] In a challenge to the Federal Republic of Germany's (FRG) foreign policy, India's PNE came just over two months after the German parliament's contentious vote in favour of NPT ratification, raising West German concerns that the global response would tighten global nuclear supply restrictions and onerous safeguard requirements.[101]

The Bundesnachrichtendienst (BND) wrote a study on 'Nuclear Energy in India' and its weapons implications in July of 1972, which has not been released.[102] The foreign ministry also kept watch: A January 1967 memorandum noted that the country's nuclear energy programme was being constructed to 'keep open the path to nuclear weapons' and tracked Indian plutonium production.[103]

A few days after the PNE, the BND provided a background paper on India's nuclear programme. It noted that India might have accumulated '60–80 kg' of plutonium and intended to enrich uranium with centrifuges.[104] The plutonium figure likely underestimated Indian capacity.[105] At the same time, India would not build a pilot uranium enrichment facility for another decade.[106]

The second BND assessment followed less than two months after the PNE, noting that fissile material had already been produced and reprocessed in India for several years, providing the foundation for indigenous production of nuclear weapons.[107] Although the development of a deliverable 'credible deterrent against China' was not possible because of technological and financial obstacles, additional tests were expected.

Nine years after the Indian test, German intelligence provided a brief to the foreign minister's visit to India. The BND noted a recent increase in the prime minister's public references to matching Pakistani efforts towards nuclear acquisition and that an unconfirmed intelligence report had recently arrived about an intensification of nuclear weapons' development.[108] A later version of this report leaked to the press:

> A May 1985 West German intelligence document cited an unconfirmed report that the 'leadership of the Bhabha Atomic Research Center had been given the assignment by the Indian Defense Department, after consultation with the highest cabinet officials and Prime Minister Gandhi, to continue working on the development of a thermonuclear weapon'.[109] Preparations were to be made so that 'within two months of a Pakistani nuclear test, the second Indian test could be carried out'.[110]

The Indian nuclear establishment was advocating for the authorisation of an operational nuclear capability at that time, and a high-level review committee was established to study the possibility. However, the BND had misread the prime minister's intent: He was personally opposed to nuclear armament and was likely using the committee to deflect those who favoured it.[111]

Later that year, the chancellor's briefing included a discussion of India's nuclear energy programme. It reported that a decision had been taken earlier in the year to be able to match any Pakistani test immediately and that there had been no new reports about the possibility of Indian work towards a thermonuclear weapon.[112] Accounts of Indian nuclear decision-making are not conclusive about whether it explicitly aimed to match any Pakistani test, although the nuclear establishment was undoubtedly working to deliver that capability.[113]

The Federal Republic's BND reported on India's nuclear programme without much analysis, allowing itself little opportunity to be wrong. This was not the result of poor collection capability since the reporting was based on detailed technical knowledge and human intelligence.

Assessments of Argentina's nuclear nationalism

Argentina invested early and deeply in nuclear technology. In 1949, as part of a broader effort of importing 'useful Germans' to advance industrialisation, the Austrian Ronald Richter was allocated vast funds to produce energy cheaply with a 'thermonuclear reactor' on a remote island.[114] Already in March 1951, President Perón and Richter announced experimental success in having achieved fusion through 'a totally new way of obtaining atomic energy that does not use materials hitherto thought indispensable', which was greeted by global scepticism and derision.[115] Perón shuttered Richter's project in September 1952.[116]

A slower, second path using the materials Richter thought dispensable proved more lasting under the auspices of the National Commission for Atomic Energy (Comision Nacional de Energia Atomica, CNEA). Established in 1950, CNEA initially focused on purchasing nuclear reactors from abroad. Plutonium reprocessing in the laboratory succeeded in 1967.[117] Nuclear technology investment grew under the military junta, which assumed control in 1976.[118] Argentina's nuclear programme expanded to pursue a uranium enrichment capability through gaseous diffusion in 1978 near Pilcaniyeu.[119] The enrichment facility was initially kept secret so that 'about a dozen people in the country knew of the entire project'.[120]

In addition to laboratory-scale reprocessing from 1969 to 1973, there was also an effort to produce 'metallic plutonium' – the form that it would need to take for an explosive purpose – between 1980 and 1982.[121] None of these activities were under safeguards, which Argentina persistently resisted in its negotiations for imported materials and facilities, as well as by refusing to sign treaties that would obligate their acceptance.

In November 1983, Argentina's president announced Pilcaniyeu's existence. The facility did not produce enriched uranium until 1986.[122] While many scholars have taken the secret construction of the Pilcaniyeu facility to have indicated weapons intent, the configuration was not optimised for HEU production and may have been the 'reckless' result of 'expressive nationalist policies in the nuclear field'.[122] The low-enriched uranium was likely intended for naval propulsion.[123] Defeat to the United Kingdom in the 1982 Falklands War briefly accelerated its nuclear work.[124] In 1983, Argentina announced that it was able to enrich uranium at its previously secret facility.[125] However, CNEA's budget was cut deeply a few months later and arrested its development.[126]

The history of Argentina's nuclear intentions remains disputed. Scholars who maintain that Argentina attempted to acquire nuclear weapons do so to argue that US pressure caused the country to refrain.[127] While much of the evidence regarding Argentine behaviour is consistent with a proliferator – especially the clandestine construction of a uranium enrichment facility – these activities are more likely to have resulted from idiosyncratic political reactions to US non-proliferation policies.[128]

West German investigation of its customer

Argentina was a top priority for West German nuclear policy. The two states broadly enjoyed a 'very good' relationship.[129] Nuclear cooperation was especially close, including the personnel exchanges (a legacy of Perón's 'useful Germans').[130] Based on the principle of 'uranium for technology', several bilateral deals – including Germany building a heavy water plant in Patagonia – were explored.[131] This was scuttled in response to US pressure, which was a persistent problem for the German nuclear export business. This pressure was always presented as proliferation concerns over insufficient

safeguards, although it was often motivated by commercial interests.[132] The most significant export was ultimately Argentina's first nuclear power reactor, which started operation in 1974.[133] Bonn promoted and subsidised these exports.[134]

In the first available assessment, the BND evaluated Argentina as part of a global proliferation survey in July 1974:

> The South American state with the most advanced nuclear research and technology possesses not only several research reactors, but also the first power production reactor, from which plutonium can be extracted beginning in 1975. Fuel is produced domestically. It is especially important that Argentina has a reprocessing facility – even if it is small – with which to extract plutonium. Argentina has possibly already generated plutonium not under international safeguards from its largest research reactor.[135]

Not reporting that Argentina had indeed already separated small quantities of unsafeguarded plutonium made the assessment – based on an in-depth analysis of the country's capabilities produced for the chancellor's information – a mild underestimation.[136]

Around the same time, the Federal Republic's intelligence service composed a formal assessment of Argentina's nuclear potential for its political leadership. The report surveyed the country's technical capability (to which a German firm had made the most significant contribution) and stopped short of making any definite predictions.

> Fuel for the nuclear power station comes from its own uranium resources; a small reprocessing facility is available for the separation of the burned-up fuel rods. There is no information about international controls of the Argentinian fuel cycle. Technical preconditions for plutonium production are available (around 80 kg annually from Atucha as of 1975). Argentina must be seen - next to Israel and the Republic of South Africa - as the third non-industrialised state that could produce its own nuclear weapons in a relatively short period.[137]

The characterisation of Argentina's technical capability was accurate, despite hardly qualifying for the same proliferation league as Israel and South Africa. The BND's uncertainty over which international safeguards applied is perplexing since there were none for the fissile material-producing facilities.

In July 1985, the BND returned to Argentine nuclear activities. It reported work on a reprocessing facility that was not expected to be completed before 1987, after which Argentina would be capable of producing nuclear weapons.[138] However, now only spent fuel under international safeguards was available. The assessment did not report on Argentina's previously secret uranium facility.

British pre-war inattention

British assessments of Argentina are available from 1979 and 1980, during which the Falklands Islands dominated the UK-Argentina policy agenda. Until the conflict, the British Foreign Office was engaged in active negotiations over supplying Argentina with a reactor, having lost the bid to build the first reactor to West Germany.[139] Simultaneously, Britain was working through multilateral mechanisms and with the United States to limit Argentinian imports of dual-use nuclear technology.[140]

Ignored in prior proliferation surveys, Argentina was dismissed in 1973 as among the unlikely 'candidates for military nuclear power'.[141] British intelligence first paid serious attention to Argentina's nuclear programme in May 1979. Describing it as 'one of the countries in the developing world which will arrive soonest at the point where she can produce much of her own nuclear equipment' and nearing the 'capability to make nuclear weapons', there was 'no evidence of any intention on the part of the present Government to embark on a weapons programme'.[142] This was a fair conclusion but overlooked the fact that Argentina was building a clandestine enrichment facility.

An April 1980 assessment described Argentina as 'a country capable of creating a nuclear weapons option, and Argentine government has consistently sought to avoid formal renunciation of it'.[143] The following month, both Brazil and its rival were seen as proliferation candidates, even in

the absence of 'current evidence of weapons intentions'.[144] In July, Argentina's impending complete and independent fuel cycle was again flagged as a proliferation concern.[145] In October, the nuclear assessment office warned that they had a 'more skeptical view of the Argentine position': "We would accept that she has no current military nuclear programme. There are however powerful forces working within the regime there against formal renunciation of the nuclear option'.[146] Like the prior year's assessment, these were accurate sketches of Argentinian intent written without awareness of the uranium facility.[147]

The United States and Argentina

The United States saw Argentina as the key to keeping its hemisphere's nuclear monopoly intact. In engagements with the Argentine government, the nuclear subject was consistently at or near the top of the agenda. In these meetings, US representatives sought Argentinian acceptance of international inspections of its infrastructure, the NPT, and the signing of the regional nonproliferation agreement – the Treaty of Tlatelolco.[148]

US intelligence tracked Argentina's nuclear development early, beginning with its post-War recruitment of German scientists and uranium mining plans.[149] The collected intelligence was first assembled into a formal proliferation assessment in the context of the campaign to gather signatures for the NPT in 1969.[150] A deeper examination appeared in an October 1974 global assessment, which concluded that Argentina was working towards nuclear technological self-sufficiency and that any future weapons crash programme would take close to a decade to succeed.[151] In December of the following year, a CIA paper found that Argentina 'could conceivably graduate to nuclear explosives'.[152] A November 1977 briefing mentioned that 'Argentina's rush toward nuclear reprocessing raises the spectre of its becoming a member of the nuclear club'.[153] An assessment, found in National Security Council files of September 1978, described Argentina's intention not only to 'become self-sufficient in nuclear energy', but to export regionally.[154] Whether this meant that Argentina would seek nuclear weapons was not conclusively predicted. These short assessments were accurate.

Following the 1982 Falklands War, American intelligence took a much closer look at Argentine nuclear policies than it had before. Argentine incentives were assessed to be tilted against weaponisation.[155] American intelligence missed Argentina's clandestine uranium enrichment facility but correctly assessed the limitations on incentives for a nuclear weapons push and the financial constraints. A global proliferation survey that summer described an Argentinian PNE as unlikely – and concluded that weapons development 'considering the nature of Argentina's defence requirements, the military utility of such a program probably would not be worth the effort'.[156]

Another NIE was commissioned in July 1984 to investigate the effect that the democratic transition had on the country's nuclear policies, grappling with whether these decisions would remain the purview of the military and announcing that Argentina was two to three years away from a plutonium separation capability.[157] The NIE missed that much of the programme had been abandoned. The prediction about Argentina's unwillingness to sign the regional nonproliferation treaty and subject itself to safeguards was also unduly pessimistic.

In November of the following year, the CIA circulated a detailed assessment of Argentina's nuclear policy and infrastructure. It still could not provide a definite assessment of the weapons' dimension, as it lacked evidence of the intentions that animated the decision-making.[158] There was likely little evidence of weapons intent to be uncovered. The document also claims that the enrichment facility had been known since 1981, despite not having mentioned it in previous assessments.[159] One possible explanation for this discrepancy is that US intelligence had detected and inspected the facility without determining its purpose. According to a former Argentinian official, 'the nuclear affairs attaché of the U.S. embassy' requested an inspection based on satellite imagery.

> We misled him and organized a false visit in which everything was camouflaged. He left without having talked to anyone, which cost him his post.[160]

The United States intelligence community has yet to declassify documents that would shed further light on whether Argentina had indeed evaded its detection.

Correlates of misestimation

Proposition 1. Intelligence analysts overestimate states that they perceive as having a proliferating rival.

The assessments reviewed above show that intelligence analysts occasionally overestimate. Frequent analysis of how a government *could* use its current nuclear capabilities to create an arsenal may have made policymakers more alarmed about proliferation than warranted by separate individual analytical judgments. However, unambiguous overestimates were a minority of the analytical judgments reviewed above. Were these overestimates associated with perceptions of an arms race? The retrospective understanding that India was indeed party to nuclear rivalries with varying intensity over time – which Argentina was not – helps test this first proposition.

The weapons aspiration in India's nuclear programme was initiated by China's 1964 nuclear test, which came two years after the countries had fought a war.[161] The eventual decision to pursue an operational nuclear capability was, in one accounting, 'in response to Pakistan's acquisition of nuclear weapons with Chinese help and US indulgence'.[162] India therefore had two rivals with nuclear ambitions that were being tracked by the intelligence assessors. Most assessments presumed that Indian intent was conditional on Chinese and Pakistani decisions, including developments in their nuclear programmes.

Early overestimates of Indian progress towards a nuclear arsenal in the 1960s regularly invoked the Chinese programme. For example, in 1965 British intelligence flagged 'further Chinese testing' as a cause of 'a decision to begin a nuclear weapons programme' if the country could not be provided with an extended deterrence.[163] A contemporary State Department report on the problem identified US and Soviet policy as a potentially powerful determinant of Indian weaponisation.[164] Hindsight has shown that discussions about guarantees did not produce satisfactory guarantees, although it is difficult to know whether stronger guarantees would have led to Indian nuclear restraint.

Western intelligence analysts' focus on China's nuclear programme contributed to their blindness towards India's preparations for a PNE. As late as December 1973, British intelligence would write that weapons development was unlikely 'unless there is evidence of Chinese long-term intentions to launch a full-scale attack on her or of practical steps by Pakistan to develop nuclear weapons'.[165] Having been alerted to India's position under China's growing nuclear arsenal, the estimates above overweighted the role of external nuclear threats in Indian decision-making, producing underestimates in the early 1970s.

Following the PNE, intelligence assessments portrayed India as more eager for nuclear weapons than it actually was. Arms race dynamics played a part in these overestimates:

> The military rationale for this has been the hope of producing an effective deterrent against China. Maintaining a decisive lead over Pakistan has probably been a secondary consideration. Prestige has also been an important element. The Indians are very unlikely to stop at a single test. Pakistani attempts to catch up will make it hard for the Indians to abandon a weapons programme even if they now wished to do so.[166]

However, compensation for failing to have foreseen the PNE and making a straight-line prediction were complementary factors in creating these overestimates.

In strong contrast to India's two-front insecurity, Argentina's competition with Brazil was ultimately more about prestige than security, although it takes the luxury of hindsight to conclude 'security dilemma dynamics' were not driving Argentina's partially clandestine programme.[167] Even Argentina's revelation of a clandestine enrichment plant produced only a muted Brazilian response. The two countries arrived at a comprehensive bilateral nuclear agreement in 1991.[168]

Intelligence assessors regularly presumed that Argentina's intentions were linked to those of Brazil. The review above showed that the systematic US overestimation of Argentina in the 1970s was created by the latter's purported interest in PNEs. That misjudgement was grounded more in Argentine resistance to external limitations on its nuclear programme than hedging against a Brazilian nuclear weapons programme. Writing in the immediate aftermath of Argentina's defeat against a nuclear-armed UK and revelation of the secret uranium enrichment facility, US intelligence later understood that nuclear weapons were not an attractive solution to Argentina's defence needs.[169]

Presumed nuclear competition introduced uncertainty into intelligence analysts' work by creating linked expectations of how one state would influence the other. In most of the above cases, this helped produce analyses that hold up:

> India has the capacity to develop its own nuclear weapon but not for at least twelve to eighteen months after a decision to do so. As far as we know this decision has not yet been taken. But the knowledge that India had embarked on a military nuclear programme would have a considerable effect on Pakistan, which has not got any comparable nuclear capability and would be likely to seek assistance from elsewhere, probably from China. [170]

The West German BND also accurately reported that India wanted the ability to match any Pakistani tests in the latter half of the study period. In the early assessments, however, British and American assessors created analytic complexity that overvalued the effect of China's nuclear evolution on India. On occasion, it generated uninformative analysis.[171]

On the whole, the first proposition receives no empirical support in the Argentine case but it was more successful with India. The possibility of a three-pronged arms race focused analytic attention on India's opaque nuclear intentions and contributed to some overestimates. The historical record examined above suggests that whatever analytic errors were made in assessing the two nuclear programmes, a deterministic proliferation domino theory was rarely the culprit.

Proposition 2. Nonproliferation commitments aid intelligence assessors.

Both countries were selective in making international commitments, decisions that received bountiful attention in their proliferation assessments. Did any of the three mechanisms – screening, differentiation, or monitoring – influence intelligence analysts' ability to assess India's and Argentina's nuclear intentions and capability?

Screening

In both cases, a reluctance to pledge nuclear abstention ensured that intelligence services paid regular attention. India's refusal to join the NPT's limitations helped foreign intelligence officers understand that an Indian nuclear armament was a possibility, even if it did not help them predict the time frame of its development. The same was true for the country's reluctance to accept expansive safeguards on imported nuclear equipment.[172] While Indian leaders presented their opposition to the treaty as a principled stand against the NPT's discriminatory nature, this did not bamboozle the intelligence analysts.

Argentina, in doing what it (and India) preached, posed more of a challenge. Driven by a nationalistic insistence on nuclear self-determination, Argentina invited suspicion in refusing to accept the NPT, the Treaty of Tlatelolco, and leveraged potential international suppliers against one another in minimising safeguards.[173] For example, an entire June 1984 CIA memorandum sought an explanation for why the

country exhibited 'a strong reluctance to make any major nonproliferation commitments', which produced a line of thinking that echoed how a former Argentinian official described the motivation: 'Argentina wanted to improve its image in the nuclear field, to make it more transparent before the international community, but was not willing in any way to pay the price of full scope safeguards'.[174] This consistent rejection of the nonproliferation regime invited suspicion, although much analysis examined this ideological impulse for nuclear independence as a serious hypothesis.

Differentiation

While Argentina's consistency offered little to analyse, India had a more differentiated stance on international proliferation agreements. Unfortunately for the assessors, the assumption that India would honour the agreements that it had voluntarily accepted proved misleading. The assumption that India would not involve foreign technology safeguarded by suppliers for explosive purposes led to the American and British failures to anticipate the PNE. In October 1969, for instance: 'Safeguards attached to the purchase of the first two power stations should make this difficult if not impossible in those cases'.[175] German and US intelligence shared the assumption that India would not break safeguards on internationally supplied materials and equipment.[176] British intelligence allowed for the possibility that safeguards evasion at 'the Canadian reactors is a possibility', but excised that judgment before sharing the assessment with Five Eyes partners.[177]

The assumption that India would not use the plutonium generated in its Canadian-supplied reactor persisted despite open warnings that India believed an underground PNE violated neither the Limited Test Ban Treaty nor the supplier agreements.[178] After the test, assessors relied less on international commitments in their studies of Indian nuclear intent but still prized information resulting from these agreements' implementation.

Monitoring

Both countries reluctantly accepted some inspections and safeguards on their foreign-supplied nuclear facilities. When the International Atomic Energy Agency (IAEA) was tasked with this monitoring, intelligence assessors used its information as raw intelligence in writing their assessments. For instance, British intelligence closely tracked safeguards information on individual Indian facilities following the PNE.[179] Their American counterparts weighed 'the adequacy of the IAEA inventory controls, surveillance equipment and inspection procedures in place' at an Argentinian reactor.[180] Revealing a symbiosis, the United States was sending leads regarding Argentina to the IAEA.[181] Beyond safeguards, while US intelligence could not 'independently confirm Argentina's capability to enrich uranium', IAEA officials were the first international eyes to visit Argentina's uranium enrichment facility after its unveiling.[182] Information exchanged among political representatives at the IAEA's headquarters in Vienna appears to have been a productive intelligence channel.[183]

Viewed in summation, the existence of formal international commitments aided intelligence assessments at multiple junctures.[184] The IAEA's limited monitoring of the Indian and Argentine programmes were important inputs to proliferation assessments, supporting the monitoring mechanism most. Except for India's surprising use of foreign-supplied technology in the 1974 PNE, these two cases provide the most robust evidence for the screening mechanism of nonproliferation agreements. Although it was not much use for Argentina, the differentiation mechanism's effectiveness could be observed in India's post-PNE approach to safeguards.

Proposition 3. Assessment accuracy is a function of collected information.

Because the precise information available to intelligence analysts when the assessments were written is not accessible, directly tracking the acquisition and processing of intelligence is not possible. A circumstantial analysis is still feasible by first establishing that the three intelligence

communities had sufficient means, motives, and opportunities to gather information about both nuclear programmes before evaluating how efficient they were in converting that information into knowledge. This section concludes with a consideration of the obstacles that stood in the way of using available information effectively.

As intelligence targets, the two nuclear programmes presented different challenges. India did not hide its facilities and, as an unfettered democracy, produced a great range of nuclear signals. The task for the assessors was to sort through the abundance. The country may even have been unusually accommodating to foreign intelligence services.[185] Argentina operated a clandestine facility under a closed political system for much of this period.

The United States intelligence community exceeded the others in its global collection capability, followed by the United Kingdom. The two actively exchanged raw intelligence and finished analyses on the Indian nuclear programme through the Five Eyes arrangement.[186] West Germany was far behind in its collection capability and not a part of Five Eyes intelligence exchanges. However, like the others, it had the theoretical advantage of reading Argentina's 'naval and diplomatic communications', something Britain did not invest in collecting before the Falklands War.[187]

The three assessors varied in information sources from intelligence channels. West Germany was the most active nuclear exporter, enjoying unusually close ties to Argentina's nuclear sector. Its connection to India included the expectation that German scientists would not have been surprised by the PNE and that it would receive technical data resulting from the test.[188] Their harmonic views on nuclear matters were discussed at the highest levels between the two governments.[189] Britain and the United States exported to India, at least in the early stages of the programmes. Britain entered a competition with West Germany to supply a reactor to Argentina in the years leading to the Falklands War. For much of the study period, the US Atomic Energy Commission had a representative in Buenos Aires to follow nuclear developments.[190]

These variations in information access are in part reflected in the accuracy of proliferation assessments. Nuclear technology cooperation appears to have increased accuracy, allowing West Germany deep insight into nuclear capabilities despite its intelligence collection disadvantage. The effect was pronounced as Argentina relied less on international cooperation in its infrastructure, making German intelligence less more hesitant about its South American partner's capabilities. Further fulfilling the proposition's expectations, the United States with its intelligence collection reach was closest to detecting the Pilcaniyeu uranium enrichment facility.[191]

In the assessments, current target country capabilities were usually reflected accurately. Making predictions about the future direction of nuclear programmes proved far harder, especially when this required modelling the intent animating their development.[192] The many instances in which analysts confessed their ignorance resulted from confusion about state intent far more frequently than over capability.

Assessing intent requires estimating how foreign decision-makers will react to possible future developments and who those decision-makers will be and who might influence their decisions. There were frequent references to political considerations, like the hawkishness of the governing party that might result from India's elections or a coup in Argentina. Budget constraints occasionally appeared in the assessments without adding much analytical value.[193] However, these were rarely treated with the same rigour as the technical and external security analyses, demonstrating that technical and political analyses require different skillsets.[194]

Subjective analytical spaces marked by 'the complexity of the subject matter, the small and biased sample of cases available for study, the conditions under which learning takes place, and the decision-makers' failure to realise how much they are influenced by their views of the past' offer cognitive biases the opportunity to thrive.[195] For example, US analysts were drawn to security competition to explain nuclear conduct, perhaps mirroring their own competition with the Soviet Union. Assessors may be trained to recognise and combat biases.[196] However, even sophisticated analysts and policymakers are susceptible to cognitive errors.[197] In addition to peer review, being part of a community of like-minded analysts can also be a source of error.[198]

Finally, internal information management difficulties obstructed the translation of available intelligence into accurate assessments. British and American intelligence were not efficient in converting sizeable resources into accurate assessments of the Indian programme. In the post-mortem of its failure to give warning of the PNE, the US intelligence community found:

> Inadequate priority against an admittedly difficult target, and lack of adequate communications among those elements of the community, both collectors and producers, whose combined talents were essential to resolving the problem. (. . .) The few reports which did provide indications of Indian intentions were given scant attention by the production analysts and were inadequately followed up by the collectors. Compounding this lack of priority was the general assumption by (. . .) collectors that the other guy was primarily responsible for producing hard evidence of Indian intentions. [199]

Knowledge management while protecting secrets is a perennial problem for intelligence work and can be observed interfering in the cases. In 1970, for example, British intelligence had difficulty accessing relevant information on India – from the FCO.[200]

The three intelligence communities did not operate as efficient information processors. While it was true that the more analysts knew about their target's nuclear infrastructure, the better they could describe it, intent was a different matter: More raw intelligence on state intent did not reliably lead to a clearer picture of the target's nuclear present and future. These cases demonstrate the limits on how much information states can acquire about another state's nuclear decision-making.

Conclusion

Foreign nuclear programmes are challenging intelligence targets. The empirical and comparative evidence presented in this article shows how factors related to the target nuclear programme and the relationship with the assessing state systematically contribute to greater and lesser accuracy.

First, if a state is believed to be in a nuclearised security competition with a rival, it is more likely for intelligence agencies to overestimate its proliferation potential. Second, international nonproliferation agreements' screening function provides useful information, although the correct interpretation poses challenges. Finally, the relationship between information quantity and assessment accuracy is far more complex than rationalist models of perception and even deterrence can accommodate. This ought to be cause for alarm.

Intelligence scholars may share the alarm, but not the surprise. While they may marvel at the naiveté of some IR assumptions about governments' talents in rational information processing, they may appreciate that the above results have demonstrated the value of structural theories for the study of intelligence.

These observations are drawn from a narrow set of Cold War circumstances. Intelligence agencies presumably have drawn their own conclusions and adjusted their practices, but technological progress has not made it any easier to assess intent. Intelligence will continue to err. As wide as the gap between them appears, abstract IR theories and practical intelligence scholarship can at least agree to be pessimistic about the ability to separate proliferation facts from fallacies.

Notes

1. Burr and Richelson, "The Chinese Nuclear Program," 54-99.
2. Fuhrmann and Kreps, "Targeting Nuclear Programs," 831-59; and Miller, "Success of Nonproliferation Sanctions".
3. Ricke, *Waffenhandel*, 236.
4. Richelson, *Spying on the Bomb.*
5. See, for instance, Jervis, *Why Intelligence Fails*; Long and Shifrinson "Intelligence Policy Relations". Failure in proliferation assessment is an extensive sub-genre of the larger literature on strategically relevant analytic errors that traces to Wohlstetter, *Pearl Harbor: Warning and Decision* and continues as an active sub-field on strategic surprise. See Marrin, *Preventing Intelligence Failures*. Proliferation analysis is practiced as a scientific intelligence discipline, which has its own scholarly tradition. See Goodman, *Jones' Paradigm.*

6. Montgomery and Mount, "Explaining US Failures"; Houghton, *The Nuclear Spies*; and Schneider, "Predicting Nuclear Weapons Proliferation".
7. Nutt, "Proof of the Bomb," compares US and Israeli assessments of the Libyan and Syrian programmes. Studies like Perl, "Comparing US and UK intelligence" have shown the value of cross-country intelligence comparisons beyond the nuclear domain.
8. Marrin, "Evaluating Intelligence Theories," 480.
9. Heuer, *Psychology of Intelligence Analysis*.
10. Lebovic, "Perception and Politics in Intelligence Assessment," 395.
11. Christensen and Snyder, *Chain Gangs and Passed Bucks: Predicting Alliance Patterns in Multipolarity*; Blainey, *Causes of War*.
12. Warner, "Building a Theory of Intelligence Systems," 17.
13. Knorr, *Historical Dimensions of National Security Problems*, 116.
14. Jervis, *The Meaning of the Nuclear Revolution*.
15. Montgomery and Mount, "Misestimation: Explaining US Failures"; and Schneider, "Predicting Nuclear Weapons Proliferation".
16. Betts, *Enemies of Intelligence*, 122.
17. Sagan, "Three Models in Search of a Bomb".
18. Pelopidas, "The Oracles of Proliferation".
19. Axelrod and Keohane, "Achieving Cooperation Under Anarchy".
20. Oppenheimer, "Memorandum," 753.
21. Acton, "The Problem with Nuclear Mind Reading".
22. Yarhi-Milo, *Knowing the Adversary*, 8.
23. Hall and Yarhi-Milo, "The Personal Touch," 561.
24. Glaser, *Rational Theory of International Politics*, 65–66.
25. Ryan, "Wilful Blindness or Blissful Ignorance," 460.
26. Swango, "The Nuclear Nonproliferation Treaty".
27. Appendix 1 in Cirincione, *Preparing the Regime*, summarises the regime elements. Formal nonproliferation commitments that were externally imposed upon a state, like UN Security Council resolutions demanding that North Korea end its weapons programmes, will be less informative about its intentions.
28. Schelling, *Arms and Influence*.
29. Rathbun, "Uncertain about Uncertainty," 537.
30. Sims, "A Theory of Intelligence and International Politics," 62.
31. Ben-Haim, "Policy Neutrality and Uncertainty".
32. Arena and Wolford, "Arms, Intelligence, and War," 352.
33. Sims, "A Theory of Intelligence and International Politics," 68.
34. However, there are also rationalist IR works in line with the intelligence literature, modelling intelligence as 'imperfect'. See Bas and Coe, "Dynamic Theory of Nuclear Proliferation"; Immerman, "Iran's Nuclear Intentions and Capabilities"; Lau and Desouza, "Intelligence and Nuclear Non-Proliferation"; and Rovner, *Fixing the Facts*.
35. Jervis, "Reports, Politics and Intelligence Failures," 41.
36. In practice, assessments can fall short of their stated scope. See Treverton, "Reflections on Conveying Uncertainty".
37. Public statements and reports were excluded because the information was likely to be shaped by policy motivations, as was reporting on nuclear programmes without analytical conclusions about intent or capability; Friedman and Zeckhauser, "Assessing Estimative Accuracy," 3.
38. Garthoff, *Assessing the Adversary*, 2.
39. The JIC has had its own staff of assessors since 1968. See Herman, "What Difference Did It Make?" 893.
40. German archives included the Federal Archives in Berlin and Koblenz, as well as the foreign ministry's archive. Other intelligence documentation sources included the British National Archives in Kew, as well as the Nixon and Reagan Presidential Libraries.
41. Perkovich, *The Impact on Global Proliferation*, 14.
42. Sarkar, "India's Proliferation Drift," 938.
43. Ibid., 944.
44. Chengappa, *Weapons of Peace*, 117.
45. Ibid., 335.
46. Kampani, "New Delhi's Long Nuclear Journey," 96.
47. FO, "Nuclear Weapons Policy".
48. PM, "UK Nuclear Trade with Taiwan," 73.
49. As an example, see FO "Atomic Energy Programme of India." A comprehensive 1960 analysis of Indian foreign and military policies did not raise the possibility of nuclear weapons development. See JIC, "The Outlook for India".
50. JIC, "Development of Nuclear Weapons," 8.

51. Ibid., 5.
52. JIC, "Indian Nuclear Weapons Programme," 1.
53. JIC, "India/Pakistan – The Military Balance," 2.
54. Half a year before this, the chief of the Indian nuclear programme had told the US State Department that it would take India 18 months. See Sarkar, "India's Proliferation Drift, 937. He said this in public as well. See Nayar and Paul, *India in the World Order*, 172.
55. JIC, "Indian Nuclear Developments".
56. JIC, "Joint Intelligence Committee".
57. Ibid.
58. Ibid.
59. FO, "Indian Nuclear Capabilities and Intentions," 4.
60. Ibid.
61. JIC, "Development of Nuclear Weapons," 10.
62. JIC, "Implications of the Indian Nuclear Test," 6.
63. MOD, "Ministerial Group on Non-Proliferation," 1.
64. FCO, "Materials for Briefs and Papers," 3.
65. Joshi, "India and the Nuclear Non-Proliferation Regime, 16.
66. JIC, "Prospects in the Medium Term," 13.
67. Perkovich, *The Impact on Global Proliferation*, 242.
68. Ibid., 244.
69. Gavin, "Strategies of Inhibition".
70. Sarkar, "India's Proliferation Drift".
71. For example, nonproliferation was listed first among five objectives in a September 1985 visit to India for an American diplomat. See "Trip of Under Secretary Armacost to India".
72. Perhaps based on the assumption that 'neither the Government of India nor the Indian public has given much; if any, consideration to the possibilities of fourth countries possessing nuclear weapons'. See Sonnenfeldt, "Department State Office of Intelligence Research," 7. In fact, Indian government officials had already given the possibility much consideration. See Perkovich, *The Impact on Global Proliferation*, 34–35; CIA, "Nuclear Weapons Production in Fourth Countries.
73. CIA, "Development of Nuclear Capabilities by Fourth Countries," 16.
74. CIA, "Likelihood and Consequences of the Development of Nuclear Capabilities," 12.
75. CIA, "Nuclear Weapons and Delivery Capabilities," 8.
76. CIA, "Likelihood and Consequences of Proliferation," 9.
77. Ibid.
78. Ibid.
79. DOS, "Background Paper on Factors," 27.
80. Ibid.
81. CIA, "Prospects for a Proliferation of Nuclear Weapons, 9.
82. Ibid.
83. CIA, "Nuclear Weapons Programs Around the World," 9.
84. INR, "Research Memorandum REU-25," 7.
85. CIA, "Likelihood of Further Nuclear proliferation," 7.
86. Perkovich, "The Impact on Global Proliferation," 124.
87. INR, "The Indian Nuclear Weapons Program," 1.
88. INR, "India to Go Nuclear?," 2.
89. Ibid., 1.
90. CIA, "Indian Nuclear Developments," 1.
91. Ibid., 2.
92. Ibid.
93. Chengappa, *Weapons of Peace*, 335.
94. CIA, "Prospects for Further Proliferation," 16.
95. Ibid., 20.
96. Ibid., 17.
97. INR, "India-Pakistani Views on a Nuclear Weapons," i.
98. The CIA prepared a study around the same time, perhaps as an input paper for the NIE, of India's nuclear capabilities. The study's declassified version is heavily redacted, including the overall assessment. See CIA, "India's Nuclear Program" and CIA, "Nuclear Proliferation Trends through 1987," 16.
99. Haeckel, "International Nuclear Commerce and Nonproliferation," 72.
100. Geier, *Schwellenmacht*, 311.
101. AA, "*Inkrafttreten des NV-Vertrages*".
102. BND, "Unterirdische Kernexplosion in Indien," 2.

103. AA, "Indisches Atomforschungszentrum".
104. Möllenberg, "Unterirdische Kernexplosion in Indien," 1–2.
105. Mian et al., "Fissile Materials in South Asia," 10.
106. Ibid., 13.
107. BND, "Beitrag Zur Kanzlerlage," 1–2.
108. Möllenberg, "Aufzeichnung über Indien zur Asienreise," 1–2.
109. By initiating nuclear fusion, thermonuclear weapons release far more destructive energy than fission-only nuclear bombs.
110. Albright and Zamora, "India, Pakistan's Nuclear Weapons," 25.
111. Perkovich, *The Impact on Global Proliferation*, 275.
112. Nauders, "*Zuarbeit zur Vorgesehenen BK-Lage*," 1–2.
113. Perkovich, *The Impact on Global Proliferation*, 283.
114. Hagood, "Armind and Industrializing Peron's 'New Argentina," 73.
115. Even the rare retrospective vigorous defence of his ideas includes the phrase, 'Richter must have been unfamiliar with nuclear physics' (Winterberg 'Ronald Richter, Genius or Nut?'). For more on this episode, see Mariscotti *The Atomic Secret*.
116. Hagood, "Arming and Industrializing Peron's 'New Argentina," 70.
117. Coutto, "History of the Brazilian Argentine Rapprochement," 312.
118. Ibid., 305.
119. Hymans, "Why Argentina Never Wanted the Bomb," 177.
120. Albright, "Bomb Potential for South America," 19.
121. Coutto, "History of the Brazilian Argentine Rapprochement," 312; and Stevens, "The Back-end of the Nuclear Fuel Cycle," 47.
122. Hymans, "Why Argentina Never Wanted the Bomb," 176.
123. Ibid., 178.
124. Coutto, "History of the Brazilian Argentine Rapprochement," 317.
125. Mallea, Spektor, and Wheeler, "The Origins of Nuclear Cooperation," 15.
126. Coutto, "History of the Brazilian Argentine Rapprochement," 305.
127. For example: "Viewpoint: Next Century Nonproliferation".
128. Hymans, "Why Argentina Never Wanted the Bomb".
129. AA, "*Deutsch-Argentinische Beziehungen*".
130. Romberg, *Atomgeschäfte: Die Nuklearexportpolitik*, 193.
131. Ibid., 199.
132. "Interview with John A. Bushnell".
133. Romberg, *Atomgeschäfte: Die Nuklearexportpolitik*, 190.
134. AA, "*Kapitalhilfe an Argentinien* (III B4 82-47)".
135. BND, "*Beitrag zur Kanzlerlage*," 2–3.
136. Stevens, "The Back-End of the Nuclear Fuel Cycle," 47.
137. BND, "Argentinien. Beurteilung der Kernwaffenentwicklung," 156–7.
138. Möllenberg, "Aktuelle Politische, Militärische" 1.
139. Nuclear commerce was seen as a possible path to improved relations with attendant risks: 'On political grounds, both because of public and parliamentary concern about the abuses of human rights in Argentina, and because of our continuing dispute with Argentina over sovereignty of the Falkland Islands, we exercise care in all our official contacts.' See FCO, "Mr. Ridley's Meeting with Lord Nelson," 3; Wolff, "Visit to the Argentine," 1.
140. FCO, "Nuclear Power Matters in Switzerland".
141. JIC, "Development of Nuclear Weapons," 12.
142. FCO, "Mr Ridley's Meeting with Lord Nelson," 3.
143. FCO, "Nuclear Power Matters in Argentina," 2.
144. FCO, "Material for Briefs and Papers," 3.
145. FCO, "Non-Proliferation: General".
146. FCO, "Nuclear Power Matters in Argentina," 1.
147. The UK has not released assessments written since the Falklands War.
148. For examples of these consistent objectives, see Burghardt and Menges, "Memorandum for Robert C. Mcfarlane" and NSC, "Nuclear Non-Proliferation – Argentina," 135.
149. "Recruitment of German Scientists and Technicians for Employment in Argentina"; "Argentine Government Exploitation of Uranium Deposits".
150. Sonnenfeldt, "NPT Memorandum Dated 24 January 1969," 1.
151. CIA, "Prospects for Further Proliferation of Nuclear Weapons," 32–33.
152. CIA, "Managing Nuclear Proliferation," 9.
153. Todman, "Your Visit to Argentina November 20-22, 1977," 63.
154. NSC, "Nuclear Non-Proliferation – Argentina," 128.

155. CIA, "Argentina's Nuclear Policies," 3–4.
156. CIA, "Nuclear Proliferation Trends Through 1987," 21.
157. CIA, "Argentina's Nuclear Policies Under Alfonsin," 3.
158. CIA, "Argentina. Seeking Nuclear Independence," iii.
159. Ibid., 9.
160. Mallea, Spektor, and Wheeler, "The Origins of Nuclear Cooperation," 68.
161. Nayar and Paul, *India in the World Order*, 171.
162. Ibid., 195.
163. JIC, "Development of Nuclear Weapons," 1.
164. Large, "Indian Nuclear Weapons Capability".
165. The next sentence mentioned a PNE as a non-military option; JIC, "Development of Nuclear Weapons".
166. JIC, "The Implications of the Indian Nuclear Test," 1.
167. Mallea, Spektor, and Wheeler, "The Origins of Nuclear Cooperation," 13.
168. Carasales, "The Story of Argentina's Nuclear Policy," 55.
169. CIA, "Nuclear Proliferation Trends Through 1987," 21.
170. JIC, "Likelihood of an Indian Nuclear Weapons Programme," 9.
171. 'The Pakistani reaction to a real or imagined Indian nuclear-weapons capability might take one of several directions.' See INR, "Addendum INR Contribution to NIE 4-65".
172. For example: 'the wide scope of the nuclear programme and her evident aversion to being tied to outside sources involving safeguards suggest that the possibility of weapons production has been kept in mind.' See CIA, "Development of Nuclear Weapons," 5. Argentina's safeguards reluctance was interpreted as nuclear hedging less often.
173. It ratified the Treaty of Tlatelolco in 1994 and the NPT the following year, beyond the study period.
174. Mallea, Spektor, and Wheeler, "The Origins of Nuclear Cooperation," 125.
175. 'There is no indication that India is preparing either for a full-scale nuclear test or merely to detonate a nuclear device for demonstration purposes. She has signed the Partial Test Ban Treaty, but could test underground. We would expect to get six months' warning of an atmospheric test and much longer of a full-scale underground test.' See JIC, "JIC(69)46," 5.
176. AA, "*Indisches Atomforschungszentrum*"; CIA, "Nuclear Weapons Programs Around the World," 9–10.
177. JIC, "Likelihood of an Indian Nuclear Weapons Programme".
178. Rabinowitz, *Washington and Its Cold War Deals*, 174.
179. JIC, "The Implications of the Indian Nuclear Test," 1.
180. "National Intelligence Daily," 7.
181. DOS, "State Dept Cable Traffic During 1981-1982," 2.
182. "Implications of Argentina's Uranium Enrichment Capability," 2.
183. FCO, "Mr Ridley's Meeting with Lord Nelson," 13.
184. As shown by the German foreign ministry requesting the BND gather information about nuclear tests to inform NPT diplomacy, the nonproliferation regime's existence was itself a motivation to seek and assess nuclear intelligence. See AA, "*Zusammenarbeit AA/BND*".
185. Andrew and Mitrokhin, *The Mitrokhin Archive*, 321.
186. FO, "Indian Nuclear Capabilities and Intentions"; DOS, *State Department Cable 69551*.
187. Jacobs, "Maximator: European Signals Intelligence Cooperation," 5.
188. AA, "Lage auf dem Indischen Subkontinent".
189. AA, "Indien Nuklearpolitk, Vermerk".
190. "Interview with Kratzer".
191. After its revelation, the US began surveilling the site with satellite imagery. See "Annual Index Photographic Exploitation Products".
192. Confirming Goodman's observation that intent is 'far more difficult to discern' than capability. See Goodman, *Jones' Paradigm*, 244.
193. Curiously, discussions of public opinion did not make any appearance, except obliquely as an influence on political considerations. Even the State Department did not consider it relevant. See DOS, "Indian Capability and Likelihood to Produce Atomic Energy".
194. I thank an anonymous reviewer for this point.
195. Jervis, *Perception and Misperception in International Politics*, 49:235.
196. Fischhoff, *Behavioral and Social Scientific Foundations*.
197. Wilson and Brekke, "Unwanted Influences on Judgments and Evaluations"; Heuer, *Psychology of intelligence analysis*.
198. Janis, *Psychological Studies of Policy Decisions*.
199. CIA, "An Examination," 1.
200. JIC, "Intelligence on the Indian Sub-Continent," 9.

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