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Staying the course: Lessons from South Africa for irreversibility of nuclear disarmament

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Cover photo: Bomb casings at South Africa's abandoned Circle nuclear bomb assembly facility near Pretoria.

Abstract

To conceptualise irreversibility of nuclear disarmament, it is better to think about nuclear disarmament as a historical *process* than a historical *moment*. I apply a path-dependency lens to do so in the case of South Africa. During the formative phase of its nuclear disarmament, narratives of intent were employed to take advantage of windows of opportunity brought about by historical contingencies and conjectures. It allowed South African decision-makers to set the disarmament course and take the first steps down this path. Timing and sequencing of decisions, actions and announcements played an important role in locking in behaviour of actors that could have reversed the process in this crucial stage. The choice to stay the disarmament course has since been informed by cost-benefit and normative drivers to reach an equilibrium point. This point reflects a circumscribed understanding of irreversibility of nuclear disarmament for South African policymakers, namely demilitarising fissile material and putting it under international safeguards. This is the status of South Africa's highly enriched uranium (HEU) today. For South Africa to move towards a broader understanding of irreversibility that includes relinquishing HEU and giving up the right to uranium enrichment will require 'correlation' of similar efforts in a broader move to nuclear disarmament by nuclear-armed states.

Introduction

It has been more than three decades since FW de Klerk's decision to dismantle South Africa's nuclear weapons placed the country on a nuclear disarmament course. From a political point of view, it would be near unthinkable to reverse that course today. The argument I make in this working paper is that irreversibility of nuclear disarmament is better thought of as a process that needs to be garnered over time to achieve a 'disarmed' path-dependency and behavioural lock-in.[1] Thinking of irreversibility in these terms means we see nuclear disarmament as a reproductive process where the decision to disarm is not once-off, but on-going. Willingness to disarm is not confined to a given administration and a single (trans)formative moment, even though such willingness at such a moment is crucial to set the course. Successive governments of the disarmed state in question at different junctures can review the decision to disarm based on its estimation of the costs, benefits, and normative justification of 'staying disarmed' in the context of its view of the national and international political environment.

The South African case study is valuable to reflect on irreversibility of nuclear disarmament as *a process*. Rather than looking for generalisable causes of (or forces

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[1] Levite (2002/3, 67) approaches nuclear rollback on the same premises, noting 'rollback processes often begin slowly and hesitantly and proceed incrementally. They are rarely if ever cemented until the trade-offs are apparent and the risks of the decision minimized...'

that produce) irreversibility, I focus especially on the narratives that inform the choice to disarm and stay the disarmed course and the reproductive mechanisms propelling a state along the disarmament path. Since 1989, decision-makers in South Africa have framed its nuclearity, i.e. the extent to which a state is regarded as 'nuclear' (Hecht, 2006, 26), in ways to justify policies that have led to 'staying disarmed' in the face of counter narratives to reverse disarmament. Having said this, despite the lack of explicit intent of nuclear hedging or developing nuclear latency, what can be thought of as the next piece of the irreversibility puzzle–foreswearing fissile material–has not been inserted to further the nuclear disarmament picture. South Africa retains highly enriched uranium (HEU) from its weapons and enrichment programme and successive administrations have guarded its right to the full nuclear fuel cycle. The paper explores the politics around South Africa's HEU and its right to enrichment, showing how narratives pull through from the past to justify these policies. I argue that it is likely South Africa will only give up its HEU and the idea to resurrect its enrichment capability once nuclear armed states embark on nuclear disarmament and, as part of this endeavour, fissile material of all states is dealt with under an international control programme.

The paper proceeds as follows. I briefly outline the analytical lens of path-dependency, which is used here as a heuristic to explore irreversibility of nuclear disarmament in the South Africa case, and then sketch the history of the South African nuclear weapons programme for context. Next, I turn to South Africa's nuclear disarmament path, distinguishing between its genesis and reproduction phases and finally end with a discussion of the politics of HEU and uranium enrichment in South Africa.

Irreversibility through the lens of path-dependency

Conceptually, path-dependency literature in the Social Sciences has much insight to offer with respect to irreversibility of nuclear disarmament. Here I briefly set out a few premises and concepts to outline the path-dependency lens that I use to think about irreversibility of nuclear disarmament in processual terms in the South African case.

Levi (1997, 28) provides a straightforward meaning of path-dependency that illuminates the link to irreversibility of political processes, namely 'once a country or region has started down a track, the costs of reversal are very high. There will be other choice points, but the entrenchments of certain institutional arrangements obstruct an easy reversal of the initial choice.' The path-dependency lens emphasises two aspects that relates to lock-in of behaviour: contingency and self-reinforcement (Vergne and Durand 2010, 737). 'Lock-in' is defined as '[a] situation of relatively stable equilibrium, caused by path dependence, from which it is difficult to escape without the intervention of shocks exogenous to the system' (Vegne and Durand 2010, 755). As for contingency, at critical junctures agents have a variety of actions or choices available that might be chosen, which makes it hard to predict which behaviour will

prevail or become 'habituated' (Sarigil 2015, 232). Sudden, exogenous, random or near random events, which may range from individual agency to natural disasters, are explored as the contingencies and conjunctures responsible for path initiation or production (Mahoney 2000, 514). Once the course is set, though, 'paths tend to reproduce themselves in the absence of those original events or conditions' (Sarigil 2015, 233). Figure 1 from Mahoney (2000, 514) illustrates contingency in self-reinforcing processes.

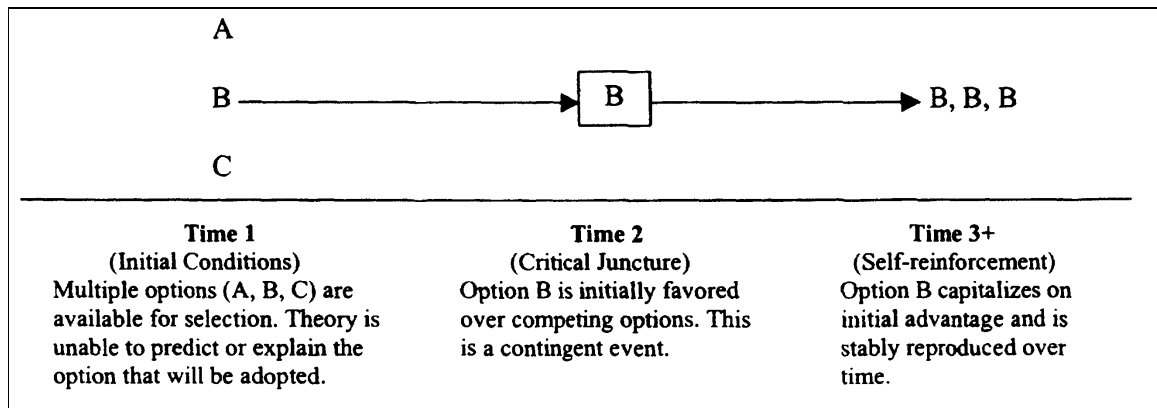|		
Time 1	**Time 2**	**Time 3+**
(Initial Conditions)	(Critical Juncture)	(Self-reinforcement)
Multiple options (A, B, C) are available for selection. Theory is unable to predict or explain the option that will be adopted.	Option B is initially favored over competing options. This is a contingent event.	Option B capitalizes on initial advantage and is stably reproduced over time.

Figure 1 Illustration of contingency (Mahoney 2000, 514)

South Africa's nuclear weapons programme can be regarded as the 'initial conditions' stage, followed by two periods of South Africa's disarmament: the critical juncture or (trans)formative moment, 1989 to 1993, and the period from 1993 to the present as the self-reinforcement stage. In highlighting how disarmament has been produced and reproduced in the South African case, I especially look for reproductive mechanisms that underpin disarmament to help us understand irreversibility in nuclear disarmament, because '[e]fficacious mechanisms of reproduction enable an institution to take advantage quickly of contingent events that work in its favor, solidifying a position of dominance before alternative institutional options can recover' (Mahoney 2000, 515). Reproductive mechanisms also refer to the factors that 'keep an outcome in place' when the initial conditions are no longer there (Soifer 2012, 1577).

Two types or models of path-dependency can be identified based on the reproductive mechanisms in play, namely utilitarian and normative models. Both models conceive of actor agency as rational, reflective, and deliberative, but the logic driving agents' continued choice of the path differs. Utilitarian path-dependency processes follow the logic of consequentiality. The policy choice delivers increasing returns, i.e., 'the relative benefits of the current activity compared with other possible options increase over time. To put it in a different way, the costs of exit – of switching to some previously plausible alternative – rise' (Pierson 2000, 263). Increasing returns dynamics therefore encourages not only attention to cost-benefit calculations, but timing and sequence. For Pierson (2000, 251) 'it is not only a question of what happens but also of when it happens. Issues of temporality are at the heart of the

analysis.' Sarigil (2015, 224-225) identifies conditions or sources of increasing returns, namely large set-up or fixed costs (e.g. the difficulty to reverse a policy course or leave and institution after having invested significant resources in it); learning effects (e.g. enhanced efficiency through the knowledge and skills acquired as part of following a policy and/or joining certain institutions); coordination effects, also referred to as network externality (e.g. when path maintenance is made more desirable, because others also follow the same path); and adaptive expectations (when the success of an option changes actor expectations and result in self-fulfilling anticipation).

Normative path-dependency, in turn, operates on the logic of appropriateness, i.e., it is presumed that 'agents stick to a certain path not because of an expected utility down the path but primarily because of belief in the "appropriateness" of the rules, ideas, values, and norms that constitute the path' (Sarigil 2015, 227). Legitimation is a key reproductive mechanism here, which can either manifest in active moral approval or passive acquiescence with the status quo. Irrespective, actors stick to a policy course based on 'self-understandings about what is the right thing to do' (Mahoney 2000, 523). In addition to legitimacy, other ideational concerns, such as identity, reputation, and prestige motivate actor choices.

Sarigil (2015) adds to this typology of path-dependency a third type, habitual path-dependency, as a corrective to utilitarian and normative models' bias towards 'purposive, calculative, and strategic' social action. Habit can certainly account for policy and institutional inertia, but for this paper my focus is on the processes through which one path becomes discursively hegemonic and deviation from this path unthinkable. In the South African case I especially identify how narratives across utilitarian and normative drivers of path-dependency were activated and sequenced in the (trans)formative moment (or genesis stage) and the period since to make the disarmament decision 'authoritative'. I draw on Larkin's (2008, 320) notion of 'narratives of intent' defined as '*fictions required by the need to talk*, and *fictions required by the need to act*.' [emphasis in original]. Using path-dependency as a lens to understand political processes requires recognition that politics is collective in nature and therefore policies and plans that address the question 'what is appropriate in this situation' is negotiated amongst a variety of interpretations (Pierson 2000, 257-259). Although at the point of authoritative decision, the 'text' (or policy) becomes fixed and enables action, the text itself again opens for contestation or re-interpretation (Larkin 1994, 94). So too, disarmament is perhaps better understood as a series of decision points.

Despite delimiting the focus of the paper to utilitarian and normative drivers of disarmament path-dependency, I am not excluding the possibility that over time the disarmament path may well be reproduced by habit (patterns of practice) and that reversing course will not only be unthinkable in terms of cost, benefits, or moral opprobrium, but may simply not be an option that comes to the mind anymore.

South Africa's weapons programme

South Africa developed nuclear weapons on the back of its peaceful nuclear energy programme. In the scramble for uranium in the 1940s, South Africa presented itself as a reliable source of the mineral. In addition to providing uranium for peaceful programmes, the United States (US)' and United Kingdom (UK)'s nuclear weapons were almost entirely reliant on South African uranium from 1959 to 1964 (von Wielligh and von Wielligh-Steyn, 2014, 97). Under the Atoms for Peace programme, South Africans received training in nuclear science and technology and obtained the SAFARI I reactor for research purposes and the production of medical isotopes, operational from 1965, from the US. It developed an indigenous technique to enrich uranium, which was revealed in 1970, followed by expected international concern over proliferation, exacerbated by the discovery of the Kalahari test sites in 1977 and suspicions around the 'Vela incident' in 1979. South Africa also acquired two reactors for power generation at the Koeberg site built by the French company, Framatome, from 1976 and operational in the mid-1980s. Both SAFARI I and the Koeberg reactors were under International Atomic Energy Agency (IAEA) safeguards (Stumpf 1995). South Africa was a founding member of the IAEA and occupied a seat on its Board of Governors but was replaced by Egypt as 'the most advanced nuclear state in Africa' in 1977. The Group of 77 (G77) and African states in particular waged a campaign against South Africa in the IAEA, which was motivated by suspicions about its nuclear weapons programme and in the context of its policy of apartheid. In 1979, the South African delegation's credentials for the General Conference were rejected and it would only be allowed back once it had joined the NPT and placed all its nuclear activities under IAEA safeguards (see van Wyk 2015). South Africa remained a member of the IAEA, but its 'nuclear isolation' and calls for its expulsion raised the opportunity costs of its nuclear weapons programme.

In the same year, 1977, that South Africa was ousted from the IAEA Board of Governors, a national strategy for a nuclear deterrent was discussed and as part of its secret 'peaceful nuclear explosive' programme a nuclear device was readied for testing (von Wielligh and von Wielligh-Steyn 2014, 133-135). The three phased nuclear strategy entailed: (i) strategic ambiguity (neither confirm or deny possession of nuclear weapons); (ii) covertly declare to a major power that South Africa had nuclear weapons in case South Africa's territory was under threat; (iii) if phase two did not lead to removal of the threat, overtly employing nuclear weapons as a deterrent either by making a public announcement to confirm possession or demonstrating it through an underground test (Stumpf 1995). No tactical or strategic use of the weapons was envisioned at this stage.

The fact that a national strategy for nuclear weapons already existed in 1977 suggests that South Africa's uranium enrichment and peaceful nuclear explosive programmes

were efforts to develop nuclear latency, which were justified from 1974 onwards by pointing to increasing Soviet influence in southern Africa and a build-up of Cuban forces in the region by 1975 (de Klerk 2013; see also Liberman 2001, 51 and Albright and Stricker 2016,13, 14). South Africa, like India, probably not only refused to join the NPT because it regarded the treaty as discriminatory, but to keep its weaponisation options open. According to Liberman (2001,64), the order to build a nuclear deterrent came from Prime Minister John Vorster, but it was PW Botha who accelerated the programme when he became Prime Minister in 1978. Botha was a military man and a securocrat. He was Minister of Defence for more than a decade before he took office and under his leadership governance was increasingly securitised and the state militarised. He was the driving force behind the domestic military industry that filled the vacuum left by international weapons sanctions (von Wielligh and von Wielligh-Steyn, 2014, 97, 261-262).

From 1984 to 1988, South Africa continued negotiations with the IAEA, indicating that it wanted to join the NPT, but it is hard to know if this was a cat and mouse game to prevent expulsion from the IAEA or a genuine prelude to the end of the programme (Liberman 2001, 73). It seems that the civilian leaders, even Botha, were trying to find a way out of the programme but wanted to barter for security assurances from the West and other quid pro quo concessions, like sanctions relief (Heald, 2010, 84; Liberman, 2001,79). South Africa's military-industrial complex had other plans. By the time the decision was made to end the weapons programme in 1989, South Africa had developed six and a half gun-type weapons deliverable by plane, but another seven warheads, deliverable by missiles were on the cards, and nuclear strategy recommended by Armscor, the defence company responsible for the programme, and approved by the Defence Force, had included a fourth phase, tactical use (or battlefield application) to deter conventional invasion. No strategic use was envisaged, only its threat (von Wielligh and von Wielligh-Steyn 2014, 188, 189, 480; Albright and Stricker 2016, 136).[2]

The formative moment of South Africa's disarmament path-dependency

This section sketches the genesis phase of South Africa's disarmament path-dependency: setting the course and taking the first steps down the disarmament path. It is a tale of contingency and conjuncture and how 'fictions required to talk and fictions required to act', i.e. narratives of intent, were employed and sequenced to make the disarmament decision authoritative for domestic and external actors.

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[2] The issue of battlefield use is also discussed by Liberman (2001). There is general consensus that the aggressive use of nuclear weapons on the battlefield (or elsewhere) would have been 'suicidal' and most actors involved in the programme ruled it out. However, there is also mention of a fringe element who wanted to fight to the 'bitter end' (Liberman 2001, 56). Irrespective, battlefield use as a deterrent was included in the revised recommended strategy.

One of the key domestic contingencies characterising the transformative moment was PW Botha's health. He had a stroke in 1989 and FW de Klerk took the reins later that year. De Klerk did not come from a military background and was uncomfortable with the military-industrial complex (von Wielligh and von Wielligh-Steyn 2014, 261-262; Purkitt et al 2002). Two other contingencies were also important: Soviet President Gorbachev and his reforms made it possible to negotiate the withdrawal of Cuban forces from the region in 1988 and the consequent smooth transfer of trusteeship of Namibia in 1989 and its independence in 1990 (Albright and Stricker 2016, 183-184). George H. W. Bush also came to power in the US and put more pressure on South Africa than his predecessor, President Reagan. The Berlin Wall fell in early November 1989, signalling the end of the Cold War. These events provided de Klerk with sufficient discursive resources to justify his domestic reforms, which foremost involved releasing Nelson Mandela and unbanning the African National Congress (ANC) and other political groups, which he announced on 2 February 1990. The decision to dismantle South Africa's nuclear weapons and join the NPT were taken to improve South Africa's international position and to reflect that de Klerk was serious about the constitutional reforms he was embarking on (Heald 2010, 4-5). There was one more influential event that coincided with the transformative moment–the disarmament of Iraq after the Gulf War. It impacted not only the decision on when and how South Africa's weapons would be dismantled, but also the way the South Africans approached the IAEA verification process (more on that later). Neither these contingencies, nor the conjuncture of events by themselves 'caused' South Africa's nuclear rollback; several outcomes were still possible at this stage. Rather they were timeously taken advantage of to frame de Klerk's disarmament decision, i.e., they could be used in the narratives of intent (or necessary fictions) that rationalised and justified switching South Africa to the disarmament path.

De Klerk was engaged in a tough balancing act. On the one hand, he had to contend with actors inside the political establishment who opposed his reforms and could have derailed the general process or at least have made it messier, not least through a military coup (Möser 2020). With respect to the disarmament decision there were potential spoilers in the defence force, amongst the nuclear scientists and engineers who worked on the programme, and political figures in his own party and the political arena at large. On the other hand, he had to contend with external pressure, especially from the US and the ANC, actors that may have had different ideas about the timing of dismantling the weapons (Das 2022, 91). De Klerk kept the Mantle Project, code name for the dismantling of South Africa's nuclear weapons, secret. The decision to dismantle was communicated to cabinet in November 1989, the enrichment plant was closed on 1 February 1990, the weapons dismantled between July 1990 and July 1991, and by September 1991, South Africa joined the NPT. It signed a comprehensive safeguards agreement with the IAEA two months later and inspections to verify South Africa's Initial Report (declared inventory) started in November of the same year.

It was decided to admit to the IAEA that South Africa had enriched uranium to weapons grade, because decontamination to hide this fact would have been near impossible, but not to admit that South Africa had a weapons programme. This was only revealed in 1993. One explanation for this delay is that the South Africans were anxious about heavy-handed (de facto US-led) inspections of the type that had occurred under the United Nations Special Commission (UNSCOM) in Iraq. These inspections were confrontational and included the physical destruction of equipment and buildings (von Wielligh and von Wielligh-Steyn 2014, 264). After de Klerk's 1993 revelation about the nuclear weapons programme, the IAEA mission was augmented with experts from nuclear weapon states (Albright and Stricker 2016, 220). Avoiding Iraq-type inspections also informed the South African approach to give the IAEA inspectors 'access anywhere at any time, within reasonable limits', an intent on transparency and cooperation over and beyond what was legally required. The government also invited the ANC to do its own inspections to verify that there were no 'bombs in the basement', but the ANC did not act on this invitation (von Wielligh and von Wielligh-Steyn 2014, 264).

This sequencing–dismantling in secret, joining the NPT, and then revealing the programme after initial inspections–in the context of de Klerk's broader political reforms, served to lock in disarmament path-dependency in the genesis phase.

Establishment 'lock-in' during the transformative moment

It is worth exploring how the apartheid state actors were brought round to accept the disarmament decision. Purkitt et al (2002, 190) argue that generals in the defence force were already supporting disarmament when de Klerk came to power, because the nuclear weapons programme was diverting resources from modernising conventional weapons and containing domestic unrest. The narrative that the nuclear weapons would 'fall into ANC hands' also circulated, not least as part of US pressure to accelerate the disarmament process, and no doubt found resonance with some in the defence force. However, the issue was more complicated than saying that the defence force supported the decision to disarm. The South African Airforce (SAA) was the designated 'user' and officially in charge of the nuclear weapons. On the eve of dismantling the weapons, the SAA peculiarly wanted to move the nuclear weapons from the Armscor Circle facility at the Pelindaba site to the Air Force's storage location. The move failed, but some argue South Africa came close to a military coup at that time and de Klerk subsequently dismissed several high-profile defence and police officials (von Wielligh and von Wielligh-Steyn 2014, 263).

The scientists and engineers, who dedicated their careers to the South African nuclear weapons programme and had been given great power in the nuclear debate were, as could be expected, anxious about the end of the programme (Liberman 2001, 65). For some, destroying the nuclear weapons were the equivalent of 'destroying the

Afrikaner state' (von Wielligh and von Wielligh-Steyn 2014, 263). Their technical achievements and the prestige of developing a nuclear weapons and enrichment capability indigenously ended abruptly, and they were informed about it without much fanfare. There is a sense more could have been done discursively and materially to get their buy-in in the disarmament process, e.g. by emphasising the historic and moral significance of disarmament and to secure alternative career options for them (von Wielligh and von Wielligh-Steyn 2014, 220, 221; Buys 2021, 3). Most personnel were retrenched. Andre Buys, a former Armscor employee attached to the programme and later turned academic, notes, 'It is therefore not surprising that the termination of South Africa's nuclear weapons programme generated a potentially dangerous backlash among those who had lost their jobs' (2021, 4). A group of employees threatened to reveal sensitive information to the highest bidder to extort greater retirement benefits from Armscor, but they were challenged with legal charges, and backed off. In addition, some of the sub-contractors in the AQ Khan network worked on the South African programme. South Africa's programme was relatively small and over the course of its existence employed an estimated 1000 people. However, in states with larger nuclear weapons programmes, personnel may become a significant lobby group and risk the irreversibility of nuclear disarmament. It is in this respect that Buys (2021, 6) lauds the International Cooperative Threat Reduction Programme (ICTRP) between Russia and the US and other Western countries during the 1990s. He underscores that even a modest support package for South Africa could have made a major difference to the fate of this group.

De Klerk was more careful to avoid a conservative or right-wing backlash in Parliament, especially amongst actors with national-militarist leanings and ties to the defence force, who could derail broader constitutional reforms. He avoided antagonising them until late in the game by delaying the public announcement that South Africa had had nuclear weapons, which he dismantled before joining the NPT, until after the 1992 referendum gave him electorate support for his political reforms (Liberman 2001, 81). In addition, although the US made it clear that there would be no quid pro quo for joining the NPT, Möser (2021) argues that the de Klerk government skilfully exploited fears of international proliferation and was able to enlist the US and other major powers in a campaign to encourage NPT accession across southern Africa. Linking its own accession to the NPT with that of its neighbouring states, Angola, Mozambique, Tanzania, Zambia, and Zimbabwe, a coalition known as the Frontline States (FLS), lessened the perception that de Klerk was caving into international pressure without anything in return. In fact, in path-dependency speak the 'adaptive expectations' reproductive mechanism was at work here. Joining the NPT could now be linked to increased regional security and improved international standing. These successful outcomes of joining the NPT could be discursively employed to change the expectations of actors, who opposed the end of the nuclear weapons programme and de Klerk's political reforms more generally. By bringing them into the fold, or at least reducing their grounds for spoiling, path-dependency was reinforced.

4 ANC 'lock-in' during the transformative moment

By dismantling the nuclear weapons and negotiating NPT accession in secret prior to the 1994 elections, de Klerk to some extent presented the future ANC government with a fait accompli. De Klerk felt that revealing the existence of the nuclear weapons programme would complicate negotiations with the ANC. Heald (2010, 310) makes the case from interviews with de Klerk and other insiders to the disarmament process that de Klerk did not want to hand the post-apartheid government 'a poisoned chalice' in the form of nuclear weapons, a significant reframing of nuclear weapons as illegitimate weapons for a post-apartheid democratic state. This is understood in terms of international law and norms against nuclear weapons (i.e. legal and moral considerations) as well as the idea that the nuclear weapons programme did not befit a constitutional democracy, in Heald's words, 'The mission [disarmament] was conducted in order to achieve state succession in a stable framework of constitutional continuity' (2010, 5). Of course, geopolitical consideration also featured. At the time of the disarmament decision there was uncertainty inside South Africa, exacerbated by US pressure to join the NPT before political transition, about the ANC's alliances, such as Iran, Libya, Cuba and the Palestinian Liberation Organisation, and what an ANC government would share with these allies (Albright and Stricker 2016, 190; Teichmann 2022). Locking in disarmament before 1994 therefore also involved joining the nuclear and missile export control regimes, in particular the Zangger Committee, the Nuclear Suppliers Group and the Missile Technology Control Regime (MTCR). The US was only willing to support South Africa's entry into the MTCR after the destruction of the apartheid government's missile programme, including satellite launch vehicles, and ended up paying for the destruction process (von Wielligh and von Wielligh-Steyn 2014, 310, 316-320).

However, some in the ANC saw this sequencing as problematic and that the decision to dismantle the weapons and joining these international institutions should have been the prerogative of an ANC government after democratic elections (Albright and Stricker 2016, 191). There was even a narrative circulating that 'Africans' were disappointed that apartheid South Africa did not bequeath the nuclear weapons to the post-apartheid state so that the continent could boast its own bomb (von Wielligh and von Wielligh-Steyn 2014, 276-278). Albright and Stricker (2016, 191) conclude, 'Despite many differences over the timing and details of past government announcements about the nuclear weapons program, Mandela unambiguously agreed that nuclear weapons would not be a part of South Africa's future.' Although the notion of an African bomb surface from time to time, the history of the ANC's and Africa's engagement more generally with nuclear weapons is predominantly one of anti-nuclearism, which I expand on in the next section.

Reproduction of South Africa's disarmament path

Two interrelated sets of reproduction mechanisms have secured South Africa's disarmament path-dependency thus far, namely utilitarian and normative drivers.

As for utilitarian (cost-benefit) drivers, although de Klerk was made to understand that there will be no quid pro quo for joining the NPT, the reforms he embarked on received international recognition and the constitutional negotiations received international support after South Africa's NPT accession. Given that South Africa was a pariah state at the time, state recognition was a significant return on relinquishing nuclear weapons and joining the NPT (see e.g. Heald 2010). South Africa also reaped recognition benefits regionally from starting down the nuclear disarmament path. In April 1993, weeks after de Klerk revealed that South Africa had a nuclear weapons programme, the United Nations (UN)/Organisation of African Unity (OAU) Group of Experts responsible for preparing the groundwork to start negotiations on an African Nuclear Weapons Free Zone (ANWFZ) allowed a presentation by Waldo Stumpf, who project managed the South African dismantling process, on nuclear energy in Africa at a Program for Promoting Nuclear Non-proliferation (PPNN) meeting held in Zimbabwe. The presentation included elaboration on South Africa's nuclear weapons programme. Stumpf emphasised South Africa's commitment to transparency and the principle of an ANWFZ. What also impressed the participants was South Africa's commitment to share expertise and experience in the peaceful use of nuclear energy with other African states. At the time the OAU would only deal with an interim South African government that included the ANC, but Stumpf's presentation built enough confidence that South Africa was invited to the ANWFZ negotiations as an observer–a significant concession towards regional recognition. South Africa's cautious participation in the early stages under the apartheid government expanded to its active post-apartheid participation in these negotiations and was rewarded by naming the AFNWZ Treaty 'the Pelindaba Treaty'. Pelindaba is the site of the South African Atomic Energy Corporation, in the words of Ambassador Oluyemi Adeniji, who chaired the UN/OAU group, 'the symbol of the change of the South African nuclear programme from being a threat to the rest of Africa, to what might become the hub of continental cooperation in the peaceful uses of nuclear energy' (Adeniji 2002, 155).

After joining the nuclear export control regime, South Africa was invited back to the IAEA's General Conference in 1991 and with Egypt's concurrence resumed the African seat on the Board of Governors again in 1995 (van Wyk 2014, 414). After coming into power in 1994, the Mandela government made it a matter of policy for South Africa to become an active participant in the different nuclear non-proliferation and suppliers groups, to actively support non-proliferation, including in Africa and amongst the NAM, and to make sure that non-nuclear weapon states are not denied the right to peaceful nuclear technology. South Africa's role in the 1995 NPT Review and Extension Conference has been well-documented and led Thomas Graham, the US ambassador to remark, 'South Africa has emerged as a major player in arms control

and disarmament, and perhaps other areas of international diplomacy as well" (quoted in von Williegh and von Wielligh-Steyn 2014, 325). The notion that South Africa was 'punching above its weight' as a middle power that could build bridges and effect change for the greater good in international relations soon took root. The argument was made that South Africa's diplomatic punch was informed by taking the moral high ground, not only because of its relatively peaceful and reconciliatory political transition, but also because it unilaterally and uniquely relinquished its nuclear weapons and the ANC's affirmation of this move. This framing of South Africa's identity enabled it to become a 'norm entrepreneur' in this issue area (Onderco and van Wyk 2019). It is not hard to see a self-reinforcing process at work in the early years of re-joining the international community, but as van Wyk (2014, 204) notes, 'there are limits to a middle power's niche diplomacy.'

The nuclear weapon states made very little progress on the disarmament obligations agreed to in the 1995 package deal for indefinite extension. Although South Africa then participated in the New Agenda Coalition to develop the 13 Steps that allowed the 2000 NPT Review Conference to agree on a final document, several factors resulted in a more revisionist approach aligned to a NAM position rather than middle power nuclear diplomacy. These factors included the US invasion of Iraq in 2003 under the premise of a clandestine Weapons of Mass Destruction (WMD) programme, the collapse of the 2005 NPT Review Conference, and South Africa's failed bid for the directorship of the IAEA Board of Governors in 2009 (Leith and Pretorius 2010). Although South Africa may not be the do-gooder and helpful-fixer of the immediate post-apartheid period in the non-proliferation regime, it still uses the nuclear issue area to exercise its African and NAM identity and to resist what it perceives as injustices in the nuclear order (see Hamidi 2020 and Pretorius 2013). In pursuit of nuclear disarmament, South Africa worked with other like-minded non-nuclear weapon states to negotiate the Treaty on the Prohibition of Nuclear Weapons (TPNW) and still plays a regional leadership role in the nuclear issue-area that promotes non-proliferation, disarmament and peaceful use.

From a utilitarian perspective, the logical conclusion is that the benefits of staying the disarmament course (membership of institutions where South Africa can pursue its interests and exercise its identity) still outweigh the costs of reversing course (being the target of international pressure, such as the sanctions regime that Iran is facing or even preventive attack), especially in the absence of an external threat. However, de Klerk (quoted in Friedman 2014) once remarked, 'Inner conviction weighs heavier on the scale than international pressure.' This remark from the person ultimately credited for South Africa's nuclear disarmament deserves serious consideration as a pointer to a narrative of intent to frame staying the disarmament course.

Although the distinction between utilitarian and normative drivers that reproduced South Africa's disarmament path-dependency is not always that clear-cut, de Klerk and some in his inner circle as well as in the ANC espoused normative convictions that

favoured disarmament even in the face of security threats. De Klerk expressed doubt that South Africa's nuclear weapons added any security value for apartheid South Africa and wrote in 2013, 'The solution was not the acquisition of greater military power through the development of nuclear weapons but the abolition of apartheid and the negotiation of a new non-racial constitution' (de Klerk, 2013). Mike Louw, director of South Africa's National Intelligence Service from 1992 and first head of the post-apartheid State Security Agency, expressed a similar conviction about the limitations of South Africa's nuclear weapons in a 2005 interview (quoted in Heald, 2010, 194), 'It was counter-productive. It resulted in South Africa drawing more fire. We were regarded as dangerous and hated. We were perceived as being a threat towards world peace. My basic instinct was that what we were doing was unjust and indefensible.' Some involved in South Africa's disarmament held the view that deterrence is justified in some instances and that South Africa's limited nuclear deterrent was successful to ward off a Cuban invasion. De Klerk espoused a broader abolitionist position that included disarmament by the NPT's nuclear weapon states, though. Some have questioned the authenticity of this position, but the point is that it informed a necessary fiction at the time to act on disarmament and was a position that Nelson Mandela shared (Das 2022, 92; Intondi 2014).

The ANC already espoused an anti-nuclear position in the 1950s long before South Africa's nuclear weapons programme and this position evolved alongside abolitionist African views on nuclear weapons (van Wyk and van Wyk 2020, 1, 6). From the time that the ANC became aware of the secret nuclear weapons program it made ending the programme a pillar of the anti-apartheid movement (see van Wyk and van Wyk 2020). It is then no surprise that Nelson Mandela in 1993 confirmed that the ANC will abide by the NPT and that it supported an ANWFZ that the OAU had been calling for. At an ANC conference on nuclear policy in 1994, Goldberg (1994, 219) explicitly linked staying the disarmed course normatively with democracy, 'Nuclear weapons, fuel enrichment, secrecy of production and storage, because of the breaches of international treaties and understandings, demand opacity in government. We, in South Africa, have been denied information about every aspect of our lives for too long. We have been excluded from decision making for too long...We have to build a culture of democracy and accountability. This too requires that we do not develop a nuclear weapons programme.'

Nuclear disarmament has consistently been framed as South Africa taking the moral high ground that no other state has done, a narrative that informs the role it plays in the nuclear order and produces increasing returns for South Africa. As such, in the South African disarmament case utilitarian and normative drivers mutually reinforce each other, thus maintaining disarmament path-dependency. Moral codes, as Robert Hinde (2009, 19) explains make social life possible. Although South Africa had to give up nuclear weapons, which can be construed as accepting constraints on its autonomy, its disarmament signalled a willingness to abide by a moral code by joining the NPT, which in turn had utilitarian effects, most notably shedding the image of a

disruptive state. South Africa could again participate in international society and pursue its interests. However, expectations of reciprocity, as Hinde argues, result in prosocial behaviour being directed to actors that abide by the dictum 'do unto others as you would be done by'. As I explain below, South Africa's disarmament path-dependency is likely impacted by this link between prosocial behaviour and expectations of reciprocity.

South Africa's enriched uranium politics and irreversibility

The politics of South Africa's HEU concerns two aspects, namely firstly, the country's retention of a stockpile of HEU left over from its nuclear weapons programme and enrichment days. Secondly, South Africa strongly defends its right to the full nuclear fuel cycle, despite other available options to obtain civilian nuclear fuel. In theory, such a capacity can allow South Africa to enrich uranium to weapons grade. The HEU is stored in a secure vault at the Pelindaba site and under 24-hour surveillance by the IAEA, but security breaches at the site have resulted in nuclear security concerns and pressure on South Africa to relinquish the HEU as part of a broader US move to reduce civilian fissile material around the world that could be obtained by 'rogue actors' and used for nuclear terrorism (see Pretorius 2013). Security concerns about South Africa's HEU are undermined by lumping the different grades of enriched uranium under one label. The complexity is illustrated by the varying estimates of how much HEU South Africa has and of this stockpile how much is weapons-grade (Stott, 2022, 16). Nevertheless, the politics surrounding the HEU provides some insights into the interpretation of irreversibility as an equilibrium point on the disarmament path.

Again, the story starts with contingency during the formative phase that impacted the present interpretation of irreversibility and its link to fissile material. Waldo Stumpf (1995) inserts the use of nuclear fuel as a political tool by the US into his account of the 'birth and death' of South Africa's nuclear weapons programme. The SAFARI I reactor used HEU that could only be obtained from the US. After political sanctions were instituted in 1975, the US cancelled a consignment of HEU that South Africa had already paid for, and then refused to refund the payment. Fuel for Koeberg was also impacted when the US refused an export permit for HEU to France, while holding South Africa financially liable for the enrichment of the fuel that could not be exported (Stumpf 1995). Although the issues were resolved under the Reagan administration, Eskom, South Africa's energy producer, incurred significant costs. Both SAFARI I and Koeberg were under IAEA safeguards at the time, and it seemed to have influenced Stumpf's (and by extension South Africa's) subsequent views on HEU. Stumpf differed strongly with some in the dismantling team, who wanted to sell the HEU to the US or the UK to prevent it from 'falling into ANC hands' (von Wielligh and von Wielligh-Steyn 2014, 265). Instead, Stumpf wanted to keep the HEU for use in SAFARI I to produce medical isotopes, which would be financially more rewarding. He succeeded in retaining the HEU, and indeed much of it was used for that purpose. However, the purpose of the HEU has since shifted.

Through the nuclear security summits initiated by US President Barack Obama from 2010-16, pressure mounted on South Africa to relinquish the remaining HEU stock. Ahead of the 2012 Summit, President Obama wrote to President Zuma stating it would be a highlight at the Summit if South Africa was to announce that it would meltdown its remaining HEU to LEU for medical isotope production (The White House 2011). Again in 2013 he expressed his 'strong hope' in a letter that South Africa will dispose of all its remaining HEU fuel and announce cooperation with the US on this issue at the 2014 Summit, stating that 'it would build on and enhance South Africa's nuclear leadership' (The White House 2013). Instead, South Africa settled on its current policy of labelling the HEU a 'strategic national asset'. What that means is not clear, but some inferences have been made, namely that South Africa maintains HEU to get other medical isotope producers to convert to LEU fuel, as well as 'to prod the nuclear weapon states on disarmament' ('Civilian HEU: South Africa' 2019). Ambassador Abdul Minty provided insight into South Africa's position at an international symposium on HEU in 2006. He asserted that addressing threats to collective security cannot be directed exclusively at 'reducing reliance on HEU for peaceful purposes, without any real commitment and progress on the elimination of HEU and other fissile materials that are primarily being used for military purposes' (Minty 2006, 2). In addition, he asserted that civilian HEU controls 'must be matched by both the reinforcement of the obligation to achieve nuclear disarmament and by concrete, irreversible, and verifiable action in that direction, based on the consensual 13 practical steps as agreed upon in 2000' (ibid.)

South Africa has almost phased out civilian HEU use completely, so its reluctance to relinquish the HEU is no longer economically inspired. It rather seems that the HEU has symbolic value for South Africa, representing an upscaled nuclearity to ascertain that it has a 'seat at the table' and is taken seriously in nuclear non-proliferation and disarmament forums. Fabricius asserts that, 'the [HEU] stockpile is a symbol of South Africa's sovereignty, its power and its integrity: of its ability to use nuclear energy for peaceful purposes – and even of its technical ability to construct an atomic weapon. But also of its firm moral determination never to do so.' The leverage value of the HEU for global nuclear disarmament is reminiscent of Ali Mazrui's notion of 'proliferate to disarm', but in 'latency' or 'virtual' form (Pretorius, 2020). In his Reith lectures, Mazrui (1979) argued that African states should not join the NPT but should develop a nuclear capability as the only way to scare nuclear armed states into the pursuit of general nuclear disarmament. Although not official policy and despite the non-use of the HEU in nuclear weapons, South Africa's possession of HEU mirrors the risk, uncertainty and fear that proponents of nuclear disarmament feel with respect to nuclear weapons back to nuclear armed states. In this way HEU becomes a tool in negotiations with nuclear-armed states about giving up their nuclear weapons.

Post-apartheid South Africa's right to enrich uranium, instead of supporting nuclear fuel banks as a non-proliferation initiative, similarly gestures to perceived negotiation

leverage. During apartheid South Africa's uranium enrichment programme was explained as a logical outflow of economic incentive, namely, to beneficiate an abundant mineral resource for domestic consumption rather than importing the same product. Enrichment was also seen in the context of earning more foreign exchange by exporting a value-added product on the international market (Stumpf 1995). This mineral beneficiation narrative still frames the state's insistence on the right to the full nuclear fuel cycle, even though the uranium enrichment facilities were decommissioned and dismantled under IAEA supervision, and it is hard to see how such an expensive and technologically specialised endeavour could be resurrected (Pretorius and Sauer 2014, 8). Rather, hanging on to the inalienability of this right, reflects a NAM narrative about the discriminatory nature of the NPT (Pretorius 2013, 395).

From conversations with South African officials, it appears that South Africa's current understanding of irreversibility is circumscribed to demilitarise fissile material and put it under international safeguards. This is the status of South Africa's HEU, which means in South Africa's conception of irreversibility of nuclear disarmament, the country has reached an equilibrium point (Stott 2022, 16). To move this point beyond continued possession of HEU and the government's insistence on uranium enrichment rights, in path-dependency speak there will have to be 'correlation effects'. Other states, including the nuclear-armed, will have to demilitarise fissile material, place it under international control and relinquish the right to produce it as part of a move towards global nuclear disarmament.

Conclusion

Path-dependency is a useful framework to think about the lessons that can be learned from South Africa for irreversibility of nuclear disarmament. The South African case is in many ways unique and because of its entanglement with South Africa's broader political transition perhaps of greater relevance to so-called 'rogue' states where nuclear disarmament may be seen as a function of peaceful constitutional reforms with resultant regional security benefits (Israel and North Korean come to mind). However, the idea in this paper was to go beyond this limited application by flagging ways in which to see irreversibility of nuclear disarmament as a process with aspects applicable to all states embarking on nuclear disarmament. As a process, the genesis phase that sets a state's disarmament course and starts it down this course is of crucial importance, because in the early stages small events may have big consequences for irreversibility. Contingencies and conjunctures provide windows of opportunities for states ready to disarm but concerned about domestic, regional, and international factors. The South African example shows how these contingencies and conjunctures can be taken advantage of, especially through narratives of intent to produce and reproduce disarmament path-dependency. Both utilitarian and normative path-dependency explains why South Africa has stayed the disarmament course. There is a sense that the whole is greater than the sum of its parts when the interplay

between these two sets of drivers is considered. In fact, the narratives of intent framing disarmament often weave them together.

Although South Africa is maintaining nuclear disarmament path-dependency, it has reached an equilibrium point. Despite the decommissioning of enrichment facilities and the destruction of the bombs and their deliver systems, South Africa retains some HEU and guards the right to enrich uranium under IAEA safeguards. South Africa's reluctance to interpret the next step of irreversible nuclear disarmament as relinquishing its HEU and the right to produce it, stems from what the HEU represents. South Africa links the role it can play in the nuclear order to its possession of HEU, which elevates it nuclearity and gives it leverage in nuclear disarmament discussions. It is likely that only a broader shift towards global nuclear disarmament, including demilitarising all states' fissile material and placing it under the same control regime, can move South Africa from its current disarmament equilibrium to a point that entrenches irreversibility even further. Such a shift would result from what path-dependency literature refers to as correlation effects—when staying the disarmament course is encouraged by others following the same path.

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