

---

# The use of analogies in developing outer space law

M. J. Peterson

---

Scholars focusing on international relations generally or foreign policy decision making are now paying increasing attention to the ways in which mental constructs—ideas, beliefs, ideologies, or worldviews—affect political actors' perceptions and behavior.<sup>1</sup> The influence of mental constructs in political interaction is particularly visible when actors are trying to extend interaction into new areas or to establish new modes of cooperation. This study will illuminate the impact of mental constructs in these situations by examining the development of outer space law. The Soviets' successful launch of Sputnik in October 1957 shifted outer space from the realm of science fiction and speculation to the realm of real international concerns. Governments were faced with the problem of determining not only what they wanted to do in space but also what sorts of rules for unilateral activity and mutual interaction should prevail there.<sup>2</sup>

When Sputnik ushered in the space age, the world was divided into two great power blocs, each consisting of one superpower plus allies, associates, and clients, and a scattering of European neutral and Third World nonaligned states. The distribution of space capability was even more starkly bipolar than the distribution of overall capability: until 1972 only the superpowers possessed the ability to launch large objects into space, place satellites into geostationary orbit, and send humans into earth orbit or beyond. Some other states could launch small rockets and later

This article is based on research for a larger project on the development of international regimes for human activity in outer space. Early phases of that research were aided by a Faculty Research Grant from the University of Massachusetts at Amherst. Peter M. Haas, Ronald B. Mitchell, and four reviewers for *International Organization* provided incisive comments on earlier versions of this paper. John S. Odell provided additional comments and much encouragement.

1. Examples of international relations studies that focus on international institutions include Ruggie 1982; E. Haas 1990; P. Haas 1992; and Ruggie 1993. Examples of studies from a social constructivist perspective include Wendt 1992; Onuf 1989; and Kratochwil 1991. Studies concerned specifically with foreign policy decision making include Vertzberger 1986; Mefford 1987; Khong 1992; Carlsnaes 1992; and Hybel 1993.

2. U.S. government hesitations are examined in Lissitzyn 1959, 126–29.

*International Organization* 51, 2, Spring 1997, pp. 245–74

© 1997 by The IO Foundation and the Massachusetts Institute of Technology

developed the ability to launch large objects, but none expected to match the whole range of superpower space activity.<sup>3</sup>

Realist theorists of international relations would expect the superpowers to define the rules for outer space activity because, in 1957, only they had the capability to act in space. Realists would also expect the superpowers to insist on rules allowing considerable room for unilateral action, particularly in the security realm. Acceptance of external constraints on state action, whether in the strong form of creating an intergovernmental organization for space exploration or the weak form of mutual monitoring of activity and enforcement of rules would be unlikely in the realist view. Rather, cooperation would be limited, and cooperative ventures would follow the lines of interbloc division.

These expectations stem from the basic assumptions of realist theory, which treats states as egoistic rational utility maximizers and assumes that ability to influence outcomes is directly related to a state's capability relative to that of others. Particularly in its more structuralist neorealist versions, realist theory assumes that states derive their utility functions not from any internal source but from the overriding desire to survive and thrive in a severely competitive environment that imposes steep costs on those who fail to act in conformity with competitive necessities. Assuring survival in such a milieu requires maintaining or augmenting power and paying careful attention to relative position. Realists expect, in consequence, that states will seek to maximize freedom to pursue their own policies and forgo cooperative activity if the benefits seem likely to be distributed in ways that permit rivals to improve their relative positions.

Current rules for and patterns of outer space activity do conform in many respects to these expectations. Outer space law permits states wide discretion in initiating, continuing, dispensing with, and defining all forms of outer space activity. Joint activity is common, but formally organized multilateral ventures are confined to the European Space Agency, the Soviet bloc Intercosmos program, and the global and regional telecommunications satellite consortia. Even the "global" consortia—the U.S.-led Intelsat and the Soviet-led Intersputnik—reflected bloc divisions until the mid-1970s. These divisions were first overcome with creation of Inmarsat, a specialized venture in ship-to-shore communications.

Yet realist expectations are indeterminate at crucial points. In particular, a realist would not have been able to predict whether outer space would be treated as a common area or as something to be "conquered" and parceled out among space-faring states. Both conceptions of space were advanced in the early 1950s; some commentators compared space to the high seas, while others compared it to national airspace. Had the superpowers agreed on one conception and other states on the other, the selection would pose no puzzle for realist theory: the superpowers could simply have imposed their preferences by agreeing between themselves and acting accordingly. However, the superpowers initially disagreed, with the U.S.

3. For a summary of the current patterns of national and regional space activity, see Jane's Information Group.

government preferring the high seas conception and the Soviet government the national airspace conception. Resolution of this disagreement poses a puzzle that cannot be explained using only the resources of realist theory, because neither superpower was in a position to coerce (much less impose on) the other.<sup>4</sup>

When imposition or coercion is not possible, political actors have to bargain to a compromise or converge through mutual persuasion on a consensus. Compromise involves trade-off, which in the space case would have involved each superpower accepting some elements of the other's preferred conception in return for the other's acceptance of some elements of its own. Persuasion involves offering arguments that bring others to share the same set of presuppositions, assumptions, logic, and conclusions. The development of outer space law did involve moments of compromise, but the decision to treat space as a commons involved a clear choice of one conception over the other, an outcome that depended on the Soviet government's shift to accepting the high seas conception. The process by which convergence occurred can be traced in some detail because outer space law was developed in a well-documented multilateral negotiation.

Even imposition involves some elements of mutually understood meaning, since the target has to understand what acts or statements are being demanded. Bargaining and persuasion are even more dependent on a shared conceptual framework with which actors can define the problem, assess the stakes involved, identify potential solutions, and agree on a particular one.<sup>5</sup> Understanding the process by which the superpowers converged on treating outer space as a common area and developing outer space law accordingly requires understanding the mental mechanisms by which political actors acquire, transmit, and refine common conceptual frameworks.<sup>6</sup>

Though analogical reasoning is only one of several types of human reasoning that can serve as the requisite mental mechanism, it is more successful than others when actors need to develop a workable conception of a new problem or issue quickly. Inductive reasoning, for example, fails for lack of enough information about the new concern to permit a "bottom-up" generation of organizing concepts from particular observations. Deductive reasoning fails for lack of a sufficiently well-developed theory of the new concern to provide the assumptions and postulates needed for a "top-down" elaboration of expectations. Reasoning by analogy, which permits the transfer of assumptions and postulates from a well-known field to an unfamiliar one, provides the necessary cognitive resources for developing a working conception of the new issue or problem.

Understanding the process of reasoning by analogy improves our comprehension of outer space law development in two ways. First, it explains the development of the superpower consensus defining outer space as a common area rather than as one subject to national claims. Once this conception was in place, the superpowers and other states were able to agree on the main outlines of outer space law. Second, the

4. The distinction between imposition and coercion follows Krasner 1996, 136–37.

5. Jonsson 1993.

6. Regarding these processes as "mechanisms" was suggested by Yee 1996, 82–83.

patterns of analogical reasoning illuminate certain facets of the later evolution of outer space law by indicating which proposals are more or less likely to be considered seriously. One subsequent debate, triggered by proposals to treat lunar resources as the “common heritage of mankind,” provides a good example of this sifting effect.

### Reasoning by analogy

Reasoning by analogy rests on the basic premise that when two knowledge domains (which can be a broad issue or problem, a set of phenomena, or new instances of some recurring problem or phenomenon) are significantly similar, the two can be treated as instances of the same thing or results of the same causal process.<sup>7</sup> This assumption allows us to treat knowledge domains that are similar in some respects as similar in others, so that information from the familiar (“source”) domain can be used to fill gaps in information about the unfamiliar (“target”) domain. Leaving aside claims that at the deepest level virtually all human reasoning is analogical, political actors use analogies either for the focused purpose of understanding a particular situation or for the broader purpose of comprehending a whole new issue-area or type of problem.<sup>8</sup> The large literature on uses of analogy in foreign policy decision making deals with the first sort of use and shows how policymakers comprehend new situations and generate expectations about what will happen if they act in particular ways.<sup>9</sup> Though the basic reasoning process is similar, the second way of using analogies involves constructing a conceptual scheme for analyzing whole classes of actual or potential situations and establishing guidelines for dealing with them.

Analogical reasoning proceeds in four steps: (1) *representation*—developing a preliminary characterization of the target domain by identifying some of its major features; (2) *retrieval*—using this preliminary appreciation to guide the calling up of potentially useful analogies from memory; (3) *mapping*—applying the source domain information to round out understanding of the target domain by matching observed features that correspond and transferring inferences about the existence of other features or of relations among features from the source to the target domain; and (4) *adaptation*—which follows when mapping succeeds and involves modifying the model drawn from the analogies to fit the target domain better.<sup>10</sup> All four steps must be performed competently for analogical reasoning to succeed. Representation

7. For general discussions of reasoning by analogy, see Rumelhart and Norman 1981; Holland et al. 1986; and Vosniadou and Ortony 1989.

8. On the claim that all reasoning is analogical, see Lakoff and Johnson 1980; Lakoff 1987; and Johnson 1987. For an application of the argument to legal matters, see Winter 1989, while for critiques of this claim, see Fernandez 1991.

9. See, for example, Neustadt and May 1986; Vertzberger 1990; and Khong 1992.

10. Novick 1988. For an argument that a fifth step—inductive creation of a general model covering both the source and target domains as cases of a larger set of things—also occurs in some cases, see Keane, Ledgeway, and Duff 1994, 388–89.

is crucial because it supplies the mental images that guide the search for possible analogies. Different representations can lead to the retrieval of very different analogies and thus very different conclusions about the target domain. All analogies retrieved will be tested at the mapping stage. This involves, first, using the matches and transfers to produce a fuller model of the target domain and, second, comparing that model to what is known about the target independently. If serious discrepancies are found, the analogy-based model must be “debugged” and adapted.<sup>11</sup> When, however, debugging fails to remove significant discrepancies, the candidate analogy will be rejected and another tried. Once adaptation occurs, the initial analogy recedes into the background. However, it remains available for retrieval if later experience reveals new aspects of the target domain that fail to fit within the adapted conception.

Because of the initial assumption that the target domain is similar in all respects to the source domain, analogical reasoning can mislead in several ways. First, elements of the source and target domains may fail to match in one or both of two ways. When a feature of the target domain has no parallel in the source domain, an analogy will not help the user anticipate its existence. Similarly, when a feature of the source domain has no parallel in the target domain, an analogy will encourage the user to assume that it exists anyway. Both failure to expect elements that are present and failure to realize that assumed elements are absent prevents the development of fully accurate conception of the target domain. Second, the analogy may be drawn from features at too large or too small a scale to pick up some significant feature of the target domain. Third, a good match between surface features is no guarantee that underlying causes or relations among those features are the same. Fourth, error can occur as reasoners cope with ambiguous matches (more than one aspect of the source domain seeming to resemble one of the target domain or vice-versa) or are caught up in the multiple shades of meaning of particular words.<sup>12</sup> Sophisticated users of analogy are aware of these pitfalls and try to avoid them by remaining alert to observable evidence from the target domain suggesting that an analogy is failing. Yet even sophisticated users’ caution can be defeated if such evidence is too confused to provide clear indications that the analogy fits poorly.<sup>13</sup>

Analogical reasoning is also vulnerable to the limits of human cognition. Besides the obvious sources of bias—such as strongly held ideology or position in the social structure—that are familiar to students of politics, cognitive scientists have identified other sources that result from how the human mind works.<sup>14</sup> Some inhere in the process of mapping, which relies on a repertoire of standard techniques for ensuring that all matches in an analogy are one-to-one matches (for example, making matches only between entities of the same type—objects to objects, attributes to attributes). Others stem from the influence of the content of the background knowledge with which a particular individual or group begins the process of characterizing the target

11. The discussion on debugging is adapted from Burstein 1988, 179–80.

12. These four are consolidated from the eight-item list in Spiro et al. 1989, 503–509.

13. Khong 1992, 245–50.

14. Keane, Ledgeway, and Duff 1994, 389–94.

domain or mapping the analogy onto it. The limits of human memory impose additional constraints. While people can retain vast amounts of information in passive (long-term) memory, their ability to keep things in the active (short-term) memory from which they retrieve analogies is limited. Most cognitive scientists believe that individual humans can retain and cope simultaneously with somewhere between two and seven “chunks” of information in active memory.<sup>15</sup> If the chunks are analytical concepts rather than discrete pieces of factual information, individuals may be able to cope with only two or three at once unless they use explicit cognitive aids like checklists.<sup>16</sup> These limits of active memory mean that initial retrieval is also affected by processes of “reminding,” in which recent events serve as triggers favoring the recall of some pieces of information rather than others.<sup>17</sup>

In principle, groups should be able to avoid the handicaps of these cognitive limits better than individuals because they can call on the capacity of several minds. Yet a group, too, might tacitly converge on a particular analysis of what is important and ignore other considerations.<sup>18</sup> Even when it avoids unconscious convergence, the dynamics of debate or the press of time may severally limit the possibilities a group considers.<sup>19</sup>

Cognitive scientists do not yet fully understand the process by which one possible analogy prevails over others in an individual mind or among members of a group. Research on foreign policy decisions supports cognitive science conclusions that retrieval of likely analogies usually rests on similarities of surface features, even though the application of analogy to comprehending the target domain involves assuming that the same deeper causal processes are involved in both domains.<sup>20</sup> When more than one analogy appears relevant, however, structural or pragmatic features may become more prominent in choosing among them. Researchers tend to agree that choosing among candidate analogies is a process of determining the “best fit”—strongest resemblance not canceled by a strong difference. In practical fields like international politics, where reasoning is closely tied to purpose, the best fit will be perceived in terms of the particular purpose at hand.<sup>21</sup> It will be sensitive over time to refinements of mental categories in the source domain that are produced by ongoing problem solving.<sup>22</sup>

Retrieval is also influenced by the level of reasoning skill, including experience solving the sorts of problems presented in dealing with the target domain. Early in

15. See Miller 1956; and Hastie 1986.

16. See Purkitt 1991, 40; and Holland et al. 1986, 84.

17. See Tversky and Kahneman 1982; Holland et al. 1986, 84; Barsalou 1989, 96–99; and Riesback and Shank 1989, 19–24.

18. Janis 1989.

19. Sylvan, Majeski, and Millikan 1991, 333.

20. See Keane 1988; and Gentner 1989. For an argument that surface similarities prevail when the source and target domains are closely related but that similarities of apparent causal processes prevail, when they are more distant from each other, see Vosniadou 1989, 414–17. For an application of these arguments to foreign policy decisions, see Khong 1992, 217–19.

21. For various views on the influence of practical concerns, see Collins and Loftus 1975; Gentner 1983; and Holland et al. 1986.

22. Mefford 1990; and Sunstein 1993.

the process of understanding a target domain, when those involved can be regarded as “novices” in their understanding, retrieval focuses on surface similarities; humans rely on a single analogy during this time to speed learning. Later, when participants have become “experts” through greater familiarity with the target domain, retrieval will rely as much or more on structural similarities and users are more apt to perceive the limits of any single analogy.<sup>23</sup> Unless or until they can develop more rigorous conceptions of the target domain that permit using inductive or deductive reasoning, experts develop knowledge through simultaneous use of multiple analogies, each capturing some aspect or aspects of the target domain.<sup>24</sup> While this lends an appearance of incoherence to the reasoning process, most people are not bothered by use of multiple analogies. Few are strongly committed to complete consistency,<sup>25</sup> most are more interested in having a conception that “works” even if it is not entirely internally coherent.

In politics, the sifting of competing analogies is not only an exercise in understanding but also an effort to set the terms of subsequent debate and action. These terms of debate are not politically neutral; they serve as frames that organize perceptions, and in the process they give greater prominence to some concerns while obscuring others.<sup>26</sup> Governments are highly aware of this, devote great attention to how problems are defined, and use all the resources at their command to nudge definitions in favorable directions. Yet a decision to hold explicit negotiations rather than let an international regime accrete by development of custom or spring ready-made from the impositions of great powers means that success in setting the terms of debate also requires the ability to offer reasons and justifications that other governments find persuasive.<sup>27</sup> One strong source of persuasiveness is appeal to widely shared values and standards of reasoning.<sup>28</sup> In the international system, common values frequently are expressed in international law and the declaratory resolutions of intergovernmental organizations. In negotiations focused on formulating or reformulating international regimes, the prevalence of lawyers means that the shared standards of reasoning are often those of legal reasoning, though on a topic like space, natural science also provides some of the common standards. Lawyers in all legal systems are well-trained in the art of analogical reasoning and can apply those skills to offering, exploring, accepting, modifying, or rejecting possible analogies and the proposed rules they inspire, as well as to fitting new situations within a body of existing rules.<sup>29</sup>

23. See Spiro et al. 1989, 500–501; and Novick and Holyoak 1988.

24. See Rumelhart and Norman 1981, 340–57; and Spiro et al. 1989.

25. See Pепitone 1986; and Purkitt 1991, 40.

26. In the political science and international relations literatures, see, for example, Connolly 1974. For cognitive science discussions, see, for example, Goffman 1974; Tannen 1993; and Schon and Rein 1995.

27. For a discussion of these contrasting modes, see Young 1983, 98–101.

28. See Schon 1983; and Holzner and Marx 1979. For warnings that such specialist reasoning is shaped by broader social and political currents, see, for example, Habermas 1971; Gouldner 1979; and Tesh 1988.

29. Good introductions of legal reasoning include Levi 1949; Burton 1985; Wellman 1985; and Sunstein 1993. For an account that draws explicitly on cognitive science to illuminate legal reasoning, see Rissland 1990.

Once a conceptualization generated by analogy is accepted, the initial analogy tends to recede into the background. However, it is still available for use when additional questions or situations arise that cannot be addressed simply by invoking the conceptual framework now established for handling the issue. Yet return to the original analogy does not necessarily produce inferences that advance the preferences of those who initially urged using the analogy. This is particularly likely in expert reasoning processes that rely on multiple analogies, because the combination often yields inferences that would not be made from any one analogy alone.

### Selecting the initial analogy for outer space

Much of the intergovernmental and transnational discussion about creating international law for outer space activity in the 1950s involved exploring the implications of competing high seas and national airspace (hereinafter “air”) analogies, because each suggested very different basic rules for space activity. Adopting the high seas analogy would encourage treating outer space as an open access area to be used by all, appropriated by none, and policed by letting each state enforce the rules on its own nationals wherever they were in space. Adopting the air analogy would encourage treating outer space as something to be divided into national segments, used only with permission of the state possessing the segment where activity would proceed, and policed by letting each state enforce the rules on everyone—foreigners as well as its own nationals—operating within its segment.

Both analogies had considerable surface appeal. The air analogy was favored by the location of outer space: it is “above” the earth. Vehicles traveling in it could cause damage by crashing or dropping things on those below, and they were invariably described as “flying.” The high seas analogy was favored by the vastness of space and the difference between the near-vacuum of space itself and the more solid, natural celestial bodies found within it. This prompted the syllogism, territorial sea is to high seas as national airspace is to outer space, with the first-named element treated as an area within which states had special rights to protect their security and the second-named as a highway open to all.<sup>30</sup>

Each analogy was preferred initially by one superpower because it appeared to advance that state’s security interests. In the 1950s, the superpowers were particularly concerned about two military potentials of outer space: use of rockets for long-distance delivery of nuclear weapons and use of camera-carrying satellites for reconnaissance. The Soviets were more strongly concerned about rocketry because they had little immediate prospect of acquiring use of foreign bases from which they could launch air attacks on U.S. territory, while the United States already had an ample array of such bases in Japan, Turkey, and Western Europe. This strong Soviet

30. Early “zone theories” of air law, under which aircraft were free to fly anywhere at high altitudes but needed permission from the subjacent state to fly at lower altitudes, had been rejected and had little influence on analogy selection. See Matte 1969, 36–44; and Gal 1985, 135–36.



interest translated into a far greater effort to develop rockets and was crowned by the late August 1957 announcement that the Soviet Union possessed intercontinental-range rockets.<sup>31</sup> The balance of eagerness was reversed on satellite-based reconnaissance. The Americans were interested in all forms of aerial and space reconnaissance because of the large gap between what they could find out about Soviet activity and what the Soviets could find out about U.S. activity. A tightly closed political system permitted the Soviets to keep more things secret—even the existence of entire cities devoted to military research and development. Photoreconnaissance would reduce this gap, and U.S. leaders did not hide their interest in it. The Soviets knew almost immediately that the Americans had begun work on satellite systems in 1954.<sup>32</sup> President Eisenhower's 1955 "open skies" proposal and the post-sputnik public uproar gave them more indications.<sup>33</sup> Not surprisingly, the Soviets wanted to preserve a great information imbalance as long as possible.

Had rocketry been the superpowers' only concern, whether outer space law was built on high seas or air analogies would not have mattered; both the high seas and the national airspace of enemy states are legitimate locales of war. However, the choice of analogy was very important for the legitimacy of satellite reconnaissance. The law of the air requires permission for all flights within national airspace. Civilian aircraft are governed by rules established in the International Civil Aviation Convention and the supplementary multilateral and bilateral agreements on air services, while government-owned and military craft may enter foreign airspace only by express permission.<sup>34</sup> It was well-settled that intruding aircraft may be intercepted and forced to land, and intruding reconnaissance craft, fighters, and bombers shot down.<sup>35</sup> In contrast, all aircraft, civilian and military alike, may fly anywhere over the high seas. Any interference with them in peacetime is not acceptable; only during hostilities can the forces of one side shoot down craft belonging to the other. The Soviet goal of securing the right to shoot down reconnaissance satellites would be served by air analogies, but the U.S. goal of pursuing reconnaissance without interference would be served by high seas analogies.

Though most governments paid little attention to space in the early 1950s, some international lawyers already were discussing the possible shape of law for outer space.<sup>36</sup> A few used air law to support upward extensions of national jurisdiction, but the majority of U.S. and other Western international lawyers commenting on space possibilities used a high seas analogy.<sup>37</sup> By suggesting that outer space should be

31. Oberg 1981, 29. For a general discussion of the Soviet and U.S. rocket programs, see McDougall 1985, chaps. 2–4.

32. Steinberg 1983, 23 and 27.

33. For an example of this reaction, see Richard Witkin, "U.S. Working on Satellite That Could Film the Earth," *New York Times*, 14 October 1957, 1.

34. For the rule, see Convention on International Civil Aviation 1944. On air law at the time, see McNair 1953.

35. See Lissitzyn 1953; and Wright 1960.

36. See, for example, Cooper 1951; Schachter 1952; Horsford 1955; Jenks 1956; ASIL 1956; and Cheng 1957.

37. The clearest use of the air analogy is found in Cooper 1951. The greater prevalence of the high seas analogy is shown in International Law Association 1960, particularly article 3; and American Bar Association 1960, especially p. 24.

used in common and regulated jointly, a high seas analogy fit well with Western lawyers' broadly multilateralist outlook. Advocates also believed that the high seas analogy fit the observable realities of outer space better. This conclusion was based partly on physics: the earth's daily rotation and its annual orbit around the sun created constantly changing geographic relations between particular states and particular areas of outer space.<sup>38</sup> In addition, the lawyers believed that states would continue to lack the material means of excluding others from any area of space that they might claim, and ability to exclude is one of the traditional preconditions for asserting sovereignty.<sup>39</sup> The underlying hope that outer space activity would become and remain a primarily peaceful pursuit in a shared common area was reinforced in 1954 when launches of artificial satellites for probing beyond the atmosphere were included in plans for the International Geophysical Year (IGY).<sup>40</sup>

Soviet bloc legal specialists came to the subject somewhat later and were aware of the ongoing Western discussions. Some more or less explicitly used the air analogy to buttress arguments that extending sovereignty into space was necessary to protecting Soviet security.<sup>41</sup> Yet others preferred the high seas analogy or argued that outer space was different from both and needed its own law.<sup>42</sup> Opponents of the air analogy did not ignore the reconnaissance problem; rather, they argued that the Soviet Union could maintain its security by rules that defined reconnaissance as an illegal activity and permitted unilateral action against it.<sup>43</sup>

Debate in the United Nations (UN) General Assembly's First Committee in 1958 revealed that the high seas analogy had wider support among governments, including those of neutrals and nonaligned countries. Most were persuaded that the similarity of space being above earth was more than canceled by the ever-shifting geographical relations between portions of space and portions of earth.<sup>44</sup> High seas analogies were also highly available in diplomats' memories because the (First) UN Conference on the Law of the Sea had just proposed four new multilateral treaties concerning activity on the oceans. Though coastal state jurisdiction was to be expanded somewhat and both continental shelf doctrines and twelve-mile exclusive fishing zones were to be accepted, the treaties as a whole reinforced the traditional rules treating the high seas as a commons open to all.<sup>45</sup> Air law had been codified in the mid-1940s and air issues confined to the level of disputes about specific application of the rules.<sup>46</sup>

38. See Jenks 1956, 103; and Roy 1956, 94–96.

39. See Huber 1928, 875; and O'Connell 1965, 1:471.

40. Sullivan 1959, 275–76 and 301–9.

41. See Kislov and Krylov 1956; Milde 1958; and Zhukov 1960. See also the discussion in Lapenna 1966.

42. Zadorozhny 1957 and Galina 1958 offer the first argument; Korovin 1959 offers the second.

43. See Zadorozhny 1957; and Galina 1958, 8.

44. See remarks of Peruvian delegate in UN GAOR 1958, First Committee, Thirteenth Session, 983d meeting, 13 November, par. 23; and remarks of Australian delegate in *ibid.*, 986th meeting, 17 November, par. 19.

45. See Convention on the Territorial Sea and Contiguous Zone 1958; Convention on the Continental Shelf 1958; Convention on the High Seas 1958; and Convention on Fishing and Conservation of the Living Resources of the High Seas 1958.

46. The multilateral framework of air law is codified in the Convention on International Civil Aviation 1944.

Debate about whether to use air or high seas analogies ended in 1961, when the Soviet government accepted General Assembly Resolution 1721A. It expressed preliminary agreement on two key propositions:

- (a) International law, including the Charter of the United Nations, applies to outer space and celestial bodies
- (b) Outer space and celestial bodies are free for exploration and use by all States in conformity with international law and are not subject to national appropriation.<sup>47</sup>

The Soviets then waged a brief campaign to have all reconnaissance declared illegal, but shifted position further in 1963 by arguing that types and levels of reconnaissance specifically included in arms control treaties would be exempt from unilateral countermeasures.<sup>48</sup>

The Soviet decision to stop opposing all satellite reconnaissance had strong practical roots easily comprehended with realist theory. Increasing tensions with the Chinese had led the Soviets to end aid programs and withdraw technicians from China in mid-1960. Since the Chinese also maintained a tightly closed political system, the withdrawal of technicians denied the Soviets much information about Chinese plans and activities and increased their interest in remote reconnaissance systems.<sup>49</sup> The Soviets launched their first reconnaissance satellite in April or October 1962 and shifted their position in UN debates soon afterward.<sup>50</sup> A superficial glance at the timing encourages drawing the wider conclusion that the same practical concerns also led the Soviets to abandon the air analogy. However, that wider conclusion requires ignoring the fact that most Soviet legal specialists were criticizing the use of an air analogy even before the row with China became acute.

There is evidence supporting the conclusion that the Soviet government was persuaded to abandon the air analogy through logical argument. Though boycotting the Ad Hoc Committee on Peaceful Uses of Outer Space in 1959 and 1960 to protest what they regarded as a too heavily Western-oriented membership, Soviet delegates participated in many of the UN debates and were aware that most other governments found air analogies unpersuasive.<sup>51</sup> A few Soviet and several Eastern European specialists participated in the transnational discussions among international lawyers, but all were aware of the direction of Western and Third World opinion from their reading of foreign publications.<sup>52</sup> The shift of opinion among Soviet international

47. UN GAOR 1961, Sixteenth Session, supplement 17, Vol. 1, 6.

48. See, for example, operative paragraph 8 in the Soviet draft declaration on outer space, reproduced in UN Doc. A/AC.105/6, 9 July 1962, 3–4; Soviet delegate's remarks in the Outer Space Committee's Legal Subcommittee, UN Doc. A/AC.105/C.2/SR.7, 7 June 1962, 5; and Soviet delegate's remarks in UN GAOR 1962, First Committee, Seventeenth Session, 1289th meeting, 3 December, 9. Also see Piradov 1976, 136.

49. Steinberg 1983, 64–65.

50. Klass 1971, 119–22 says April; Burrows 1986, 131 says October.

51. UN GAOR 1958, First Committee, Thirteenth Session, 982d–995th meetings, 12–24 November; UN GAOR 1959, Fourteenth Session, 1079th–1081st meetings, 11–12 December; and UN GAOR 1961, Sixteenth Session, 1210th–1214th meetings, 4–11 December.

52. See International Institute of Space Law 1958; International Institute of Space Law 1959; and International Law Association 1960. Haley 1963, 348–68, discusses their significance in detail.

lawyers became more pronounced after January 1959, when Evgenii Korovin, one of the most senior Soviet legal specialists, joined the discussion on the side of those criticizing air analogies.<sup>53</sup> Though some still pointed to the limits of high seas analogies, none advocated using air law as a source of inspiration in 1961.<sup>54</sup>

### Moving to multiple analogies

By the time governments rejected the air analogy in 1961, the process of discussion also had revealed the limits of high seas analogies for developing outer space law. They were most obvious in addressing questions raised by the possibility of human activity on the solid bodies—the moon, asteroids, other planets, and moons of other planets—that exist in outer space. The governments most actively seeking a ban on all military activity in space also concluded that the high seas analogy, with its acceptance of military activity, would not promote the sort of legal order they desired.

Though a few Soviet bloc and Western legal specialists supported the idea of making national claims to celestial bodies, the overwhelming majority opposed that idea.<sup>55</sup> Third World and Western delegates participating in the UN's Ad Hoc Committee on Peaceful Uses of Outer Space contended that "serious problems could arise if States claimed, on one ground or another, exclusive rights over all or part of a celestial body" in 1959 but did not regard the issue as urgent enough to require immediate settlement.<sup>56</sup> Their governments, particularly those of the superpowers, regarded the matter as pressing and continued discussions on the question. Agreement to treat celestial bodies as common areas was first registered in General Assembly Resolution 1721A.<sup>57</sup> Article II of the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty) stipulates that "Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."<sup>58</sup>

Extending the nonappropriation principle to celestial bodies was a rational decision for the superpowers. The "race for the Moon" had already begun: the U.S. government was publicly committed to landing astronauts there by 1970<sup>59</sup>; the Soviet government had landed an unmanned probe on the moon in September 1959, sent another to photograph the far side of the moon in October, and was developing launchers powerful enough to send cosmonauts beyond earth orbit.<sup>60</sup> Each hoped to

53. Korovin 1959, 54.

54. See, for example, Osnitskaya 1959; Zadorozhny 1962; and Korovin 1962.

55. American Bar Association 1960.

56. Report of the Ad Hoc Committee on the Peaceful Uses of Outer Space, UN Doc. A/4141, Part III, par. 30, UN GAOR 1959, Fourteenth Session, Annexes, agenda item 25.

57. General Assembly Resolution 1721A, par. 1(b).

58. Outer Space Treaty 1967.

59. Kennedy 1961, 287–93.

60. McDougall 1986, 202 and 287–93.

reach the moon first but feared the consequences of being beaten and having the other claim the moon.<sup>61</sup> Little imagination was needed to envision a similar race for asteroids and other planets. Neither superpower, however, was particularly anxious to disturb the relaxation of tensions that had begun in 1955 by extending cold war rivalry to distant space; nor were they eager to commit the higher level of resources needed for staking and defending a national claim until they knew more about the composition and resource potential of the moon and planets. Unlike the Iberian explorers of the late fifteenth century, who were inspired by desires to link up with the powerful Christian communities they believed lived in Africa and India and to control the lucrative spice trade, would-be spacefarers could only speculate on what lay out there.<sup>62</sup> The moon was the most inviting destination simply because of its proximity to earth.

Yet the material calculations that supported conflict avoidance could not supply the positive foundation necessary for developing stable rules for activity or for persuading third governments to accept them. High seas analogies were not helpful here. The moon and other celestial bodies looked too much like land: they were solid, and at least some of them appeared to be places where astronauts could park their craft, disembark, and set up fixed camps. Interpreting the physical facts with high seas analogies would encourage the syllogism, high seas are to islands as outer space is to celestial bodies, which would entail treating the first as a common highway and the second as open to national claim. This was so obviously counterproductive to superpower and other states' purposes that the period of relying solely on models suggested by high seas analogies was very brief.

Even so, replacing analogical reasoning with constructing a rationale for treating celestial bodies as common areas by induction from many instances of space activity or by deduction from an already-established framework of principles for outer space law would have been difficult this early in the space age. Yet no such move away from analogical reasoning was necessary because a shift back to retrieval quickly produced another candidate analogy: Antarctica.<sup>63</sup> Antarctic analogies were timely, since the Antarctic Treaty was negotiated in 1958–59. Additionally, they were likely to be retrieved even without such a strong reminder because Antarctica combined the surface resemblance of being land with the structural resemblance of having been legally designated a common area. Human activity in Antarctica also resembled likely activity on celestial bodies in three ways. First, humans in Antarctica would have to cope with an extremely harsh environment and bring along almost everything needed for survival, making them dependent on large logistical efforts that only governments could afford. Second, the extent of Antarctic resources was unknown and their location remote. In the late 1950s, most of Antarctica was still unexplored. Geologists began suggesting the most promising areas for resource seeking only after

61. For similar expressions of anxieties, see Broushey 1957; and Larinov 1964.

62. Scammel 1989 summarizes the fifteenth-century outlook.

63. For an extensive treatment of this analogy, see Jessup and Taubenfeld 1959. See also remarks of Indian delegate, UN GAOR 1959, First Committee, Fourteenth Session, 1,080th meeting, 11 December, par. 11.

continental drift theory won acceptance a decade later.<sup>64</sup> Finally, distance from other continents meant that military and other installations were easy to establish but hard to defend from attack.<sup>65</sup>

Perception of the structural similarity between Antarctica and celestial bodies was reinforced during analogy mapping by strong similarities in the politics of the two areas. Though seven states (Argentina, Australia, Chile, France, New Zealand, Norway, and the United Kingdom) had made territorial claims to parts of Antarctica, the status of the continent remained open to question. First, the Argentine, British, and Chilean claims overlapped, so even the claimants did not accept all of each others' claims. More importantly, most states, including the superpowers, had not recognized the claims. Though each superpower believed it had as good a right to make a claim as any of the seven claimants, and reserved the right to do so if the continent were divided in the future, both preferred being able to send expeditions anywhere in Antarctica.<sup>66</sup> By late 1958, the superpowers were also sponsoring the largest programs of Antarctic research and exploration, though their lead there was not as overwhelming as their lead in outer space.

Setting claims disputes aside and treating Antarctica as a common access area for scientific research had been proposed in 1948 during a round of diplomatic discussions about the continent.<sup>67</sup> Opening Antarctica to the expeditions and research stations of all states participating in IGY programs on the understanding that activity would be temporary and would "not modify the existing status of the Antarctic regarding the relations of the participating countries" became the basis of IGY planning in July 1955.<sup>68</sup> When scientists expressed interest in continuing Antarctic research after the IGY ended in December 1958, the U.S. government took the lead in convening a conference to work out a more enduring legal regime for Antarctic activity.<sup>69</sup> Negotiations among the twelve states—the superpowers, the seven claimants, and three others—that had sponsored Antarctic research during the IGY led to the Antarctic Treaty, by which states agreed to continue treating Antarctica as a joint access zone and put national claims and disputes about national claims into abeyance.<sup>70</sup>

The Antarctic analogy survived the mapping stage because it supplied solutions to a number of practical problems. Conceptually, it provided a rationale for leaving territorial claims issues aside that had wide appeal. Those who hoped that celestial bodies would never become the objects of competition could take heart from the Antarctic Treaty's preambular pronouncements that "it is in the interest of all mankind that Antarctica continue forever to be used exclusively for peaceful

64. Wright and Williams 1974.

65. For contemporary appreciations, see Lepotier 1961; Taubenfeld 1961, 261–62; and Gould 1958, 31–32.

66. Watts 1992, 120.

67. Hanessian 1960, 441. The relevant diplomatic correspondence is reproduced in Bush 1982, 2:383–84.

68. Sullivan 1959, 319–20.

69. Fuller accounts of the diplomacy appear in Auburn 1982; Beck 1986; and Peterson 1988.

70. Antarctic Treaty 1959.

purposes and shall not become the scene or object of international discord.” Those who thought that nonappropriation was only a useful temporary solution could take heart from the Article IV provision that neither recognized nor required renunciation of claims, but required only that they not be asserted while the Antarctic Treaty remained in force. Operationally, the Antarctic Treaty indicated how states could combine a nonappropriation principle with the retention of legal control over humans, space vehicles, and stations on celestial bodies. Just as the high seas analogy suggested using the concept of flag state jurisdiction for spacecraft, the Antarctic analogy suggested using the Antarctic Treaty rule that each state sending an expedition or establishing a research station retain control over it. The Antarctic Treaty provisions for freedom of scientific research and exploration and mutual noninterference with other states’ activities also provided useful parallels for developing space law.

The Antarctic analogy appealed to the superpowers because it permitted continuation of lunar activity without bringing celestial bodies into the cold war rivalry. At the same time, it also appealed to governments hoping to link acceptance of space as a common area with the imposition of limits on the types of activity undertaken there.<sup>71</sup> They were quick to see that the Antarctic Treaty provided a model for the demilitarization of all of outer space, not just celestial bodies.<sup>72</sup> However neither an Egyptian proposal for demilitarization advanced in 1963 nor an Egyptian-Cameroonian proposal advanced in 1965–66 gained much support.<sup>73</sup>

The lack of support reflected other governments’ reluctance to press proposals opposed by both superpowers. The superpowers willingly accepted nonmilitarization of celestial bodies; both agreed that military facilities there would be too far from earth to be useful or be defended against attack. Military activity in space, particularly near-earth space, was another matter. Rocketry and satellite reconnaissance were too closely bound up in other strategic calculations to be forgone except as part of agreements limiting overall military competition. The superpowers’ 1963 consensus to forgo stationing nuclear and other weapons of mass destruction in space was part of a wider deal in which the United States also agreed to stop seeking a ban on intercontinental ballistic missiles (ICBMs) and the Soviet Union confirmed their tacit acceptance of satellite reconnaissance.<sup>74</sup> Similarly, the 1963 partial nuclear

71. See remarks of Indian delegate in UN GAOR 1959, First Committee, Fourteenth Session, 1980th meeting, 11 December, par. 11; Chilean delegate in UN GAOR 1958, First Committee, Thirteenth Session, 982d meeting, 12 November, pars. 28–33; Italian delegate in *ibid.*, par. 40; Austrian delegate in *ibid.*, 990th meeting, 19 November, par. 12; and Peruvian delegate in *ibid.*, par. 33.

72. Remarks of Japanese delegate in the Outer Space Committee’s Legal Subcommittee, UN Doc. A/AC.105/C.2/SR.5, 4.

73. See Egyptian proposal in UN Doc. A/AC.105/12, 6 May 1963, 7 and reactions noted in remarks of Lebanese and Indian delegates in the Outer Space Committee’s Legal Subcommittee, UN Doc. A/AC.105/C.2/SR.21, 24 April 1963, 9–10, and UN Doc. A/AC.105/C.2/SR.23, 25 April 1963, 7, respectively. Egyptian-Cameroonian proposal in UN Doc. A/6212, 20 December 1965, par. 20 and reactions noted in remarks of Indian, Sri Lankan, and Pakistani delegates in UN GAOR 1966, First Committee, Twenty-First Session, 1493d meeting, 17 December, pars. 9, 19, and 64.

74. Space weaponry was the subject of General Assembly Resolution 1884 (XVIII), UN GAOR 1963, Eighteenth Session, supplement 15, 15. On the larger agreement, see Garthoff 1981, 23–24 and 31.



test ban agreement covered outer space, the atmosphere, and the oceans.<sup>75</sup> This pattern persisted throughout the cold war. The 1972 agreement to limit development of antiballistic missile systems, which also had implications for work on antisatellite weapons, was part of the first strategic arms limitation talks (SALT I) package. The 1979 agreement to ban “fractional orbital bombs”—nuclear weapons delivered by ICBMs with sufficient range to fly to the target via the South Pole—was part of the SALT II package.<sup>76</sup> Progress in discussions of limiting antisatellite, antimissile, and orbital weapons systems in the late 1980s were also part of wider negotiations including limits on intercontinental and intermediate-range nuclear arms.

Though neither analogy was mentioned explicitly in the UN debates, the superpower consensus on military activity was consistent with mixing the available analogies to generate a set of rules congruent with their current perceptions of interest. By treating the vacuum of space like the high seas and celestial bodies like Antarctica, the superpowers could secure both the freedom to pursue military uses of near-earth space and the nonextension of arms competition to celestial bodies that they desired. Thus Article IV of the Outer Space Treaty departs from the usual references to “outer space” to stipulate only that “The moon and other celestial bodies shall be used by States Parties to the Treaty exclusively for peaceful purposes.”

However, the political appeal of demilitarizing all of outer space was strong enough that both superpowers felt constrained to accept demilitarization as an ultimate goal. The Outer Space Treaty contained a glancing acknowledgment of this goal in a preambular statement that the parties recognize “the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes.”<sup>77</sup> Nevertheless, each superpower found ways to defer this ultimate result. The United States insisted that complete demilitarization could be accomplished only through concrete agreements addressing particular activities and providing for strong verification of compliance.<sup>78</sup> During most of the cold war, this insistence on strong verification assured Soviet rejection. The Soviet Union often linked demilitarization of space to limitations on earth-based weapons that it knew the United States would not accept, or proposed banning only certain forms of military activity in space.<sup>79</sup>

## Returning to analogies

Though the high seas and Antarctic analogies faded from view after the Outer Space Treaty was elaborated, they were invoked again when particular space activities

75. Treaty banning Nuclear Weapons Tests in the Atmosphere, in Outer Space, and under Water 1963.

76. For a discussion of the Soviet interest in fractional orbital bombs, see Durch and Wilkenning 1984, 38–39.

77. Outer Space Treaty 1967, preambular paragraph.

78. U.S. statement on proposals to ban antisatellite weapons, *UN Disarmament Yearbook 1990*, 30.

79. For an example of the first tactic, see the Soviet proposal in UN Doc. A/3818 and Corr.1, 15 March 1958. For an example of the second, see the Soviet “draft treaty on the stationing of weapons of any kind in outer space,” UN Doc. A/36/192, in UN GAOR 1981, Thirty-Sixth Session, Annexes, agenda items 39–56, 128, and 135, 2–3, August.



raised questions that could not be answered by referring to or interpreting the existing rules of outer space law.<sup>80</sup>

Negotiation of the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (the Moon Treaty) in 1970–79 provides a particularly clear example of this return to analogical reasoning. In this negotiation, expert reliance on multiple analogies led to new combinations of elements, promoting inferences different from those expected by the proponents of any of the analogies. While most of the questions posed by human activity on celestial bodies could be answered by reference to the Outer Space Treaty or use of the Antarctic analogy, neither source addressed the issue of resource exploitation. This gap gave Third World governments the opportunity to propose a major new departure.

The superpowers initiated the Moon Treaty negotiations in the late 1960s because they were concerned that lack of clear understandings about lunar activity would disturb their broad agreement to exclude celestial bodies from cold war competition. Left to their own devices, they would have agreed fairly quickly on a set of rules because they both accepted the relevance and usefulness of Antarctic analogies for questions not settled by the Outer Space Treaty.<sup>81</sup> They were not particularly sensitive to the fact that both the Outer Space Treaty and Antarctic analogies failed to suggest how to regulate exploration for or exploitation of natural resources. Though Antarctic cooperation had developed considerably since 1961, neither the Antarctic Treaty nor any of the ancillary agreements among the parties addressed mineral resources.<sup>82</sup> Signatories to the Antarctic Treaty did not start addressing hydrocarbon or mineral resource issues until 1975.<sup>83</sup> They completed a draft agreement in 1988 but then set the issues aside by a formal moratorium on mining and drilling.<sup>84</sup>

This gap in Antarctic precedent opened the door to invoking other analogies. The Argentine government quickly supplied one by returning to the oceans for inspiration and bringing forward the notion of treating resources as the “common heritage of mankind” then being advocated for regulation of resource activity on the deep seabed.<sup>85</sup> Cognitive science suggests that the parallel between the deep seabed and outer space was likely to be drawn because surface similarities, conceptual similarities, and timeliness were all promoting it. The deep seabed had some physical similarity to land and celestial bodies since it is the solid floor of the ocean. In addition, the key resource issues on both the deep seabed and celestial bodies involved mining. Ocean floor mining is treated differently from fishing because miners need a different form of legal security for their activity. Fishers use movable equipment to chase a renewable mobile resource, so their main concern is assuring

80. Moon Treaty 1979.

81. Korovin 1962, 63, noted the relevance of the Antarctic analogy, and Piradov 1976, 86, records Soviet acceptance of it. U.S. acceptance is reflected in the many borrowings from Antarctic rules in a 1972 draft moon treaty in UN Doc. A/AC.105/101, 11 May 1972, Annex I.

82. Peterson 1988, 113–14.

83. *Ibid.*, 100.

84. See Anderson 1991; and Watts 1992, 287.

85. Argentine draft in UN Doc. A/AC/105/C.2/L.71, 23 June 1970, reprinted in Report of the Outer Space Committee, UN GAOR 1970, Twenty-Fifth Session, supplement 21, 17 September.

access to opportunities for hunting and capturing. Miners exploit a finite fixed deposit, so their main concern is securing protection against others taking advantage of knowing where the deposit is located to take some of it away. The conceptual similarity involved the fact that the deep seabed, like celestial bodies, had been defined as a common area.<sup>86</sup> Such a definition meant that the legal security miners desired could be provided only through a widely supported multilateral agreement that defined and protected property rights. Adding to the conceptual similarities, the preamble of the Outer Space Treaty even stated that space is “the province of all mankind” and that space activity “should be to the benefit of all nations.” Timeliness involved a near simultaneity of negotiations, which “created a situation in which negotiations in one field could easily influence the positions of states on corresponding issues in the other.”<sup>87</sup>

Yet the Argentines were leaping into the unknown by proposing use of the common heritage principle. While the UN General Assembly registered broad support for treating the deep seabed as common heritage in the 1970 Declaration on Principles Governing the Seabed, it did not agree what that would involve.<sup>88</sup> Many Third World governments used the UN Committee on Peaceful Uses of the Seabed (1967–72) and the ensuing Third UN Conference on the Law of the Sea (1973–82) to promote a definition that would place resources under the control of a global multilateral body, the International Seabed Authority. It would assure transfer of investment funds and technology from industrial countries and divide the profits from exploitation among member states by formulas favoring developing countries.<sup>89</sup>

This return to an ocean analogy triggered very clear perceptions of interest by all the governments involved in the moon treaty negotiations. These perceptions had less to do with mining, of which there was little immediate prospect, than with arguments over the general shape of the international economy. Both supporters and opponents recognized that the Argentine proposal to apply the common heritage principle to celestial bodies as part of the broader Group of 77 effort to shift at least part of the global economy from a market-oriented system to a state-centered and explicitly redistributive one. Most industrial states resisted joint management on celestial bodies for the same reasons they resisted it for the deep seabed. Here, both superpowers were on the same side, though for somewhat different reasons. The U.S. government was concerned about preserving access to the resources and about the implications of substituting intergovernmental management for markets and private enterprise. The Soviet government was not opposed to supplanting markets or private

86. Compare the characterization of the deep seabed given in the Declaration of Principles Governing the Sea-Bed and the Ocean Floor, and the Sub-Soil Thereof, Beyond the Limits of National Jurisdiction, General Assembly Resolution 2749 (XXV) UN GAOR 1970, supplement 28, 24–25.

87. Danilenko 1988, 252.

88. General Assembly Resolution 2749 (XXV), UN GAOR 1970, Twenty-Fifth Session, supplement 28, 24–25.

89. For a fairly typical early proposal see the Organization of African Unity Declaration on the Issues of the Law of the Sea, CM/Resolution 289 (XIX), Sec. I. Reprinted in UN Doc. A/AC.138/89, 2 July 1973 and in *International Legal Materials* 12:1207 (1973).

enterprise but was reluctant to confide management to an intergovernmental organization in which it would have little influence.

The Argentine proposal was examined on several levels, including the deep seabed analogy itself. Industrial state governments generally cautioned that the state of knowledge about resources and the economics of their potential exploitation in the two areas were too different to permit apt comparison.<sup>90</sup> This was particularly clear in a Japanese comment: “. . . it is still too early to consider seriously the problem of sharing the benefits of the resources of the Moon or other celestial bodies. The quality and quantity of the resources of the Moon are still not clear to us and this, naturally, is even more true in the case of other celestial bodies. It is economically and technically very difficult to imagine how to exploit and utilize these unknown resources. To stipulate that the resources of the moon are a common heritage of mankind might be tantamount to introducing a new concept, going beyond the scope of the Outer Space Treaty. My delegation is inclined to be cautious in the face of a new and not well-defined concept.”<sup>91</sup> Soviet bloc governments argued, in varying detail, that common heritage is a civil law concept and as such had no place in international law generally or outer space law in particular. While conceding that the law of the sea had absorbed some civil law concepts over the centuries, they insisted that outer space law had been developed without such concepts. With outer space law now developing as an autonomous branch of international law, they also concluded that sea analogies were no longer necessary.<sup>92</sup>

The industrial states were forced to devote so much energy to denying the relevance of the common heritage principle to celestial bodies because they already had accepted it for the deep seabed. No government had raised formal objections to using the term in the 1970 Seabed Declaration, which was adopted by a vote of 108 to 0 with 11 abstentions.<sup>93</sup> Even the Soviet bloc abstained rather than cast negative votes, and its statements of objection were buried in the records of First Committee debates.<sup>94</sup> The U.S. government labored under a far heavier political burden. It had used phrases much like “common heritage” in its initial statements about the deep seabed and voted for the 1970 declaration.<sup>95</sup> It had also used the term “common heritage” in its 1972 draft moon treaty.<sup>96</sup>

This clash over resource rules slowed but did not stalemate negotiations. None of the Group of 77 proposed establishing an intergovernmental body dealing with all

90. See, for example, Italian delegate in the Outer Space Committee's Legal Subcommittee, UN Doc. A/AC.105/C.2/SR.98, 4 April 1973, par. 59; and East German delegate in the Outer Space Committee, UN Doc. A/AC.105/PV.154, 22 March 1976, pars. 27–30.

91. Remarks of Japanese delegate in UN GAOR 1972, First Committee, Twenty-Seventh Session, 1866th meeting, 18 October, par. 9.

92. See Soviet position paper of 28 March 1973, reproduced in UN Doc. A/AC.105/196, 11 April 1977, Annex I, 11–12; and remarks of Soviet delegates in the Legal Subcommittee, UN Doc. A/AC.105/C.2/SR.204, 92–93; SR.206, 127, and SR.226, 8. See also discussions in Gorbziel 1985, 142–44; and Danilenko 1985, 122–26.

93. UN GAOR 1970, Plenary Meetings, Twenty-Fifth Session, 1933d meeting, 17 December, par. 230.

94. UN GAOR 1970, First Committee, Twenty-Fifth Session, 1798th meeting, 15 December.

95. Johnson 1966 and U.S. draft seabed declaration in UN Doc. A/AC.135/1 June 1967.

96. Text in UN Doc. A/AC.105/C.2(XI)/WP.12/Rev.1, 17 April 1972.

activity on celestial bodies. That decision is consistent with pragmatic awareness of industrial state opposition to the most ambitious forms of joint management. It is equally consistent with the fact that all proposals for revising the law of the sea combined joint management of mineral and hydrocarbon resources on the deep seabed with reaffirmation of traditional high seas freedoms for fishing and other activities. Whatever the reason, confining common heritage to resource activity meant that all Third World governments accepted the relevance of the Antarctic analogy for deciding the other issues raised in the moon treaty negotiations. This permitted the Outer Space Committee to agree on most of the nonresource issues during one negotiating session in 1972.<sup>97</sup> In space, as in Antarctica, prohibiting claims to sovereignty did not prevent states from retaining ownership of and jurisdiction over their stations and other equipment on the moon.<sup>98</sup> States undertook a similar obligation to avoid interfering with one another's stations and expeditions.<sup>99</sup> Each state also retained control over all persons in any expedition it organized or any station it established.<sup>100</sup> Antarctic Treaty provisions also served as the model for most of the operational features of the moon treaty mutual inspection system.<sup>101</sup>

The impasse over resource activity was overcome in a slowly assembled compromise paralleling in time, though not in substance, the Group of 77 shift from insisting that the ISA be the sole miner, to the 1977 compromise on ISA as manager of a "parallel system" in which it would mine half the deep seabed and license others to mine the other half.<sup>102</sup> In 1974, France suggested treating the Moon Treaty as a transitional regime governing scientific research and exploration with provision for later adoption of rules for resource activity preserving "the inalienable rights of the international community over lunar resources once they are brought into exploitation."<sup>103</sup> Seven Third World governments endorsed the proposal two years later.<sup>104</sup> The entire Group of 77 accepted the idea in 1978–79.<sup>105</sup>

Though a similar realization that resource exploitation was a distant prospect also affected the seabed negotiations, Group of 77 concessions in the Moon Treaty were greater.<sup>106</sup> Article 11 states that "The moon and its natural resources are the common

97. Chairman's draft and summary of discussions in Report of the Legal Subcommittee, UN Doc. A/AC.105/101, 11 May 1972, 6–16.

98. Implied in Antarctic Treaty 1959, Article II; and Moon Treaty 1979, Article 12.

99. Implied in Antarctic Treaty 1959, Articles III and IX; specified in Moon Treaty 1979, Article 12.

100. See Antarctic Treaty 1959, Articles II (indirectly) and V; and Moon Treaty 1979, Article 12, par. 1.

101. See Antarctic Treaty 1959, Article VIII; and Moon Treaty 1979, Article 15, par. 1.

102. Informal Composite Negotiating Text, Part XI, Sec. 4. UN Doc. A/CONF.62/WP.10, in *UN Conference on the Law of the Sea, Official Records* 7:25–35. Also reprinted in *International Legal Materials* 16:1152–63 (1977).

103. Remarks of French delegate in UN GAOR 1974. First Committee, Twenty-Ninth Session, 1992nd meeting, 16 October, 11.

104. Joint working paper submitted by Argentina, Brazil, Indonesia, Mexico, Nigeria, Romania, Sierra Leone, and Venezuela, in UN Doc. A/AC.105/171, 28 May 1976, annex I, 2–4.

105. Report of the Outer Space Committee, UN GAOR 1978, Thirty-Third Session, supplement 20, 7 August, pars. 58–62 and annex III, and *ibid.*, Thirty-Fourth Session, supplement 20, 14 August 1979, pars. 55–66.

106. For a seabed example, see the statement of the Philippines delegate in GAOR 1979, Special Political Committee, 34th sess. 19th meeting, 1 November, par. 37.

heritage of mankind, which finds its expression in the provisions of this Agreement, particularly in paragraph 5 of this article.” Paragraph 5 is a commitment to negotiate, not the outline of an international regime. It specifies that states accepting the Moon Treaty “undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible.” Article 18 gave the Group of 77 some protection from perpetual deferring of the issue by stipulating that resource activity would be included in the agenda of a review conference that could be convened by a majority of the parties any time after the treaty had been in force for five years.

This solution of accepting the principle but insisting that its development in outer space law would be autonomous did not keep governments from arguing that particular parts of the moon resources regime should follow seabed precedent.<sup>107</sup> Nor did it keep domestic groups in key countries from opposing the Moon Treaty for the same reasons they opposed the 1982 Convention on the Law of the Sea.<sup>108</sup> Most observers believe the eventual moon resources regime will differ from the seabed regime. Perhaps encouraged by the continuing seabed discussions (which produced yet another reformulation of the ISA’s role in 1994), some have proposed different organizational forms.<sup>109</sup>

Though the superpowers lost control of the negotiations in both the Outer Space Committee and the General Assembly and thus had to accept incorporation of the common heritage principle into the Moon Treaty, they reasserted themselves at the implementation stage by refusing to sign the treaty. They are therefore under no legal obligation to respect the common heritage principle. Nevertheless, the principle has been expressed and has enough supporters to make a political difference, though the remoteness of lunar or other space mining makes judging the principle’s practical effects difficult. The principle stands as a point of appeal and an indication that the superpowers were unable to control the direction of conceptualization despite their huge lead in relevant capability.

## Conclusions

Realist theories of international relations, with their focus on rational actors perceiving interests and calculating how well they can do in the prevailing distribution of capability, easily anticipate that the states most able to pursue space activity would have the greatest influence on writing outer space law. However,

107. See, for example, Syrian and Chilean delegates’ claims in Outer Space Committee debates that similar provisions on technology transfer should apply. UN Doc. A/AC.105/PV.232, 1982, 36–37, and PV.234, 1982, 56.

108. Remarks of Richard Darman and letter from an executive of United Technologies Corporation in U.S. Senate. 1980. U.S. Congress, Senate. 1980. Committee on Commerce, Science, and Transportation, Subcommittee on Science, Technology, and Space. *Hearings: The Moon Treaty*. 96th Congr., 2d sess. (1980), 171 and 220.

109. On the reformulation of the ISA’s role see Oxman 1994. For new lunar proposals see Jasentuliyana 1990, 353–55.

realist theories cannot explain why the superpowers chose to treat outer space as a commons rather than as open to national appropriation or why developing states later were able to gain so great a hearing for common heritage norms. The basic choice between commons and appropriation was not settled by imposition, coercion, or bargaining; it resulted from a process of weighing competing proposals based on different analogies and converging on the view that one of the underlying analogies was better than the other. Common heritage won as much hearing as it did, despite a distribution of capability greatly favoring governments that opposed common heritage ideas, because it fit well with the already-developed framework of outer space law and was transferred from an area that had been accepted as an apt source of analogy for space law.

We can understand these developments only by comprehending the reasoning processes involved as actors made choices and contended for influence. Political power does not operate on its own; it is summoned up by goal-seeking agents guided by a sense of purpose as well as an appreciation of the material realities within which they live. Developing a sense of purpose involves having a mental conception of the situation that permits estimating how different outcomes will affect material interests and preferred values, identifying which outcome should be preferred, and calculating how to increase the chances of securing the preferred outcome in interactions with other actors. Mental conceptions of the situation, awareness of interests, and awareness of values all coexist in actors' minds and exert a mutual influence. In the space cases, interests served as a significant screen in the selection among competing analogies: the superpowers and other governments strongly resisted any analogy that was obviously inimical to their interests. At the same time, mental conceptions filled out perceptions of interest by more clearly defining what was at stake in the choices between different rules. The common heritage proposal was not merely an elaboration of commons norms; it was a bid to define them in a way that would have given states not active in space much say in the direction of space activity and reinforced the state-centric emphases of the new international economic order.

Because rational actor models often explain choices accurately enough and the relative capability of coalitions supporting and opposing particular choices often indicates whose preferences prevail, the separate influence of mental conceptions on international negotiations is often obscured. When those models work, we have no theoretical reason to explore other explanatory factors. Yet sometimes focusing only on rational utility maximizing and the distribution of capability fails to explain important aspects of the choices or outcomes. This is particularly obvious when political actors are trying to make sense of new issues or problems. Before they can work out a sense of the problem, define interests and values at stake, choose desired ends, and select strategies for attaining them, actors have to develop a mental conception of the issue or problem.

Though realist theories of international relations ignore mental conceptions, other theoretical schools have sought to understand them better. Yet even they have not yet

offered a fully rounded explanation of how mental conceptions develop initially and are modified over time. Postmodernists posit the strong influence of “regimes of truth” that define what will and will not be considered, and say much about how taken-for-granted conceptions of what constitutes valid knowledge permit powerful social actors to control the development of mental conceptions.<sup>110</sup> However, they tend to lose sight of agents in their efforts to uncover the workings of “discourses,” “disciplinary power,” and “resistance.” Institutional theorizing about ideas often ventures little further than claims that ideas fitting with currently held conceptions have a better chance of being adopted, with “fitting” left vaguely defined.<sup>111</sup> Many of the scholars investigating the impact of learning in international relations focus far more on understanding the substantive content of ideas and the networks through which they are diffused than on the thought processes involved in individuals’ reception of particular new ideas.<sup>112</sup> Constructivist claims that international relations involves socially constructed conceptions of proper conduct have been weakened by an inability to illuminate the processes of norm construction anywhere near as clearly as the effects of changes in norms.<sup>113</sup> Without a microtheory of how individual minds receive and absorb ideas, postmodernist, learning theory, and constructivist claims end up resting entirely on macro-level claims that do not directly challenge the rationalist microtheory underlying neorealism.

Cognitive science offers some clearer micro-level propositions on how mental conceptions develop that merit attention from students of international relations. It suggests that political actors faced with new issues or problems requiring prompt attention cope with the incompleteness of their information by building their mental conceptions on analogical reasoning. Cognitive science further sharpens our understanding of this process by identifying four tasks that must be accomplished for analogical reasoning to be effective: developing a preliminary appreciation of the new issue or problem, retrieving relevant analogies from actors’ stores of existing knowledge, mapping the new issue or problem in more detail to assess whether the fit between analogy-driven ideas and other information about the new problem or issue is good enough for further use, and adapting the analogy-based conception for actual use. These provide a useful heuristic for identifying what ideas are being handled and what mental conceptions are being developed at various stages of international discussions.

The transnational discussions among legal specialists in the early to mid-1950s were important because they yielded both preliminary appreciations of outer space as a subject of legal rulemaking and initial retrievals of candidate analogies. Though no

110. See Der Derian 1987; Keeley 1990; and George 1994. Postmodernist studies of foreign policy decisions pay more attention to agents but do not use cognitive science to help explain why those agents adopt one conceptualization of a situation rather than another. See, for example, Doty 1993; and Weber 1995.

111. See, for example, Hall 1989; Sikkink 1991; and Goldstein 1993.

112. See, for example, P. Haas 1990 and 1992; and Finnemore 1993.

113. See, for example, Klotz 1995; and Florini 1996.



formal intergovernmental discussions of space took place before 1957, the results of these transnational specialist colloquys were transmitted to states through the government-employed lawyers, engineers, and scientists participating in them.

Specialists identified two candidate analogies. Though most international lawyers settled fairly quickly on high seas analogies, a minority, particularly strong in the Soviet bloc, preferred air analogies. This retrieval of more than one analogy would not surprise students of cognitive science. Both airspace and high seas had prominent surface similarities with outer space, so would be easily called up even by “novices” in the field. The international lawyers were expert reasoners: while they knew little about space, they were well-trained in the arts of analogical reasoning. Though not informed by insights of cognitive science, their training did rest on well-developed juridical traditions sensitizing them to the need for careful assessment of candidate analogies and continued openness to other ideas as experience in a particular field develops.

Retrieval of two analogies sped the process of mapping and assessing their relative merits as advocates of each put forth their strongest arguments and sought to demolish arguments put forward by opponents. Cognitively, the strongest impulse for rejecting air analogies came from their poorer fit with what was known about space. Though oceans and outer space differed in some fairly obvious ways, these differences were small when compared with those between air and space. The atmosphere as a whole is stable in relation to earth, and it makes sense to regard certain portions of it as lying above particular parts of the earth’s surface even though individual air molecules move around. The same cannot be said of space, because the earth’s daily rotation and annual orbit mean that there is no stable relation between any part of its surface and any part of outer space. This dissimilarity was so prominent because lawyers and governments alike had trouble conceiving how a country might claim sovereignty over a vacuum whose location was constantly shifting. As the legal specialists argued their way to this conclusion, governments were beginning to pay attention and drew on the specialist discussions for inspiration. While individual specialists did consider how various conceptions would affect the interests of their own country or countries in general, the governments were far more attentive to implications for national interest. At the same time, the specialist discussions (as well as the unrecorded in-house discussions among government officials and legal advisors) permitted a more dynamic process of considering how interests might be served by working from alternate premises. In the outer space case, this is most obvious in the Soviet discussions. Soviet specialists and officials realized by 1961 that they would be able to advance their national interest in inhibiting satellite reconnaissance without having to assert sovereignty over orbital trajectories passing above Soviet territory.

As governments began considering how to deal with the moon and with planets, the lawyers had developed greater space expertise by following the course of early efforts to launch satellites and other objects. This sensitized them to the weaknesses of the high seas analogy. As they and governments began converging at about the same time on the idea of treating celestial bodies as common areas, efforts



to identify useful analogies were driven as much by analytical similarities as by physical ones: both legal specialists and governments sought justification for treating solid masses of matter as international commons. Renewed retrieval efforts quickly led them to another analogy serving their needs.

The Antarctic analogy was accepted initially by the superpowers as a way of extending the open access and nonappropriation principles of outer space law to celestial bodies. Yet the features and gaps of that analogy inspired ideas opposed by the superpowers. Read back onto the vacuum of space, the Antarctic analogy supported banning military activity anywhere in space, including near-earth space. Such a course had been urged by a few developing states in the 1960s and came back onto the international agenda after 1978. Yet the superpowers remained unpersuaded. To them, the syllogism that “space is to high seas as celestial bodies are to Antarctica,” produced by combining high seas and Antarctic analogies, was hard to dislodge because it accorded so well with their perceived interests. Lack of a mineral resources element in the Antarctic analogy permitted the Group of 77 to draw on other inspirations for rules regarding lunar resource activity. The analytical similarity of being outside the limits of national jurisdiction encouraged drawing on proposals to treat the deep seabed as “common heritage of mankind.” Though the eventual expression of the principle was very weak, the text of the Moon Treaty represented a greater move in that direction than the superpowers would have adopted on their own. Unable to stop the impetus in negotiations, they had to resort to nonacceptance of the treaty to avoid association with it.

Students of foreign policy have shown how analogical reasoning helps political leaders, military commanders, and diplomats understand the particular situations they face at any time, evaluate the material and moral impact of possible actions, and anticipate the results of taking each one. Yet the same reasoning process, applied at a more abstract level, can also be used to develop the conceptual framework guiding activity regarding an entirely new issue or problem. Here analogies are used to create definitions of the issue and what is at stake, establish regulatory rules for conduct, and even establish the symbolic meanings that permit creation of the social and institutional facts needed for successful management of an issue or cooperation on solving a problem. Thus, the insights of cognitive science are relevant not only to students of comparative foreign policy but also to those seeking to understand the development of broad patterns of cooperative or competitive behavior among states and other actors.

## References

- American Bar Association. 1960. ABA Section on Comparative and International Law, Committee on Law of Outer Space. *The law of outer space: Report to the National Aeronautics and Space Administration*.
- American Society of International Law. 1956. Panel on international air law. In *Proceedings of the American Society of International Law at its fiftieth annual meeting*, 85–98. Washington, D.C.: American Society of International Law.

- Anderson, Rolf Trolle. 1991. Negotiating a new regime: How CRAMRA came into existence. In *The Antarctic treaty system in world politics*, edited by Arnfinn Jørgensen-Dahl and Willy Østreng, 94–108. Basingstoke, England: Macmillan.
- Antarctic Treaty. 1959. *United Nations Treaty Series* 402:71–84 (1961).
- Auburn, F. M. 1982. *Antarctic law and politics*. Bloomington: Indiana University Press.
- Barsalou, Lawrence W. 1989. Intraconcept similarity and its implications for interconcept similarity. In *Similarity and analogical reasoning*, edited by Stella Vosniadou and Andrew Ortony, 76–121. Cambridge: Cambridge University Press.
- Beck, Peter J. 1986. *The international politics of Antarctica*. New York: St. Martin's.
- Broushey, A. 1957. Who controls the moon controls the earth. *U.S. News and World Report*, 7 February 1957, 54.
- Burrows, William B. 1986. *Deep black: Space espionage and national security*. New York: Random House.
- Burstein, Mark H. 1988. Combining analogies in mental models. In *Analogical reasoning: Perspectives of artificial intelligence, cognitive science, and philosophy*, edited by David H. Helman, 179–203. Dordrecht, Netherlands: Kluwer Academic Publishers.
- Burton, Steven J. 1985. *An introduction to law and legal reasoning*. Boston: Little, Brown.
- Bush, William. 1982. *Antarctica and international law*. 3 vols. plus looseleaf supplements. New York: Oceana.
- Carlsnaes, Walter. 1992. The agent-structure problem in foreign policy analysis. *International Studies Quarterly* 36:245–70.
- Cheng, Bin. 1957. International law and high altitude flight: Balloons, rockets, and man-made satellites. *International and Comparative Law Quarterly* 10:487–505.
- Collins, Allan M. and Elizabeth F. Loftus. 1975. A spreading-activation theory of semantic processing. *Psychological Review* 82:407–28.
- Connolly, William. 1974. *The terms of political discourse*. Lexington, Mass.: Heath.
- Convention on the Continental Shelf. 1958. *United Nations Treaty Series* 499:311–20 (1964).
- Convention on Fishing and Conservation of the Living Resources of the High Seas. 1958. *United Nations Treaty Series* 559:285–301 (1966).
- Convention on the High Seas. 1958. *United Nations Treaty Series* 450:82–102 (1962).
- Convention on International Civil Aviation. 1944. *United Nations Treaty Series* 15:295–362 (1946).
- Convention on the Territorial Sea and Contiguous Zone. 1958. *United Nations Treaty Series* 516:205–24 (1964).
- Cooper, John Cobb. 1951. High altitude flight and national sovereignty. *International Law Quarterly* 4:411–18.
- . 1956. Legal zones problems of upper space. In *American Society of International Law 1956*, 90–92.
- Danilenko, Gennady M. 1985. International law of the sea and outer space: Transfer of technology problem. *Proceedings of the twenty-eighth colloquium on the law of outer space*, 122–26.
- . 1988. The concept of the 'common heritage of mankind' in international law. *Annals of Air and Space Law* 13:247–63.
- Der Derian, James. 1987. *Diplomacy*. Oxford: Basil Blackwell.
- Doty, Roxanne. 1993. Foreign policy as social construction: A post-positivist analysis of U.S. counterinsurgency policy in the Philippines. *International Studies Quarterly* 37:297–320.
- Durch, William J., and Dean A. Wilkenning. 1984. Steps into space. In *National interests and the military uses of space*, edited by William J. Durch, 11–34. Cambridge, Mass.: Ballinger.
- Fernandez, James W., ed. 1991. *Beyond metaphor: The theory of tropes in anthropology*. Stanford, Calif.: Stanford University Press.
- Finnemore, Martha. 1993. International organizations as teachers of norms: The United Nations Educational, Scientific, and Cultural Organization and Science Policy. *International Organization* 47:565–98.
- Florini, Anne. 1996. The evolution of international norms. *International Studies Quarterly* 40:363–89.

- Gal, Gyula. 1985. Territorial sea and airspace: Passages to free spaces? *Proceedings of the twenty-eighth colloquium on the law of outer space*, 135–36.
- Galina, A. 1958. On the question of interplanetary law. July 1958, 52–60. Rand Corporation translation T-98, 25 September 1958.
- Garthoff, Raymond L. 1981. Banning the bomb in outer space. *International Security* 5.
- Gentner, Diedre. 1983. Structure-mapping: A theoretical framework for analogy. *Cognitive Science* 7:155–70.
- . 1989. The mechanisms of analogical learning. In *Similarity and analogical reasoning*, edited by Stella Vosniadou and Andrew Ortony, 199–241. Cambridge: Cambridge University Press.
- George, Jim. 1994. *Discourses of global politics: A critical reinroduction to international relations*. Boulder, Colo.: Lynne Rienner.
- Goffman, Erving. 1974. *Frame analysis: An essay on the organization of experience*. Cambridge, Mass.: Harvard University Press.
- Goldstein, Judith. 1993. *Ideas, interests, and American trade policy*. Ithaca, N.Y.: Cornell University Press.
- Gorbiel, Andrej. 1985. Questions of analogies between sea and space international law. *Proceedings of the twenty-eighth colloquium on the law of outer space*, 142–44.
- Gould, Lawrence M. 1958. *Antarctica in world affairs*. Foreign Policy Association Headline Series, no. 128. Philadelphia, Penn.: Foreign Policy Association.
- Gouldner, Alvin W. 1979. *The future of the intellectuals and the rise of the new class*. New York: Seabery Press.
- Haas, Ernst B. 1990. *When knowledge is power*. Berkeley: University of California Press.
- Haas, Peter M. 1990. *Saving the Mediterranean*. New York: Columbia University Press.
- , ed. 1992. *Epistemic communities and international policy coordination*. Special issue of *International organization* 46:1–390.
- Habermas, Jürgen. 1971. *Knowledge and human interests*. Translated by Jeremy J. Schapiro. Boston: Beacon Press.
- Haley, Andrew G. 1963. *Space law and government*. New York: Appleton-Century-Crofts.
- Hall, Peter A., ed. 1989. *The political power of economic ideas: Keynesianism across nations*. Princeton, N.J.: Princeton University Press.
- Hanessian, John. 1960. The Antarctic treaty, 1959. *International and Comparative Law Quarterly* 9:436–80.
- Hastie, Reid. 1986. A primer of information-processing theory for the political scientist. In *Political cognition*, edited by Richard Lau and David Sears, 11–39. Hillsdale, N.J.: Lawrence Erlbaum Associates.
- Holland, John H., Keith J. Holyoak, Richard E. Nisbett, and Paul R. Thagard. 1986. *Induction: Processes of inference, learning, and discovery*. Cambridge, Mass.: MIT Press.
- Holzner, Burkhardt, and John H. Marx. 1979. *Knowledge application: The knowledge system in society*. Boston: Allyn and Bacon.
- Horsford, C. E. S. 1955. The law of space. *Journal of the British interplanetary society* May–June, 144–150.
- Huber, Max, sole arbitrator. 1928. Award in the Isle of Palmas Case (Netherlands v. USA), *American Journal of International Law* 22:867–912.
- Hybel, Alex Roberto. 1993. *Power over rationality: The Bush administration and the gulf crisis*. Albany, N.Y.: State University of New York.
- International Institute of Space Law. 1958. *Proceedings of the First Colloquium on the Law of Outer Space, The Hague*. Vienna: Springer Verlag.
- . 1959. *Proceedings of the Second Colloquium on the Law of Outer Space, London*. Vienna: Springer Verlag.
- International Law Association. 1960. *Report of the 49th Conference, Hamburg, 1960*. International Law Association.
- Jane's Information Group. *Jane's Spaceflight Directory*. London: Jane's Information Group. Annual.

- Janis, Irving. 1989. *Psychological studies of policy decisions and fiascoes*. 2d ed. Boston: Houghton Mifflin.
- Jasentuliyana, Nandasiri. 1990. International space law and the mining of asteroids. *Annals of Air and Space Law* 15:343–55.
- Jenks, C. Wilfred. 1956. International law and activities in space. *International and Comparative Law Quarterly* 5:99–114.
- Jessup, Philip C., and Howard J. Taubenfeld. 1959. *Controls for outer space and the Antarctic analogy*. New York: Columbia University Press.
- Johnson, Lyndon Baines. 1966. Speech at the launching of the government research vessel *Oceanographer*, 13 July. *Messages and Papers of the President: Lyndon Baines Johnson*. Vol. 2, 724. Washington, D.C.: U.S. Government Printing Office.
- Johnson, Mark. 1987. *The body in the mind: The bodily basis of meaning, imagination, and reason*. Chicago: University of Chicago Press.
- Jonsson, Christer. 1995. Cognitive factors in explaining regime dynamics. In *Regime theory and international relations*, edited by Volker Rittberger, 205–13. Oxford: The Clarendon Press.
- Keane, Mark T. 1988. *Analogical problem solving*. Chichester, England: Ellis Harwood.
- Keane, Mark T., Tim Ledgeway, and Stuart Duff. 1994. Constraints on analogical mapping: A comparison of three models. *Cognitive Science* 18:387–438.
- Keeley, James F. 1990. Toward a Foucauldian analysis of international regimes. *International Organization* 44:83–105.
- Kennedy, John F. 1961. Special message to Congress on urgent national needs, 25 May. *Public Papers of the Presidents of the United States: John F. Kennedy*. Washington, D.C.: U.S. Government Printing Office.
- Khong, Yuen Foong. 1992. *Analogies at war: Korea, Munich, Dien Bien Phu, and the Vietnam declarations of 1965*. Princeton, N.J.: Princeton University Press.
- Kislov, A., and S. Krylov. 1956. State sovereignty in airspace. *International Affairs* (Moscow), March, 35–44.
- Klass, Philip J. 1971. *Secret sentries in space*. New York: Random House.
- Klotz, Audie. 1995. Norms reconstituting interests: global racial equality and U.S. sanctions against South Africa. *International Organization* 49:451–78.
- Korovin, Evgenii. 1959. International status of cosmic space. *International Affairs* (Moscow), January, 53–59.
- . 1962. Peaceful cooperation in space. *International Affairs* (Moscow), 61–63.
- Krasner, Stephen D. 1996. Compromising Westphalia. *International Security* 20:115–51.
- Kratochwil, Friedrich V. 1991. *Rules, norms, and decisions: On the conditions of practical and legal reasoning in international relations*. Cambridge: Cambridge University Press.
- Lakoff, George. 1987. *Women, fire, and dangerous things: What categories reveal about the mind*. Chicago: University of Chicago Press.
- Lakoff, George, and Mark Johnson. 1980. *Metaphors we live by*. Chicago: University of Chicago Press.
- Lapenna, Ivo. 1966. Some Soviet views on space law. In *Current problems in space law: A symposium*, 87–97. London: British Institute of International and Comparative Law.
- Larinov, V. 1964. Doctrines of military domination in outer space. *International Affairs* (Moscow), October, 25–30.
- Lepotier, Admiral A. 1961. La demilitarisation de l'Antarctide. *Revue de defense nationale* 17:788–807.
- Levi, Edward H. 1949. *An introduction to legal reasoning*. Chicago: University of Chicago Press.
- Lissitzyn, Oliver J. 1953. The treatment of aerial intruders in recent practice and international law. *American Journal of International Law* 47:559–88.
- . 1959. The American positions on outer space and Antarctica. *American Journal of International Law* 126–31.
- Matte, Nicholas Mateesco. 1969. *Aerospace law*. London: Sweet and Maxwell.
- McDougall, Walter A. 1985. *The heavens and the earth: A history of the space age*. New York: Basic Books.
- McNair, Arnold Duncan. 1953. *The law of the air*. 2d ed. London: Stevens.
- Mefford, Dwain. 1987. Analogical reasoning and the definition of the situation. In *New directions in the*

- study of foreign policy*, edited by Charles Hermann, Charles Kegley, and James N. Rosenau, 211–44. Boston: Allen and Unwin.
- . 1990. Case-based reasoning, legal reasoning, and the study of politics. *Political Behavior* 12:125–58.
- Milde, Michael. 1958. Considerations on legal problems of space above national territory. *Contemporary Law Review* 5:1–22.
- Miller, George. 1956. The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review* 63:81–97.
- Moon Treaty. 1979. Agreement Concerning the Activities of States on the Moon and Other Celestial Bodies. *United Nations Treaty Series* 1363:22–28 (1984).
- Neustadt, Richard, and Ernest May. 1986. *Thinking in time: The uses of history for decision-makers*. New York: Free Press.
- Novick, Laura R. 1988. Analogical transfer: Processes and individual differences. In *Analogical reasoning*, edited by David H. Helman, 125–45. Dordrecht, Netherlands: Reidel.
- Novick, Laura R., and Keith J. Holyoak. 1988. Analogical transfer, problem similarity, and expertise. *Journal of Experimental Psychology, Memory, Cognition, and Learning* 14:510–20.
- Oberg, James. 1981. *Red star in orbit*. New York: Random House.
- O'Connell, D. P. 1965. *International Law*. 2 vols. London: Stevens and Dobbs Ferry, NY: Oceana.
- Onuf, Nicholas J. 1989. *World of our making: Rule and rules in social theory and international relations*. Columbia: University of South Carolina Press.
- Osnitskaya, G. A. 1959. International law problems and the conquest of space. *Soviet Yearbook of International Law* 1959, 51–65. Moscow: Soviet Academy of Sciences.
- Outer Space Treaty. 1967. Treaty on Principals Governing the Activities of States in the Exploration of Outer Space, including the Moon and Other Celestial Bodies. *United Nations Treaty Series* 610:208 (1970).
- Oxman, Bernard H. 1994. The 1994 agreement and the convention. *American Journal of International Law* 88:687–95.
- Peitone, Albert. 1986. Some conceptual and empirical problems of consistency models. In *Cognitive consistency*, edited by Shel Feldman, 258–97. New York: Academic Press.
- Peterson, M. J. 1988. *Managing the Frozen South*. Berkeley: University of California Press.
- Piradov, A. S. 1976. *International space law*. Moscow: Progress Publishers.
- Purkitt, Helen E. 1991. Artificial intelligence and intuitive policy-makers viewed as limited information processors. In *Artificial intelligence and international relations*, edited by Valerie M. Hudson, 35–55. Boulder, Colo.: Westview.
- Riesback, Christopher K., and Roger C. Shank. 1989. *Inside case-based reasoning*. Hillsdale, N.J.: Lawrence Erlbaum Associates.
- Rissland, Edwina L. 1990. Artificial intelligence and law. *Yale Law Review* 99:1957–81.
- Roy, P. K. 1956. Comment. In *American Society of International Law* 1956, 94–96.
- Ruggie, John G. 1982. International regimes, transactions, and change. *International Organization* 36:379–415.
- . ed. 1993. *Multilateralism matters: The theory and praxis of an institutional form*. New York: Columbia University Press.
- Rumelhart, David E., and Donald A. Norman. 1981. Analogical processes in learning. In *Cognitive skills and their acquisition*, edited by John R. Anderson, 335–60. Hillsdale, N.J.: Lawrence Erlbaum Associates.
- Savage, James G. 1989. *The politics of international communications regulation*. Boulder, Colo.: Westview.
- Scammel, G. V. 1989. *The first imperial age: European overseas expansion c. 1400–1715*. London: Unwin Hyman.
- Schachter, Oscar. 1952. Who owns the universe? In *Across the space frontier*, edited by Cornelius Ryan, 118–131. New York: Viking Press.
- Schon, Donald A. 1983. *The reflective practitioner*. New York: Basic Books.
- Schon, Donald A., and Martin Rein. 1995. *Frame reflections: Toward the resolution of intractable policy controversies*. New York: Basic Books.

- Sikkink, Kathryn. 1991. *Ideas and institutions: Developmentalism in Brazil and Argentina*. Ithaca, N.Y.: Cornell University Press.
- Spiro, Rand J., Paul J. Fetlovich, Richard L. Coulson, and Daniel Anderson. 1989. Multiple analogies for complex concepts: Antidotes for analogy-based misconception in advanced knowledge acquisition. In *Similarity and analogical reasoning*, edited by Stella Vosniadou and Andrew Ortony, 498–531. Cambridge: Cambridge University Press.
- Steinberg, Gerald M. 1983. *Satellite reconnaissance: The role of informal bargaining*. New York: Praeger.
- Sullivan, Walter. 1959. The international geophysical year. *International Conciliation*, no. 521.
- Sunstein, Cass R. 1993. On analogical reasoning. *Harvard Law Review* 106:741–91.
- Sylvan, David J., Stephen J. Majeski, and Jennifer L. Millikan. 1991. Theoretical categories and data construction in computational models of foreign policy. In *Artificial intelligence and international relations*, edited by Valerie M. Hudson, 327–46. Boulder, Colo.: Westview.
- Tannen, Deborah, ed. 1993. *Framing in discourse*. New York: Oxford University Press.
- Taubenfeld, Howard J. 1961. *A treaty for Antarctica*. *International Conciliation*, no. 531.
- Tesh, Sylvia Noble. 1988. *Hidden arguments: Political ideology in disease prevention policy*. New Brunswick, N.J.: Rutgers University Press.
- Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space, and under Water. 1963. *United Nations Treaty Series* 480:45–49 (1963).
- Tversky, Amos, and Daniel Kahneman. 1982. Judgment under uncertainty: Heuristics and biases. In *Judgment under uncertainty: Heuristics and biases*, edited by Daniel Kahneman, Paul Slovic, and Amos Tversky, 3–20. Cambridge: Cambridge University Press.
- UN GAOR. United Nations. General Assembly. Official Records.
- Vertzberger, Yaacov. 1986. Foreign policy decision-makers as practical-intuitive historians. *International Studies Quarterly* 30:223–47.
- . 1990. *The world in their minds*. Stanford, Calif.: Stanford University Press.
- Vosniadou, Stella. 1989. Analogical reasoning as a mechanism in knowledge acquisition: A developmental perspective. In *Similarity and analogical reasoning*, edited by Stella Vosniadou and Andrew Ortony, 413–37. Cambridge: Cambridge University Press.
- Vosniadou, Stella, and Andrew Ortony, eds. 1989. *Similarity and analogical reasoning*. Cambridge: Cambridge University Press.
- Watts, Sir Arthur. 1992. *International law and the Antarctic treaty system*. Cambridge: Grotius Publications.
- Weber, Cynthia. 1995. *Simulating sovereignty: Intervention, the state, and symbolic exchange*. Cambridge: Cambridge University Press.
- Wellman, Vincent A. 1985. Practical reasoning and juridical justification. *University of Colorado Law Review* 57:45–115.
- Wendt, Alexander. 1992. Anarchy is what states make of it: The social construction of power politics. *International Organization* 46:392–425.
- Winter, Steven L. 1989. Transcendental nonsense, metaphoric reasoning, and the cognitive stakes for law. *University of Pennsylvania Law Review* 137:1105–1237.
- Wright, N. A., and P. A. Williams. 1974. *Mineral Resources of Antarctica*. U.S. Geological Survey circular no. 705. Washington, D.C.: U.S. Geological Survey.
- Wright, Quincy. 1960. Legal aspects of the U-2 incident. *American Journal of International Law* 54:836–54.
- Yee, Albert S. 1996. The causal effects of ideas on policies. *International Organization* 50:69–108.
- Young, Oran R. 1983. Regime dynamics: The rise and fall of international regimes. In *International regimes*, edited by Stephen D. Krasner, 93–114. Ithaca, N.Y.: Cornell University Press.
- Zadorozhny, G. P. 1957. Iskustvennye sputniki i mezhdunarodnoye pravo (Artificial satellites and international law). *Sovietskoye Rossiya*, 17 October. English translation in *Legal problems of space exploration: A symposium*, Washington, D.C.: U.S. Government Printing Office, 1048–49.
- . 1962. Oshovnyye problemy nauki kosmicheskogo prava (Basic problems of space law). In *Kosmos i mezhdunarodnoe pravo*, edited by E. Korovin, 23–30. Moscow. Institute of International Relations.
- Zhukov, G. P. 1960. Space espionage plans and international law. *International Affairs* (Moscow), October, 72–79.