

PROJECT ON MANAGING THE ATOM

# A Theory of Engagement with North Korea

Christopher Lawrence



HARVARD Kennedy School  
**BELFER CENTER**  
for Science and International Affairs

DISCUSSION PAPER 2019-02  
MAY 2019

## **Project on Managing the Atom**

Belfer Center for Science and International Affairs  
Harvard Kennedy School  
79 JFK Street  
Cambridge, MA 02138

**[www.belfercenter.org/MTA](http://www.belfercenter.org/MTA)**

Statements and views expressed in this report are solely those of the author and do not imply endorsement by Harvard University, the Harvard Kennedy School, or the Belfer Center for Science and International Affairs.

The author of this report invites liberal use of the information provided in it for educational purposes, requiring only that the reproduced material clearly cite the source, using:

Christopher Lawrence, "A Theory of Engagement with North Korea," Discussion Paper 2019-02, (Cambridge, Mass.: Project on Managing the Atom, Belfer Center for Science and International Affairs, Harvard Kennedy School, May 2019).

Layout by Jacob Carozza

Copyright 2019, President and Fellows of Harvard College

PROJECT ON MANAGING THE ATOM

# A Theory of Engagement with North Korea

Christopher Lawrence



HARVARD Kennedy School

**BELFER CENTER**

for Science and International Affairs

DISCUSSION PAPER 2019-02

MAY 2019

# Acknowledgments

The author would like to sincerely thank Martin Malin, Matt Bunn and Shelly Asiala for their helpful comments on this report and on background research; Jacob Carozza for his assistance with editing and preparation of the report; and Steven E. Miller, Sheila Jasanoff, Siegfried Hecker, Gabrielle Hecht, Lynn Eden, John Park, and Scott Sagan for their helpful comments on background research that contributed to this report. Research for this report was supported by a grant from the John D. and Catherine T. MacArthur Foundation.

## About the Project on Managing the Atom

The Project on Managing the Atom (MTA) is the Harvard Kennedy School's principal research group on nuclear policy issues. Established in 1996, the purpose of the MTA project is to provide leadership in advancing policy-relevant ideas and analysis for reducing the risks of nuclear and radiological terrorism; stopping nuclear proliferation and reducing nuclear arsenals; lowering the barriers to safe, secure, and peaceful nuclear energy use; and addressing the connections among these problems. Through its fellows program, the MTA project also helps to prepare the next generation of leaders for work on nuclear policy problems. The MTA project provides its research, analysis, and commentary to policy makers, scholars, journalists, and the public.

E-mail: [atom@hks.harvard.edu](mailto:atom@hks.harvard.edu)

Website: <http://belfercenter.org/MTA>

# About the Author

**Christopher Lawrence** is a postdoctoral research fellow with the Belfer Center's International Security Program and Project on Managing the Atom. He earned his PhD in nuclear science and engineering at the University of Michigan, where he developed novel neutron spectroscopy techniques to characterize nuclear warheads for treaty verification. After leaving Michigan, Christopher studied the history of North Korea's nuclear program as a Stanton Nuclear Security Fellow at Stanford's Center for International Security and Cooperation. He then became a fellow in Harvard's Program on Science, Technology, and Society, where he studied the role of commercial satellite imagery in the framing of public narratives about weapons of mass destruction.



# Table of Contents

<b>1. Introduction .....</b>	<b>1</b>
<b>2. A Theory of Engagement with North Korea.....</b>	<b>9</b>
2.1. The Commitment Problem at the Heart of the North Korean Nuclear Crisis .....	13
2.2. From Carrots and Sticks to Techno-Political Futures.....	15
<i>Box: Irreversible Processes and the “Arrow of Time”</i> .....	17
2.3. Exploring Nuclear Preferences .....	19
2.4. Managing Nuclear Risks.....	21
<b>3. Light Water Reactors and the 1994 Agreed Framework .....</b>	<b>25</b>
3.1. Commitment in Physical Space—Building a Political Future .....	27
3.2. Arrow-of-Time Confidence Building .....	29
3.3. The Success and Failure of the Agreed Framework .....	31
<b>4. Moon Jae-in’s New Economic Map.....</b>	<b>35</b>
4.1. Rail Gauge as Geo-Politics.....	37
4.2. Connective Energy Infrastructures .....	38
4.3. Mineral Reserves, Mining Infrastructure and Sea Ports .....	40
4.4. A Pacific Rimland Meets a New Eurasian Continentalism.....	41
<b>5. Two Paradigms of Diplomacy Under Nuclear Proliferation     Crisis .....</b>	<b>43</b>
<b>6. A Techno-Diplomatic Approach to Engaging North Korea ...</b>	<b>53</b>
6.1. Techno-Diplomatic Iteration .....	55
6.2. A Sample “Differentiator”: Yongbyon Dismantlement for Sanctions Waivers on Infrastructure Investment?.....	57
6.3. <i>A Physical Path</i> to a Nuclear-Free Korean Peace Regime .....	61
6.4. "A Very Different Future for the United States and North Korea" .....	62





# 1. Introduction

Twenty-seventeen was an ominous year on the Korean Peninsula. After years of economic sanctions and political isolation, North Korea demonstrated that it was on the cusp of acquiring an intercontinental-range nuclear capability. A high-yield nuclear test in July implied that it may have mastered the fusion-boosting technology needed to miniaturize a high-yield implosion device, if not a full-scale hydrogen bomb. And missile tests conducted over lofted trajectories proved that its Hwasong-14 and -15 missiles had achieved sufficient range to target the continental United States. The technical displays were complemented by a volley of nuclear threats between the United States and North Korea, and President Trump's "maximum pressure" campaign had reached its apex. As North Korea's nuclear development showed continued immunity to sanctions and threats, Western analysts began debating whether bringing the regime to the edge of collapse might "induce" it to disarm, or whether the United States should plan to "live with a nuclear North Korea" for the foreseeable future.<sup>1</sup>

The next year brought a reversal that few analysts could predict. It began with the 2018 Winter Olympics, which saw the two Koreas compete together for the first time. The North Korean regime then froze its nuclear and missile tests; held historic summits with South Korea, China and the United States; and announced its transition to an "economy-first" policy that would ultimately need international cooperation to succeed. South Korean President Moon Jae-in was ready to capitalize by proposing a "new peace" architecture in East Asia, and a "new economic map" on the peninsula.<sup>2</sup> In a variety of diplomatic settings, the North Korean regime suggested that if such a peace architecture were realized, it would be willing to give up its nuclear weapons. But in order to verifiably roll back its nuclear program, it would need "corresponding measures" from the United States to take place concurrently. Many of the concessions demanded by the North Koreans, such as sanctions relief and a peace declaration, could erode U.S. leverage

1 Uri Friedman, "[Can America Live with a Nuclear North Korea?](#)", *The Atlantic*, September 14, 2017 (accessed February 26, 2019).

2 "[Implementation Measures for a 'New Economic Map' Initiative of the Korean Peninsula.](#)" 2017 Sejong Policy Forum, September 29, 2017 (accessed February 26, 2019).

over North Korea, and the United States has been reluctant to offer them until *after* denuclearization occurs. After two dramatic summits between President Trump and North Korean leader Kim Jong-un, neither side has yet taken tangible steps toward a nuclear-free Korean peace regime.

Is North Korea serious about denuclearizing in exchange for a new peace architecture on the peninsula? Nonproliferation analysts and Korea specialists are split on the answer to this question. Many reject the possibility out of hand, insisting that the regime views nuclear weapons as essential to its identity and security going forward.<sup>3</sup> Others point to North Korea's security environment,<sup>4</sup> and suggest that if its hostile environment were to change, then the regime may be less committed to remaining a nuclear weapons state. But these competing hypotheses about regime intent and self-image can neither be proven nor falsified by North Korea's observable nuclear behavior to date, and the ultimate prospect of denuclearization remains an open question. The goal of U.S. diplomacy with North Korea should be to earnestly probe for an answer to that question, while leaving U.S. security and alliances better off even if the answer is 'no.'

This discussion paper offers a new conceptual framework to better explore North Korea's nuclear intentions and commitments. My contention is a bold one: I argue that after years of international nonproliferation efforts, North Korea's long-term nuclear intentions remain opaque to the outside world because Western analysts have been stuck in a one-dimensional framework of thought<sup>5</sup> that cannot discern those intentions in the diplomatic process. This failed conceptual framework—which I call the *induce-*

---

3 See, for example, Jonathan Pollack, *No Exit*, (Washington, D.C.: International Institute for Strategic Studies, 2011); Evans Revere, "Kim Jong-un Will Not Give Up North Korea's Nuclear Weapons," Brookings Institution, April 9, 2018 (accessed February 26, 2019); David Sanger et al., "On North Korea and Iran, Intelligence Chiefs Contradict Trump," *The New York Times*, January 19, 2019.

4 See, for example, Justin Fendos, "What North Korea Really Wants: A Normalized Relationship with the United States." *The Diplomat*, April 25, 2018 (accessed February 26, 2019); Leon Sigal, "All Take and No Give Won't Work with North Korea." 38North.org, August 29, 2018 (accessed February 26, 2019); Robert Carlin, "More Signals on Denuclearization." 38North.org, September 17, 2018 (accessed February 26, 2019); Joel Wit, "What the North Koreans Told Me About Their Plans." *The Atlantic*, May 20, 2018 (accessed February 26, 2019); Remarks of Gen. Vincent Brooks in "What a 2nd Trump-Kim Summit Could Mean for the Push Toward Denuclearization," *PBS Newshour*, June 18, 2019.

5 For work on cognitive "frames," see George Lakoff and Mark Johnson, *Metaphors We Live By* (Chicago: University of Chicago Press, 1980); Erving Goffman, *Frame Analysis: An Essay on the Organization of Experience* (Boston: Northeastern University Press, 1974).

ment paradigm of carrots and sticks<sup>6</sup>—focuses primarily on punishing and rewarding North Korea’s past nuclear behavior, and deploys a moralistic diplomatic vocabulary that cannot speak credibly about the political future. In order to bring North Korea’s long-term nuclear goals into clearer view, nonproliferation analysts must “reperceive”<sup>7</sup> engagement as primarily staked in the political future, and come to see *credibility*, rather than *inducements*, as the main currency in the diplomatic process.

A conceptual shift from *inducement* to *credible political futures* has outsized implications for nonproliferation diplomacy. The first is to highlight the *dimension of time* as a central consideration in the diplomatic process. Committed political change has a discernible time structure that looks different from the punitive and remunerative engagements prescribed under *inducement*. With the proper conceptual lens, that difference becomes visible both in the path dependence of the individual concessions that are offered by both sides, and in the order in which those concessions are to be implemented. To appreciate the make-or-break importance of time structure for nuclear diplomacy with North Korea, we need look no further than the present standoff, in which the order of proposed concessions has become the major crux of the impasse.<sup>8</sup> This sequencing dilemma is not new, but has been a chronic challenge throughout the 30-year history of the nuclear crisis. Yet it is not insurmountable.

*The goal of U.S. diplomacy with North Korea should be to earnestly probe the question of denuclearization, while leaving our security and alliances better off even if the answer is ‘no.’*

6 The *inducement paradigm* of nonproliferation diplomacy is most explicitly outlined in Etel Solingen ed., *Sanctions, Statecraft, and Nuclear Proliferation* (Cambridge, UK: Cambridge University Press, 2012).

7 This report makes use of the “gestalt shift” metaphor in cognitive science. For discussion of gestalt shifts in the history of scientific theories, see Edmond Wright, “Discussion: Gestalt Switching: Hanson, Aronson, and Harre,” *Philosophy of Science*, Vol. 59 (1992), pp. 480-486, and Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962). For gestalt shifts in moral perception, see Peggy DesAutels, “Gestalt Shifts in Moral Perception,” *Philosophy Faculty Publications*, Paper 74, 1996.

8 See remarks of Stephen Biegun, U.S. Special Representative for North Korea, in conversation with Helene Cooper, at 2019 Carnegie International Nuclear Policy Conference, Washington, D.C. See also, Alex Ward, “A Top U.S. Diplomat Just Laid Out the New Approach to North Korea, and It’s Doomed,” *Vox*, Mar. 11, 2019; and Vali Nasr, “Trump’s Maximum Pressure Strategy for Iran and North Korea will Fail,” *Defense One*, Oct. 4, 2018 (accessed February 26, 2019).

The second implication is that the primary function of U.S. diplomatic concessions to North Korea may not be to “reward” it for nuclear rollback, but to invest an *American stake* in the political changes promised. No matter how lavish a “prosperous future” is offered to North Korea in exchange for nuclear rollback,<sup>9</sup> no rational regime would agree to go down that path without concurrently seeing some American skin in the game.<sup>10</sup> That stake can come in many forms, and may involve larger investments from our regional allies than directly from the United States. But I will argue that committed political change is fundamentally a physical process—it requires states to make physical changes on the ground that an uncommitted state would be unlikely to accept, and that are costly or difficult to reverse. The art of physical commitment is one of building new sources of shared vested interest and mutual leverage that promote continued benign engagement in the future. These physical sources of shared interest come most naturally in the form of shared technological infrastructure.

Taken together, the importance of time structure and physical commitment suggests an alternate conceptual framework, which I will call the *techno-diplomacy paradigm of political futures*.<sup>11</sup> I use the term *techno-diplomacy* as an explicit call for practitioners to combine technical and political analysis *throughout* the diplomatic process. In short: when historically-adversarial states seek positive political change, they might overcome credibility deficits by inscribing the changes they seek into collaborative technological infrastructures that embody them. But inscribing political change into these inert media requires a technical understanding of how different physical arrangements can redistribute shared interest and mutual leverage in different ways. It thus demands a deeper and more sustained collaboration between technologists and diplomats than often has taken place.

When we turn this techno-diplomatic lens on the history of past engage-

---

9 Lesley Wroughton et al., “North Korea ‘Brimming with Prosperity’ if it Denuclearizes, Says Mike Pompeo,” *The Independent*, May 12, 2018 (accessed February 26, 2019).

10 Vipin Narang et al., “The Trump-Kim Summit and North Korean Denuclearization: The Good, the Bad and the Ugly,” *War on the Rocks*, March 14, 2018 (accessed February 26, 2019).

11 My term *techno-diplomacy* is a variant of Gabrielle Hecht’s term “techno-politics.” See Hecht, *Radiance of France* (Cambridge, MA: MIT Press, 2009). Earlier use of the term *techno-diplomacy* dates back to Glenn Schweitzer, *Techno-diplomacy: US-Soviet Confrontations in Science and Technology* (New York, NY: Springer 1989). The conceptual content of techno-diplomacy as it is deployed here is articulated with remarkable clarity in Najmedin Meshkati’s concept of “tight integration” between national technical infrastructures in a letter to the editor of *The New York Times*, entitled “Isolating Nuclear Iran Endangers World Health,” May 7, 1995, pp. 4.14.

ments with North Korea, grave missed opportunities come to light. Principal among them was offered in the 1994 Agreed Framework (AF), which centered around a “reactor trade.”<sup>12</sup> In that document, North Korea agreed to dismantle its plutonium reactors in exchange for two large civilian light water reactors (LWRs) from the West. The North’s historical preference for LWRs has mystified Western nonproliferation analysts, many of whom see infrastructure investment as a “carrot” to reward nuclear rollback. These analysts point out (correctly) that fossil fuel power plants (FFPPs) would have been a much better “carrot,”<sup>13</sup> and suggest that the regime’s seemingly quixotic demand for LWRs was merely a diversion. But when we take a technically informed look at the physical realities entailed in LWR construction and operation, and place those alongside the political dilemmas at the heart of the nuclear crisis, a different historical picture emerges. The LWR fuel cycle is one of the most globalized technologies in existence,<sup>14</sup> and inevitably draws reactor-operating countries into international collaboration and interdependence networks associated with things like fuel supply, reactor operation and safety. If one of the political goals of the AF was to reintegrate North Korea into the global community, building large Western LWRs north of the Demilitarized Zone (DMZ) would have gone much further than FFPPs in achieving that goal, and it may have obviated the regime’s perceived need for nuclear weapons. It also would have given the international community new sources of leverage over the regime’s subsequent nuclear choices by tying its energy generation capabilities into tightly controlled international fuel and knowledge markets. But this prospect vanishes from our analysis when we black box energy technology as simply a “carrot.”

The distinction between LWRs and FFPPs as energy infrastructures provides an ideal “toy model” for illuminating the conceptual shift between the *inducement* and *techno-diplomacy* paradigms, and it will be a central example for illustrating the ideas presented here. When LWRs and FFPPs

---

12 Christopher Lawrence, “Normalization by Other Means: The Failed Techno-diplomacy of Light Water Reactor Export in the North Korean Nuclear Crisis,” working paper, 2018 (accessed February 26, 2019).

13 For technical analysis of LWRs versus FFPPs for North Korea, see Peter Hayes, “Should the US Provide LWRs to North Korea?” (Nautilus Pacific Research, 1993) (accessed February 26, 2019). For political analysis, see Victor Galinsky et al., “These North Korean Reactors Light Up Danger Signals,” *The Washington Post*, August 4, 2002 (accessed February 26, 2019).

14 Richard Lester et al., “The Growth of Nuclear Power: Drivers and Constraints,” *Daedalus* (Fall, 2009), pp. 19-30. See pp. 20-21.

are compared as candidates for export to North Korea during the AF era, the very same attributes of LWRs figure as cons under *inducement* and pros under *techno-diplomacy*. Extensive research has been conducted on the technical and diplomatic history of the AF, and I have reported lessons drawn about the successes and failures of previous diplomacy with North Korea elsewhere in detail.<sup>15</sup> Key among them are that North Korea's nuclear behavior became correlated with the political and financial status of the LWR project, and that the choice of technology—LWRs over FFPPs—mattered as much or more than the megawatts that would be generated by them. During its eight years in force, the AF produced a sustained platform for engaging North Korea,<sup>16</sup> and physically rolled back its nuclear weapons infrastructure further than any other U.S. policy to date.<sup>17</sup> While many analysts today brush it off as “failed engagement,” these analysts overlook the AF's partial, yet singular success, and misinterpret the mechanisms for its ultimate collapse.

The prospect of building Western LWRs in North Korea may be unrealistic today, but the West may be overlooking similar opportunities for progress with North Korea. The most obvious prospects may be contained in Moon Jae-in's North-South peace process and “New Economic Map.” Moon has proposed building shared trade and transit infrastructure that would connect South Korea to the Asian mainland through North Korea.<sup>18</sup> In principle, this could inextricably tie North Korea into the regional and global economy by creating enduring economic benefits to regional actors that would depend on continued political stability in the North. It would also create previously unimaginable inroads—both literally and metaphorically—that could gradually transform North Korean society and politics. There may also be opportunities for direct U.S. collaboration to rebuild North Korea's energy grid and mining infrastructure, so that North Korea can bring its enormous mineral reserves into the world economy. But recognizing and pursuing the opportunities at hand requires a theory of engagement that is informed by the successes and failures of past diplomatic

---

15 Lawrence, “Normalization.”

16 See: Charles Kartman et al., “The History of KEDO: 1994-2006.” (Stanford, CA: Center for International Security and Cooperation (CISAC), Stanford University, 2012) (accessed February 26, 2019).

17 Siegfried Hecker, Chaim Braun, Chris Lawrence, “North Korea's Stockpiles of Fissile Material,” *Korea Observer*, Vol. 47, No. 4 (2016), pp. 721-749 (accessed February 26, 2019).

18 Bak Byeong-ryul, “‘New Economic Map on the Peninsula’: President Moons Pledge in the Spotlight,” *The Kyunghyang Shinmun*, April 24, 2018 (accessed February 26, 2019).



efforts, and that attends to the physical realities of diplomatic concessions.

My focus in this discussion paper on the potential role of infrastructure development in diplomacy is not intended to suggest a diminished importance of changes to military posture and deployment. If any progress in engagement is to proceed, changes in military posture will almost certainly be necessary. An extensive literature exists on confidence building for maintaining peace and mitigating arms races,<sup>19</sup> and particular measures that shift reliance to defensive military postures and technologies (in favor of offensive ones) will likely have application for engaging North Korea.<sup>20</sup> I suggest that these can be supplemented by building other forms of interdependence outside the military realm.

This document proceeds as follows. I first outline the basic distinction between the *inducement* and *techno-diplomacy* paradigms of nonproliferation engagement, and highlight the communicative/observational function of concessions under *techno-diplomacy*. I argue that for proposed diplomatic concessions to effectively probe North Korea's long-term nuclear preferences, they must be designed to speak credibly about our own through physical action. While this inevitably involves risk, those risks can be better managed than those associated with continued "maximum pressure" on North Korea. I then revisit the AF era to extract lessons from history, outlining the distinct political realities that would be associated with building LWRs versus FFPPs in North Korea, and the time structure through which the LWR construction process was to be synchronized with nuclear rollback steps. The *techno-diplomatic* framework is then applied to examine current diplomatic opportunities, and how the two Korea's might physically alter East Asian political relations in ways consistent with a nuclear-free peninsula. The conceptual distinction between *techno-diplomacy* and *inducement* is then further clarified with a list of key points where they offer opposite policy prescriptions for diplomacy with North Korea. Finally, I outline an iterative four-step approach to explore the prospect of North

---

19 For instance, see: Michael Krepon, ed., *A Handbook on Confidence Building Measures for Regional Security*. (Washington D.C.: Stimson Center, 1998).

20 Charles Knight, "In Support of a Korean Peace Regime: The Constructive Role of Confidence-building Defense Approaches for Military Modernization and Restructuring," working paper, Feb. 2019.

Korea's denuclearization through *techno-diplomatic* "give and take,"<sup>21</sup> while managing risks to U.S. security and alliances.

---

21 The phrase "diplomatic give and take" was coined by Leon Sigal, and suggests a concept of diplomacy through which states communicate and observe each other's intentions iteratively through concessions. An *iterative Techno-diplomacy* approach simply reapplies Sigal's concept, but added attention to a physical description of concessions traded. See Sigal, in *Disarming Strangers* (Princeton, NJ: Princeton University Press, 1998).



## 2. A Theory of Engagement with North Korea

This document does not advance a fully-formed roadmap for denuclearizing North Korea, nor a particular theory about the regime's long-term intent. Rather, it offers a conceptual rubric for practitioners to construct that roadmap as information is gathered in the early stages of engagement. The truth is we don't presently know what North Korea's prevailing preferences are, nor how nuclear weapons or international relations fit into its vision of the future. A primary function of diplomacy is to discern those preferences, and to credibly demonstrate and pursue our own. This requires a calculated agnosticism on the part of diplomats, who must hold in their minds competing hypotheses of regime preferences, and offer choices to the regime that incrementally render those preferences visible. If the U.S. enters negotiations rigidly committed to a particular interpretation or roadmap, then the regime's observable choices among those limited options will bear little information about its ultimate preferences.

Consider, for instance, previous U.S. policy that the only path forward is for North Korea to unilaterally dismantle its nuclear weapons *up front* and hope to receive rewards in the future, or else it will face continued “maximum pressure.”<sup>22</sup> Due to the security challenges that currently exist on the peninsula, no sane regime in North Korea would ever accept the first option, regardless of whether it truly preferred an improved relationship with the US over keeping its nuclear weapons indefinitely (see Section 2.1 below). The fact that the regime has instead chosen the singular remaining option—to weather international pressure, continue deploying ballistic missiles<sup>23</sup> and keep its nuclear stockpiles at undisclosed locations<sup>24</sup>—tells us nothing about whether it has a conditional willingness to give up nuclear weapons in exchange for a new relationship. On the other hand, the fact that the regime took some symbolic nuclear rollback steps in 2018 is equally uninformative. Even a nuclear-determined regime may be willing

22 Gardiner Harris, “Pompeo Hails Talks with North Korea, but Says Sanctions Must Continue.” *New York Times*, September 27, 2018 (accessed February 26, 2019).

23 Joseph Bermudez, “Undeclared North Korea: Missile Operating Bases Revealed.” *Beyond Parallel*, Center for Strategic and International Studies, November 12, 2018 (accessed February 26, 2019).

24 Siegfried Hecker, “Why Insisting on a North Korean Nuclear Declaration Up Front is a Big Mistake.” *38North.org*, November 28, 2018 (accessed February 26, 2019).

to collapse a few nuclear test tunnels,<sup>25</sup> which can easily be redug elsewhere, if it helps to temporarily lighten the load of sanctions.

*If the regime trades nuclear weapons for written US commitments to future political changes, it cannot rationally expect the US to follow through on those commitments, once it has given up its only bargaining chip.*

A better way to discern the regime's long-term preferences would be to hold open a range of plausible hypotheses about those preferences, and offer the regime credible and observable choices that can help us differentiate between the competing hypotheses. Then, as information is exchanged in the engagement process, practitioners can incrementally update their hypotheses, and how

plausible they consider them to be. This iterative process of “diplomatic give and take” can help the US gradually accumulate more information about the regime's goals, and adjust U.S. posture to pursue its own goals in a more informed way.

Plausible hypotheses about North Korean intent can be parsed around the binary question that is central to U.S. nonproliferation policy (see Table 1):

*Is North Korea **determined** to remain a nuclear weapons state? Or is its nuclear status **conditional** on attributes of its international environment that the United States has the power and willingness to change over time?*

Many analysts offer overconfident answers to this question, and creatively fill in the other elements of their hypotheses around their answer in ways that aren't necessarily supported by the observable evidence. Some are convinced that the regime has staked its future and political identity on becoming a nuclear weapons state (NWS),<sup>26</sup> and believe the regime will seek to normalize its current nuclear status.<sup>27</sup> Perhaps it will also deploy intercontinental ballistic missiles (ICBMs) targeting the U.S. homeland to

25 “North Korea Nuclear Test Tunnels at Punggye-ri ‘Destroyed,’” BBC News, May 24, 2018 (accessed February 26, 2019).

26 See, for example, Pollack, *No Exit*.

27 See, for example, Richard Bush, “North Korea's Bid for Security Pledge May be a Trap,” Brookings Institution, August 7, 2018 (accessed February 26, 2019).

deter a U.S. attack, or even attempt to “de-couple” the U.S.-RoK alliance.<sup>28</sup> Many of these same analysts believe that the regime fears integration with the outside world because it may loosen its internal grip on power.<sup>29</sup> These are all plausible hypotheses that are consistent with a hypothetical regime that is *determined* to maintain its long-range nuclear weapons capability indefinitely, irrespective of U.S. behavior going forward (see Table 1, left column).

More optimistic analysts suggest that the regime’s perceived need for nuclear weapons is driven by its current security environment,<sup>30</sup> and perhaps by a desire to trade those weapons away for a better relationship with the outside world.<sup>31</sup> The regime may see the prospect of economic failure as a greater threat to its long-term survival than U.S. aggression,<sup>32</sup> or else it may desire a better relationship with the United States to balance a rising China.<sup>33</sup> While a sudden opening of its economy may threaten its grip on power in the short term, a more controlled economic opening modeled after other Asian dictatorships<sup>34</sup> may be a better way to balance short- and long-term threats to the regime.<sup>35</sup>

These possibilities give the United States good reasons to explore whether it might be able to ultimately persuade North Korea to roll back its nuclear weapons program (see Table 1, right column).

Two points of clarification are in order here. First, note that parsing plausible regime intentions into two groups does not suggest that there are only two possibilities. Rather it is a methodological choice to parse the space of possibilities based on whether they are consistent with different answers

---

28 See, for example, David Straub, “The South Korea-US Alliance: Responding to North Korea’s ICBM Test,” *The Diplomat*, July 7, 2017 (accessed February 26, 2019).

29 See, for example, Arnold Fang, “North Korea’s Self-imposed Isolation,” *The Diplomat*, March 15, 2016 (accessed February 26, 2019).

30 See, e.g., Narang et al., “Trump-Kim Summit.”

31 See, e.g., Fendos, “What North Korea Really Wants.”

32 See, e.g., remarks of Jean Lee at the 2018 Korea Global Forum, November 15, 2018.

33 See, e.g., Robert Carlin et al., “What North Korea Really Wants,” *The Washington Post*, January 27, 2007 (accessed February 26, 2019).

34 See, e.g., Bradley Babson, “How Vietnam’s Experience May be Helpful to North Korea Today,” 38North.org, February 7, 2019 (accessed February 26, 2019).

35 For commentary on the potential for ‘slow opening’ of North Korean economy, see Ruediger Frank, “North Korea’s Economic Policy in 2018 and Beyond: Reforms Inevitable, Delays Possible,” 38North.org, August 8, 2018 (accessed February 26, 2019).

**Table 1: Common Hypotheses about North Korean Intent**

<p style="text-align: center;"><b>Determined Nuclear Weapons State</b></p>	<p style="text-align: center;"><b>Conditional Nuclear Weapons State</b></p>
<p>Perhaps the regime will seek to normalize its status as a nuclear weapons state (see, e.g., footnote 27).</p> <p>The regime could attempt to use its ICBM capability to decouple the U.S.-RoK alliance and drive U.S. troops off the peninsula (see, e.g., footnote 28).</p> <p>Maybe the regime will be satisfied with a regional nuclear capability to deter U.S. invasion.</p> <p>The regime could demand concessions from the United States that it finds unacceptable, such as the end of extended deterrence in East Asia (see, e.g., footnote 38).</p> <p>The regime sees economic and cultural engagement with the outside as a threat to its grip on domestic power, and hence will shun major outside investment in its economy (see, e.g., footnote 29).</p> <p>The regime sees nuclear weapons as bargaining chip to extract aid and other benefits from the U.S., and will keep them indefinitely so as to keep extracting aid.</p>	<p>The regime may see a failing economy as a greater long-term threat to its survival than U.S. aggression (see, e.g., footnote 32).</p> <p>The regime may desire a normalized political relationship with the United States more than nuclear weapons in the long-term (see, e.g., footnote 31).</p> <p>The regime may plan to pursue a slow economic opening modeled after China or Vietnam (see, e.g., footnote 34).</p> <p>The regime may desire a changed role for U.S. troops on the peninsula, perhaps to balance a rising China (see, e.g., footnote 33).</p> <p>The regime's perceived need for nuclear weapons is primarily driven by its security environment, which the United States has the power to change (see, e.g., footnote 39).</p> <p>The regime sees nuclear weapons as bargaining chip to draw the United States into engagement in hopes to change the relationship (see, e.g., footnote 40). Once the relationship changes, the regime will have achieved its goal and no longer need nuclear weapons.</p>

to the binary *yes or no* question asked above. Second, several important propositions are consistent with all hypotheses listed in Table 1, such as the common refrain that ‘the regime’s top goal is its own survival.’<sup>36</sup> The two groups listed in Table 1 differ not on whether the regime seeks long-term survival, but on what the regime views as the requirements for its survival—namely whether it views U.S. invasion or continued economic and political isolation as its biggest long-term threat.

It is tempting to believe that the United States must have a confident understanding of North Korea’s intent before entering negotiations, and that our policy depends from the start on that answer. It is asserted that policies designed to engage North Korea may compromise our security or diplomatic stance if they fail to reach full denuclearization. But that is not necessarily true, and there are policy options that, when compared with the previous “maximum pressure” campaign, can better explore the regime’s willingness to denuclearize while improving U.S. security if they will not.<sup>37</sup> As noted above, this depends on offering the regime choices that help differentiate whether its nuclear status is *determined* or *conditional* (left and right sides of Table 1, respectively). However, shaping those differentiating choices, and accrediting them in the eyes of the North Korean regime, requires a theory of engagement that is symmetric,<sup>38</sup> and which recognizes that the regime must make *its own* judgements, using partial information, about U.S. intentions and plans in order to proceed down any path that alters its nuclear status. This is why *techno-diplomacy* focuses on building the credible option of political change for North Korea, rather than rewarding or punishing North Korea in the short term.

---

36 See, e.g., Zachary Cohen, “CIA: North Korean Leader Kim Jong-un isn’t Crazy,” CNN Politics, October 6, 2017 (accessed February 26, 2019).

37 For an excellent analysis of U.S. interests on the Korean peninsula if denuclearization is impossible, see Adam Mount and Andrea Berger, “Report of the International Study Group on North Korea,” (Federation of American Scientists, 2019).

38 I use the term *symmetry* to refer to the balance of uncertainty. Some international relations scholarship uses the terms “symmetric” and “asymmetric” to refer to the balance of power, which is a different use of the term.

## 2.1. The Commitment Problem at the Heart of the North Korean Nuclear Crisis

There are obvious reasons why credibility would be a central issue for engagement with North Korea. Questions about the regime's credibility are off-noted and important, but lending credibility to U.S. commitments may be an even larger challenge. If the regime does indeed seek a new relationship with the outside world, that would inevitably involve long-term commitments on the part of the United States—not just security assurances and the lifting of sanctions, but commitments to maintain that changed relationship and allow North Korea to slowly integrate with the world economy. However, the only reason the United States currently has for engaging North Korea is our fear of its nuclear weapons program. If the regime were to give up its nuclear capability in exchange for *written* commitments from the United States to maintain a more benign relationship into the future, it could not rationally expect the United States to follow through on those commitments, once it had given up what has proven to be its only bargaining chip. Something more concrete and durable is needed to accredit U.S. commitments.

International relations scholarship offers a simple model for understanding credibility dilemmas of this sort. In the words of James Fearon, a *commitment problem* is a “situation in which a mutually-preferable bargain is unobtainable because one or more sides would later have an incentive to renege on the terms.”<sup>39</sup> Note here the dimension of time—it's not the present incentive structure that precludes a bargain, but rather a foreseeable change in the incentive structure down the road that makes a written commitment at time  $t = 0$  not credible. In the case of the North Korean nuclear crisis, the changing incentive structure would be directly tied to the nuclear rollback steps sought by the United States.<sup>40</sup> However, bargaining theorists suggest

39 James Fearon, “Rationalist Explanations for War,” *International Organization*, Vol. 49, No. 3 (1995), pp. 379-414. Some theorists will note that Fearon distinguishes the *commitment problem* from *information problems* in which two sides fail to credibly communicate or observe intentions. However, he suggests that, in practice, most bargaining impasses mix these two “ideal types” of credibility challenge. I argue that the North Korean nuclear crisis is characterized by a *commitment problem* that is complicated by *information problems*, and for the purposes of this paper, the *commitment problem* will refer to this confluence of changing incentive structures and communicative challenges.

40 This is known as an *endogenous commitment problem*. See James Fearon, “Bargaining over Objects that Influence Future Bargaining Power,” *Annual Proceedings of the the American Political Science Association*, Washington, D.C.: August 28-31, 1997.

that states can add credibility to their commitments by carrying out concrete, observable actions that are consistent with those commitments, but which incur costs that an uncommitted state would be unlikely to accept. These committed gestures are referred to as *costly signals*.<sup>41</sup>

Just as the *commitment problem* hinges on the time dimension, *costly signals* have a discernible time structure that is congruent with that of the commitment problem. Fearon parses out this time structure by distinguishing between *sunk costs* that are irreversibly incurred in the act of making a commitment, and *tied-hands costs* that are set in place by the committed act, but which are only incurred in the event that the commitment is later broken. This time-directionality will be a key consideration for overcoming the commitment problem at the heart of the North Korean nuclear crisis, and it differs considerably from that of *inducement* diplomacy.

## 2.2. From Carrots and Sticks to Techno-Political Futures

The *inducement paradigm of carrots and sticks* is a popular vision of American diplomacy that sees all U.S. policy options as condensed along a one-dimensional axis.<sup>42</sup> On one end, we have more sanctions and isolation—negative *inducements* we can use to coerce the regime into doing what we want. On the other end we have things like energy assistance, food aid, security assurances—these are the positive *inducements* we can offer to bribe North Korea into giving up nuclear weapons. To the extent that there has been debate in the West about how to engage North Korea over the years, it has often focused on how to get the right balance of carrots and sticks, and on how to maximize their effectiveness. It is widely recognized that the regime is unlikely to give up its nuclear weapons without receiving some benefits in return,<sup>43</sup> but there is little discussion about the technical and political realities entailed in implementing those “inducements,” nor

---

41 James Fearon, “Signaling Foreign Policy Interests: Tying Hands versus Sinking Costs,” *Journal of Conflict Resolution*, Vol. 41, No. 1 (1997), pp. 68-90.

42 Solingen, ed., *Sanctions*.

43 See, e.g., Missy Ryan, “What will U.S. Give North Korea in Exchange for Nukes? Ahead of Summit, Questions Loom,” *The Washington Post*, May 31, 2018 (accessed February 26, 2019).



of how different concessions would speak differently about the political future.

The main conceptual thread of the *inducement paradigm* is a focus on the content of *inducements*—their intrinsic utility or cost to the target state—and on linking those to the moral content of *previous* target state behavior. To the extent that credibility is at issue under *inducement*, it relates to the moral accounting of previous target state behaviors, and to whether the utility or punishment of appropriate *inducements* themselves will actually be received by the target state. Practitioners may seek to buttress credibility with summits or written commitments, but if they fail to distinguish between costless written words and physical committed action, then they won't address the steep *commitment problem* at the heart of the North Korean nuclear crisis. *Inducement* diplomacy therefore leads very predictably to deadlock.

Recent debates have begun to grapple with the importance of the time dimension in our current standoff with North Korea. While the United States has assured the regime that denuclearization will be rewarded with security and economic benefits after the fact, many analysts recognize that U.S. assurances lack credibility.<sup>44</sup> They point to North Korea's demand for "corresponding measures" to take place alongside nuclear rollback steps, and suggest that the United States should consider a "phased approach."<sup>45</sup> But missing from these debates is the distinction between concessions that "reward" the regime for previous steps (*positive inducements*), and ones that would subsequently promote continued engagement from the United States and the international community going forward (and thereby *signal* commitment to that continued engagement). Even if North Korea is offered incremental concessions for each nuclear rollback step, those concessions will say little about the political future if they only come in the form of transient rewards that can be quickly consumed, but have no bearing on future decision making. If the fundamental stake in engaging North Korea is the future political relationship, then U.S. measures may only influence North Korean decision making if they speak credibly about the relative probabilities of distinct political futures.

44 See Narang et al., "The Trump-Kim Summit."

45 See, e.g., Daniel Wertz, "[How to Use Sanctions as a Lever, Not Just a Hammer: A Proposal for Phased Sanctions Relief](#)," 38North.org, June 8, 2018 (accessed February 26, 2019).



## Irreversible Processes and the “Arrow of Time”

An important premise of *techno-diplomacy* is that negotiators can leverage *time-irreversible* physical processes, such as construction or dismantlement of technological infrastructure, as bargaining chips and signals of long-term national intent. But how would they deploy or interpret those signals without a detailed technical understanding of the physical processes themselves? Nowhere in the diplomat’s language do we find words like “entropy” or “the second law of thermodynamics.” Indeed, I will argue in Section 3.3 that some *techno-diplomatic* steps were poorly planned during the Agreed Framework era, and their delayed implementation may have contributed to the Framework’s ultimate collapse.

Yet time directionality is one of the most intuitive features of our everyday lives. When the physicist Arthur Eddington famously coined the phrase “arrow of time” for a non-technical audience (see footnote 48), he emphasized that it is both “vividly recognized by consciousness, and insisted upon by our reasoning faculty.” In fact, we rely on that intuition in everyday life, for who would be able to get through the day without, say, dropping a wine glass, overcoming friction, spilling milk or garbling a message? The simple experience of breaking an egg teaches us much of what we need to know about time-directionality, and we learn early in life that cleaning up these messes takes more time and effort than avoiding them in the first place.

Diplomats, meanwhile, have extremely sophisticated understandings of the worlds they negotiate, and often a surprisingly detailed grasp of the technical choices at stake. It is no wonder, then, that while their language differs from that of the technologist or physicist, it is nevertheless replete with vivid descriptions of how certain technological developments might “hardwire us all in,” offer a “physical guarantee,” “let the horse out of the barn,” require “action for action,” or “degenerate to heaps of scrap metal.” These evocative images have permeated previous episodes of engagement with North Korea, suggesting that time-directionality is not some arcane scientific concept remote from the negotiating table, but a primary stake in those negotiations. Where diplomats’ knowledge might be supplemented is in the technical planning of implementation. We will explore the importance of implementation in Section. 3.3.

*Techno-diplomacy* represents a fundamental conceptual break from *inducement*. Instead of focusing on rewarding or punishing past or present behavior, *techno-diplomatic* measures are designed to set the stage for, and ultimately bring about, changes in political relationships that are consistent with nonproliferation goals. Toward that end, a key analytical move is to recognize that any political reality has a physical embodiment—whether it is manifest in shared technological infrastructure, trade or transit networks, or military deployments—that is beholden to physical law. Since some aspects of physical reality are more difficult and costly to change than others, political change is path dependent and time-consuming. For instance, if two states decide to become more frequent trading partners, that political decision will become more difficult to reverse as it becomes ingrained into trade infrastructures and daily habits of political constituencies over time. Those infrastructures will, in turn, redistribute political agency, shared interest and mutual leverage among actors in ways that depend on how the technology works.

The conceptual thrust of *techno-diplomacy* can be concisely stated in two fundamental principles. The first principle suggests that diplomatic concessions speak about the political future through *time-directionality*:

*Definition 1* – a diplomatic concession is **time-directional** if either its implementation or its reversal would exact costs on the conceding state.

This is analogous to the *costly signals* concept discussed in the previous subsection, where the magnitude of cost serves to gauge the extent of commitment, but it also draws from intuitive principles in thermodynamics and information theory (see Aside Box).<sup>46</sup> Costs can come in several forms, such as material or economic costs; risks posed to economic or security interests; or irreversible transfers of sensitive information. But in any case, the focus is shifted toward the cost-utility to the conceding state, and the *time directionality* is governed as much by physical law as by political or juridical norms.

---

46 For the “arrow of time” and time-irreversible processes, see Arthur Eddington, “Time’s Arrow” in *The Nature of the Physical World* (Ann Arbor, MI: 1958), pp. 68-70; Hans Reichenbach, *The Direction of Time* (New York: Dover, 1956); Ilya Prigogine, *From Being To Becoming* (New York: Freeman, 1981).

If diplomatic concessions constitute *time-directional* physical steps, that suggests they point toward some physical reality that is distinct from the present one. But how does this relate to changing political relationships? This brings us to the second principle of techno-diplomacy, which is *embodiment*:

*Definition 2* – political relationships are **embodied** in technological infrastructures that choreograph human behavior, distribute agency and risk amongst political actors, and constitute shared interest and mutual leverage between them. Distinct technological arrangements constitute distinct political realities.

This second principle invites us to consider the shape and character of technology itself, and how it distributes agency among actors and across space and time. For instance, modern railways connecting cities *within* states may have little effect on political relationships between those states, whereas railways connecting cities *between* them may promote cultural and economic exchange, and require continued engagement to coordinate and maintain. Similarly, shared energy infrastructures that require different technological contributions from different states (as in a ‘distribution of labor’) can promote continued collaboration more effectively than infrastructures that can be produced and maintained by each state indigenously. Capital- or knowledge-intensive infrastructures tend to be more inert and collaborative than cheaper and simpler ones. We will see these distinctions more clearly in the different infrastructures envisioned during the AF era, and in those that are being proposed today in Moon Jae-in’s “New Economic Map.”

Putting these two principles together suggests a way in which diplomatic concessions can be deployed to manage the credibility of a nominally-desired political future—namely, by constituting *time-directional* physical steps toward the *physical embodiment* of that political future, and away from more undesirable political arrangements. I will later suggest how these can be arranged into a *physical path* for political change.

## 2.3. Exploring Nuclear Preferences

Let's return now to the central goal of U.S. diplomacy with North Korea: exploring the prospect of denuclearization. I argued in Section 2.0 that this will require offering the regime “differentiating choices” that help distinguish between the left and right sides of Table 1. We can now refine this notion into an operational concept for designing “corresponding measures” to incrementally probe North Korea’s long-term political and nuclear preferences. Due to the commitment problem that defines the nuclear crisis, in order to arrange a *differentiating choice* we must overcome a dual credibility challenge that requires *time-directional* physical actions from both sides to overcome. So a *differentiator* must be *symmetric*:

*Definition 3* — a **differentiator** is a proposed exchange of reciprocal *time-directional* diplomatic concessions that North Korea is unlikely to accept/implement if it is determined to retain nuclear weapons indefinitely, but more likely to accept if its current nuclear status is conditional.

The obvious follow-on question from here is: what *are* those concessions? This is unknown prior to engagement. Are the physical changes needed primarily in the realm of military deployments, or does the regime seek shared infrastructure investments that shift the geopolitical landscape? If the latter, then does it seek transit infrastructure connecting it to the outside world, or shared energy infrastructure? Is South Korean investment sufficient, or should the United States invest directly? These are questions to be incrementally answered in the diplomatic process. But we are helped by the fact that plausible hypotheses consistent with possible denuclearization all posit a hypothetical North Korean desire to slowly improve its political relationships with the United States and its allies. This suggests a fairly well-defined set of corresponding measures to offer North Korea, namely ones that constitute physical investments on the part of the United States or its allies in continued engagement going forward.

The problem with these differentiators is that they are inherently risky. Each exchange of concessions doesn't *prove* both sides' intent, but simply shifts the balance of likelihood one way or another. This is why the engagement process is incremental, with steps that are designed to manage risk

along the way. But the good news is, many of the information gains associated with *techno-diplomacy* offer security benefits that can offset the risks associated with investing in North Korea.

## 2.4. Managing Nuclear Risks

Given that some uncertainty about North Korea's intentions will persist well into the engagement process, diplomacy must be designed to manage risks to U.S. security and alliances even if denuclearization is impossible. Since managing risk is inherently a comparative task,<sup>47</sup> this section briefly outlines the risks associated with two previous U.S. policies toward North Korea as a baseline for comparison. Each can be characterized as a policy of *inducing* the regime to disarm through sanctions and promised rewards, and as one that neglects the credibility deficits of written or spoken U.S. assurances to North Korea. In addition to leaving North Korea's long-term intentions unobserved, both policies fail to address important risks to U.S. interests.

The most recent policy is President Trump's "Maximum Pressure," which was explicitly designed to bring the regime to the edge of collapse through economic sanctions in order to *induce* unilateral disarmament. The flip side of this policy was to promise that "the road to a prosperous future runs through the gate of denuclearization."<sup>48</sup> The risks that "Maximum Pressure" posed to United States and regional security became apparent throughout 2017, when the United States and North Korea appeared on the brink of nuclear war, and the regime conducted its most advanced nuclear and missile tests. Some analysts have pointed out that regime collapse itself would be a regional security disaster, since North Korea has around a hundred thousand special-operations troops across the country. These troops are unlikely to acquiesce to U.S. occupation if the regime collapses, and could spell an insurgency nightmare comparable to what unfolded in Iraq after the United States toppled Saddam Hussein.<sup>49</sup> Thus, any policy that

---

47 Siegfried Hecker et al., "A Technically-informed Roadmap for North Korea's Denuclearization." CISAC, 2018 (accessed February 26, 2019).

48 Remarks of Mark Knapper, Dep. Asst. Sec. of State for Japan and Korea, at the Wilson Center Korea Global Forum 2018, Nov. 15, 2018.

49 For outline of dangers of regime collapse, see remarks of Joel Wit, "Freezing North Korea's Nuclear Program: Part III", ICAS Spring Symposium, May 26, 2016 (accessed February 26, 2019).

enhances the risks of either war or regime collapse presents a grave threat to regional security.<sup>50</sup>

Western analysts may have overlooked an additional factor that could convert regime instability into a direct threat to the U.S. homeland. North Korea's clandestine uranium enrichment program has introduced large uncertainty into Western estimates of the size and location of North Korea's fissile-material stockpiles.<sup>51</sup> It is well known that terrorist organizations have attempted to obtain highly-enriched uranium (HEU) for use in a terrorist attack on the U.S. homeland. But as it stands, U.S. intelligence has uncovered no evidence that the North Korean regime has sought to sell HEU on the black market.<sup>52</sup> This is probably because the regime understands that nuclear material could be traced back to its origin through forensic techniques, and that selling HEU would create a risk of U.S. retaliation that would destroy the regime. But if Kim Jong-un begins to see his economic woes as an immediate existential threat—a perception that Trump's Maximum Pressure campaign was *designed* to create—then the regime's risk-benefit calculus may shift in favor of selling some HEU on the black market in order to obtain an economic lifeline. In the extreme case that the regime does collapse, the authority structures guarding that material in North Korea would begin to crumble, and U.S. special operations forces would face the harrowing task of rounding up an unguarded HEU stockpile of unknown quantity, at unknown locations, under conditions of political chaos. The North Korean individuals possessing knowledge of those locations—the regime's nuclear scientists and military authorities—might come to see some unaccounted material as a “golden parachute,” and potentially sell it to obtain safe passage out of the chaos. In short, a Maximum Pressure policy has the perverse feature that, if it is successful in bringing the regime closer to collapse, its success would *enhance*, rather

---

50 It is tempting to believe that the North's recent turn toward engagement was brought about by Maximum Pressure. This is not a reasonable conclusion for three reasons. First, Maximum Pressure has not been successful at threatening the regime with economic collapse. Rather, its economy has somewhat improved. Second, the shift is in line with what the regime has communicated in Track 1.5 settings for several years, as well as in its propaganda and official statements. Third, it has recently been revealed that the current diplomatic track has been in the making for several years through secret communications between governments in North Korea, South Korea and the US.

51 Hecker, “North Korea's Stockpiles of Fissile Material.”

52 Remarks of Rolf Mowatt-Larssen, 2017 Public Policy and Nuclear Threats Boot Camp, University of California, San Diego, CA, July 23, 2017.

than diminish, the threat that North Korea's fissile material stockpiles pose to the U.S. homeland.

President Trump's Maximum Pressure policy was preceded by the Obama administration's policy of "Strategic Patience," which was essentially a less extreme version of *inducement*. In the words of Daniel Russell, who served Obama as Assistant Secretary of East Asia and Pacific Affairs, the United States "pointed a big bright arrow to the exit sign (from sanctions and isolation), which is denuclearization." But when asked about the credibility of that path, or about the appropriate sequencing of steps in that direction, Secretary Russell dismissed those issues as unimportant: "the regime knows the path it must take toward sanctions relief, and it simply needs to choose to go down that path."<sup>53</sup> The results of this policy speak for themselves: while Strategic Patience was in effect, North Korea made its greatest technical advances toward a nuclear ICBM capability to threaten the U.S. homeland.

The insistence on "full denuclearization up front" that defines previous U.S. policies has also damaged its diplomatic standing and alliances with regional actors. Nearly all other national stakeholders view a phased reciprocated approach as the only realistic path to a nuclear-free Korean Peninsula. In particular, South Korea's Moon Jae-in administration proposes establishing a "virtuous cycle" between economic integration and denuclearization,<sup>54</sup> and to date this path has been blocked by U.S. sanctions policy. As a result, some South Koreans are beginning to view the United States as standing in the way of North-South reconciliation.<sup>55</sup> The present U.S. nonproliferation policy toward North Korea thus became self-isolating due, in part, to the sequencing it prescribes.

If the present campaign of engagement with North Korea moves forward to explore the prospect of denuclearization, it should also pursue three risk-mitigating priorities. First, the United States should seek to maintain a freeze on North Korea's nuclear and long-range missile tests. North

53 Remarks of Daniel Russell, Stanford University, Winter 2016.

54 "Creating a Virtuous Circle with North Korea," *Christian Science Monitor*, July 17, 2017 (accessed February 26, 2019).

55 Christy Lee, "US-South Korea Rift Grows on How to Denuclearize North Korea," *Voice of America News*, August 24, 2018 (accessed February 26, 2019).



Korea is on the cusp of obtaining a long-range ICBM capability, and the challenge of sustaining warhead survival through the re-entry phase of a long-range ballistic trajectory is likely the sole remaining technical barrier to threatening the U.S. homeland. Any additional nuclear or long-range missile test would give North Korean scientists crucial data for overcoming that barrier. Therefore, every month that passes without another test is an unmitigated good for U.S. security. Continuation of the test freeze is also beneficial for preserving the U.S. alliance with South Korea, since a direct ICBM threat to the U.S. homeland could bring the U.S. commitment of extended deterrence into question. Second, the United States should maintain enduring engagement to mitigate the risks of either war or regime collapse, since each would dramatically enhance the threat of nuclear use on the Korean Peninsula or the U.S. homeland. Third, the United States should avoid becoming diplomatically isolated and appearing as a barrier to reconciliation and peace on the Korean Peninsula, because these perceptions pose risks to our regional alliances.

A *techno-diplomatic* approach to engaging North Korea can perform better than *inducement* in all three of these areas. Because it is designed to prolong and accredit the engagement process, it can better preserve the test freeze as the baseline requirement for that process. Since it is fundamentally a *communicative* approach, it can help mitigate the risks of miscommunication that could lead to nuclear use. These benefits became apparent in the history of the 1994 AF, which dramatically rolled back North Korea's emerging plutonium capability, and avoided a potential 'second Korean War' in the 1990s.<sup>56</sup> And today, as we will see, *techno-diplomacy* is more in line with Moon Jae-in's current North-South engagement approach, which is premised on the infrastructure investments of his "New Economic Map."

---

56 Sigal, *Disarming Strangers*.



### 3. Light Water Reactors and the 1994 Agreed Framework

The first North Korean nuclear crisis emerged at the end of the Cold War.<sup>57</sup> North Korea had mastered the gas-cooled reactor (GCR) fuel cycle and was on the verge of being able to produce large amounts of weapons-grade plutonium at its Yongbyon reactors.<sup>58</sup> Meanwhile, it was also losing its most important allies, and its economy was in steep decline. At this time, the regime is believed to have made political normalization with the United States one of its top foreign policy objectives.<sup>59</sup> Yet the United States had little reason to engage with a failing Communist regime it didn't like, other than to stop it from building nuclear weapons. This situation led to a crisis of brinkmanship that almost erupted into a second Korean War. But as the crisis was heating up in 1993, the North Korean regime formally proposed that it would dismantle its proliferation-prone GCRs in exchange for more proliferation-resistant LWRs from the West. The “reactor trade” proposal set off a 14-month period of bilateral negotiations that culminated in the 1994 AF between the United States and North Korea.<sup>60</sup>

The stated end goal of the AF was denuclearization of the Korean Peninsula and normalization of relations between the United States and North Korea. But the main implementation steps were entailed in the “reactor trade,” which was to be carried out in a phased process: North Korea agreed to freeze and slowly dismantle its plutonium reactor complex, and alongside

57 This research is reported in detail in Lawrence, “[Normalization](#).” For general writing on the first nuclear crisis and the Agreed Framework, see Sigal, *Disarming*; Joel Wit et al., *Going Critical: The First North Korean Nuclear Crisis* (Washington, D.C.: Brookings Institution, 2004).

58 See David Albright et al., *Solving the North Korean Nuclear Puzzle* (Washington, D.C.: Institute for Science and International Security, 2000); Siegfried Hecker et al., “North Korean Nuclear Facilities After the Agreed Framework,” (Stanford, CA: CISAC, 2016) (accessed February 26, 2019).

59 For the purposes of this paper, *normalization* will refer to a wholesale change in relations between the US and North Korea: establishment of a peace treaty and normal diplomatic relations; an end to economic sanctions; and a shifted role for U.S. troops on the peninsula. There is ample evidence that in the late 1980s, normalization became a top priority for the Kim regime. See Sigal, *Disarming Strangers*, (Princeton, NJ: Princeton University Press, 1998), p. 24; Don Oberdorfer, *The Two Koreas* (New York: Basic Books, 2014), p. 207; Robert Carlin and John Merrill, “North Korea’s Relations with the United States and Japan,” *Korea 1991: The Road to Peace*, ed. Michael Mazaar (Washington, DC: Institute for International and Strategic Studies, 1991), pp. 118-121; For a South Korean perspective, see Lim Dong-won, *Peacemaker: Twenty Years of Inter-Korean Relations and the North Korean Nuclear Issue* (Stanford CA: Shorenstein Asia Pacific Research Center, Stanford University, 2012) p. 124.

60 Agreed Framework of 21 October 1994 Between the United States of America and the Democratic People’s Republic of Korea, INFCIRC/457.

this a U.S.-led consortium would build two 1000MWe LWRs, of American design, in North Korea. The consortium that was created for this purpose was called the Korean Energy Development Organization (KEDO), and the two main players behind the United States were its allies South Korea and Japan. The site chosen for the reactor construction project was in the Kumho province near the North Korean port city of Sinpo.

The 1994 AF and associated KEDO project constitute the principal historical episode of engagement between the United States and North Korea. The arrangement held together for about eight years—from 1994 to 2002—long enough for the North to divest more than 90 percent of its emerging plutonium capacity, and for KEDO to build about two thirds of the first LWR. From a nonproliferation standpoint, that makes the AF the most successful U.S. policy to date at physically rolling back North Korea’s nuclear weapons capability. But in 2002, the Bush administration discovered that the regime had secretly obtained centrifuge parts from the AQ Kahn network, and accused the regime of “cheating” on the AF by pursuing an alternate route to the bomb.<sup>61</sup> The United States demanded that the LWR project be terminated, and North Korea responded by restarting its remaining 5MWe reactor, and threatening to build nuclear weapons unless the United States abandoned its “hostile policy.” Throughout the subsequent six party talks, the regime prioritized restarting the LWR project as one of its top demands, which it commonly referred to as a “physical guarantee” for confidence building.<sup>62</sup>

North Korea’s fixation on a *particular* form of energy-generation technology—LWRs over FFPPs—has been a perennial mystery throughout previous U.S. engagements with the regime. Energy analysts have tirelessly pointed out that FFPPs would have been a much better solution to North Korea’s energy challenges—they’d have been quicker to build than LWRs, easier for North Korea to operate and maintain, and could be more easily sized to fit North Korea’s aging energy grid.<sup>63</sup> Yet for almost two decades, the North persistently demanded LWRs in exchange for dismantling its indigenous nuclear capabilities. Nonproliferation analysts have tended to brush this

61 Mike Chinoy, “The Scrub,” in *Meltdown: The Inside Story of the North Korean Nuclear Crisis* (New York: St. Martin’s Griffin, 2007).

62 See, e.g., Statement of the North Korean Ministry of Foreign Affairs, Sept. 20, 2006.

63 Hayes, “Should the US Provide LWRs to North Korea?”

off as part of the duplicitous or even incomprehensible behavior of the regime.<sup>64</sup> But when we consider the potential role of infrastructure development as a diplomatic instrument—in other words, as a way to change the physical aspects of a political relationship—a different picture emerges. This section examines the KEDO LWR project as an experiment in *techno-diplomacy*; one that made considerable headway in nuclear rollback, but that ultimately failed at achieving complete denuclearization. I begin by comparing the technical attributes of LWRs and FFPPs, and outlining how the respective merits and drawbacks of each stack up very differently when viewed through the lenses of *inducement* and *techno-diplomacy*. Then I examine how the LWR construction process was to be situated in a diplomatic track to political normalization. Finally, I assess the partial success of the AF at influencing the regime's nuclear behavior, and the signaling failures that likely contributed to its eventual collapse.

### 3.1. Commitment in Physical Space— Building a Political Future

The first nuclear crisis with North Korea has all the markings of the *commitment problem* outlined in Section 2.1. If the regime in North Korea, as it claimed, wanted a normalized political relationship with the United States, that would have involved long-term commitments on the part of the United States to maintain that changed relationship for the indefinite future. Yet the only reason the United States had for engaging at all with North Korea stemmed from its emerging plutonium capability. If the North were to dismantle that plutonium capability in exchange for *written* U.S. commitments to normalization in the future, the regime could not rationally expect the United States to follow through on those commitments once it had given up what had proven to be its only source of bargaining leverage. In other words, the envisioned political future of normalization and denuclearization lacked credibility on paper, and would need to be expressed in an alternate, more physically-inert medium.

Opening up the technical attributes of LWRs and placing them into this *commitment-problem* context illuminates the choice for LWRs over FFPPs.

---

64 See, e.g., testimony of Gary Milhollin, "U.S.-North Korea Nuclear Issues," hearing before the Senate Committee on Energy and Natural Resources (January 19, 1995).

First, if commitment to political change is more credibly demonstrated through costly, time-directional steps that would establish a shared stake in that change, then the financial time-structure of LWR projects aligns closely with that diplomatic imperative. Seventy percent of the cost of nuclear energy is in the up-front capital investment in the reactors themselves, and there are economies-of-scale factors that favor large reactors.<sup>65</sup> Building Western LWRs north of the DMZ would entail a multibillion dollar investment on the part of U.S. allies in North Korea's energy future. That investment would have the potential to produce returns for several decades, but doing so would demand extremely low reactor-operating costs, which in turn rely on the knowledge-intensive task of efficient reactor operation. Low-cost fuel supply, reactor maintenance, and sound in-core fuel management practices for North Korea's reactors would suddenly become very important to a range of international actors, and these are deeply collaborative international endeavors.

The second attribute to consider is the nuclear safety imperative.<sup>66</sup> With proper operation, siting, and liability arrangements, LWRs can be run safely. But this requires international collaboration on safety and liability, and international pools of knowledge derived from decades of operating hours worldwide. If Western reactors were operated unsafely in North Korea, a meltdown would not be simply a North Korean disaster, but a regional or even global one. Managing that risk would require incorporating North Korea into global knowledge networks and liability pools, drawing international actors into a shared interest in reactor safety and liability in North Korea for the decades-long life of those reactors.

Building FPPs in North Korea would represent a much more limited commitment on the part of the international community, and for precisely the same reasons why they would be more convenient as a "carrot." The up-front cost and construction time would be much smaller; the fuel supply would be more expensive and anonymized by market economics; the

---

65 For the economic peculiarities of nuclear power, see Harold Feiveson, "A Skeptic's View of Nuclear Energy," *Daedalus* (Fall 2009), pp. 60-70. For a more optimistic take, see Lester, "The Growth." For LWR economics during the 1970s, see William E. Mooze, *Cost Analysis of Light Water Reactor Plants*, RAND Corporation, R-2304-DOE (1978). For these reasons, investments in nuclear power typically require government subsidy.

66 See Lester, "The Growth"; Richard Maserve, "The Global Nuclear Safety Regime," *Daedalus* (Fall 2009), pp. 100-111.

maintenance and operation would require meager international collaboration; and there would be no international safety imperative. While LWRs were “not the sort of thing a country gives to its enemy,”<sup>67</sup> FFPPs would have been much more consistent with North Korea’s continued economic, political and cultural isolation.

Altogether, Western LWRs on the ground in North Korea would have constituted a profound shift in shared vested interests, mutual risks and vulnerabilities among nations in East Asia. These inert distributions are part of the physical stuff of international relations.

## 3.2. Arrow-of-Time Confidence Building

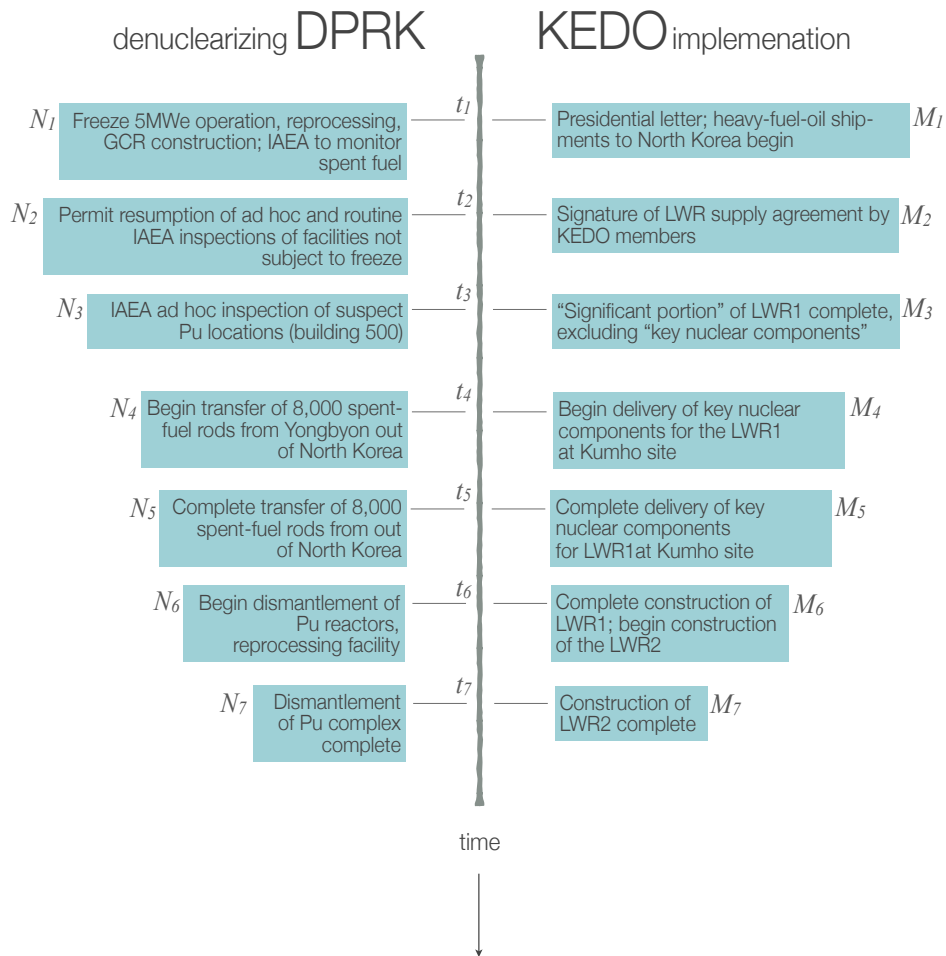
We can now surmise an initial state, and an envisioned end state articulated in the AF. In the initial state of affairs, the United States is engaging with North Korea primarily because it can produce plutonium. In the envisioned end state, North Korea has dismantled that capability, but in its place stand two large Western reactors on North Korean soil, constituting a very different political reality in East Asia. But what about the path between those two realities? How was credibility to be managed along that path? This was one of the more carefully deliberated issues during the negotiations, and the outcome was somewhat paradoxical—the AF itself was *expressly not* a binding written commitment. Rather, it proposed a sequence of synchronized *time-directional* steps to be taken by both sides to manage the credibility of a pending political future—a physical path, in other words, toward denuclearization and normalization. If commitments to that envisioned political future were not credible on paper, then the essential innovation of the AF was to take those commitments *out of juridical space* altogether, and attempt to express them on the ground at Yongbyon and Kumho.

---

67 Comments of former U.S. Ambassador to South Korea Thomas C. Hubbard, interview with author, February 2018.

## Figure 1: Arrow-of-time confidence building

Timeline of reciprocal time-irreversible physical processes outlined in the KEDO LWR Supply Agreement.



North Korean nuclear rollback steps are listed along the left, and KEDO construction steps on the right. Time points in the down direction.

The proposed sequence of physical steps was more precisely spelled out in Annex 3 of the KEDO LWR supply agreement (see Figure 1).<sup>68</sup> North Korea's most *time-directional* steps toward denuclearization were to be spread out across time, and synchronized with the most costly and *time-directional* steps in the LWR construction process. This example gives us a great opportunity to explore the meaning of *time-directionality*. Note that each pair of synchronized steps, taken on their own, would offer little or no benefit to either side if progress along the path were thereafter terminated

68 Agreement on Supply of a Light-Water Reactor Project to the Democratic People's Republic of Korea Between the North Korean Peninsula Energy Development Organization and the Government of the Democratic People's Republic of Korea, December 15, 1995.

prematurely. No one benefits from a partially-built LWR at Kumho, and at any phase in the process North Korea could simply restart its frozen 5MWe reactor if the diplomatic process breaks down. However, each step is either costly to implement or reverse, and offers *pending benefits* to both sides that are *contingent on continued engagement*. With this careful combination of irreversible costs and reversible pending benefits, each pair of synchronized *time-directional* steps could function as an exchange of costly signals, indicating both side's willingness to continue down the path, and incrementally shifting the incentive structure in favor of taking the next steps.

The sequence shown in Figure 1 will be our main takeaway from the AF era. The details of the actual steps are unimportant for our purposes (for more detail, see reference in footnote 71). Our attention is instead drawn to the elegant, almost vertebrate structure of the sequence when represented visually. As a historical artifact, this symmetry was not necessarily the product of conscious human design, but perhaps more an emergent structure that crystalized as two nations came together in pursuit of *their own* political designs in the face of reciprocal uncertainties, and grappled iteratively with the *symmetric* credibility challenges that confronted them. We will later use this skeletal artifact as a rubric for arranging “corresponding measures”—i.e. *time-directional* steps—into a *physical path* for committed political change in hopes to overcome the *commitment problem*.

### **3.3. The Success and Failure of the Agreed Framework**

If the AF and associated KEDO LWR supply agreement articulate a physical path between two disparate political realities, then significant actualized progress along that path is evident in the partially-constructed reactors at Yongbyon and Kumho. During the AF era, North Korea is said to have “taken a bet on the AF, and basically just shut the lights out at Yongbyon and Taechon.” This “bet” would effectively consign North Korea's uncompleted plutonium reactors to physical ruin. On the KEDO side, approximately two thirds of the first LWR was built, constituting close to \$2 billion invested by U.S. allies. What to make of this singular, yet incomplete success?



Common appraisals of the AF are grounded in the *inducement paradigm* of nonproliferation diplomacy, which frames the LWR project as a *carrot* to *induce* North Korea into giving up nuclear weapons. Under this framing, the regime's eventual pursuit of enrichment technology constitutes "cheating on the agreement," and its cheating is interpreted as the cause of the AF's demise. But when we think in terms of *techno-diplomacy*, which frames the LWR project as a physical commitment, two crucial factors come to light that may have contributed to diplomatic failure.<sup>69</sup>

The first factor is cost displacement. If LWR construction steps were to function as *costly signals* of a U.S. commitment to normalization with North Korea, then to first approximation it would follow that the United States would need to fund those construction steps. But it was clear from the beginning that total U.S. funding of the LWRs was not feasible, and that it would instead be carried out by a U.S.-led consortium, with the United States sharing cost with its allies. Shortly after the AF was signed, however, Congress mandated that no U.S. funding could go to building reactors in North Korea, displacing the entire cost of the LWR project to U.S. allies. If the reactors were to signal U.S. commitment to normalization, then if the United States isn't willing to foot any of the bill, that implies that it isn't very committed to proceeding down that path.

The displacement alone of the U.S. share of cost may not have been fatal to the AF, because if the United States' main regional allies were to make major investments in a U.S.-led venture in North Korea, that *could* constitute an indirect U.S. stake in the process. Rather than completely nullifying the U.S. signal of commitment, the offset of costs may have attenuated it, making the political stability of the AF more tenuous in the face of other challenges it would later encounter.

The second factor contributing to the tenuousness of the AF was that the physical steps themselves were poorly planned. By the admission of the U.S. negotiators themselves, they had committed the United States and its allies to a major and unprecedented technological endeavor—building large LWRs north of the DMZ—without sufficient technical appreciation for the major challenges that endeavor would entail. That led to massive

---

69 Lawrence, "Normalization," section 2.c.



delays in LWR construction, which North Korea interpreted as a lack of U.S. commitment to the AF.<sup>70</sup>

The credibility deficits emerging from these two factors came to a head in 1997. That year, the LWR project had barely left the ground, KEDO was on the verge of bankruptcy, and the regime explicitly stated its concern that the United States was not committed to the AF in a range of diplomatic and public venues. It conducted some maintenance on the 5MWe reactor at Yongbyon, and secretly procured enough centrifuge parts to begin a modest R&D effort for an indigenous uranium enrichment capability. Both the timing and small scale of its enrichment efforts strongly suggest that the enrichment program served as a hedge against AF failure, rather than a *determined* commitment to build nuclear weapons, irrespective of the AF's fate.<sup>71</sup> Unfortunately, the program would later be used by the Bush Administration to justify scrapping the AF.

Two lessons emerge from this history.<sup>72</sup> First, when designing a path for political change, the distribution of “skin in the game” is a crucial but nuanced question for *techno-diplomacy*. Since the major U.S. stake in the region is its alliances, then South Korean investment in North Korean infrastructure can go some way to build a U.S. stake in normalization. But offsetting the entire cost to allies may have been a partial source of the AF's ultimate demise. Finding the appropriate balance might be a crucial question for future negotiations, and for shaping the future geopolitical architecture on the Korean Peninsula. Second, if technological infrastructure is to be deployed as a diplomatic instrument, then deep collaboration between diplomats and technologists should be sustained from beginning to end in order to ensure proper design and execution of technical steps, and preserve their signaling function. While diplomats who negotiated the AF clearly had a deep understanding of the consequences and meaning of different technical choices, they fell short in designing their implementation in the early stages. We will come back to these lessons when we consider the current prospects for engaging North Korea.

70 This interpretation was expressed in public official statements, as well as direct communication in Track I and 1.5 settings. See Lawrence, “[Normalization](#),” section 2.c.

71 For interpretation of North Korea's enrichment program as “hedging” on possible failure of Agreed Framework, see: Siegfried Hecker, “[Lessons Learned from the North Korean Nuclear Crisis](#),” *Daedalus*, Vol. 139, No. 1 (2010), pp. 45-56 (accessed February 26, 2019).

72 See Lawrence, “[Normalization](#),” section 2.c.

By and large, North Korea's nuclear behavior during the AF era seems to have been most responsive to U.S. moves that spoke credibly about the political future, and those moves became embodied in the KEDO LWR process. The aspects of North Korea's behavior that are most important to U.S. interests—the centrifuge procurements, activities at Yongbyon, its missile developments and North-South engagement—exhibit a clear correlation with the financial and political status of the KEDO process.<sup>73</sup> This suggests that engagement with North Korea has not been about *inducement*, but that what was really at stake was an envisioned future network of political relationships in East Asia.

---

73 See Lawrence, *ibid.*

## 4. Moon Jae-in's New Economic Map

In April 2018, Korea's two leaders walked across the demarcation line together for the first time. With television cameras shooting from every angle, Moon Jae-in and Kim Jong-un stepped effortlessly back and forth over a short concrete marker symbolizing the national barrier that has divided the peninsula for over six decades.<sup>74</sup> The ritual would be reenacted months later by Korean troops venturing peacefully into respective enemy territories to verify the dismantlement of armed guard posts and other confidence building measures.<sup>75</sup> In these unprecedented performances, the two Korean governments signaled to each other, to the world, and to their respective peoples that the current diplomatic campaign would go further toward reconciliation than previous attempts.

But reconciliation between the two Koreas would be more than merely symbolic. While Western media absorbed the drama and pageantry of the first North-South Summit at Panmunjom, President Moon discretely handed Kim a thumb drive containing the broad outlines of his proposed "New Economic Map" (NEM).<sup>76</sup> The proposal envisioned a shared trade and transit infrastructure that could link the two Koreas, and form the backbone of a "new peace architecture" in East Asia. The goal of the project would be explicitly *techno-diplomatic*: to establish a "virtuous cycle" between security and economic development in Korea, and to integrate a denuclearized North Korea into the regional and global economies of the 21<sup>st</sup> century.<sup>77</sup>

When Western analysts consider Moon's infrastructure plans, they often think in terms of *inducement*, seeing a "prosperous future" as North Korea's

---

74 "Kim Jong-un and Moon Jae-in Meet for Inter-Korean Summit," *Voice of America News*, April 26, 2018 (accessed February 26, 2019).

75 "North and South Korean Soldiers Cross the DMZ in Peace," *BBC News*, December 13, 2018 (accessed February 26, 2019).

76 Nathan Park, "A Genius Plan to Modernize North Korea's Trains," *CityLab*, May 4, 2018 (accessed February 26, 2019).

77 "Implementation Measures," Sejong Policy Forum; "President Moon Offers Methodology on Denuclearization of North Korea," *Hankyoreh*, February 28, 2018 (accessed February 26, 2019); "Future Plan: New Economic Map," The Presidential Committee on Northern Economic Cooperation (accessed February 26, 2019).

reward for giving up nuclear weapons. Along these lines, we expect that infrastructure investment should only commence *after* denuclearization is fully achieved. If Moon pushes for construction steps *in tandem* with denuclearization, rather than *after* it, that must indicate that he prioritizes reconciliation over North Korea's complete disarmament.<sup>78</sup> Great discord has emerged between the United States and South Korea over the sequencing of engagement steps,<sup>79</sup> culminating in a U.S. threat of secondary sanctions on one of its closest allies, should construction steps proceed too soon in the North.<sup>80</sup> But a *techno-diplomatic* approach considers technological change—whether in the realms of nuclear weapons, military posture or infrastructure investment—as the *embodiment* of political change, rather than the cause or effect of it. If this conceptual mismatch between *inducement* and *techno-diplomacy* is indeed at the heart of U.S. differences with its South Korean ally in 2018, then reconciling it may be one of the great barriers to denuclearization. For if the United States remains unwilling to offer any sanctions relief or waivers to North Korea in 2019, it would render international investment in North Korea illegal, and may block key steps in the process of political change needed to make denuclearization possible.

As with the LWRs of the AF, in order to interpret the political aspirations of Moon's NEM, we must look at the shape and character of the technology itself. This section briefly examines the time-structure, geographical layout and technological character of three prospective infrastructure projects—rail-transit integration, energy connectivity, and mineral extraction—to suggest how they might redistribute political agency in ways that align with the two Koreas' stated political goal of integrating North Korea into the international system. I comment on how the United States might facilitate and perhaps influence these confidence-building construction steps through tailored sanctions waivers in exchange for nuclear rollback steps. However, the other dynamic from the AF era that re-emerges today is the question of whether investments from U.S. allies might be sufficient to signal American commitment to eventual normalization, or whether direct investment from the United States might be needed. Hence, I also point to

---

78 See, e.g., Nyshka Chandran, "South Korean Peace Efforts Look Out of Sync with Elimination of North Korean Nukes," *CNBC*, December 4, 2018 (accessed February 26, 2019).

79 Lee, "US-South Korea Rift Grows on How to Denuclearize North Korea."

80 Damin Jung, "Seoul Warns South Korean Companies on US Secondary Sanctions," *NKNews.org*, August 28, 2018.

opportunities for more direct U.S. involvement in infrastructural change in Korea.

## 4.1. Rail Gauge as Geo-Politics

The U.S. nonproliferation community has paid little attention to Moon Jae-in's development proposals for North Korean transit infrastructure. The scant reporting that has occurred has focused on the prospect of "rebuilding North Korea's rail lines" and shortening commutes for North Koreans. While direct benefits to North Korea would clearly be an important part of the puzzle, modernizing transit *within* North Korea alone would do little to alter its trade and cultural interchange with the outside world. Moon's ultimate proposal, however, is to connect South Korea's economic powerhouse to the entire Eurasian continent, *through* North Korea. This could place North Korea as an obligatory geographical passage point<sup>81</sup> for important currents of regional and international trade, and bring international actors into a shared interest in its political stability. It would also involve a much more substantial and drawn-out investment than simply modernizing North Korean rail, because it would require "harmonizing" it with the rail systems that span the continent.<sup>82</sup> Physical differences in rail gauges, weight limits, curve radii, and station platform heights will require major investments to reconcile.<sup>83</sup>

Across Asia and some of Europe, the political forum for reconciliations in rail specifications has been the Organization for Cooperation between Railways (OSJD).<sup>84</sup> As an intergovernmental organization created to improve coordination between national rail systems, the OSJD has expanded from its Cold War Eastern Bloc origins to connect with parts of the European economy. In early 2018, the regime announced its support for South Korea's membership in the OJSD, and South Korea officially joined that

81 The phrase "obligatory passage point" was coined by Michel Callon in "Elements of a sociology of translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay", in John Law, ed., *Power, Action and Belief: A New Sociology of Knowledge?* (London: Routledge, 1986), pp. 196-233.

82 This section draws from Joe Bermudez et al., "Making Solid Tracks: North and South Korean Railway Cooperation," CSIS, December 10, 2018 (accessed February 26, 2019); and "Making Solid Tracks: North Korea's Rail Connections with China and Russia," CSIS, January 7, 2019 (accessed February 26, 2019).

83 Bermudez et al., *ibid.*

84 Organization for Cooperation Between Railways (OJSD) (accessed February 26, 2019).

year.<sup>85</sup> This change in regime policy may indicate a political desire in North Korea to pursue rail integrations such as those proposed in Moon's NEM.

If we compare these technical endeavors with that of building LWRs in North Korea, we see several striking similarities. First, each would involve multibillion dollar investments on the part of the international community in North Korean infrastructure. It is estimated that it will require \$35 billion to modernize North Korean rail and bring it in line with OSJD standards.<sup>86</sup> Second, these construction steps will be drawn out over a long duration,<sup>87</sup> and each step on its own would do little to “reward” North Korea at the time it is taken. Third, the project will set the stage for *shared pending* benefits among several nations in the future, but these will be *contingent* on continued international engagement, political stability in North Korea, and a sanction-free relationship between North Korea and the West (which in turn could rely on a nuclear-free Korean peninsula). South Korea, in particular, would benefit greatly from having its automotive and other newly-mature industries connected by land to the Eurasian continent. With these *techno-diplomatic* prospects in mind, we can begin to imagine how sanctions waivers, specially tailored to allow specific construction steps, could be offered as “corresponding measures” alongside simultaneous denuclearization steps in a way that maintains an incentive for continued engagement and nuclear rollback throughout the process.

## 4.2. Connective Energy Infrastructures

Western analysts have long recognized that modernizing North Korea's energy sector will be key to rehabilitating its economy,<sup>88</sup> and some have consulted with North Korean energy experts who express an interest in energy cooperation with the West.<sup>89</sup> The North's aging energy grid is currently one of the main technical bottlenecks to reliable electricity provision, with es-

---

85 Kim Tae Won et al., “[Seoul Joins International Railway Cooperation Body Thanks to Pyongyang Support.](#)” *Korea.net*, June 8, 2018 (accessed February 26, 2019).

86 Park, “[A Genius Plan to Modernize North Korea's Trains.](#)”

87 Bermudez et al., “[Making Solid Tracks: North and South Korean Railway Cooperation.](#)”

88 David von Hippel et al., “[Transforming the DPRK Through Energy Sector Development.](#)” 38North.org, March 4, 2011 (accessed February 26, 2019); David von Hippel et al., “[Fueling DPRK Energy Futures and Energy Security.](#)” Nautilus Institute, June 30, 2007 (accessed February 26, 2019).

89 Von Hippel et al., “[Transforming the DPRK Through Energy Sector Development.](#)”

estimated losses due to failures and inefficiency ranging up to fifty percent.<sup>90</sup> Rebuilding the grid could entail extensive and sustained on-the-ground presence of foreign engineers, trainers and specialists in North Korea. The North is also in need of more diversified energy resources.<sup>91</sup> Shared infrastructure developments in electrical transmission and liquid natural gas (LNG) constitute a second component of Moon's NEM.

It would be one thing to rebuild North Korea's infrastructure for the sake of benefitting North Korea. But the NEM appears explicitly geared toward regional integration. In the area of transmission, it plans not only to modernize North Korea's grid, but to build an international "super grid" that would distribute electricity between the two Koreas, China and Russia.<sup>92</sup> Similar to rail coordination, this would entail extensive coordination of infrastructure compatibility, integrated generation (energy generated in one country may be shared with others), technical collaboration, consistent metering and performance monitoring, maintenance protocols, etc.<sup>93</sup> In the area of fuel supply, the NEM calls for pipelines to bring Russian LNG not only to North Korea, but also *through* North Korea and into the South.<sup>94</sup>

Both of these infrastructures would be intrinsically tied to geography, and hence constitute geo-political commitments. Electrical grids are fixed connections between fixed geographic locations and population centers. Once they are set in place, they are costly to reorganize in response to changing political whims. Similarly, while many fossil fuels like oil and coal can come from multiple national sources and be rerouted as political relationships evolve, LNG pipelines are fixed to the ground to become inert links between *particular* states, tying them into a shared interest in continued political stability and sustained cooperation.

One impetus behind Moon's proposal to link with China and Russia is a fear that the United States may exit the region as a major economic player and guarantor of peace. But there are prospects for U.S. involvement in

90 Von Hippel et al., "Fueling DPRK Energy Futures and Energy Security."

91 Von Hippel, *ibid.*

92 "Nine Bridge Strategy: Power Generation," The Presidential Committee on Northern Economic Cooperation (accessed February 26, 2019).

93 Von Hippel et al., "Fueling DPRK Energy Futures and Energy Security."

94 "Nine Bridge Strategy: Gas," The Presidential Committee on Northern Economic Cooperation (accessed February 26, 2019).



these projects as well. During the AF, plans were laid out for rebuilding North Korea's energy grid and integrating it with South Korean energy infrastructure. Japan, in particular, set aside approximately \$5 billion for infrastructure development in North Korea, and Track II diplomats have indicated that that money remains in a "lock box" in case Japanese involvement in North Korean development becomes politically feasible. The United States could add its own financing to the Japanese sum and contribute on-the-ground expertise in this area, and in doing so could influence the shape of infrastructure as it is built.

### 4.3. Mineral Reserves, Mining Infrastructure and Sea Ports

Mineral reserves are one of North Korea's most promising economic assets. The isolated state sits atop massive reserves of iron, gold, magnesite, zinc, copper, limestone, molybdenum, graphite, and rare earth metals.<sup>95</sup> Estimates of the total value of North Korea's mineral reserves range from six to ten trillion dollars.<sup>96</sup> Yet these reserves remain relatively untapped because the North lacks the equipment, expertise and basic infrastructure to develop them.<sup>97</sup> Developing North Korea's mining industry could represent an opportunity for massive infrastructure investment, and integration of North Korea into international economies and knowledge networks. This has not been overlooked in the NEM, which proposes to develop a pair of "resource belts" along the east and west coasts of Korea, constituting a network of sea port facilities and logistics centers for maritime trade, and rail networks linked to mining locations within North Korea.<sup>98</sup> If this plan moves forward, new international trade routes will become solidified over time, as other countries physically adjust their own ports to accommodate it, and establish economic constituencies dependent on the associated trade relations. Since mineral reserves and much of the infrastructure needed to develop them are geographically fixed, these investments have important

---

95 Steve Mollman, "North Korea is Sitting on Trillions of Dollars of Untapped Wealth, and its Neighbors Want In," *Quartz*, June 16, 2017 (accessed February 26, 2019).

96 Mollman, *ibid.*

97 Mollman, *ibid.*

98 Jiyeun Lee, "These Maps Show How to Unlock North Korea's Economy," *Bloomberg*, June 3, 2018 (accessed February 26, 2019).

path dependencies that could solidify relationships between North Korea and the global economy.

## 4.4. A Pacific Rimland Meets a New Eurasian Continentalism

South Korea's NEM offers a range of opportunities to leverage infrastructure investment to build new forms of shared international interest in North Korea's political stability, and potentially to demonstrate a U.S. stake in that stability. One can imagine a sequence of construction steps to serve as "corresponding measures" that are synchronized with important nuclear rollback steps in a *physical path* toward better relations between North Korea and the outside world. But as in the AF era, a crucial question for *techno-diplomacy* is whether the United States should invest directly in these steps (and if so, how much), or whether major investments from its regional allies may suffice to constitute a U.S. stake in continued engagement with North Korea. The answer to this question can only be discerned in the diplomatic process by testing different proposals.

The nonproliferation community's exclusive focus on *inducing* denuclearization may be diverting America's view from the real geopolitical game in East Asia. While the North Korean nuclear crisis looms large in American consciousness, it may be the iceberg tip of a much broader historical shift. Since the Second World War, South Korea and Japan have served as major outposts of American military and economic presence. These strategic points on the Eurasian rimland have helped guide economic flows in ways that preference U.S. maritime strength, while slowing the convergence of a major continental power.<sup>99</sup> But as the economies of the Eurasian continent come to maturity, a "new continentalism"<sup>100</sup> may emerge that could re-route trade and political relations toward more land-oriented convergences of power, possibly at the expense of U.S. influence.

99 For "Rimland Theory," see Geoffrey R. Sloan, *Geopolitics in United States Strategic Policy 1890-1987*, (New York: St. Martin's Press, 1988) (accessed February 26, 2019); Nicholas Spykman, *America's Strategy in World Politics* (New York, 1942).

100 See Kent Calder, *The New Continentalism: Energy and Twenty-first Century Eurasian Politics* (New Haven, CN: Yale University Press, 2012).

The U.S. insistence on complete denuclearization *before* any reconciliation of North and South Korean economies may already be pricing America out of these geopolitical shifts. While the United States sees the political rift in Korea as a result of North Korea's nuclear weapons program, virtually all other stakeholders view the causal arrow as pointing the other way, and envision a phased reciprocal approach to denuclearization and political change. Previous U.S. nonproliferation policy has thus become self-isolating, and continuing it risks presenting the United States as standing in the way of Korean reconciliation and economic development. In recent years, South Korea has made major economic overtures to China<sup>101</sup> and Russia.<sup>102</sup> And in its recent New Year's Address, North Korea has threatened "going another way" if its diplomacy with the United States fails. These are not-too-subtle suggestions that China and Russia may serve as better patrons to a unified Korea than the United States.

There are two factors in the North Korean nuclear crisis that the United States may leverage to influence developments. First, it is well known that the North Korean regime wants to reduce its dependence on China.<sup>103</sup> Some Korea specialists in the United States even argue that the regime may actually *desire* a continued U.S. military presence on the peninsula to balance against a rising China.<sup>104</sup> At times, North Korean diplomats have explicitly expressed that continued U.S. troop presence would be acceptable if their role was shifted to be less adversarial to the North.<sup>105</sup> Second, a major component of Moon's NEM is a maritime trade belt along the Korean coast of the Sea of Japan. Combined with the prospect of new infrastructure investments to develop North Korea's electrical grid and mineral resources, this may offer an opportunity to reinvigorate more Western-oriented maritime networks, and tie them into some of the geoeconomic shifts afoot in the region.

---

101 Patrick Cronin, "How South Korea's New Economic Map Could Shift Northeast Asia's Balance of Power," *The Diplomat*, August 10, 2018 (accessed February 26, 2019).

102 Timothy Stanley, "The Growing Russia-South Korean Relationship," *The Diplomat*, May 24, 2018 (accessed February 26, 2019).

103 Ravi Shankar Buddhavarpu, "China and North Korea: Sharp Shift in Optics," *The Citizen*, July 5, 2018 (accessed February 26, 2019).

104 Carlin, "What North Korea Really Wants."

105 This is reported by U.S. officials and diplomats who engaged with North Korea in the 1990s. See Lawrence, "Normalization." For a more recent example, see Euan McKirdy, "North Korea Drops Withdrawal of U.S. Forces as Condition for Denuclearization, Moon Says," *CNN*, April 20, 2018 (accessed February 26, 2019).

## 5. Two Paradigms of Diplomacy Under Nuclear Proliferation Crisis

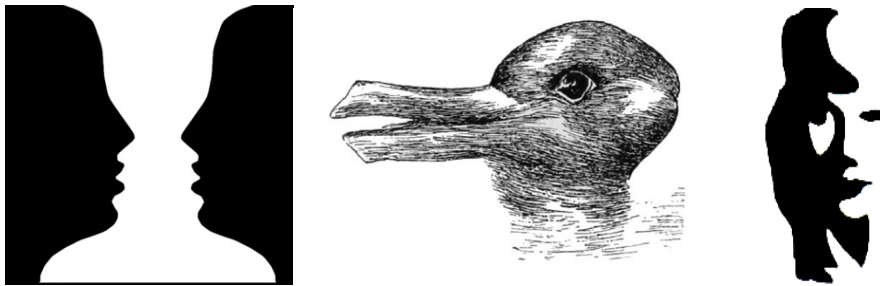
We've now outlined how the *techno-diplomacy paradigm* can reshape our interpretation of the history of U.S. engagement with North Korea, and illuminate the dynamics of the current diplomatic process. But the conceptual shift is somewhat unstable—it is easy to revert back to inducement tropes of “rewarding and punishing North Korea,” or to fixate on the danger of North Korea “cheating on an agreement.” These abrupt conceptual shifts between competing paradigms present serious challenges to sustained engagement with North Korea because they scramble and attenuate the signals needed to communicate and build long-term commitment. This section seeks to solidify a clear interpretive distinction between the *techno-diplomacy* and *inducement paradigms* by consolidating a list of the differences between them.

The reader may recognize the word “paradigm” as an allusion to Thomas Kuhn’s famous theory about the discontinuous evolution of scientific theories.<sup>106</sup> Kuhn, in turn, points to the visual phenomenon of the “gestalt shift,” in which a single visual stimulus gives rise to multiple “incommensurable” image recognitions on the part of the observer. Figure 2 shows three well-known examples—the flower vase *or* two faces (left); the duck *or* rabbit (center); and the saxophone player *or* woman’s face (right). The hallmark of these gestalt shift pictures is that the two competing images contained in each cannot be integrated into a single whole, and the visual apparatus instead flips erratically back and forth between them. Cognitive scientists and moral philosophers have shown that a similar phenomenon happens in the cognitive realm, between different ways of framing and understanding the world.<sup>107</sup>

106 Kuhn, *The Structure of Scientific Revolutions*.

107 DesAutels, “Gestalt Shifts in Moral Perception”; Goffman, *Frame Analysis*; Lakoff et al., *Metaphors We Live By*; Lakoff, *Don't Think of an Elephant!* (White River Junction, VT: Chelsea Green Publishing Company, 2004).

Figure 2: **Three classic examples of “gestalt shift” pictures.**



Each can be assimilated by the visual system into two incommensurable images: the flower vase *or* two faces (left); the duck *or* rabbit (center); and the saxophone player *or* woman's face (right). Similar gestalt shifts can take place in the cognitive realm between different ways of framing the world.

I argue that the *inducement* and *techno-diplomacy* paradigms are *incommensurable* in this gestalt sense, and hence cannot be combined into a coherent picture of nonproliferation diplomacy with North Korea. In fact, they often suggest *precisely the opposite* prescriptions for nonproliferation diplomacy. I'll illustrate this by outlining several important dimensions of diplomacy that become *inverted* when our analysis shifts between these incommensurable ways of framing nonproliferation engagement. For clarity, I have adopted a color-coding scheme, with orange text indexing *inducement* thinking, and blue marking *techno-diplomacy* prescriptions. For each “cognitive inversion,” I briefly describe the “appropriate” way to design diplomatic concessions under each paradigm. I then illustrate how the inversion applies when viewing the FFPP/LWR distinction during the AF, and provide an example of how the inversion might apply during the current nuclear standoff with North Korea today.

## D1. Primary Currency of Diplomatic Concessions

What is being traded in concessions, and what is the goal of offering/accepting them?

### Inducement

Concessions should be designed to provide an ***intrinsic utility*** to the target state in a timely manner to “reward good behavior.”

### Techno-diplomacy

Concessions should be designed to offer an ***enduring shared utility*** to bind states into a mutual interest in continued engagement.

***During the Agreed Framework era:*** Many analysts argued that FFPPs would have been a better “***carrot***” than LWRs because they’d be quicker to build and easier for North Korea to operate. But under ***techno-diplomacy***, LWRs would be a more credible commitment to continued engagement because of their high up-front costs, longer construction time and collaborative operational requirements. No one benefits from a half-built or inoperable reactor, yet all sides stood to gain from finishing and operating the reactors.

***Today:*** Many nonproliferation analysts have recognized that North Korea is very unlikely to give up its nuclear weapons without receiving some benefits in return. However, there is very little discussion about what different concessions might say about the political future. If concessions are offered in the form of ***transient rewards*** that can be consumed quickly, or if they are designed to ***benefit North Korea exclusively***, then they will have little bearing on the future decision-making of any of the parties involved. On the other hand, shared infrastructure investments could offer international benefits that are contingent on further engagement and political stability in Korea. They may thus constitute a new form of ***shared interest and mutual leverage*** that could start to replace the leverage that North Korea is currently getting through its nuclear threats.

## D2. Time Structure of Concessions

How should implementation of concessions be time-linked to target state behavior?

### Inducement

Concessions should only come **after** denuclearization occurs so as not to “reward bad behavior.”

### Techno-diplomacy

Concessions signal commitment to a non-nuclear peace architecture, and thereby **set the stage** for subsequent nuclear rollback steps.

*During the Agreed Framework era:* We saw a clear *techno-diplomatic* time structure in Annex 3 of the KEDO supply agreement. Each construction step, on its own, would offer no *reward* for North Korea’s *previous* denuclearization steps, since North Korea would scarcely benefit from a partially-built reactor. Rather, each construction step was designed to *set the stage* for *subsequent* denuclearization steps by signaling KEDO’s commitment to continued engagement.

*Today:* Officials from the U.S. State Department have suggested that the “road to a prosperous and secure future for North Korea **passes through the gate** of denuclearization,”<sup>108</sup> and have resisted any sanctions relief until full denuclearization occurs. Meanwhile, the Moon Jae-in administration has suggested that infrastructure investments and denuclearization steps could be entwined in a “*virtuous cycle*,”<sup>109</sup> recognizing that until the international community puts down some skin in the game for a new peace architecture, we should expect little progress on denuclearization.

108 Remarks of Mark Knapper, Deputy Assistant Secretary of State for Japan and Korea, at the Wilson Center Korea Global Forum 2018, November 15, 2018.

109 “Implementation Measures.” Sejong Policy Forum.



### D3. Time Structure of Coercion

How are coercive steps time-linked to target state behavior?

#### Inducement

Preliminary coercion is needed to **set the stage** for subsequent denuclearization steps, which in turn should bring relief from coercion.

#### Techno-diplomacy

Preliminary coercion can reinforce the adversarial relationship, and **discourage** subsequent denuclearization steps. Conversely, enhanced interdependence can build new forms of potential coercive leverage, the threat of which can stabilize nonproliferation gains as engagement progresses.

*During the Agreed Framework era:* **Preliminary coercion** engendered little progress in denuclearizing North Korea, and indeed contributed to the crisis.<sup>110</sup> Conversely, building LWRs in North Korea, if completed, would have given the outside world significant control over North Korea's energy infrastructure through fuel supply, reactor operation and maintenance, which would have been impossible for North Korea to continue alone. The prospect of withholding those would have provided **new forms of potential coercive leverage** for the US that could be implemented if the regime were to decide to return to its nuclear weapons program.

*Today:* Officials from the U.S. State Department have insisted that "maximum pressure" is needed to **set the stage** for denuclearization," and that this must be maintained until denuclearization occurs. Meanwhile, the Moon Jae-in administration has suggested that "maximum pressure" tactics and further nuclear threats have been entwined in a "**vicious cycle**,"<sup>111</sup> making denuclearization steps much more difficult to achieve. Building new forms of shared value can give the US more levers to pull in future negotiations.

110 For analysis on failure of preliminary coercion during first nuclear crisis, see Sigal, *Disarming Strangers*, "Part One: Coercion Fails."

111 "Implementation Measures." Sejong Policy Forum.

## D4. Content versus Source of Concession

Does it matter who the concession comes from (source)? Or is the content of the concession of primary importance?

### Inducement

The **content of the “carrot”** is foregrounded in the diplomatic process, while its source is of peripheral concern.

### Techno-diplomacy

The **source of concession** is foregrounded in the diplomatic process, and its content may be of peripheral concern.

*During the Agreed Framework era:* Major disputes arose over the source and “national identity” of the KEDO LWRs, and these disputes jeopardized the entire diplomatic process altogether.<sup>112</sup> If the LWRs were simply a “**carrot**,” then why would it matter who pays for them or takes ownership of their operation, as long as North Korea is on track to receive them? But if they are a **costly signal of commitment** to a different **political future**, then the bearer of that cost is the actor about whose commitment the signal speaks.

*Today:* Major questions persist over how to shape a future geopolitical architecture in East Asia. If engagement and nuclear rollback are to proceed, then those questions will likely be mirrored in the question of who invests in North Korea’s infrastructure. Both South Korea and China are currently planning infrastructure investment in North Korea, but if North Korea also desires an improved relationship with the US, and if the US desires continued influence in the region, then the US may need to consider investing some material stake in a new peace architecture that relies less on military threats and more on shared economic, security and cultural value.

<sup>112</sup> See Lawrence, “Normalization,” Sec. 2.a.

## D5. Cost versus Credibility of Commitments

Does high cost of concessions degrade or enhance credibility of engagement?

### Inducement

The cost of a concession is a **drain on the credibility** that it will be actually implemented, thus degrading the overall credibility of continued engagement.

### Techno-diplomacy

The cost of a concession **is the signal of commitment** to a political future, and thus enhances the credibility of continued engagement.

*During the Agreed-Framework era:* Massive construction cost would make LWRs a very poor choice as a “**carrot**” for rewarding North Korean denuclearization, whereas FFPPs could offer a similar **intrinsic energy-generation value** to North Korea at much lower cost to the US and its allies. But as a **techno-diplomatic signal**, costly LWR construction could constitute a much more convincing demonstration of commitment to North Korea’s energy future than inexpensive FFPPs.

*Today:* It will be tempting to search for low-cost ways to **reward** North Korea if it denuclearizes, but low-cost concessions will entail little skin in the game on the part of the US and its allies. Meanwhile, high-cost investments can **signal commitment** on the part of the United States and its allies in continued engagement and peace, and work to stabilize the political future.

## D6. Desirable Time Horizon

Should negotiators seek a conclusive or open-ended resolution to the nuclear issue?

### Inducement

A nonproliferation agreement should provide a **final resolution** to the nuclear issue that does not require continued diplomatic engagement.

### Techno-diplomacy

A nonproliferation agreement should be **open-ended** in order to incentivize continued diplomatic engagement consistent with nonproliferation goals.

*During the Agreed Framework era:* The AF was often described as a “stop-gap measure” to “**buy time**” by delaying North Korea’s nuclear program. But if the real stake is a future political relationship, then an **open-ended arrangement** is a crucial part of **techno-diplomacy**, because it indicates endurance of continued engagement.

*Today:* Many analysts argue that the U.S. negotiators should hold out for a deal that **eliminates North Korea’s nuclear program once and for all**, and doesn’t require continued engagement. However, North Korea’s basic nuclear competence will remain, regardless of what it physically gives up, and if its political relationship with the West then deteriorates, it will simply reconstitute its program. Hence, an **open-ended approach** that entails continued engagement offers a better chance to manage the relationship and nuclear risks going forward.

## D7. Bindings of Commitment

What medium should be leveraged to bind actors to their commitments?

### Inducement

Nonproliferation agreements achieve credibility through **legally-binding commitments**.

### Techno-diplomacy

Nonproliferation frameworks achieve credibility through **entropically-binding commitments**.

**During the Agreed Framework era:** When the AF was signed, U.S. negotiators were explicitly advised by their legal counsel not to refer to it as an “**agreement**,” but rather as a “**framework for action**.” We do stuff, they do stuff. The stuff we do depends on what they do. But at this stage there is no ‘agreement.’” Critics charged that the AF was meaningless without **binding legal commitments**. But under *techno-diplomatic* thinking, the real commitments take place on the ground in the form of *time-directional* processes, and rigid legal structures can often get in the way of those more **physical commitments**.

**Today:** Some analysts have fixated on the fact that North Korea’s undeclared facilities are “illegal” under international law because they violate UN sanctions resolutions. Under *inducement* these violations of international norms must be **punished**. However, in order for international legal norms to have any relevance, states must see them as in their interest and choose to adopt them. Clearly North Korea has not yet done this—possibly because the international system has done little to integrate North Korea—and hence those legal norms have become irrelevant to the regime’s choices. Further punishment is unlikely to change this. On the other hand, a *techno-diplomatic* approach seeks to incorporate North Korea into the international system, and **build a North Korean interest** in adopting international norms like nonproliferation.

## D8. Residual Nuclear Capability

What role does residual nuclear capability play in nonproliferation agreement implementation?

### Inducement

Any residual nuclear capability constitutes ***cheating on the deal***, and is thus incompatible with nonproliferation goals.

### Techno-diplomacy

Residual nuclear capability is ubiquitous in the modern world, and constitutes ***sustained leverage*** and ***hedging against uncertainty*** for the target state. If acknowledged, it may indirectly serve nonproliferation goals.

***During the Agreed Framework era:*** North Korea's procurement of centrifuge parts was framed as "***cheating***" on the AF because it constituted a way to maintain a latent nuclear capability. Under ***inducement***, this is framed as the cause of the AF collapse. However, the timing and nature of its R&D efforts strongly suggest that the centrifuge program constituted a ***hedge*** against the possible collapse of the AF, rather than a North Korean determination to abrogate it. Further, U.S. intelligence was aware of the procurements, and North Korean officials appeared to hint at them in Track 1.5 settings when they expressed doubt about U.S. commitments.<sup>113</sup> These procurements were in turn followed by one of the most productive periods of U.S.-North Korean engagement (toward the end of Clinton's second term), suggesting that having the confidence and leverage of a hedge allowed the North to take a bolder approach toward positive engagement.

***Today:*** North Korea is, and will remain, a nuclear-capable state. There is no physical possibility of verifiably eliminating all aspects of its enrichment capability with complete certainty once and for all, nor of ending its ability to reconstitute the nuclear program should the United States choose to revive an adversarial relationship. No matter what concessions we get from North Korea, these latent capabilities will serve as a de facto hedge for North Korea, and continued incentive for the United States to continue engagement. Paradoxically, a nuclear ***hedge*** may indirectly ease the challenge of convincing North Korea to take significant nuclear rollback steps.

<sup>113</sup> These Track 1.5 communications were recounted to the author by John Lewis and Leon Sigal.

## 6. A Techno-Diplomatic Approach to Engaging North Korea

What does a *techno-diplomatic* approach look like in the context of today's North Korean nuclear crisis and contemporary shifts in regional security and geoeconomic relationships? If we don't currently know with confidence what the regime's long-term intentions are, how do we deploy *techno-diplomatic* gestures to probe those intentions in a credible way, while managing risks to U.S. security and alliances. This section outlines an iterative *techno-diplomatic* approach to engaging North Korea. The apparent simplicity of the approach as I present it is intended not to suggest that diplomacy with North Korea is simple or easy, but to add clarity to the general "diplomatic give and take" structure that appears to have made some progress during the AF era, and may hold promise today.

The basic building block of a *techno-diplomatic* approach is the *differentiator*, defined in Section 2.2 as a proposed exchange of *time-directional* concessions that helps differentiate between competing hypotheses of long-term regime intent. This concept should guide the selection of "corresponding measures" proposed, which at the coarsest level should be designed to distinguish whether the regime is *determined* to retain its nuclear weapons status (left side of Table 1) or whether that current status is *conditional* on acceptable variation in U.S. policy (right side of Table 1). But we can also tailor our proposed concessions to obtain (or communicate) more granular information about what the regime (or the United States) envisions as an acceptable political and security arrangement on the peninsula.

The engagement process can be usefully divided into two phases, which I will call the *visualization* and *arrow-of-time* phases of *techno-diplomacy*. The goal of the initial *visualization* phase is for each side to gain a clearer picture of the other side's long-term preferences and vision of the future. Negotiation scholars often refer to a "zone of possible agreements,"<sup>114</sup> but this suggests that the agreement itself is the end goal, whereas the real stake is in the physical attributes of a political future. A more appropriate terminology can be drawn from the literature on conflict resolution, which

114 See, for instance, John Odell et al., "Negotiating Agreements in International Relations," American Political Science Association, 2013 (accessed February 26, 2019).



suggests that reconciliation between adversaries often depends on whether each side can articulate a “vision of a shared future.”<sup>115</sup> Along these lines, negotiators should search for a *zone of mutually-acceptable political futures* that each side considers preferable to realistic alternatives. Where *techno-diplomacy* advances on the conflict-resolution approach is to suggest that the articulated vision must be incrementally accredited through physical steps, and that the technical character of those steps bears information that either enhances or detracts from credibility. Thus, the *visualization* phase of *techno-diplomacy* contains the usual face-to-face negotiation with written and verbal communication, but can be interspersed with physical *differentiators* to both accredit and pursue stated intentions.

If engagement proceeds long enough for a *zone of acceptable political futures* to be articulated with modest credibility, and for the *physical embodiment* of that future to be sufficiently specified, then diplomats may begin arranging prospective *differentiating* steps into a *physical path toward* that political future. The sequence laid out in Annex 3 of the LWR supply agreement (Figure 1) can serve as a blueprint for designing this *physical path*.

Agreement on a *physical path for political change* marks the transition to the *arrow-of-time* phase of engagement, in which the steps of that path are to be sequentially and reciprocally implemented. This is often interpreted as an “agreement,” and framed as the end-goal of engagement. But in reality, this second phase is the more drawn out and delicate process because each side will continue to harbor uncertainty and questions about the other’s intent, and those credibility and knowledge gaps must be managed through smooth implementation. It is only on the ground that real commitment takes place.

While the *techno-diplomatic* approach must be *symmetric* to address the uncertainties of both sides of the engagement process, it is described here from the perspective of U.S. nonproliferation practitioners engaging North Korea. I begin by outlining the basic four-step iteration of *techno-diplomacy* through which differentiators are proposed to North Korea, either

---

115 Byron Bland et al., “Barriers to dispute resolution: Reflections on peacemaking and relationships between adversaries,” in Ryan Goodman et al., eds., *Understanding Social Action, Promoting Human Rights*, (Oxford, UK: Oxford University Press, 2012).

implemented or rejected, and information on regime intent updated. This iterative structure characterizes both the *visualization* and *arrow-of-time* phases of engagement. I then illustrate a sample *differentiator* that could be deployed early in the engagement process to help gain a basis of insight into regime intentions and build a foundation of credibility for engagement to ensue further.

## 6.1. Techno-Diplomatic Iteration

*Techno-diplomacy* begins with two competing hypotheses about the regime's long-term intent. The highest-order distinction between these two hypotheses is that they differ on whether the regime's commitment to nuclear weapons is *determined* or *conditional*, as suggested in Table 1 (left and right columns, respectively). That binary distinction will be maintained throughout the iterations to maintain a calculated agnosticism about the prospect of ultimate denuclearization, with further detail being gained in each iteration.

### **Step 1: consider two opposing hypotheses, *detH* and *condH*, about the regime's long-term nuclear intent.**

Recall that this does not imply there are only two possibilities for regime intent, but rather is a choice for how to parse the space of possibilities. However, plausible hypotheses do tend to cluster naturally around two groups. For instance, it is very difficult to imagine why the regime would ever give up its nuclear weapons if it *did not* desire an improved relationship with the United States or the outside world. In fact, nonproliferation scholars have shown that a determined commitment to nuclear weapons is mostly consistent with an “inward-looking” domestic political narrative, whereas political systems seeking engagement with the outside world tend to be less committed to nuclear weapons.<sup>116</sup> These observations can add definition to our two hypotheses, as in the following:

---

116 On “inward-looking” political narratives and nuclear proliferation, see Etel Solingen, *Nuclear Logics* (Princeton, NJ: Princeton University Press, 2007). For “oppositional-nationalist” political identities and nuclear proliferation, see Jacques Hymans, *The Psychology of Nuclear Proliferation* (Cambridge, UK: Cambridge University Press, 2006).

$^{det}H$  = Nuclear-determined, isolationist North Korea

$^{cond}H$  = Nuclear-conditional North Korea seeking normalization

Next, we consider U.S. interests and likely observables if either hypothesis is true:

**Step 2: for each hypothesis, ask two questions  $^{US}Q$  and  $^{NK}Q$ :**

$^{US}Q$  = If  $^xH$  is true, what are U.S. interests?

$^{NK}Q$  = If  $^xH$  is true, what observable choices is North Korea likely to make?

The first question should be answered to address the dual goals at the heart of U.S. nonproliferation policy—to explore and pursue the prospect of denuclearization while leaving U.S. security and alliances better off if denuclearization is impossible (see Secs. 2.3 and 2.4). The second question is designed to translate different North Korean intentions into visibly divergent observable behaviors. In general, we want to bring about a situation in which the answers to question  $^{NK}Q$  differ for our two hypotheses  $^{det}H$  and  $^{cond}H$ , while preserving U.S. interests regardless of which hypothesis ultimately proves to be true. For this we must begin envisioning the physical/observable aspects of realistic *techno-diplomatic* end states for each hypothesis, which brings us to the third step:

**Step 3: imagine a space of acceptable, realistic *techno-diplomatic* end states for each hypothesis  $^xH$ , given answers to questions  $^{US}Q$  and  $^{NK}Q$ .**

This is where we begin incrementally sketching the rudiments of a *zone of acceptable political futures*, and translating that into physical steps in the direction of that future.

**Step 4: propose differentiators  $\delta$ , between  $^{det}H$  and  $^{cond}H$  that protect U.S. interests in both cases; implement or reject; update information; return to step 1.**

The initial phase of diplomacy may require several of these iterations to gain enough information to sketch out a *zone of acceptable political futures*, and to build some credibility for future steps. But if this picture becomes more filled out, negotiators can start to plan several iterations into an *physical path* for political change (similar to that presented in Figure 1), and enter the *arrow-of-time* phase of engagement.

## **6.2. A Sample “Differentiator”: Yongbyon Dismantlement for Sanctions Waivers on Infrastructure Investment?**

During the February 2019 Hanoi summit, the United States and North Korea explored the possibility that the regime may be willing to verifiably dismantle its nuclear facilities at Yongbyon, in exchange for “corresponding measures” from the United States. While the two sides did not finalize a deal in Hanoi, the proposal offers an opportunity to construct a promising *differentiator* as an initial step in the engagement process. Specifically, if sanctions waivers could be designed to allow some infrastructure projects associated with Moon Jae-in’s NEM to proceed alongside dismantlement steps at Yongbyon, much information could be exchanged to accredit future engagement. This subsection explores that prospect.<sup>117</sup>

Yongbyon is North Korea’s main nuclear facility. It contains the 5MWe reactor where North Korea produces plutonium and tritium; the radiochemical laboratory where it extracts plutonium from spent fuel; an enrichment plant with approximately 8,000 IR-2 centrifuges; an experimental LWR that has yet to become operational, and several other facilities.<sup>118</sup> While shutting down this facility would not eliminate North Korea’s clandestine enrich-

117 The prospect of pursuing dismantlement at Yongbyon as a *differentiator* was explored by the author in Christopher Lawrence, “A Window into Kim’s Nuclear Intentions? A Closer Look at North Korea’s Yongbyon Offer,” *War on the Rocks*, January 15, 2019 (accessed February 26, 2019).

118 See Hecker et al., “North Korea’s Stockpiles of Fissile Material.”

ment capability, it would almost certainly eliminate its ability to produce plutonium and tritium.<sup>119</sup>

The most interesting of these materials for our purposes is tritium. In order to miniaturize high-yield nuclear weapons for mounting on intercontinental-range missiles, their efficiency must be “boosted” with tritium.<sup>120</sup> Tritium can only be produced in relevant quantities in a reactor or a large accelerator, and these are much more difficult to replace at a clandestine location.<sup>121</sup> Since tritium also has a 12-year half-life, whatever tritium North Korea currently has will diminish over time. Therefore, dismantling its reactors at Yongbyon could place an expiration date on the regime’s ability to field intercontinental-range high-yield nuclear weapons in the future.<sup>122</sup> This would directly benefit U.S. security, since it would eventually curtail North Korea’s ability to target the U.S. homeland.

Let’s return now to the hypothetical distinction in Table 1 (Step 1 of iteration), and consider  $^{NK}Q$  for each side (Step 2). If the regime were indeed committed to remaining a nuclear weapons state and deploying ICBMs to target the U.S. homeland indefinitely ( $^{det}H$ , Table 1, left side, second entry), it would be very reluctant to dismantle the 5MWe reactor at Yongbyon, because forfeiting its lone tritium source would directly contradict that long-term goal.<sup>123</sup> In that case, its offer is likely a bluff, and pursuing it would give U.S. negotiators information by revealing that bluff. Conversely, if the regime views its nuclear weapons as a temporary security blanket, and hopes to eventually trade them away in a peace process with South Korea and the United States ( $^{cond}H$ , Table 1, right side), it would need to make a

119 Lawrence, “A Window into Kim’s Nuclear Intentions? A Closer Look at North Korea’s Yongbyon Offer.”

120 “It is almost impossible to produce high-yield nuclear weapons that meet the space and mass constraints of ICBMs without tritium boosting.” Tom Plant, “[Toward an Assessment of North Korea’s Strategic Deterrent](#),” *RUSI Newsbrief*, Vol. 37, No. 5 (2017) (accessed February 26, 2019). See also Gregory Jones, “[The Role of Boosting in Nuclear Weapons](#),” *Proliferation Matters*, July 25, 2017 (accessed February 26, 2019).

121 Martin Kalinowski et al., “[International Control of Tritium to Prevent Horizontal Proliferation and to Foster Nuclear Disarmament](#),” *Science and Global Security*, Vol. 5 (1995), pp. 131-203 (accessed February 26, 2019).

122 Arms control practitioners refer to this constraint as the ‘tritium forcing function.’ See Carson Mark et al., “[The Tritium Factor as a Forcing Function in Nuclear Arms Reduction Talks](#),” *Science*, Vol. 241 (1988), pp. 1166-1168 (accessed February 26, 2019); Tom Plant, “[Toward an Assessment of North Korea’s Strategic Deterrent](#).” Forfeiting access to tritium and plutonium alone does not preclude fielding of low-yield nuclear weapons at ICBM ranges (perhaps a few tens of kilotons), but it does dramatically constrain the design options in a way that no previous NWS to date has willingly accepted.

123 This argument applies to ICBMs but not to regional capabilities.

significant concession to demonstrate that intention early on in the diplomatic process. It would also, however, need to retain some residual nuclear capability for continued bargaining leverage to keep the diplomatic process alive until a peace architecture is irreversibly established. Allowing U.S. inspectors to verify the dismantlement of its plutonium and tritium sources, while leaving its clandestine uranium enrichment capability temporarily intact, may be a way for the regime to split that distance. Thus, observing whether North Korea is indeed willing to dismantle Yongbyon would *strongly differentiate* between  $^{det}H$  and  $^{cond}H$  (left and right sides of Table 1).

The sample *differentiator* proposed here, if implemented, wouldn't *prove* that ultimate denuclearization is possible, but rather would shift the likelihood in that direction. Therefore, we must also ask  $^{US}Q$  to manage U.S. interests even if ultimate denuclearization is impossible. But our *differentiator* clears this hurdle better than the continued Maximum Pressure because it could diminish North Korea's long-range capability, improve communication to reduce nuclear risks, and may bring U.S. policy into better alignment with that of South Korea (see Section 2.4).

Pursuing the Yongbyon offer could yield other pieces of information about North Korea's nuclear capabilities and intentions, helping clarify the *zone of acceptable political futures* and potential steps toward it (Step 3). Verifiably dismantling the Yongbyon enrichment facility would help answer important questions about the sophistication and layout of the overall centrifuge program, and aid in designing future steps and a verification regime to roll it back. What is the performance of their IR-2 centrifuge? Does it use marring steel or carbon-fiber rotors? Are those materials produced indigenously, or are they obtained on international black markets? What are the main technical and material bottlenecks on the program, and how can those be influenced or monitored?<sup>124</sup> Negotiating the fate of the known enrichment plant and the ELWR could help answer these important questions. It could also give important insights into whether the regime hopes to maintain a civilian nuclear program. Western experts have pointed out that civilian nuclear cooperation with the North, while requiring extensive verification arrangements, could allow the west to better observe and influ-

---

124 See Hecker et al., "North Korea's Stockpiles of Fissile Material," and "North Korean Nuclear Facilities After the Agreed Framework."

ence North Korea's future nuclear choices.<sup>125</sup> This may be an important part of political reconciliation in the future.

Further granularity can be derived on the “corresponding measures” front by offering tailored sanctions waivers. Does the regime seek blanket sanctions relief with no political strings attached, or does it hope to see progress in North-South reconciliation through infrastructure investments? Does it hope for U.S. investment as well, or are security arrangements or an end-of-war declaration sufficient? How does it envision its future relationship with China, and does it also seek Chinese investment? If it does intend to open up its economy, then with what speed would that process take place? By floating different packages of sanctions waivers that are tailored to allow particular projects to proceed, the United States can start to discern some of these gradations in North Korean intent.

If this *differentiator* were successfully negotiated soon, then much of it could be implemented in the remainder of Trump's first term, laying a strong foundation for future steps to be taken by later administrations. Concrete could be poured into the core of the 5MWe reactor to render it permanently inoperable. U.S. personnel could tour and analyze the centrifuge plant quickly to irreversibly gain sensitive information about the broader enrichment program. Meanwhile, South Korea could lay the groundwork for some infrastructure investments in North Korea during the remainder of Moon Jae-in's current term. Yet each side would retain some leverage for negotiating future steps—North Korea's retained leverage would be constituted by its remaining clandestine sites, and the United States could retain substantial sanctions on the regime.

---

125 Siegfried Hecker et al. call for civilian nuclear cooperation with North Korea in “[Total Denuclearization is Not an Attainable Goal. Here's How to Reduce the North Korean Nuclear Threat.](#)” *Foreign Policy*, June 25, 2018 (accessed February 26, 2019). See also Viet Phuong Nguyen et al., “[First, Cooperate on Nuclear Safety in the Korean Peninsula.](#)” *The Hill*, October 6, 2018 (accessed February 26, 2019).



### 6.3. A *Physical Path* to a Nuclear-Free Korean Peace Regime

The *arrow-of-time* structure presented in Figure 1 exhibits three essential features. First, it is *iterative*, with pre-planned, discrete steps taking place sequentially so that information can be exchanged and credibility managed as the political relationship evolves over time. Second, it is *time-directional* in the sense that the steps involve physical processes that are costly and difficult for either side to reverse, and these steps are directed toward the physical *embodiment* of a prenegotiated *zone of acceptable political futures*. Third, it must be *symmetric*—throughout the process both sides will continue to face serious, if diminishing, uncertainty about whether the other side will follow through on subsequent steps, and managing that credibility requires synchronized *time-directional* steps from *both* sides.

Outlining a *physical path* that bears these three features requires initial agreement on the *zone of acceptable futures*, and this presents difficulties. On the nuclear-rollback side, negotiators will likely need to obtain an initial declaration that lists North Korea's nuclear facilities, and the assets housed at each. But it would be irrational of North Korea to provide such a declaration prematurely, since doing so would amount to handing over a "target list"<sup>126</sup> to a military superpower that has a history of threatening preemptive strikes, and which hasn't yet credibly demonstrated an intent to improve its political relationship with North Korea. Therefore, demanding a full and transparent declaration up front will likely derail the engagement process.

However, verification practitioners have recently presented a possible solution to this problem. Sébastien Phillipe et al. have designed a cryptographic escrow that would allow North Korea to make a complete declaration and commit to its content, but only reveal the sensitive information therein sequentially.<sup>127</sup> Facility locations would initially be declared in encrypted form, and placed in a shared database. From there, each decryption of a facility location would amount to a *differentiating* and *time-direction-*

126 Hecker, "Why Insisting on a North Korean Nuclear Declaration Up Front is a Big Mistake."

127 Sébastien Phillipe et al., "A Cryptographic Escrow for Treaty Declarations and Step-by-step Verification," *Science and Global Security*, forthcoming; Alexander Glaser et al.; "Denuclearizing North Korea: A Verified, Phased Approach," *Science*, Sept. 7, 2018.

*al process*—once the location is known to the United States, the facility inspection would reveal whether the declaration is indeed accurate (*differentiation*), and “re-hiding” the assets of the facility (in the event of diplomatic breakdown) would take time and incur costs and risks to North Korea (*time-directionality*). These decryption-verification steps—if paired with suitable *time-directional* “corresponding measures” from the United States—would make ideal *differentiators*, and could be arranged into a *physical path* to denuclearization.

The “corresponding measures” side of the *physical path* may be much more challenging to outline than the nuclear-rollback side. The key will not be “rewarding North Korea” for each previous step, but allowing controlled shifts in leverage that replace the bargaining leverage North Korea will be giving up in each nuclear rollback step, while preserving additional U.S. leverage to promote future steps. Moon Jae-in’s New Economic Map provides a wealth of opportunities for constructing these steps, and these can be incorporated via tailored sanctions waivers or limited sanctions-relief steps, while retaining some sanctions leverage on North Korea to promote continuation of the process. However, at this early stage of engagement, we do not yet know how these fit into a *zone of possible futures* in East Asia.

## 6.4. "A Very Different Future for the United States and North Korea"

At the February 2018 Hanoi Summit between the United States and North Korea, President Trump “encouraged Chairman Kim Jong-un to go big...to buy into this vision of a very different future for North Korea and the United States.”<sup>128</sup> This is quintessential *inducement* language that frames engagement with North Korea as an exchange of “carrots.” It suggests North Korea should give up its nuclear weapons and hope to receive a “bright future” as a reward. But the dramatic collapse of the Hanoi Summit, as well as the decades-long history of U.S. engagement with North Korea, clearly demonstrate that the real action is in the sequencing and confidence building. As one American commentator asked: “why should North Korea believe that

128 See remarks of Stephen Biegun, U.S. Special Representative for North Korea, in conversation with Helene Cooper, at 2019 Carnegie International Nuclear Policy Conference, Washington, D.C. See also, Alex Ward, “A Top U.S. Diplomat Just Laid Out the New Approach to North Korea, and It’s Doomed,” *Vox*, Mar. 11, 2019.

at the end of this process, there will be a pot of gold.”<sup>129</sup> Until the Trump Administration has an answer to this question, we can expect to learn little about whether denuclearization is indeed possible on the Korean Peninsula.

---

129 Question was asked by Helene Cooper in conversation with Stephen Biegun at the 2019 Carnegie Nuclear Policy Conference.





**Project on Managing the Atom**

Belfer Center for Science and International Affairs

Harvard Kennedy School

79 JFK Street

Cambridge, MA 02138

[www.belfercenter.org/mta](http://www.belfercenter.org/mta)