On Nuclear Embeddedness and (Ir)Reversibility

A Working Paper

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Contents

On 2–3 February 2019, Princeton University's Program on Science and Global Security hosted a Workshop on the embeddedness of nuclear weaponry in national and international contexts. This Working Paper is a revised and extended version of the background paper that William Walker provided for the occasion. He intends to publish a monograph on the subject in due course. The Working Paper is being made available now to encourage wider consideration of this important topic and of the ideas here presented. Although the author has drawn on the Workshop's discussions and on comments received, for which he is very grateful, the Paper's contents and opinions are solely his responsibility.

I.
Introduction

In history, several states have abandoned nuclear weapon programmes before they have come to fruition. In contrast, no fully-fledged nuclear weapon state has given up its weapons or come close to doing so.[1] This suggests that, beyond a certain stage, a state's possession and use of nuclear weapons become embedded, highly resistant to pressure, entreaty and altered circumstance. Reversibility appears to give way to irreversibility. Although ideas, policies and capabilities may be adjusted over time, the commitment to nuclear armament seems ingrained thereafter.

The embeddedness of nuclear weaponry is a phenomenon that demands more serious attention. Implicit in much literature and public discussion, it has too seldom been submitted to rigorous examination despite its augury of future catastrophe. In the realm of politics, it has long frustrated the NPT's ambition to achieve universal disarmament, sapping the Treaty of its legitimacy and overall effectiveness. It is now thwarting the Treaty on the Prohibition of Nuclear Weapons (TPNW) whose assertion of nuclear weapons' illegality seems unlikely, present trends continued, to alter the nuclear weapon states'—and their allies'—attachment to their habits, attitudes and possessions. Disarmament aside, embeddedness and inflexibility are perennial sources of inefficiency, maladjustment, wastage and heightened risk in the structuring and usage of military nuclear forces, especially (as now) in periods of rapid technological change.

Post-Cold War confidence that institutional and other constraints on the possession and use of nuclear weapons would hold, constituting a progressive order and ordering of nuclear affairs, is fast diminishing. Nuclear armouries are being modernised, new capabilities are being developed, arms control treaties are fragile, threats are being made, and ideas of warfighting with nuclear weapons have resurfaced. Contrary to expectations following the Cold War's end, the embeddedness of nuclear weaponry is not being matched, and increasingly appears incapable of being matched, by an equal embed-

[1] During the Workshop, a view was expressed that South Africa provided an exception to this rule, given the extent of its commitment and capability prior to its nuclear disarmament (when is a nuclear weapon state "fully fledged"?). My observation still stands. South Africa had manufactured seven warheads before dismantling its capability. It had not "weaponized" them, however, and did not exhibit the six characteristic marks of nuclear embeddedness presented below. As suggested later, drawing a distinction between entrenchment (evident in South Africa's case) and embeddedness (absent there) helps to clarify matters.

dedness of the norms, rules and processes designed to constrain their political and military usage and avert catastrophe. Furthermore, the crises over Iran and North Korea have intensified, putting on open display the unreliability of nuclear order's traditional sponsor and guardian, the United States. However valuable nuclear deterrence may be considered as a preventer of wars in a period of great power transition, this all points in a dark direction.

It follows that we need to understand the sources and nature of nuclear embeddedness, which is obviously complex and multi-faceted. What does it entail, how prevalent is it and what are its sources, dynamics and consequences? Its presence implies that nuclear disarmament and significant steps in its direction must always involve, beyond the traditional effort in persuasion, negotiation and regulation, an exercise in disembedding an enterprise and set of beliefs, attitudes and ideas that have deep and resilient foundations. What might this involve politically, instrumentally and in other ways, especially if it is to be achieved non-violently and by consent? How might its prospects be affected, positively or negatively, by changes in wider social and technological landscapes? Looked at from the other angle, what might and should the embedding of nuclear disarmament, and moves towards it, entail? Does our inquiry affect the ways in which this is regarded?

By nuclear embeddedness, I do not imply an absence of change. It is possible that the foundations of nuclear deterrence are less secure than they appear. Technological and other changes may gradually be weakening them. Despite today's negative trends, comparison with the Cold War period suggests that nuclear weapons have lost and may be continuing to lose some centrality in global and politico-military affairs, which is not to say that they have become any less dangerous and disruptive, nor to ignore the presence of regional hot-spots. The purpose of embarking on this inquiry is not to encourage resignation and despair. It is to raise questions that, posed in unfamiliar ways, might bring fresh insights and suggest novel directions in which to move whilst accepting that "to know the worst is not always to be liberated from its consequence. Nevertheless, it is preferable to ignorance."[2] Furthermore, by calling a spade or spade, nuclear decision-makers cannot so easily find shelter in vague promises of eventual disarmament.

As the Table of Contents shows, the paper moves from discussion of nuclear embeddedness to that of disarmament and disembedding. Attention should be drawn at the outset to the Annex on terminology that readers are encouraged to visit before proceeding. Several terms have been used by social scientists to denote strong, enduring resistance to change and tendency towards irreversibility. They in-

[2] Isaiah Berlin, "The Originality of Machiavelli" in *Against the Current: Essays in the History of Ideas,* Oxford University Press, 1981, p. 79.

clude obduracy, entrapment, lock-in, path dependence, entrenchment and embeddedness, that are ascribed particular meanings in some fields. Entrenchment remains the best general term in my view and, following Paul Starr, will be adopted here.[3] I have chosen, however, to vary the vocabulary by identifying three degrees of entrenchment and (ir)reversibility: entrenchment itself, denoting the process of becoming more resistant to change and the attainment of a condition of resistance that is still open to reversal; embeddedness denoting hardened entrenchment that is highly resistant to reversal; and permanence denoting irrevocability, an absolute impossibility of reversal in a human timeframe. I also have proposals to make on matching antonyms (disembedding, disentrenching and impermanence). Investigation of the meaning attached to these and related terms inevitably invites discussion of the nature and effects of change, and of its presence even amidst embeddedness.

[3] Paul Starr, *Entrenchment: Wealth, Power and the Constitution of Democratic Societies,* Yale University Press, New Haven, 2019. Starr prefers the word entrenchment partly because embeddedness lacks its "active element."

II.
Crossing the Threshold to Nuclear Embeddedness

Six "threshold states" were the focus of much international attention and non-proliferation activism in the 1960s and 1970s.[4] The term could be applied to all states, beginning with the UK, US and Soviet Union that have taken steps to acquire nuclear weapon capabilities. It points to the existence of development programmes that are likely, if certain thresholds are crossed, to bring a step-change—a kind of metamorphosis—as the state emerges from a chrysalis to become an actively militarised and institutionalised nuclear weapon state with political and cultural identities that are both distinctive and shared. It is widely acknowledged that the prospect for reversal, and for joining the community of dedicated non-nuclear weapon states, diminishes sharply once this threshold has been crossed. An emphatic decision openly proclaimed (Israel being the exception) to cross into weapon possession and deployment has been the ultimate "embedding move" for individual states and for the international community of states in reality and perception.

In the past, conduct of an explosive nuclear test has been regarded as the decisive move across the threshold, partly due to the role ascribed to it by the NPT. The threshold is fuzzier in practice—India and Pakistan experienced a long period of latency—and has varied with time and context.[5] North Korea and Iran have shown how difficult and politicized the assessment of capabilities and intentions can become in practice.

Six aspects of threshold-crossing, marking the transition to nuclear embeddedness, may be singled out:

a) Estate formation.[6] The move from development to acquisition and deployment of nuclear weapons entails the establishment and expansion of a production estate, involving a shift from science, R&D and craft activity into the industrialisation of material and warhead supply, intensification of intelligence-gathering, and provision of means

[4] The six were Argentina, Brazil, India, Israel, Pakistan, and South Africa.

[5] India made a step towards the threshold, without crossing it, by conducting a nuclear explosion in 1974 purportedly for civil reasons.

[6] I coined the terms production and operational estate in William Walker, *A Perpetual Menace: Nuclear Weapons and International Order,* Routledge, London, 2012.

of delivery and of command, control & communication systems.[7] Together, they require a steep increase in state expenditure and involvement of a wider range of actors including from the private sector where private ownership is allowed. The move also entails formation and activation of an operational estate, involving the incorporation of nuclear weapons into military structures and chains of command, and the modification or establishment of military bases, launch sites and other types of infrastructure. In each respect, activity is subject to considerable secrecy and state control over property rights and information flows.

b) Politico-military activation. Becoming a nuclear weapon state entails incorporation of nuclear deterrence and war-fighting into politico-military practices, doctrines and strategic thinking, including arrangement of the interplay with conventional forces, requiring bureaucratic development and institutional adaptation inside and outside government, and establishment of appropriate civil-military relations. It involves substantial reconfiguration of patterns and processes of interaction with foes, friends and allies within regions and the wider international system.

c) Security dilemmas/paradoxes. Although security dilemmas may already be alive where there is developmental activity, as in South Asia before 1998, the dynamics of acquisition and deployment are reinforced by (a) and (b) occurring in combination, by inter-service rivalry and the expansion of nuclear/missile scientific and industrial complexes, and by embark on often casuistical debates about current and future threats and requirements. Armament processes can entrench the future as well as the present. Passage from potential to actual possession and use of nuclear weapons is typically accompanied by loud assertion of the strategic challenge posed by one or more opposing states, marking passage (in Booth and Wheeler's terms) from dilemmas of interpretation and action to the paradox of a state embarking on the competitive, tit-for-tat, acquisition of weapon capabilities and associated practises that may diminish rather than enhance its security.[8]

d) Identity formation. Early programmes to develop nuclear weapons are usually clandestine, sometimes gaining cover from civil activities. Within a country, the presence of opposition notwithstanding, identities are consolidated and given expression as national interests within enlarged actor-networks when the nuclear threshold is crossed.[9] At a political level, nuclear weapons usually become popular as symbols of power and advancement especially when possession is made overt (viz. Indian and Pakistani public jubilation in 1998). They are incorporated into "the national identity" that is boosted, in public perception, by acquisition and would be diminished by their removal.

[7] Especially regarding fissile materials, industrialization may begin in the developmental phase (viz. Iran and its enrichment capability). It may also accompany establishment of a civil fuel-cycle, a reason why US and other holders of enrichment and reprocessing technologies have discouraged their general diffusion for civil purposes.

[8] Ken Booth and Nicholas J. Wheeler, *The Security Dilemma: Fear, Cooperation and Trust in World Politics,* Palgrave Macmillan, Basingstoke, 2008.

[9] On actor-networks, identity and the national interest, see Nick Ritchie, "Relinquishing Nuclear Weapons: Identities, Networks and the British Bomb," *International Affairs,* 86 (2), March 2010, pp. 465–487.

Attention was also drawn at the Workshop to the manner in which the identity of political leaders in nuclear weapon states is affected by their anointment with god-like powers when attaining the right and responsibility to decide on nuclear war.[10]

e) Construction of narratives, consolidation of belief. Threshold-crossing always involves the crafting by government of political and strategic narratives designed to justify possession and the practice of nuclear deterrence, assuage national and international audiences, signal to rivals, and enable politicians and bureaucrats to sing from the same hymn sheet. Besides providing a security rationale, the narratives often encompass national myths, ambitions and historical experiences, deepening their resonance at home.[11] At the same time, belief in the manageability of nuclear deterrence, in its value as a preventer of war and projector of power and prestige, and in its moral worth, is necessarily consolidated, to the extent of becoming dogma. To challenge this belief is to risk disqualifying oneself from participation in nuclear policy-making. At the same time, the narrative has to finesse the evident illogicality and injustice of proclaiming the value of deterrence to the self when denying it to others (identification with the collective end of complete disarmament has been one way of squaring the circle).

f) International recognition. The final step in the passage to nuclear embeddedness, and confirmation of irreversibility, comes when a state's possession of nuclear weapons and practice of nuclear deterrence are recognised internationally—especially by great powers—as faits accomplis. Thereafter, they are considered to be beyond being overturned and are no longer a focus of non-proliferation policy and subjected to sanctions (the state is no longer a nuclear "pariah"). Among the current nine nuclear-armed states, only North Korea has been denied this recognition, Israel and Pakistan having attained it de facto, outside their regions at least. The NPT put a gloss on recognition by granting legal rights of possession to the US, Russia, China, France and the UK that also happened to be the five permanent members of the UN Security Council. Hitherto, the US has assumed the main role of granter-in-chief of nuclear recognition, others usually following in its wake.[12] That includes its own foundational recognition in 1945.

We should note that non-proliferation policy entails keeping states, through various forms of inhibition and persuasion, as far as possible from the threshold into armament in each of the above respects: constraining estate formation through export controls and by placing assets under international safeguards; dampening and opposing the strategic assertions and competitive dynamics that energize security dilemmas and paradoxes; holding a state to the identity of a

[10] The "mystery" of nuclear weapons and their role in the elevation of individual and group status is examined in a recent paper by Jacques Hymans (Twilight of the Bomb: Nuclear Disarmament as a Political-Theological Problem, forthcoming). Reference was made at the Workshop to the British Prime Minister's initiation, on the first day in office, involving the writing of a private letter to submarine commanders giving orders on how to respond to a nuclear attack if the Prime Minister and command centre are "decapitated." This anointment aside, studies suggest that Heads of State have often experienced anguish over their nuclear responsibilities that they have been unable to express openly, sometimes being cowed into acceptance by the technical and military advice that they have received. See John Gaddis, Philip Gordon, Ernest May and Jonathan Rosenberg, eds., *Cold War Statesmen Confront the Bomb*, Oxford University Press, 1999.

[11] An example is the French claim, often heard, that the *force de frappe* guarantees that France will never be invaded again.

[12] Notable examples are Israel's informal and India's formal recognition during the presidencies of Richard Nixon and George W. Bush, respectively.

non-nuclear weapon state and opposing, with recourse to the non-proliferation norm, a narrative that justifies weapon development; and denying it recognition as a potential, legitimate nuclear weapon state.

The standard presumption is that states embarking on nuclear weapon programmes will become progressively less likely to abandon them as capabilities are acquired and momentum builds around them. Reversibility will be lost when the threshold is crossed into full acquisition and deployment. Thereafter, a state's attachment to nuclear weaponry will become embedded, implying that its disarmament will require disentrenching and ultimately disembedding actions in each of the above six respects (the sway of non-proliferation policy having been lost). Reversal would then entail the closure or conversion of estates, de-activation of nuclear weapons' role in political-military relations and strategizing, dampening of arms racing and security dilemmas, detachment of nuclear weapons from a state's national and international identity, and change in public narrative, all accompanied by means of ensuring that the actions are taking place and will be sustained.

Put another way, nuclear disarmament must also entail threshold-crossing when achieved incrementally, but in reverse—from possessing to not possessing nuclear weapons and associated programmes, and from being a fully-fledged nuclear weapon state to becoming a fully-fledged non-nuclear weapon state. For nuclear disarmament to occur, a nuclear-armed state would have to become a threshold state in this sense.[13] Besides overcoming stronger resistance to change, disarmament would require a more thorough and complex embedding of abstinence than in the context of non-proliferation given the scale, complexity and long duration of the state's and its agencies' involvement with nuclear weapon.

Two other points should be made here.

Firstly, Starr correctly insists that entrenchment "is not synonymous with complete stasis or inertia; it requires active reinforcement, renewal and resilience." Embeddedness notwithstanding, change has occurred in many regards during the nuclear age, including in the quantity and quality of weaponry, strategic doctrine, international regulation, public attitudes and the perceived nature of problems. Indeed, change is built-in, not least by weapon-succession processes and pressures to respond to technological developments coming from inside and outside the military domain. There would be redundancy otherwise. Starr refers to the famous aphorism in Lampedusa's The Leopard, when the Prince of Salina faces Garibaldi's and his young followers' challenge to the old Sicilian aristocratic order. In Starr's chosen translation, for "things to stay as they are, things have to

[13] To be accepted without strong opposition, perceived losses need to be compensated by perceived gains. Besides security calculations and the satisfaction of vested interests, "... as a political and psychological matter, people contemplating losing things they already have tend to place higher value on them than people who have never possessed them." George Perkovich and James M. Acton, *Abolishing Nuclear Weapons,* Adelphi Paper 396, Oxford University Press and International Institute for Strategic Studies, Oxford/London, 2008, p. 16.

change."[14]

Secondly, during most of nuclear history it has been assumed that nuclear weapon states would exercise a duty of care over their assets and use them "responsibly" once they had acquired nuclear arms, fearing reputational damage if they failed to do so. This has included absorption, albeit routinely denied by governments, of the nuclear "taboo" or "tradition," whereby aversion to nuclear war would cause them to use nuclear weapons only in extremis, despite the constancy of deterrence's threat of war.[15] This assumption has not extended to non-state actors, especially after 9/11 and other events that have demonstrated the preparedness of some terrorist groups to inflict mass casualties. American bracketing of certain "rogue states" with such groups resulted in Washington's radicalisation of non-proliferation policy and its displacement, for a time, by a more aggressive and militarised counter-proliferation policy. The existence of nuclear weapon programmes in such rogue states (forming an "Axis of Evil") was identified as a "present danger." It created, it was claimed, an imperative and obligation to avoid threshold-crossing to armament and the emergence of a threat that was beyond reasonable containment.

The prospect of nuclear embeddedness and irreversibility was claimed to be intolerable in these circumstances, calling forth the George W. Bush administration's embrace of preventive war and regime last contemplated by the US in the early Cold War. It became a powerful source of justification for war, as in Iraq, despite the intervention having other principal reasons.

[14] Giovanni Tomasi di Lampedusa, *Il Gattopardo,* Giangiacomo Feltrinelli Editore, Milan, 1958. Spoken by the Prince's nephew Tancredi, the aphorism in its original Italian is "Se vogliamo che tutto rimanga come è bisogna che tutto cambi."

[15] The question of embeddedness and its reality is central to the debate that Nina Tannenwald sparked on the nuclear taboo. Nina Tannenwald, *The Nuclear Taboo: The United States and the Non-Use of Nuclear Weapons Since 1945,* Cambridge University Press, 2007.

III.
Is Nuclear Embeddedness Rooted in the States System?

So far, the discussion has focussed mainly on the individual state and the embedding that takes place when it becomes an active and recognized nuclear weapon state. At the Workshop, a view was expressed that this was to look through the wrong end of the telescope. It was suggested that Paul Starr's analysis, which was concerned with "constitutive aspects of society and politics" within states, had limited relevance in the nuclear domain. The embeddedness of nuclear weaponry and deterrence had arisen principally from their infiltration into the anarchic states system, which is itself embedded, and from the manner in which states have reacted to the radical threats and opportunities arising from the character of nuclear weapons and warfare in the missile age.

At one end of the realist spectrum, Kenneth Waltz maintained that nuclear weapons brought stability and constraint to relations among states, lessening the occurrence of war, and that their very destructiveness forced governments and their leaders, of whatever character, to handle them with the utmost care. There could be high confidence that they would not be used in anger or through mishap. Nuclear deterrence was intrinsically reliable. The embeddedness of nuclear weapons within an embedded international system was therefore beneficial since it entrenched restraint among states. Waltz even suggested that nuclear proliferation was "a good thing" and that its discouragement was an error.[16]

At the other end of the realist spectrum, where stand John Herz, Reinhold Niebuhr, Hans Morgenthau, Jonathan Schell and Daniel Deudney among others, nuclear deterrence can moderate behaviour but at eternal risk to humankind and the planet.[17] It is folly to assume permanent safety given their possessors' unreliability, the fallibility of complex technological systems, the constant preparedness for nuclear war that deterrence requires, and the difficulty of man-

[16] Scott Sagan and Kenneth Waltz, *The Spread of Nuclear Weapons: An Enduring Debate,* WW Norton, New York, 2002.

[17] The crisis in realism in the 1950s and 1960s arising from nuclear weapons, and Waltz's side-stepping of it, is discussed with great insight by Campbell Craig, *Glimmer of a New Leviathan: Total War in the Realism of Niebuhr, Morgenthau and Waltz,* Columbia University Press, New York, 2003.

aging intense crises. The embeddedness of nuclear weaponry in the embedded, untransformable states system is tragic rather than a source of salvation.

Early proposals to avoid catastrophe by replacing the system of sovereign states with world government or by putting all nuclear assets and activities under common ownership (as proposed in the Acheson-Lilienthal Plan) came to nought. Short of disarmament, the only recourse thereafter was to place trust in the effective management and regulation of nuclear weapons, technologies and materials, and of relations among adversaries.[18] Safety and stability could only be found in nuclear order and ordering—establishment of a grand "configuration that works" (a phrase discussed below)—that encompassed both the regulation of deterrent relations among nuclear-armed states and their allies, and institutionalisation of the majority of states' abstinence from nuclear weapons.[19] The NPT and its safeguards system became central framing institutions. This nuclear order included the disciplined management of nuclear forces and decisions relating to them; constant attention to power balancing as adversaries sought to match capabilities and uphold deterrence by gaining advantage and avoiding disadvantage; regulation of international nuclear relations through treaties and regimes; and adoption of certain norms and rules, including the informal rule that all nuclear weapons, of whichever kind and destructiveness, should be regarded as exceptional for use in war only in extreme circumstances. For sceptics, this "republican" project was and remains inherently unreliable and open to contestation and defection. It is incapable of satisfying the extraordinary standards of coherence, reliability, trust and compliance required to provide permanent immunity to nuclear catastrophe.

A weakness of realism in its systemic form—whereby the possession and use of nuclear weapons are inescapable products of an anarchical arrangement of sovereign entities possessing rights to threaten violence—is that it does not account for the presence of variety of behaviour. Large numbers of states have chosen to live without nuclear weapons and appear content to devote resources to other ends and achieve security by other means. Insofar as it resides in the international arena, the embeddedness of nuclear weapons arises less from the intrinsic nature of the states system than from the character of relations among certain sets of states, including great powers with global reach. The reasons why states possess nuclear weaponry are always particular as are the patterns of their political, cultural and military assimilation and the manner in which the weapons' presence affect relations within and across regions. Nuclear South Asia, East Asia, Europe and the Middle East are not the same, de-

[18] In Daniel Deudney's terminology, "classical nuclear one worldism" (entailing world government) was rejected in favour of the "nuclear strategism" (unfettered anarchy) of the 1950s that gave partial way—spurred by the Berlin and Cuban Missile crises—to the "institutional deterrence statism" that predominated from the 1960s into the 1990s. Daniel Deudney, *Bounding Power,* Princeton University Press, 2007.

[19] I discussed these matters in *A Perpetual Menace, op. cit.*

spite some common features. From this perspective, transformation of political and security relations within regions and among sets of states may become a necessary condition for embarking upon nuclear disarmament, let alone achieving it. We are all familiar with claims that lasting peace in these regions (viz. Israel in the Middle East) and among great powers has to be attained before nuclear disarmament can be contemplated.

There is no denying the force of these realist arguments, whether systemic or particularist. Whatever their truthfulness, their value to nuclear deterrence's supporters also resides in their justifying power and authority. They are often presented, and accepted, as being beyond refutation. Even in relatively good times when nuclear war appears a distant possibility, the states system's eternal nature and unreliability of its actors are frequently cited as justification, on prudential grounds, for the retention, modernisation and further development of nuclear weapons. The UK Government gave prominence to this prudential rationale when presenting its case for Trident's replacement. "We believe that an independent British nuclear deterrent is an essential part of our insurance against the uncertainties and risks of the future."[20] This was held to be the case despite Trident's replacement being propelled mainly for other reasons, uppermost being desire to sustain the UK's identity as a great power and its "special relationship" with the US, together with the difficulty of closing down an enterprise granted longstanding politico-military, industrial and cultural significance.

It deserves mention here that the US Government similarly restricted attention to the security relations among states when calling in April 2018 for a more "realistic" dialogue of nuclear disarmament's prospects.[21] A world without nuclear weapons "will only be possible when a fundamental shift in the geopolitical landscape has brought about security conditions in which all States conclude, based on their own sovereign threat perceptions, that nuclear weapons are no longer required. That will, of course, be a very long process." However valid this observation, it effectively transfers all blame for nuclear possession and non-cooperation from the national to the international.

Rather than nuclear weaponry being embedded above all else by the international system's embeddedness, it is both an inter- and intra-state phenomenon. It arises from the entanglement—knotting—of states' external relations with various internal interests, attitudes, relationships and "facts on the ground," most of which display path dependence and are hard to change. This compounds the complexity of nuclear disarmament and resistance to threshold-crossing "in reverse." For it is commonly assumed in the study and diplomacy of

[20] This is but a variant of the British MAUD Committee's assertion, in the report of July 1941, that "except in the unlikely event of complete disarmament . . . no nation would care to risk being caught without a weapon of such decisive possibilities." The insurance metaphor's validity may be questioned on two grounds especially: the party taking out the insurance would be unable to collect payment, whose amount is incalculable, after a nuclear war; and the metaphor implies denial and neglect of the vulnerability created by possession of nuclear weapons. See Benoît Pelopidas and Nick Ritchie, "European Nuclear Nationalism: UK and French Perspectives on Nuclear Disarmament," in Nik Hynek and Michal Smetana, eds., *Global Nuclear Disarmament: Critical and Normative Perspectives,* Routledge, London, 2016, pp. 225-250.

[21] *Creating Conditions for Nuclear Disarmament,* Working Paper submitted by the United States to the Preparatory Committee for the 2020 NPT Review Conference, 18 April 2018. The arguments and proposals in this paper became the basis in 2019 of the US Government's initiative Creating an Environment for Nuclear Disarmament (CEND), promoted especially by Christopher Ford. A critical assessment is provided by Paul Meyer, "Creating and Environment for Nuclear Disarmament: Striding Forward or Stepping Back?," *Arms Control Today,* April 2019.

nuclear disarmament that, given the logic and reality of international politics, such threshold-crossing must be carried out collectively, globally and in unison. I shall return to this matter when discussing "models of disarmament." Just to observe here that by making co-ordination of steps towards disarmament a precondition, states are in effect locating the source of embeddedness primarily within the states system rather than within national environments. The perpetual dismissal and denigration of unilateral disarmament is one consequence.

IV.
Power, Secrecy, and Embeddedness

Power is always involved in nuclear entrenchment and embeddedness. Power is conferred by the technology on the state and military for use to influence the behaviour of rivals, giving rise to the routine presumption that nuclear disarmament would result in a loss of power and prestige. Power is exercised by the US and other states to further non-proliferation and the disentrenchment of weapon programmes, to resist pressures to disarm or engage in arms control (or to advance it, depending on circumstance), and to shape international norms and laws in their interest. Power is not just external. Within the state, power over decision is granted to, attained and tightly held by certain individuals, groups and organisations. Their power is checked in nuclear weapon states that are constitutional democracies, but only to a slight degree in most circumstances. It is least checked in authoritarian societies especially when in the thrall of leaders for whom nuclear weapons are emblems of their muscular reign.

It follows that disentrenching and disembedding nuclear weaponry will always involve the exercise of power. However, actors promoting disarmament are often disadvantaged, even when non-nuclear weapon states are in a large majority (as within the NPT), by their relative lack of power and fear of retaliation. They are perennially frustrated by the nuclear weapon states and their agencies' greater "marshalling of power and presence that deters or defeats potential challenges."[22] They will always struggle to achieve change unless it is also being propelled from within those more powerful states and agencies.

There was discussion at the Workshop of secrecy and its relationship to power and contribution to embeddedness. Although endemic to nuclear deterrence, secrecy can inhibit debate inside and outside government and the military whilst reducing its quality and range and deflecting challenges, including challenges from within government and the military.[23] It was also noted—in the US context, probably applicable elsewhere—that "decision-making structurally

[22] Paul Starr, *Entrenchment*, *op. cit.*, p. 6.

[23] A counterargument is that secrecy gives experts freedom to debate issues in the public interest without constraint. However, secrecy prevents demonstration that this is happening.

isolates nuclear from conventional military affairs." A consequence is that trade-offs between nuclear and conventional forces and strategies are not routinely considered.

In addition, governments' control over information, supported by rules on secrecy and punishment for its breach, has frequently been used to enforce obedience among operatives and discourage public knowledge of nuclear risks and mishaps. Secrecy can also shroud vacancy and conformity. Issues that one might assume would be debated are not debated and are prevented from being debated with any thoroughness. This applies to nuclear disarmament itself. When did an elite responsible for decision-making in a nuclear weapon state last examine, in full and without prejudice, the advantages and disadvantages of persisting with nuclear deterrence?[24] If such an examination did precede Gorbachev and Reagan's discussions of disarmament at Reykjavik in 1986, it was extremely unusual.

Although arising from more than secrecy, secrecy helps to preserve the "assumed given" of nuclear deterrence's value among communities involved in it. Starr again puts his finger on it: "It is from those givens that people derive many of the beliefs that they think *with* . . . as opposed to the beliefs that they think *about*" (his italics). The same may be said of communities adamantly opposed to nuclear deterrence, their "assumed given" being strengthened by the secrecy attached to nuclear weapons and its encouragement of mistrust.

[24] The UK Government did not carry out this examination when launching its campaign to renew Trident in 2006. The value of continuity was assumed. Its main focus was on steering the decision, already taken, through Parliament in order to entrench political and legal commitment to the project.

V.
Configurations and Reconfigurations That Work and Do Not Work

In the background paper prepared for the Workshop, I commented on the now extensive literature on "the social construction of technology," suggesting that it was valuable as a source of ideas, a reminder that we were dealing with technological systems and dynamics that should not be abstracted, and invitation to consider similarities and differences between nuclear and other fields. Embeddedness and irreversibility, and their emergence and dissipation, are regarded in this literature as intrinsic to the histories of various "socio-technical systems." Their study has been spurred especially by concerns about climate change and environmental degradation and the evident need to alter structures, attitudes and behaviours that threaten survival across the animal kingdom.

Writing within this tradition, Arie Rip and René Kemp coined the term "configuration that works" in the late 1990s.[25] *Configuration* acknowledges complexity and refers, in Frank Geels' words, to the "alignment between a heterogeneous set of elements" that are social as well as technological, ideational and material.[26] Configurations may range from the local to the overarching. Motorised transport is an oft-cited example.[27] *That works* implies that a configuration, once developed, "fulfils a function" that comes to be widely valued and accepted. Particular configurations, arrived at over years or decades, often break down when functions change or are no longer being fulfilled, or when technological and other social changes cause redundancy and demand replacement. Support for an established configuration then gives way to a search for its reconfiguration, often entailing successive reconfigurations of the reconfiguration. This may involve major transitions—even transformations—as the emergence of social media has shown in recent times.

I find this notion useful and revealing when applied in our field. It reminds us that nuclear disentrenchment—and ultimate disarmament—

[25] I am grateful to Frans Berkhout for bringing this notion to my attention. See Arie Rip and René Kemp, "Technological Change," in S. Rayner and E. L. Malone, eds., *Human Choice and Climate Change*, Volume II, Resources and Technology, Battelle Press, Columbus, Ohio, 1998.

[26] Frank W. Geels, *Technological Transitions and System Innovations: A Co-Evolutionary and Socio-Technical Analysis*, Edward Elgar, Cheltenham: 2005, p. 11. See also Johan Schot and Frank Geels, "Typology of Sociotechnical Transition Pathways," *Research Policy*, 36 (3), 2007, pp. 399–417.

[27] Its configuration and perpetual reconfiguration has entailed, among many other things, road networks and "rules of the road," vehicle design and production, and fuel supply and taxation, all "co-evolving" with urban development and the movement of people and goods nationally and internationally. It includes attachment of symbolic value as well as utility to motor cars.

must entail politico-military, regulatory, cultural and other forms of reconfiguration. They are bound to be recreative acts. Various questions arise nonetheless. What is being configured and reconfigured, by whom and through which processes, and for what purposes? What confidence can be attached, upon what evidence and whose authority, to claims that this or that configuration "works"—or does not work—and that reconfiguration(s) will work—or will not work—in the future? (How could it ever have been considered that the amassing of tens of thousands of nuclear weapons during the Cold War was "a configuration that works"?) Matters are complicated in the nuclear context by a secretive and politicised "selection environment," prone to illusion, in which choices are made by states and their agencies in negotiation with powerful corporate entities.

In the broad sweep of nuclear history, no government of a nuclear-armed state has, after crossing the threshold to armament, seriously contemplated abandoning its nuclear weapons (Gorbachev and Reagan's conversation in 1986 was the fleeting exception). Together, governments of weapon states have encouraged the view that nuclear disarmament is a grand configuration that will not and cannot work. Declared commitments to nuclear disarmament, when genuine, have always been conditional and have envisaged achievement "over the long term," usually stretching to decades. Instead, finding "configurations that work" politically, militarily and economically now and in the future has been the constant preoccupation, a preoccupation as embedded as the weapons and their usage. Commitment to preserving the power and identity of a nuclear weapon state, to the achievement of strategic advantage and stability, whilst limiting the availability of nuclear deterrence to others, has often seemed absolute even when it is being denied. Thousands upon thousands of individuals and organisations have been involved in this enterprise.

The US has regarded itself in this history as the prime configurer and judge of what works and is appropriate. Looking inwards, within the US and other nuclear-armed states, the search for "configurations that work" has included sustenance of production and operational estates, choice and design of myriad weapon systems and sub-systems (including pertinent conventional weapon systems), elaboration of nuclear strategies and doctrines, political and bureaucratic oversight, and the bounding of civil-military relations. Looking outwards from the state, the search has included effective deterrence strategies, relations with allies and foes, the quest for shared norms and rules, and development of arms control treaties and regimes, including the non-proliferation regime.

Of course, what does, can and should work has been contested at various levels and times. Contestation has been intrinsic. There have

been occasions when concerns within governments that established "configurations" were so seriously dysfunctional, to the point of endangering survival, that substantial reconfiguration became imperative. Years of argument and negotiation within and between states have usually followed. Prime examples from the 1960s, responding to fears of nuclear war and uncontrolled weapon proliferation, were the United States and NATO's doctrinal shift from Mutually Assured Destruction to Flexible Response, advance of the institutions of nuclear arms control involving hotline, arms limitation and test ban treaties, and establishment of the non-proliferation regime. Until fears of armageddon took hold in the Cold War's last years, the solution of nuclear disarmament was viewed as fanciful amidst the stresses in East-West relations and the immensity of US and Soviet commitments to the development, production, deployment and use of nuclear weapons.

The apparent futility of continuing to press for universal nuclear disarmament contributed to the shifting of the UN's attention, beginning with the Irish Resolution of 1961, towards foundation of a non-proliferation treaty and regime (a stopgap of sorts). The wording of the NPT's Article VI ensured that disarmament would have no bite and the nuclear weapon states' interests in deterrence would remain protected.[28] Although later expressions of commitment to disarmament in the Final Documents of NPT Review Conferences appeared to have more political force, they too were readily ignored.[29] Nevertheless, the ideal of nuclear disarmament, and responsibility not to let it go, remained intrinsic to the nuclear order that developed in the 1960s and thereafter. It was fundamental to the NPT's contract, whereby states would forego nuclear weapons and deterrence in return for the nuclear weapon states' pursuit "in good faith" of arms control and disarmament, enabling states possessing very different capabilities and ambitions to co-exist, if never comfortably, in a regulatory framework that aspired to serve a universal good.

This draws attention to what Zia Mian referred to at the Workshop as the nuclear weapon states' "constitutive ambivalence" about nuclear armament and disarmament. The pursuit of disarmament served purposes that went beyond the NPT and its contract for some of them—and some of their agencies—for some of the time at least. It provided a direction of travel, an impetus to the achievement of arms control agreements that would moderate their relations and the costs and risks of deterrence, bringing amelioration if not release. It also helped to legitimise and gain support for additional non-proliferation measures. It should not be assumed that statements on disarmament by governments of nuclear weapon states are always disingenuous. The commitment to eventual disarmament (always eventual) has

[28] Article VI: "Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control."

[29] The Action Plan agreed at the 2010 NPT Review Conference expressed the "unequivocal undertaking by the nuclear-weapon States to accomplish the total elimination of their nuclear arsenals leading to nuclear disarmament to which all States parties are committed under Article VI."

been a true ambition of many of those engaged in nuclear decision-making in my experience, stemming from their recognition of the dangers accompanying nuclear deterrence and its inescapable moral predicaments. This said, they have seldom displayed the courage or found means to act in ways that would seriously advance the cause, at least prior to retirement when their influence over policy has waned. Instead, expressions of commitment to eventual disarmament (commonplace in the NPT's history), and participation in projects furthering its ends (slight though they may be), deflect criticism and help to salve the consciences of decision-makers when their acquiescence to armament seems unavoidable politically and in the progress of their careers.[30]

[30] The behaviour of senior British cabinet ministers over Trident's renewal in 2007 provides a clear example. In return for supporting it, they were allowed a free hand to campaign for multilateral disarmament. Outcomes were the prominent speeches by the Foreign Secretary in Washington, DC, and Defence Secretary in Geneva, the latter being the only occasion on which a nuclear weapon state's minister of defence has, to my knowledge, spoken on this theme at the Conference on Disarmament. See Margaret Beckett, *A World Free of Nuclear Weapons?*, Keynote Address to the Carnegie Endowment's Non-Proliferation Conference, Washington, DC, 25 June 2007, and Des Browne, *Laying the Foundations for Nuclear Disarmament*, Conference on Disarmament, Geneva, 5 February 2008.

VI.
The Model Disarmament Pathway and Process

The US-Soviet discussion of nuclear weapons' elimination at Reykjavik in 1986 did not result in agreement. However, the winding down of the Cold War in the late 1980s was followed by a decade of substantial arms reduction and negotiation of bilateral (INF, START) and multilateral (CFE, CTBT) treaties. Approach of the NPT Extension Conference in 1995, when the Treaty's fate would be decided, provided an incentive to display serious commitment to nuclear disarmament and its achievement.

Despite many disagreements on detail, a "model disarmament pathway and process" took shape at this time with considerable support from governments and NGOs. It envisaged a gradual, cumulative marginalisation of nuclear weapons in national, international and global political and military affairs, involving the disentrenchment of commitments of various kinds leading eventually to the final, permanent disembedding of nuclear weaponry in every context. Each significant step in this direction would be framed by international law, building irreversibility along the way through an accumulation of ratchets.[31] It would conclude with a Nuclear Weapons Convention, following the Chemical Weapons Convention's example, that would ban all possession and use whilst providing the verification and compliance measures required to keep the weapons locked permanently in the cupboard. Specifically:

[31] See the discussion of ratchets in the Annex.

- Nuclear disarmament should be complete and universal, arrived at multilaterally, involving states' conformity with agreed rules and processes. Although guided by great powers, the process would be overseen by the United Nations, negotiated through the Conference on Disarmament and answerable to NPT Conferences.
- US and Russian nuclear arsenals would be progressively reduced through a succession of START treaties accompanied by a strength-

ening of verification measures. Other nuclear weapon states would join the reduction process when the US and Russian arsenals approached their level. In the meantime, steps would be taken to impede the further development and production of nuclear weapons through, inter alia, treaties banning explosive testing and the production of fissile materials for weapons purposes.

- The non-proliferation regime would be upheld and progressively strengthened, with means developed to ensure that investment in nuclear power could continue without undue constraint.

- Each step would involve development, agreement upon and implementation of appropriate verification measures in regard inter alia to warhead dismantlement and material accounts, accompanied by the conversion or closure of facilities and supervised reemployment or retirement of erstwhile weapon designers.

- Compliance would be overseen by the UN Security Council and would become increasingly routine as attachment to nuclear weapons diminished.

The envisaged step-by-step process did not bind nuclear weapon states, individually or collectively, to a precise destination or time of arrival. Although a target date for elimination (2000) was discussed by Gorbachev and Reagan in 1986 and proposed by Rajiv Gandhi at the UN in 1988, "time-bound disarmament" was rejected by nuclear weapon states as unwise and impractical. Despite being open-ended, concerted movement towards complete disarmament would still be beneficial, it was claimed, since it would encourage the positive reconfiguration of nuclear forces (towards further reduction and restraint on use), strengthen adherence to the non-proliferation regime, and allow time for adjustment and learning.

With some variation, this model process and pathway underlay the Canberra Commission's Report on the Elimination of Nuclear Weapons of 1996 and numerous others since. Its adoption was assumed in the 1995 "Principles and Objectives for Nuclear Nonproliferation and Disarmament" and in Final Documents agreed by NPT Review Conferences since 1995, including the Action Plan of 2000 and its "thirteen steps." It was submitted to close scrutiny by George Perkovich and James Acton in their Adelphi Paper of 2008 and in its successor with attached commentaries.[32] It underlies the Swedish Government's "Stepping Stone Approach" to the unlocking of disarmament diplomacy that was launched in June 2019.[33]

However desirable, this concerted approach has suffered from inherent problems that have strained its plausibility.

[32] George Perkovich and James W. Acton (eds.), *The Abolition of Nuclear Weapons: A Debate*, Carnegie Endowment for International Peace, Washington, DC, 2009.

[33] *Unlocking Disarmament Diplomacy Through a "Stepping Stone" approach*, Working Paper submitted by Sweden to the Preparatory Committee for the 2020 NPT Review Conference, 25 April 2019.

Firstly, it has assumed that all states would come to accept the desirability of eliminating nuclear weapons and would cooperate accordingly. In his commentary on Perkovich and Acton's analysis, Harald Müller wrote about "the overwhelming need to create and maintain cordial great-power relations" if there were to be progress towards nuclear disarmament.[34] A lasting concert of greater and lesser nuclear powers would be needed to shepherd negotiations, develop necessary instruments and implement results, along with commitments to avoid exploiting undue advantage from superiority in conventional forces. Even when enmity arose among them, settled agreement on the removal of nuclear weapons and deterrence from their relations, step by step, would be required. This implied both displacement and replacement, regionally and globally, of policies, practices and attitudes that were well entrenched, the overcoming or ignoring of various asymmetries and imbalances among affected states and regions, and the ending of the prerequisite that peace must be established, region by region, before nuclear disarmament could be contemplated. It required habitual compartmentalisation, detachment of nuclear from other issues that dog relations among powers and influence their general willingness to negotiate.

[34] Harald Müller, "The Importance of Framework Conditions," in Perkovich and Acton, *op. cit.*, p. 171.

Secondly, progress towards disarmament, and its irreversibility, depended heavily on governments' and their leaders' lasting commitment to international institutions, on their respect for international norms and the rule of law, on effective verification, and on trust in compliance and the means of ensuring it.

Thirdly, this approach assumed that political leaders and governments in nuclear weapon states, and their successors, would have the strength and authority to overcome internal resistance to nuclear abolition, that their publics and the media would support them in the endeavour, and that political parties (in democracies) would abandon the partisanship that has frustrated progress in the US in particular. As noted, success would depend on their decisive, unwavering embark on disentrenching and disembedding actions in regard to each of the six sources of embeddedness that were identified earlier: (i) closure or reorientation of the production and operational estates associated with nuclear weapons; (ii) politico-military deactivation—disentrenchment of nuclear deterrence and war-fighting and of the organizations and practices built around them; (iii) termination of weapon development programmes that encourage imitation and fuel security dilemmas; (iv) proud adoption of a non-nuclear identity; (v) construction of narratives and embrace of belief systems extolling non-possession; and (vi) quest for recognition as a committed non-nuclear weapon states, fully compliant with the NPT and other multilateral treaties.

Fourthly, this model disarmament process was seriously vulnerable to disruption and prolongation, especially in a world lacking hegemonic commitment to its adoption and achievement. The insistence on universal engagement of nuclear-capable states effectively granted veto powers at all stages to individual states and their legislatures (the problem of spoilers and defectors). Furthermore, the CD's consensus rules and the presumption, following the CTBT's example, that entry into force of all disarmament-related treaties required universal ratification, made negotiations easy prey for individual states that did not wish to participate. Permanent membership of the UN Security Council also gave five of the nuclear weapon states legal rights to block collective moves to punish any of them for non-compliance, a problem already identified in the Baruch Plan of 1946 which recommended suspension of veto powers where nuclear technology was concerned.

Finally, reference should be made here to the idea of maintaining "virtual" nuclear capabilities and deterrence until a durable "world without nuclear weapons" has been established. A substantial literature has developed on the subject since the early 1990s, some supportive of the idea, other critical of it.[35] It will not be considered here. An aspect of "virtuality" deserves note nonetheless: the necessary devotion of attention to reversibility and irreversibility and to their regulation. Embrace of the idea implies that steps taken towards nuclear disarmament, and to the abandonment of nuclear deterrence, are reversible; and that commitments to nuclear disarmament are not irreversible, for a period at least. This begs a host of questions. Which state(s) or entities should retain virtual arsenals? What would they comprise and what capabilities and infrastructures would be preserved to enable reconstitution (of what?)? What would "strategic stability" entail where virtual nuclear deterrence was in play? What verification would be required and applied by which organization(s)? How would commitments be formalised in bilateral and multilateral treaties, and would they be compatible with NPT obligations? How should judgements on the legitimacy and legality of reversal be arrived at and by whom?

Note also that retention of a virtual nuclear capability would, in effect, perch the nuclear weapon state on the threshold between nuclear armament and disarmament. Views of the future would encompass both the real prospect of life without nuclear weapons, pending final transition to that end point, and the prospect of reversion to the use of nuclear weapons and deterrence if "break-out" occurred or threatened. The achievement of "virtuality"—itself a step-by-step process involving arms reductions, the de-targeting and disassembly of remaining weapons and the reshaping of production and operational

[35] The topic's consideration is sometimes considered to have begun with Jonathan Schell's discussion of "weaponless deterrence" in his *The Abolition,* Picador, London, 1984. See also Michael Mazarr, "Virtual Nuclear Arsenals," *Survival,* 37 (3), Autumn 1995; George Paloczi-Horvath, *Virtual Nuclear Capabilities and Deterrence in a World Without Nuclear Weapons,* VERTIC, London, October 1998; Sukeyuki Ichimisa, *The Concept of Virtual Nuclear Arsenals and a World without Nuclear Weapons,* December 2011; James Acton, "Virtual Nuclear Deterrence and Strategic Stability," in Nik Hynek and Michal Smetana, eds., *Global Nuclear Disarmament: Strategic, Political and Regional Perspectives* Routledge, London, 2015.

estates—would require substantial movement towards the disarmament threshold without stepping decisively across it. It would entail significant acts of disentrenchment accompanied by the installation of various ratchets to prevent easy reversal. It would postpone—for how long?—the final disembedding of nuclear possession. It does not invite confidence.

VII.
The Humanitarian Initiative and TPNW

There is no need to record the many setbacks that have occurred since the high point of NPT-related disarmament diplomacy in the early to mid-1990s, now quarter of a century ago. They are well known. They have shown that the problems listed above were real. They were always likely, in the absence of severe shocks or fundamental shifts in norms and understandings, to frustrate the pathway and process that have so dominated thought and action on nuclear disarmament.

The Humanitarian Initiative and ensuing Treaty on the Prohibition of Nuclear Weapons, TPNW, grew partly from recognition of the implausibility of claims that nuclear disarmament could be achieved through a grand multilateral project of the kind discussed above, especially one that would be guided by nuclear weapon states in whom trust was in short supply. Expected to take decades to complete at the best of times, such a project was an inappropriate response to the nuclear danger's imminence.

The Initiative therefore strove to cut through the complexity, entanglement and knottedness of international nuclear politics by subordinating it to the high moral imperative of removing the threat of nuclear catastrophe once and for all.[36] It drew inspiration from the International Court of Justice's advisory opinion of 1996, the Ottawa Convention of 1997 that had instituted a ban on possession of anti-personnel land mines despite great powers' opposition, and from developments in humanitarian law linked to the UN's prioritizing of human security. Driven by an alliance of respected NGOs working with a group of states, the hope was that TPNW would freshly stigmatise nuclear weapons and establish their illegitimacy and illegality. The Treaty's negotiation and publicity given to the cause would ignite a global social movement against nuclear weapons, impelling nuclear weapon states to change tack.[37]

It remains to be seen whether and how TPNW and the movement behind it will impinge significantly on the behaviour of nuclear

[36] The Humanitarian Pledge, initiated by the Austrian Government, committed its signatories to "cooperate with all relevant stakeholders, States, international organisations, the International Red Cross and Red Crescent Movements, parliamentarians and civil society, in efforts to stigmatise, prohibit and eliminate nuclear weapons in light of their unacceptable humanitarian consequences and associated risks."

[37] From a large literature on the Humanitarian Initiative and TPNW, see George Perkovich, *The Nuclear Ban Treaty: What Would Follow?*, Carnegie Endowment for International Peace, May 2017; William C. Potter, "Disarmament Diplomacy and the Nuclear Ban Treaty," *Survival,* July 2017; Nick Ritchie and Kyølv Egeland, "The Diplomacy of Resistance: Power, Hegemony and Nuclear Disarmament," *Global Change, Peace and Security,* April 2018.

powers, and how it will affect the 2020 NPT Review Conference's outcome and the regard in which the NPT is held. TPNW's outcome has been disappointing so far. Signature and ratification of TPNW has been rather slow among supporters of its negotiation, delaying entry into force.[38] Furthermore, the social movement against nuclear weapons has not developed as hoped, despite award in 2018 of the Nobel Peace Prize to the International Campaign to Abolish Nuclear Weapons (ICAN) that had spearheaded the campaign. Global Zero's effort to exert pressure on governments through a network of mainly retired officials, politicians and academics, again aspiring to energize a social movement especially among the young, also had little effect.

The absence of significant social protest brought comment at the Workshop on the relative "invisibility" of and inattention to nuclear weapons in contemporary public discourse. A participant spoke of the "lack of a visceral recognition and response from the individual to the implications of living in a world with nuclear weapons." Since 1945, extensive public protest against the possession and use of nuclear weapons has occurred only at times of acute crisis and fear of imminent nuclear war. Even during the Cold War, anti-nuclear activists found it hard to maintain consistent support, especially after the ban on atmospheric testing ended concerns about radioactive fallout. Out of sight, out of mind. Indeed, electorates have on occasion been more aroused by promises to expand nuclear forces (as in Kennedy's election campaign in 1960 and Reagan's in 1980) than by pledges to reduce them.[39] Even in Japan, public support for nuclear deterrence has waxed and waned, recently strengthening in response to anxiety about an expansionist China and nuclear-armed North Korea, weakening disarmament's traditional appeal there.

In part, the lack of significant opposition to nuclear weapons among the general public reflects its resignation when there have been so few opportunities—none in autocracies—to influence decisions taken by powerful groups behind closed doors. Political movements against nuclear power have been more prominent and (occasionally) effective in history partly because decisions on development and construction of power stations, reprocessing plants and radioactive waste sites have been required from civil authorities, involving relatively open planning and regulatory procedures and some possibility of legal challenge. Nuclear power has been more "visible" than nuclear weaponry in several respects, with Three Mile Island, Chernobyl and Fukushima providing vivid demonstrations of dangers that have often seemed more "present" than the dangers of nuclear wars and accidents.

[38] TPNW's conclusion in July 2017 bore the support of 122 states in the UN. By the end of 2019, the Treaty had been signed by 80 states and ratified by 34 (50 ratifications are needed for entry into force). Among the states that had ratified the Treaty, sixteen were from Latin America and the Caribbean (Antigua & Barbuda, Bolivia, Costa Rica, Cuba, Dominica, Ecuador, El Salvador, Guyana, Mexico, Nicaragua, Panama, St Lucia, St Vincent & Grenadines, Trinidad & Tobago, Uruguay and Venezuela), seven from Asia (Bangladesh, Kazakhstan, Laos, Maldives, Palestine, Thailand and Vietnam), six from Pacific & Australasia (Cook Islands, Kiribati, Palau, Samoa, Vanuatu and New Zealand), three from Europe (Austria, Holy See and San Marino), and two from Africa (Gambia and South Africa). Significant signatories yet to ratify the Treaty were Algeria, Brazil, Indonesia, Ireland, Nigeria, and the Philippines.

[39] During the Workshop, attention was drawn to a recent study of public attitudes in the United States. It revealed a disturbing willingness of sections of the US public to support the use of nuclear weapons against states or terrorist groups that caused injury to American interests and personnel. It suggested that the taboo against use is not as widespread and unconditional among publics as has been commonly assumed, and that it may be weakening in today's more bellicose environment. See Scott D. Sagan and Benjamin A. Valentino, "Revisiting Hiroshima in Iran: What Americans Really Think about Using Nuclear Weapons and Killing Noncombatants," *International Security*, 42 (1), Summer 2017, pp. 41–79.

VIII.
Changes in Future Landscapes

Although it is too early to pass judgement on the TPNW, it currently seems unlikely that the Treaty, and its supporting alliance of "civil society" and a community of non-nuclear weapon states, can significantly disentrench let alone disembed nuclear weapons. One wishes that it were otherwise. The change in moral landscape sought by the Humanitarian Initiative has not caused the nuclear weapon states to alter course. Nor does it currently seem likely that substantial and lasting progress towards nuclear disarmament can be achieved through the engineered, multilateral approach that has long been proposed in the NPT and other contexts. Reinforcement of the institutional landscape, its precondition, that took place in years following the end of the Cold War has not been sustained. Presently, the step-by-step movement by nuclear weapon states away from arms control and disarmament seems to have more momentum than movement towards it.

A catastrophe involving nuclear weapons would change this situation.[40] However, conjuring this catastrophe in the public imagination has failed again and again to loosen attachment to them. Nor have non-nuclear weapon states' cries of irresponsibility and injustice brought a response from the nuclear weapon states, inside or outside the NPT, other than declarations on disarmament that lack legal force and are seldom honoured. Nor have attitudes to nuclear weaponry among possessors been significantly affected by the presence of unreliable leaders with "fingers on triggers" that cannot be trusted to manage grave crises and act responsibly.

It is therefore becoming commonplace to depict the future as one in which nuclear weapons not only persist, but become re-entrenched after a post-Cold War period of comparative disentrenchment. The invigoration of nuclear deterrence is often linked to power transitions and the rivalries that they engender. The rise of China is frequently invoked, linked now to anxieties about US decline.[41] But that future is not inevitable. We have entered a time of unsettling, radical change

[40] There has long been concern that a limited tactical use of nuclear weapons, breaching the taboo, might encourage possession and use if military objectives were achieved without large casualties.

[41] A future is frequently imagined in which the United States and its allies regard nuclear forces as indispensable tools in the balancing of Chinese power (in particular) and bottling up of China's expansion. "US policymakers should ensure that they create a formidable bounded order that can contain Chinese expansion . . . The time has come for the US foreign policy establishment to recognize that the liberal international order was a failed enterprise with no future." John Mearsheimer, "Bound to Fail: The Rise and Fall of the Liberal International Order," *International Security,* 43 (4), Spring 2019. Mearsheimer's article appears on the 30th anniversary of publication of Francis Fukuyama's famous article on the US-led liberal order's triumph bringing "the end of history." Neither author has been a reliable guide to the future.

in social affairs of every kind. In this environment, one cannot and should not assume continuity within states, in their construction and in relations among them. That includes the value attached to nuclear weapons and attitudes of their possessors to the safety and reliability of nuclear deterrence.

Let me highlight two respects in which radical change is happening today and may accelerate in years ahead: in the technological landscape, and in what may be termed the landscape of existential threat.[42] Each has a bearing on nuclear affairs.

The technological landscape. In nuclear history's first decades, the development of nuclear weaponry and associated delivery and communication systems helped to propel the period's technological change. They had many spin-offs, galvanizing innovation in materials, microelectronics and computing, radar and satellite communications, aircraft and rocketry and many other fields. Furthermore, nuclear power and its fuel-cycle were regarded as sources of the energy's system's eventual transformation, attracting enormous investment in R&D and physical capital.

This is not the case today to anything like the same degree. Most of today's prominent technological innovations are being driven in other fields. They are, however, flooding into the nuclear and conventional military domains, attracting investment in new and improved weapon systems and raising many questions about the risks attached to nuclear deterrence, the future role of nuclear weapons in military affairs and inter-state rivalry, and their ethical implications. A significant literature has already emerged on, amongst other things, the effects of artificial intelligence on command and control and nuclear strategy, the increasing "entanglement" of nuclear and conventional weaponry, interference with vital communication systems using cyber techniques and anti-satellite weaponry, and the relative worth of nuclear deterrence if cyber and other means emerge that offer, to quote one of the Workshop's participants, "alternative modes of incapacitating society."[43]

This returns us to the subject of political, military and technological "configurations that work." Current configurations are being disturbed by the wash of technological change happening in a competitive, secretive and under-regulated environment. Are there reconfigurations that can work in response, and for whom? How can and will their efficacy be tested and demonstrated, by whom and to whose satisfaction? What can and should strategic stability entail in these unsettled and unsettling circumstances? If there is doubt that any reconfigurations can work, and concerns that states and peoples are increasingly imperilled, what then? Could they be made to work through novel approaches to arms control, if states chose to engage

[42] Adoption of the word landscape is here inspired partly by Frank Geels' use of it to denote a broad contextual, largely exogenous field of forces that encourages or discourages transitions and transformations in socio-technical systems. In his multi-level perspective, change may be precipitated at the macro ("landscape"), meso ("regime") and/or micro ("niche") levels. F. W. Geels, "Technological Transitions as Evolutionary Reconfiguration Processes: a Multi-level Perspective," *Research Policy,* 31 (8), 2002, pp. 1257–1274.

[43] See, for instance, Vincent Boulanin, ed., *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk,* Stockholm International Peace Research Institute, May 2019; P. Sharikov, "Artificial Intelligence, Cyberattack and Nuclear Weapons—a Dangerous Combination," *Bulletin of the Atomic Scientists,* 74 (6), November 2018; James M. Acton, "Escalation Through Entanglement: How the Vulnerability of Command-and-control Systems Raises the Risks of an Inadvertent Nuclear War," *International Security,* 43 (1), Summer 2018; Keith Payne, "Artificial Intelligence: A Revolution in Strategic Affairs," *Survival,* 60 (5), September 2018.

with them? If risks are indeed multiplying, will influential "insiders" from across nuclear weapon states, whether democracies or autocracies, have sufficient courage to challenge orthodoxy and call for changes in direction? Might they begin to see disarmament with fresh eyes? Or will nuclear embeddedness in all its forms heavily constrain governments and agencies causing them, until compelled by a revealing shock, to downplay the risks and need for action? The questions are legion.

The landscape of existential threat. The prospect of nuclear war, its consequences so vividly illustrated by Hiroshima and Nagasaki, woke governments, peoples and individuals to the possibility that humankind could bring about its own annihilation. Technological progress was double-edged. This has now been joined by realisation that climate change, the loss of bio-diversity and the eco-system's contamination threaten existence, albeit in ways that are different in kind. As evidence of deterioration mounts, mitigating this threat is likely to become the great challenge of this century, with profound political, economic and cultural consequences. Denial of its effects by US, Australian, Brazilian and some other political leaders will surely pass.

Comparison of these existential crises—their dynamic character, causes and effects, public and private representations, and the responses to them—would be very instructive but will not be attempted here. Despite differences, resistance to change—the phenomenon of entrenchment and embeddedness—is a fundamental, shared problem. Abandoning deeply engrained ways of thinking and doing will be required in each context if the threat is to be lifted, or even moderated.

The arrival in public and political consciousness of this second existential threat was touched on briefly at the Workshop. Might it significantly affect attitudes towards and the politics of nuclear weapons? Might responses to the threats become intertwined, for instance through developments in humanitarian law and norms (invigorating TPNW?), or are they destined to remain separate? Or might the environmental crisis suck more life out of the movement against nuclear weapons?

These are important questions that I cannot answer. Here are just three observations:

Firstly, Richard Falk wrote in 2010 that "the problematic character of a world order premised on the interplay of territorial sovereignty and hegemonic geopolitics . . . is unable to address in satisfactory fashion any of humanity's most urgent challenges." First on his list were climate change and nuclear weaponry.[44] Writing today, he might also speak of the problematic character of the state, the loss of public

[44] Richard Falk, "A Radical World Order Challenge: Addressing Global Climate Change and the Threat of Nuclear Weapons," *Globalizations*, 7 (1–2), 2010. Other challenges on his list were global poverty, unregulated world economy, pandemics, and genetic engineering.

trust in its institutions, leaders and policy elites, and the consequent loss of confidence in its abilities to address such urgent challenges. He pins his rather slender hopes on "paradigm change" and "emergence of a humane form of global governance . . . transcending nationalism and statism, which means a form of global governance that is post-Westphalian, privileging people over market and state, which is to say, the emergence of a new structure and normative mandate for world order." He looks to civil society to drive change, the option of world government discussed in earlier times having lost any plausibility. Unfortunately, the Humanitarian Initiative and TPNW have shown that civil society, even when backed by a large body of states and the UN General Assembly, is a weak entity when confronted by powerful governments and agencies that are determined to preserve the status quo. Change has to come from within as well as without.

Secondly, it is commonly assumed, especially among realists, that climate change will exacerbate international conflict. An exhaustive review of literature has recently revealed, however, the absence of consensus on this matter.[45] Amidst great complexity, much depends on local and regional circumstance and on the influence of political, economic and other factors. We should note here that the United States, China, Russia, India, and NATO's member countries are the principal actors in regard to both nuclear weaponry and climate change. So much rests on whether these nations and their leaders choose to compete or cooperate, and how. Might an encompassing panic over the eco-system's disintegration push them, sooner than is now expected, to suspend differences and act together for the common good, with consequences extending to their nuclear relations? Would a severe nuclear crisis have consequences for relations in the environmental field, and vice-versa?

Thirdly, "the well-regulated use of nuclear power could be a formidable tool in the world's effort to dramatically reduce greenhouse gases that contribute to climate change."[46] On the contrary, its significant take-up outside a few countries, notably China and India, seems unlikely. The disincentives are too great: high capital costs, long lead-times in construction and problems with finance; safety concerns; and technological changes that are bringing rapid reduction in the cost of renewable energy forms and novel ways of managing of electricity supply systems. As in the 1970s, however, there needs for wariness of states' proclaimed interest in nuclear power, and assertion of rights of access to capabilities, when their main purpose is to prepare ground for weapon programmes.

[45] Katherine Mach, Caroline M. Kraan, et al., "Climate as a Risk Factor for Armed Conflict," *Nature,* 12 June 2019. Study carried out for the International Panel on Climate Change.

[46] Daniel Poneman has a more optimistic view of nuclear power's role, perhaps not surprisingly since he is now working within the nuclear industry after a diplomatic career in the US Government. Daniel B. Poneman, *Double Jeopardy: Combatting Nuclear Terror and Climate Change*, MIT Press, Cambridge, MA, 2019.

IX.
National Differences: Back to the State Level of Analysis

A session was devoted at the Workshop to variation in the sources and character of nuclear embeddedness among nuclear-armed states (there were presentations on France, India/Pakistan, Russia and the UK).[47] North Korea was also discussed. The embeddedness or otherwise of its nuclear weapon programme and commitment to nuclear deterrence, and the circumstances that would bring about their abandonment, are vital issues on which there is little agreement.

It is striking how little state security, in its traditional politico-military sense, featured in the presentations and their discussion. It was present but not uppermost in each case. Elsewhere, I wrote about Erik Ringmar's persuasive argument that the US and USSR had, during the Cold War, become involved "in a struggle for recognition, causing each relative improvement or diminution of capability to be experienced as a gain or loss in prestige. Perceived inferiority, now or in the future, became threatening to the state's security and identity ... It is thus appropriate to speak of a security and recognition dilemma ... becoming entrenched."[48] This certainly applies to the nuclear contest between India and Pakistan, and to a degree between Russia, the US and now China (space races are also being spurred by "recognition dilemmas"). However, the significance of identity is best revealed by nuclear weapon states that are little or only peripherally involved in nuclearized conflicts and for whom the security value of deterrence is most questionable. France and the UK come especially to mind.[49]

It was remarked during the discussion that "France will never give up nukes." Although this may be an exaggeration, these words accurately convey an opinion held across political parties and widely supported (it is usually assumed) by the French public. Secrecy, absence of democratic debate, and the extent of investment in productive, bureaucratic and military capital were also mentioned in France's re-

[47] There was no discussion at the Workshop of NATO's non-nuclear weapon states, all of whom are committed to non-possession under NPT rules, but which support nuclear deterrence and have hitherto distanced themselves from TPNW. I hope to consider their positions in this paper's next development.

[48] William Walker, *A Perpetual Menace, op. cit.*, p. 59, referring to Erik Ringmar, "The Recognition Game: Soviet Russia against the West," *Cooperation and Conflict*, 37 (2), 2002, pp. 115–136.

[49] It should also be recalled that the Indian government's decision to test and deploy nuclear weapons was taken primarily for political rather than military reasons, linked to national identity and prestige, by the Hindu-nationalist BJP after its success in the 1998 general election. It was not welcomed by the Indian military, and arguably resulted in a weakening of India's security by prompting Pakistan's development and deployment of a nuclear arsenal.

gard. Its nuclear enterprise was said to be "too big to fail." The broad conclusion was that nuclear weaponry had become, in Starr's telling phrase, "part of the order of the universe" in French political culture. Its retention was felt to be fundamental to the esteem with which the French state and people regarded themselves and were regarded by other states and people. Although of questionable politico-military utility, possession of nuclear weapons upheld perceptions of France's continuing power and prestige and of the respect due and attention paid to it by other countries.

The case of the UK is more complex. It acquired nuclear weapons when it was still an imperial power with global reach. Unlike France, their presence in the UK has always been controversial and subject to democratic challenge, although never to the extent of threatening continuity. Possession of nuclear weapons has been considered by successive governments as essential to the UK's security policies, foreign relations and self-image.

Whether this will survive the Brexit storm is uncertain. On the one hand, nuclear weapons may be ascribed even greater value by people and groups desperate to bolster self-esteem and uphold the state's position as a respected international power and important player in NATO. On the other hand, their value may well come to appear less of an "assumed given," especially to a military and security apparatus preoccupied with technological and other developments in an economically diminished country experiencing severe pressure on public resources.

Although nothing is certain, it is also widely acknowledged that Brexit may hasten the UK's disintegration by precipitating Scotland's departure from it. The world may have to contend with the break-up of a second nuclear weapon state in the next few years.[50] In the Soviet case, Russia's retention of the status and capability of a nuclear weapon state was assisted by the location on Russian territory of the principal nuclear assets and decision-making machinery. In the UK's case, the presence in Scotland of the primary asset—the submarine bases at Faslane and Coulport—would seriously complicate, probably rendering unachievable, retention of a nuclear deterrent by "rUK" (the rest of the UK, effectively England). There are no plausible alternative bases outside Scotland by common consent.[51] The now dominant Scottish National Party (SNP), likely to form the first government of a sovereign Scottish state, has long campaigned for nuclear weapons' removal from Scottish territory whilst desiring to join the NPT as a non-nuclear weapon state (nuclear identity is not singular within the UK).

There are many questions. If Scotland did assert its right to independence legally through the ballot box, might its stance on nuclear

[50] The issues were examined in Malcolm Chalmers and William Walker, *The UK, Nuclear Weapons and the Scottish Question,* Tuckwell Press, East Linton, 2001.

[51] Falmouth in Cornwall has been proposed but has various drawbacks, prominent among them being the establishment of a safe and secure facility akin to Coulport for storing missiles and warheads and for loading warheads on to missiles. Operating out of King's Bay in Georgia has also been mooted, again with various drawbacks, including the unavoidable loss of national independence in the nuclear force's operation.

weapons—if held to—become an obstacle to its gaining entry to the EU and NATO, and to its attaining international recognition as a sovereign state that would be open to obstruction by the UN Security Council's permanent members?[52] In political reality, however, would the P5 choose to make this a defining issue before the court of international opinion when faced with a nuclear weapon state's unprecedented demand to base its entire nuclear deterrent on the territory of a non-nuclear weapon state that wished to be rid of them?[53] Would a Scottish Government nevertheless be impelled to compromise when confronted by the need to cooperate on many issues with governments in London, Paris and Washington (in particular) that would probably regard its proposed actions as an affront to reason and their vital interests?

Let me make three general points relevant to our subject.

Firstly, the centrality of identity to nuclear embeddedness deserves emphasis. It is a significant factor binding nuclear weapon states to their assets. If there is to be progress on nuclear disarmament, much more attention needs to be paid to puncturing the relationship between identity and the possession of nuclear weapons.

Secondly, the embeddedness of nuclear weaponry in a state's policies, practices and identity depends upon the embeddedness of the state, its institutions and its ability to contrive "configurations that work" (broadly defined) and that will continue to work.

Thirdly, if the UK's abandonment of its nuclear weapons followed the state's disintegration, it would become the first "fully-fledged" nuclear weapon state to disarm. Consequences of its or another nuclear weapon state's decision to disarm deserve to be explored. As in the Soviet Union, it would involve the dismantling and disposition of nuclear assets and the conversion of careers and infrastructures. It would require the development and testing of means of embedding non-possession of nuclear arms legally and in other ways, including applying verification techniques and processes needed to assure full, lasting disarmament (the state in question would become a "disarmament laboratory").[54] It would entail strategic reorientation and construction of counter-narratives to justify, at home and abroad, the state's abandonment of nuclear weapons and deterrence (unless the state disarmed involuntarily, with its tail between its legs). Admission of a nuclear weapon state to the community of non-nuclear weapon states would affect the political dynamic of relations within the NPT and between the nuclear-armed states and the TPNW.

Most significantly, it would puncture perceptions of irreversibility and break the mould enveloping the class of nuclear weapon states, itself a source of embeddedness. The ripple effects would hardly be negligible.

[52] UN recognition depends on the Security Council's recommendation, involving the permanent members' unanimous support, to the General Assembly.

[53] Whether the UK's permanent membership of the Security Council would survive its break-up is another open question. Among other considerations, it might be argued that the UK's personality as a state had been fundamentally altered by Scotland's departure from the UK's union of nations, preventing near automatic inheritance of the UK's permanent seat.

[54] Over 30 years ago, when the Labour Party was campaigning for unilateral disarmament in the run-up to a general election, I co-authored a paper on how the UK, defined by the NPT as a nuclear weapon state, could become a non-nuclear weapon state under international law if taken down this path. Norman Dombey, David Fischer, and William Walker, "Becoming a Non-nuclear Weapon State: Britain, the NPT and Safeguards," *International Affairs*, 63 (2), Spring 1987, pp. 191–204.

X.
Some Last Reflections

In a famous article published twenty years ago, Nina Tannenwald wrote that "the non-use of nuclear weapons since Hiroshima remains the single most important phenomenon of the nuclear age."[55] A few years later, Thomas Schelling opened his Nobel Prize lecture with: "The most spectacular event of the past half century is one that did not occur. We have enjoyed sixty years without nuclear weapons exploded in anger."[56] Each drew attention to the great significance of the taboo on use or tradition of non-use of nuclear weapons that had held, seemingly becoming entrenched, since 1945.

How entrenched, whether universally entrenched, and whether the taboo's entrenchment can withstand future crises and mishaps have been the subject of much debate and contention, not least because the practice of nuclear deterrence requires persistent expression of nuclear-armed states' preparedness to breach it. Whatever position one takes, there are no analytical means of attaching probabilities to the use of nuclear weapons in anger or by accident—where, when and on what scale. Beyond calculation, the risks are real whatever history may suggest. The permanence of non-use cannot be assumed. On the contrary, that nuclear weapons will be used should be the guiding assumption. It is unrealistic to expect that the active development and deployment of, and power play with, nuclear weapons in four regional theatres (South and East Asia, Europe and the Middle East), overlain by great power competition, will not end in grief.

As has often been pointed out, our survival is therefore a gamble on non-use, and on luck holding.[57] The desire to abolish nuclear weapons is therefore logical, understandable and, many would say, a moral and political imperative. This opinion has been expressed innumerable times since the nuclear weapon's invention. It has again found expression in statements of many governments in the run-up to the 2020 NPT Review Conference.

The nuclear possessor's standard response is that, whilst nuclear disarmament is a desirable goal over the long-term, nuclear deter-

[55] Nina Tannenwald, "The Nuclear Taboo: the United States and the Normative Basis of Nuclear Non-Use," *International Organization*, 53 (3), Summer 1999, p. 433.

[56] Thomas Schelling, *An Astonishing Sixty Years: The Legacy of Hiroshima*, Nobel Prize Lecture, Stockholm, 8 December 2005. Although awarded a Nobel Prize for his contribution to economics, Schelling chose to speak on nuclear affairs that he had addressed in his career especially through the application of game theory to deterrence.

[57] Benoît Pelopidas, "The Unbearable Lightness of Luck: Three Sources of Overconfidence in the Manageability of Nuclear Crises," *European Journal of International Security*, 2 (2), July 2017, pp. 240–262.

rence brings restraint and provides protection against disastrous great wars. Faced with a choice between nuclear deterrence and its absence, the common good is served, it is claimed, by its continuance especially in periods of great instability and conflict such as the present. At such times, the recovery of commitment to nuclear arms control must be the primary objective.

This is an understandable point of view. But is this a choice arrived at through good judgement and the exercise of reason? An argument of this paper is that the presence of choice is habitually extinguished, in reality, by the embeddedness of nuclear weaponry, in all its complexity. Where expressed, the choice is often more a pretence than a presence. It follows that the "fact" of nuclear embeddedness, which is a danger and affront wherever one sits, needs to be acknowledged and addressed openly, rationally, courageously and without dissembling, especially by nuclear powers and their agencies. After all, they and their citizens would be among the first to perish in a nuclear war.

Let me wind up with two points of view.

Firstly, I have emphasised that nuclear embeddedness is both an intra- and inter-state phenomenon and is deepened by interaction of the domestic and international. The balance and relationship between them depend on context and circumstance. In weighing their effects, I would suggest nonetheless that "the intra" is generally more significant than, and certainly as significant as, "the inter." The anchors of nuclear weaponry are to be found more within states than in their external relations—in the preoccupation with identity, in vested interests, in entrenched loyalties and bureaucratic processes, in material "facts on the grounds" and weapon succession processes, in cultures of conformity and in factional struggles among other things. Representing nuclear possession and usage as primarily an inter-state phenomenon, to be solved mainly through international pacification and multilateral processes, can become an impediment by averting eyes from internal obstacles that governments shy away from acknowledging and become less tractable in consequence.[58] Whether primary or secondary factors, internal sources of embeddedness and its justification deserve more attention, nuclear weapon state by nuclear weapon state.

Secondly, nuclear embeddedness is also an intra-intra-state phenomenon to a significant degree. Nuclear policies and estates are overseen by relatively small groups, albeit with penumbra, that drive decision-making and create the justifying narratives. In democracies, these groups' activities and outlooks are transparent in some degree, although never fully. In nuclear weapon states that are autocracies—the majority among them—transparency is minimal even within the

[58] When presenting the US initiative on "Creating an Environment for Nuclear Disarmament," for instance, Christopher Ford makes no reference to the absence of an environment conducive to nuclear arms control, let alone disarmament, in his own country. The CTBT's rejection by the US Senate is as clear an example as any of the sway of domestic politics.

structures of the state. Movement in the direction of arms control and disarmament will always be strongest if it comes from within these nuclear fraternities, especially if they are communing with one another and acting in accord with political leaders. A great worry is that they will become locked, voluntarily or involuntarily, in a competition for advantage as the technological landscape changes, especially in the cyber domain, jeopardising the safety and reliability of nuclear deterrence wherever it is being practised.

What happens if it becomes evident there are no longer nuclear configurations that can be made to work in ways that are safe and reliable? How will these groups respond, individually and collectively? Whether in democracies or autocracies, how can they be pushed into responding, by whom, if they are in denial? These are as important as any of the questions before us.

* * *

The embeddedness of nuclear weapons in the beliefs, actions and policies of their possessors is a reality that is dangerous—and becoming more dangerous—to us all, whatever the proclaimed benefits of nuclear deterrence may be. This paper's purpose has been to encourage greater understanding of this embeddedness, and honesty about its presence and roots, not least amongst those in charge of nuclear policy-making. The weakness of and resistance to this understanding, and the all too frequent public and private distortion of realities, are part of the problem.

Annex
Entrenchment, Embeddedness and Permanence: Degrees of Irreversibility

Paul Starr writes that "Entrenchment . . . can refer to any process whereby an institution, a technology, a group, or a cultural form—any kind of social formation—becomes resistant to pressures for change."[59] He speaks of "tenacious structures." He identifies two kinds of constraint: on, amongst other things, the reversibility of decisions, developments and social formations; and on change itself, through change's channelling in particular directions to the exclusion of others. He points out that entrenchment refers to both a condition and a process, and that it may be both purposive and an emergent, unintended property.[60] It may also arise unconsciously, actors sometimes being unaware that their actions, large and small, are contributing to undesirable entrenchment. Although institutionalization is often an important feature of entrenchment, it does not equate to it.

Various other terms have been used by social scientists when describing this phenomenon or aspects of it. They include obduracy, entrapment, lock-in and path dependence. The term obduracy has been used when discussing the "tension between the dynamics and malleability of urban space, on the one hand, and its hardness and obduracy on the other."[61] Lock-in has come to refer to the lasting adoption of technologies that are sub-optimal, the QWERTY keyboard being an oft-cited example.[62] "Path dependence characterizes specifically those historical sequences in which contingent events set in motion institutional patterns or event chains that have deterministic properties."[63] My own interest in the subject began with the study of civil nuclear reprocessing in the UK. I chose the term entrapment regarding the extraordinary persistence of governmental support for it when "normal reason" for continuation had long since

[59] Paul Starr, *op. cit.,* pp. 1–2.

[60] Starr calls entrenchment "strategic" when it is "deliberate and purposeful." I prefer to call it purposive rather than strategic, given the latter's particular connotations in political and military affairs. Paul Starr, *op. cit.,* p. 3.

[61] Anique Hommels, *Unbuilding Cities: Obduracy in Urban Sociotechnical Change*, MIT Press, Cambridge, MA, 2005.

[62] Paul David, "Clio and the Economics of QWERTY," *The American Economic Review,* 75 (2), 1985, pp. 332–337.

[63] James Mahoney, "Path Dependence in Historical Sociology," *Theory and Society,* 29, 2000, p. 507.

evaporated.[64]

Entrenchment is my favoured general term. However, although Starr emphasizes that entrenchment "is always a matter of degree," he does not provide terminological means for distinguishing between his general entrenchment and the strong entrenchment that can follow, as in the nuclear case, crystallisation of a social formation. All nuclear weapon programmes, at whatever stage of advance, exhibit the entrenchment that invariably accompanies advocacy and the commitment of resources and expertise. It is even evident in stories of resistance to the abandonment of nascent weapon programmes in cases such as Sweden and Switzerland. There is, however, a big difference between this level of entrenchment and that exhibited by nuclear-armed states such as the US, Russia, France and India. I propose here that beyond certain thresholds of realisation—of commitment to the possession of nuclear weapons and practice of nuclear deterrence—entrenchment becomes and will be called embeddedness.[65] By which I mean that entrenchment is open to reversal, whereas embeddedness implies closure to reversal, to disembedding. Such closure is never absolute in actuality or perception. Nevertheless commitments, practices and states of mind become extremely hard to shift. Irreversibility becomes set in a tough concrete.

Following Georgescu-Roegen, a further distinction can be drawn between irreversibility and irrevocability.[66] Whereas the former retains the possibility of reversal, the latter implies its impossibility. A condition of permanence has come into being. There is little in the social world that can be regarded as permanent and irrevocable, despite common assumptions to the contrary (viz. the collapse of communism). This does not apply, however, to scientific and other forms of knowledge, certainly in the modern era when discoveries and developments are so rapidly published and diffused.[67] Nuclear history began with the discovery of atomic fission, realisation of its explosive potential, and demonstration at Hiroshima and Nagasaki of its catastrophic but power-laden result. Knowledge became irrevocable in each respect, as did the vision of nuclear apocalypse in the public imagination. Indeed, fear that human society would be irrevocably destroyed by a nuclear war, without prospect of recovery, has been present throughout the nuclear age.[68] Paradoxically, the technology's extraordinary destructiveness gave nuclear deterrence its special appeal and authority, for certain states and communities at least, whilst giving the idea and goal of complete nuclear disarmament their persistence.

I am therefore proposing a vocabulary that indicates three degrees of entrenchment and irreversibility:

- entrenchment denoting the general process of becoming more

[64] William Walker, "Entrapment in Large Technology Systems: Institutional Commitment and Power Relations," *Research Policy,* 29, 2000, pp. 833–846.

[65] Note that embeddedness has been ascribed a meaning in economics that lacks relevance in our context. Granovetter, following Polanyi, asserted that economic relations between individuals and firms are embedded in social networks and should not be abstracted. See M. Granovetter, "Economic Action and Social Structure: The Problem of Embeddedness," *American Journal of Sociology,* 91 (3), 1985, pp. 481–510.

[66] Nicolas Georgescu-Roegen, *The Entropy Law and the Economic Process*, Harvard University Press, Cambridge, MA, 1971, p. 197.

[67] There are claims and counterclaims that the technology of nuclear weapons can be "uninvented," often linked to ideas about forgetting over time. For a recent discussion, see Nick Bourne, "Invention and uninvention in nuclear weapons politics," *Critical Studies on Security,* 4 (1), 2016, pp. 6–23.

[68] It was expressed most tellingly by Hans J. Morgenthau in "Death in the Nuclear Age," Commentary, September 1961. Besides the loss of life, he mourned the loss of human history and culture that would follow a nuclear apocalypse.

resistant to change, as well as an entrenched condition that is still open to reversal, albeit with difficulty;

- embeddedness denoting a hardened, but not absolute, entrenchment that is highly resistant to reversal; and
- permanence denoting irrevocability, an absolute impossibility of reversal.

Finding appropriate antonyms to these words is not straightforward. Nuclear disarmament is, of course, the term commonly used in diplomacy and public discourse to denote the end-state of a world without weapons and movement towards it. But entrenchment lacks an appropriate antonym (Starr provides none). Various words—unlocking, loosening, disentangling and dislodgement among them—are found in our and other contexts, depending on the meaning being conveyed. Although disembedding offers itself, I am reluctant to adopt it as antonym to the general process and condition of entrenchment, and to lose by implication the special meaning already attached to embedding ("disembeddedness" also makes little sense). My solution is to draw a distinction between nuclear disembedding and disentrenchment. Although not ideal, adoption of the latter word provides terminological symmetry.

I therefore propose a vocabulary that indicates three degrees of disentrenchment and reversibility:

- disentrenchment denoting the general process of becoming less resistant to change, as well as a condition that is still open to reversal (i.e. re-entrenchment), albeit with increasing difficulty;
- disembedding denoting the overcoming of hardened entrenchment, accompanied by strong, but not absolute, resistance to reversal (i.e. re-embedding);
- impermanence denoting fluidity and reversibility.

The embedding of nuclear weapon programmes and commitment to nuclear deterrence are this Working Paper's subject. We should not overlook the flipside—the attempt to entrench nuclear abstinence and movement in its direction, and to entrench agreements and processes reducing risks of nuclear war. Rendering irreversible the disentrenchment entailed thereby has long been seen as fundamental to the achievement of nuclear non-proliferation and disarmament and to the durability of nuclear arms control and reduction. Prominent expressions of this ambition are found in the NPT Action Plan of 2010's affirmation that "the principle of irreversibility [applies] to nuclear disarmament, nuclear and other related arms control and

reduction measures," and in the TPNW's eight references to irreversibility.

It should be noted that there are at least four "objects" that states and other actors typically try to render irreversible:

- existence of a desired condition or state of affairs (e.g. absence of nuclear war, maintenance of peace in Europe);
- movement towards a desired condition or state of affairs (e.g. the NPT's universality, ending fissile material production for weapons, nuclear weapon-free zones);
- application and honouring of measures (e.g. the CTBT, the IAEA's Additional Protocol, arms control treaties, de-targeting);
- commitment to norms, processes and institutions (e.g. non-use, international law, diplomacy).

Creation of a world without nuclear weapons would require attainment of irreversibility in each of these respects. Long-lasting vigilance and oversight would be required since establishment of such a world could not be irrevocable.

Of course, reversibility and irreversibility may be parallel and mutually enhancing goals. In the Cold War, for example, reversal of the nuclear arms race was sought hand in hand with the irreversibility of nuclear arms control agreements. They may also be regarded as incompatible goals, prominently when desired reversibility of commitment to nuclear deterrence is considered by powerful actors to be incompatible with the desired irreversibility of war's absence among great powers. Furthermore, reversibility and irreversibility can become the subject of intense political struggle, as when competing groups sought to maintain or overturn the ABM Treaty. Their relationship is not straightforward.

Ratchets. I suggested in the Workshop's background paper that ratchets were useful metaphors in regard to irreversibility and its attainment. A mechanical ratchet is a device that allows motion in one direction whilst preventing its reversal. Embeddedness and irreversibility are helped by the introduction of ratchets, or locking mechanisms, to hold policies and practices and their direction of development in place. They may take conceptual, technological, institutional and other forms. Rules, especially when set in international law and treaties, can function as ratchets in the pursuit of arms control and disarmament (viz. the ban on explosive testing enshrined in the CTBT). The IAEA and its safeguards system may be regarded as ratchet-sustaining institutions, impeding the reversal of commitments to non-proliferation. The dismantlement of warheads and disposition

of weapon-grade material are ratchets hindering the re-accumulation of arms. And so on.

For advocates of eventual nuclear disarmament, an objective of arms control and non-proliferation is to edge states, through the installation of ratchets, towards a situation where elimination appears more attainable. A step-by-step process implies that ratchets will be assembled at each stage to prevent backsliding. However, ratchets can be strong and weak instruments and may be prone to neglect, decay and removal. States may also insist on their being time-limited, as when arms control treaties such as START are given specific durations.

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