



ARTICLE



<https://doi.org/10.1057/s41599-020-00609-5>

OPEN

Conceptualizing science diplomacy in the practitioner-driven literature: a critical review

Pierre-Bruno Ruffini ¹ 

Science diplomacy and the practices it covers have existed for a long time, but the related vocabulary emerged only recently. It is only in the last fifteen years or so that there has been a discourse on science diplomacy, in which the practitioner-driven literature dominates. This article is based on a careful examination of some of its key writings. It aims at reflecting on the construction of the concept of science diplomacy, as it is penned by practitioners. Mainstream narratives magnify the practices of international scientific cooperation and generally under-represent the use of science in foreign policy for competitive purposes. In order to explain the gap that exists between the discourse and the reality of practices, this article puts forward a hypothesis, that of a cultural bias originating from the profile of the leading authors, who are both scientists and actors of science diplomacy.

¹ Faculty of International Affairs and EDEHN (Equipe D'Economie—Le Havre Normandie), University of Le Havre Normandie, Le Havre, France.
email: pierre-bruno.ruffini@univ-lehavre.fr

Introduction

Some fifteen years or so have passed since science diplomacy (SD) entered the vocabulary of international relations. Although the practices of SD did not change much in that short period, the same is not true of the way the concept is looked at and analyzed. Definitions have followed one another, many case studies have been made, and several academic disciplines have been mobilized to try to better understand what SD is and what it is not. There is an abundant professional literature and a growing academic literature on the subject, which though has not led to the emergence of a genuine theory of SD.

Practitioners—often referred as “science diplomats”—are all those who are engaged in action at the interface of questions of science and diplomacy, whether or not they are officially invested with diplomatic functions. Being at the center of the implementation of SD, practitioners are, for several of them, at the origin of its conceptualization. The views and statements that launched the subject came from them. Practitioners have produced definitions and categories that have greatly shaped the understanding of SD. The conceptualization has been marked by two milestones, with two taxonomies that were elaborated almost ten years apart. The Royal Society-AAAS typology (2010) appeared first. Then came the challenging taxonomy proposed by Gluckman et al. (2017). This corpus constitutes what is called the “mainstream approach” in this article and which essential characteristic is to vest SD with the power to improve the international order and to work for the common good.

A bewildering observation is at the origin of this introductory paper: there is a gap between the practices and the concept of SD as it is conveyed in the practitioner-driven literature. In a word, practices are broader than what the mainstream discourse covers. This text seeks to describe and explain this gap. It questions the practices that should or not be labeled as SD. Based on a critical reading of the writings of practitioners, it aims at identifying what the narratives highlight, but also what they leave in the shade. It puts forward hypotheses which verification would require further work applying the tools of qualitative empirical research to the discourse and to those who produce it. It opens in particular a line of reflection by assuming that a cultural bias inherent to the community of authors has guided the dominant conceptualization of SD.

The article unfolds as follows. The key points of the mainstream vision of SD are presented in the “Science diplomacy in the mainstream approach: the key-characteristics” section. Section “National interests in the conceptualization of science diplomacy” observes that from one taxonomy to another, the narrative has explicitly acknowledged national interests as a key driver of SD. Section “Gray areas in the mainstream approach to science diplomacy” argues that mainstream narratives still leave aside practices guided by the spirit of competition and the search of power. Section “Hypotheses about the discrepancy between the discourse and the reality of SD” puts forward hypotheses about the discrepancy between the discourse and the reality of SD. Section “Concluding remarks” concludes.

Science diplomacy in the mainstream approach: the key-characteristics

SD covers a set of practices in which science and technology intersect with foreign affairs and international relations. In such words, SD is not new. The impact of science and technology on international relations or the part taken by scientists in the foreign policy of states are well known to historians, who have brought up convincing illustrations regarding the period of colonization or that of the Cold War (MacLeod, 2000; Krige and Barth, 2006; Wolfe, 2018). But if the substance is not new, the

words to name it are very recent. In 2007, a brief article declared that the “time for a new era of science diplomacy” had come (Lord and Turekian, 2007), suggesting that there had been a previous era when SD existed but was not called that. The large dissemination of a hitherto dormant vocabulary came from the creation of the Center for Science Diplomacy by the American Association for the Advancement of Science (AAAS) in 2008, from the conference “New Frontiers of Science Diplomacy” organized jointly by the Royal Society and the AAAS in 2009, and from the report which followed the year after (Royal Society and AAAS, 2010). Since then, SD has caught the attention of most of those interested in international relations.

The first definitions were penned by practitioners originating from the academic world and whose career had evolved toward scientific advice to policymakers, to the administration of science or to diplomacy. That was the time when Norman Neureiter, then-science and technology adviser to the US Secretary of the Department of State, stated that SD was “an intentional effort to engage with other countries where the relationship is not good otherwise” (Hsu, 2011). Vaughan Turekian, then-director of AAAS’s Center for Science Diplomacy (and future science and technology adviser to the Secretary of State), stated that SD is “the use and application of science cooperation to help build bridges and enhance relationships between and amongst societies, with a particular interest in working in areas where there might not be other mechanisms for engagement at an official level” (CORDIS, 2009). Nina Fedoroff, another science and technology adviser to the Secretary of State, stated that “science diplomacy is the use of scientific collaborations among nations to address the common problems facing 21st century humanity and to build constructive international partnerships” (Fedoroff, 2009). Among these initial efforts to clarify definitions, a keystone was the Royal Society-AAAS pioneering report, which placed the discourse of SD on its launch pad. The first-ever taxonomy came out of this report, identifying the three pillars that are “science in diplomacy”, “science for diplomacy” and “diplomacy for science”. Although criticized since, particularly because of overlaps between these three dimensions (Copeland, 2016; Penca, 2018), this ternary definition still owes to its simplicity and clarity its remarkable resilience.

The reflections generated by these definitions have shaped the dominant understanding of SD, outlining its three essential features:

Thanks to the universal values of science, SD can transform international relations. A central idea is that SD has the capacity to bring about a better international order. Driven by the “values of science” (Merton, 1942) and its universality in particular, scientists can act as middlemen in peace-building and science can “contribute, through its use of neutral, non-ideological language, to the mitigation of international political differences when regular diplomatic channels are strained, blocked or non-existent. (...) It usefully combines international political agency with the scientific method of knowledge production, and is an effective emissary of essential values such as evidence based learning, merit, openness and sharing” (Copeland, 2016, p. 629). The creation of the European Organization for Nuclear Research (CERN, 1954), the creation of the International Institute for Applied Systems Analysis (1972), the Appollo-Soyuz Test Project (1975) or the setting up of the synchrotron light facility SESAME in the Middle East (2017) are frequently called to illustrate the soothing role that scientific relations can play between nations. These examples feed a heartening narrative in which science is convened to reduce political tensions between countries, thanks

to its values and practices and to the conjunction of efforts of scientists and diplomats across borders for achieving common goals. “Trust”, “understanding”, “transparency”, “bridge-building” or even “hope” are among the favorite keywords of the discourse. These insights explain why SD can be regarded as a cause to be championed and an area of civic commitment to the service of the common good.

Scientific cooperation is a preferred means to transform international relations. In the dominant approach, international scientific cooperation is central for building positive country to country relationships, and SD can be defined as “scientific cooperation and engagement with the explicit intent of building positive relationships with foreign governments and societies” (Lord and Turekian, 2007, p. 769). It is also critical for dealing with environmental threats and other urgent global issues which challenge the international order. International scientific cooperation is omnipresent in the founding writings: it appears as its dominant and even exclusive ingredient, and many have seen it as a mere synonym of the new vocabulary. Going back to the Royal Society-AAAS triptych, we note that two of its three constituents explicitly mention cooperation: “diplomacy for science” means “facilitating international science cooperation”, and “science for diplomacy” means “using science cooperation to improve international relations between countries” (Royal Society and AAAS, 2010, p. 6). The core idea is that, besides bringing scientific benefits—which is its first goal—international scientific cooperation can generate non-scientific benefits through its capacity to bring positive externalities such as a better understanding between peoples and countries and a smoothening of international political tensions. Being credited of such benefits, international scientific cooperation is recognized by diplomats for its diplomatic potential. Combined with the transformative power of SD already mentioned, the expected role of international cooperation gives the dominant discourse its optimistic tone.

SD as a process to address global challenges. This is a widely shared view that the inclusion of global challenges in the international agenda is a major reason for the visibility gained today by SD. The very first words of the Royal Society-AAAS 2010 seminal report were devoted to “the defining challenges of the 21st century”. The first page of an important edited volume outlined “the emergence of science diplomacy whereby scientific collaborations among nations are necessary to tackle increasingly common challenges” (Davis and Patman, 2015, p. 3). The challenges refer to global public goods having a scientific dimension—climate stability, biodiversity or human health, to name a few. No country can tackle alone the dangers threatening these global public goods, and this calls for international scientific collaborations and for the establishment of global governance schemes based on the knowledge provided by experts. The Sustainable Development Goals Agenda has made the involvement of science advice in policy-making even more evident. More generally, “the strength of the involvement of science in diplomacy over the last two-and-a-half decade since the end of the Cold War, coupled with the rapid expansion of globalization, (...) seems to be qualitatively changing the relationship between science and diplomacy” (Davis and Patman, 2015, p. 261). Since the first writings, the capacity of SD to address global challenges has been pervasive in the discourse, and is probably its most consensual manifestation

National interests in the conceptualization of science diplomacy

We agree with the view that SD “is rarely subject to critical analysis” (Smith, 2014, p. 825) and we discuss in this section

some aspects of the initial setting which continue to permeate today’s dominant vision of SD. A critical reading of the literature highlights changes in the way SD is thought and presented. Besides its *raison d’être* of addressing and helping to solve global challenges, which has been constantly reaffirmed since the origins, another driver is considered: SD at the service of national interests.

It may seem trivial to discuss the place held by the national interest in a country’s SD strategy. When interacting with others, Nation-States care first about their interests and SD’s “direct relationship to government interests and objectives” (Copeland, 2011, p. 1) was certainly noted in the early literature, but almost always incidentally as if it were perfectly self-evident. However, although its presence remained subliminal in definitions recalled in section “Science diplomacy in the mainstream approach: the key-characteristics”, the national interest has always been a key driver in the exercise of SD. It has been present in an unspoken manner in the US-origin conceptualization of SD, and then became a central reference in the second taxonomy, thus driving the discourse towards more realism.

American interests and the conceptualization of SD. The United States has historically been the center of birth and dissemination of the vocabulary and the concept of SD. The first definitions were carried by practitioners, many of whom served as advisers to the country’s executive. These authors gave a specific meaning to the “science for diplomacy” dimension, that of easing tensions and opening dialog between nations thanks to international scientific cooperation. This argument was developed in abundance and historical precedents (Turekian and Neureiter, 2012) were summoned to reinforce and legitimize what the newly created concept emphasized. The place taken by scientific agreements in the restoration of dialog with Japan (1961), the scientific agreements signed during Nixon-Brejtnev (1972) and Nixon-Mao Zedong (1972) historical summits, were often recalled in the first steps of the practitioners’ literature, which was almost entirely inspired by American examples supporting the idea that “scientists are among America’s most effective diplomats” (Lord and Turekian, 2007, p. 770). From a historical perspective, this interference between questions of science and technology and USA’s foreign policy interests should come as no surprise. Such links have been documented in the scholarly literature, particularly in the contexts of the Cold War and of the European integration (Skolnikoff, 1993; Weiss, 2005; Krige, 2006; Oreskes and Krige, 2014). And as early as 1950, the Berkner report advocated for taking science into account at different levels of the diplomatic apparatus (Department of State, 1950).

The examples given in the early practitioners’ literature can be read from the perspective of the contribution of scientific cooperation to the softening of international tensions and to peace. But another view can be taken, more centered on direct interests of the USA. The shaping of the concept of SD that took place was well in phase with the USA’s foreign policy goals, and in particular with President Obama’s “reset” of diplomatic relations expressed, among others, in the highly publicized Cairo speech (2009). By emphasizing conflict mitigation through the benefits of cooperation, the first definitions favored a certain vision of SD and inaugurated a narrative closely articulated to the USA’s geopolitical interests of the period. Several years later, promoters of this vision bore witness to this: “Indeed, the subtext of the AAAS–Royal Society 2009 meeting on science diplomacy was the potential use of science to reduce tensions between Western and Muslim-majority countries, especially in the wake of the 9/11 attacks and the highly publicized war on terror” (Gluckman et al., 2017).

Returning to the historical context of the concept's emergence, one can understand what could be contingent in the meaning given to the "science for diplomacy" dimension: emphasizing the mitigation of political tensions between countries. This view was circumstantial and therefore it could not be extended to countries having no geopolitical tensions to alleviate or any conflict to mitigate. In contrast, by emphasizing the need for sound consideration of scientific knowledge and advice in international policy-making, the "science in diplomacy" dimension could be seen as an essential part of SD. Relating to global issues and therefore on the common interests of humanity, this "science in diplomacy" dimension did a lot in the success of the concept of SD. But it also took part in the downplaying of national interests in the first wave of writings. Global challenges and common interests have acted "as a common denominator that justifies several SD activities without touching the delicate issues of competition in science and innovation, particularistic national interests or conflicting functional logics of research and politics." (Flink and Ruffin, 2019, p. 117). This was indeed a success of influence of the USA that SD, as a new doctrine, could be understood and disseminated as a concept of universal scope, detached from a particular national base, which it was not at the beginning.

From one taxonomy to another: national interests openly enter the discourse. In the brief history of the concept of SD, there has been an "increasing recognition of national interests guiding the foreign policy of science diplomacy..." (Kaltofen and Acuto, 2018b, p. 10). Although present in the intentions, national interests remained unspoken in the first writings. Subsequent developments would make them explicit. This refocusing is visible in the choice of the words that weave more recent writings. Prominent contributors to the practitioner-driven literature could state in 2015 that SD "is the process by which states represent themselves and their interests in the international arena when it comes to areas of knowledge (...) acquired by the scientific method", which can be used to "leverage one country's influence over another", adding that "the central purpose of science diplomacy is often to use science to promote a state's foreign policy goals or inter-state interests" (Turekian et al., 2015, p. 4, 6). When comparing the two main practitioners' taxonomies that have been produced to date, this change of emphasis is noteworthy.

The first taxonomy describing SD came from the Royal Society-AAAS seminal report of 2010. The second one was brought forward in an article published in 2017 (Gluckman et al., 2017), in which some notable practitioners proposed a new frame intended to be pragmatic and operative for foreign ministries and other agencies with international responsibilities. As an "alternative" to the "traditional taxonomy", they introduced a new pattern of actions to be labeled as SD:

- "Actions designed to directly advance a country's national needs" (... "from exercising soft power to serving economic interests to promoting innovation"),
- "Actions designed to address cross-border interests" (regarding for instance "matters relating to transborder shared resources"),
- "Actions primarily designed to meet global needs and challenges" (addressing the "global interest" regarding shared challenges across borders and spaces beyond national jurisdictions).

Unlike the traditional taxonomy, the alternative taxonomy explicitly highlighted the needs and interests of countries, which the authors emphasized by asserting that "for a country to make

any investment that supports science diplomacy, the actions must be seen to either directly or indirectly advance its national interest" (Gluckman et al., 2017, p. 3). It is to the credit of this alternative grid to have recognized the essential driving role of national interests in science diplomacy.

The assertion of states' foreign policy interests allows a clear reformulation of what SD is about. SD seeks to marry and balance two imperatives: advancing a country's national interests, and addressing common challenges. It follows that issues of SD can be addressed from two distinct and complementary entry points, national and global:

- In the national approach, SD refers to practices which directly or indirectly advance a country's national interest. This is in accordance with the traditional state-centered approach to diplomacy. In such a perspective, SD is understood as a subset of the country's foreign policy and the related actions must be consistent with the general orientation of its overall diplomacy. The national approach is favored by agents and institutions invested with a public mission under the state's external action, and primarily by the Ministry of Foreign Affairs, which plays in it a leading role. Most actions are essentially of a top-down nature.
- In the global approach, SD is seen first and foremost from the angle of common problems that need to be resolved. In this common issues' perspective, most of the inspiration and impulses come from the scientific community, who very often raised awareness on threats over global public goods and pushed for their entry into diplomatic arenas. This global approach is preferred by scientific actors, individuals and non-state institutions, which advocate for using science to engage in problem solving. Their actions have essentially a bottom up nature.

These are basically the two ways of getting into the questions of SD. Individual actors who, in one way or another, lead actions labeled as SD are more marked by one or the other of these visions, which depends on their intellectual training, their professional position or the interests they represent. This will be developed below in section "Hypotheses about the discrepancy between the discourse and the reality of SD". But we must beware of a too clear-cut and schematic vision: the two approaches meet and complement each other where issues of science and shared interests of countries intermingle, which allows to account for important developments of multilateral SD.

A discourse more marked by realism? Between the two taxonomies of 2010 and 2017 there was a shift in the description of SD. The recent discourse is more marked by realism, and its flagship expression—Gluckman et al.'s, 2017 article—brings out the driving role of national interests and needs. The realism of diplomacy has gradually penetrated the practitioner's discourse. One may assume that it has incorporated the criticisms that have been made to the overly irenic vision of the first advocates of SD. Another hypothesis is that a learning process may have played its role: there has been over the years a growing understanding of what SD is, and scientists engaged in it could have gradually changed their perception through their interaction with diplomats, who are realist figures par excellence. But in a more diffuse way, the evolution of the global environment could also explain why narratives on SD are today more permeable to realism. Multi-polarization of SD is at work. More and more countries claim their commitment to it and recognize it as an important dimension of their foreign policy. When countries like China, Brazil, Turkey, or India engage in SD, they certainly believe in the virtues of international scientific cooperation and they agree to

follow the overall movement towards building an improved governance of global public goods (the “addressing global challenges” approach to SD). But what they are looking for most is to attract scientific resources and talents and access international networks, and to build capacity for sustaining the national scientific development (the “advancing national interests” approach). The updated and more realist characterization of SD is more suited to them. Political change may also have played some role. Analyzing the recent evolution of USA’s SD since 2017, a prominent author could write that “science diplomats are realists and recognize that politics is a more powerful force than science, at least in the short run” and that “the proponents of science diplomacy recognize that national interests do indeed trump idealistic visions” (Colglazier, 2017, p. 1,2). Finally, having in mind the questioning of multilateralism and the surges of nationalism that are manifesting here and there in the world, it appears that the integration of more realism in the discourse on SD is in line with these changes of the contemporary world.

Gray areas in the mainstream approach to science diplomacy

A contrasting judgment emerges when turning the pages of the mainstream literature. The reference to national interests has openly surfaced, and this reflects a better consideration of the practices of SD. However, not all of the consequences of this more realistic conceptualization have been drawn. At the interface of science and diplomacy, there exist situations where the interests of some countries do not correspond to that of others, there are cases where the spirit of competition prevails over that of cooperation and where unilateral national strategies lead to asymmetries of power and tensions between countries. States may conduct strategies of SD that are strictly rooted to their national interest and aiming only at taking advantage over others, thus not contributing to the quest for a better world order, which is at odds with the prevailing vision of SD. In this section, we focus on what this vision leaves in the shade. We identify three gray areas.

Power relations between countries are overshadowed. Power relations are mentioned in some of the first writings, pointing for instance at science as “providing a way for countries to exercise their own soft power” or at SD as a tool for “expressing national power or influence” (Turekian and Neureiter, 2012). By introducing the “science for diplomacy” dimension, the Royal Society-AAAS 2010 report illustrated that science can contribute to the achievement of foreign policy objectives. However, the impression conveyed from these first writings was that, although mentioned, questions of national interests and power receded to the periphery. The 2010 report *New Frontiers in Science Diplomacy* has a subtitle, “Navigating the changing balance of power”, which has generally remained unnoticed. From this subtitle, one could expect the report to examine the place taken by science in power relations between countries, and the ways in which some countries could use SD for creating situations of hegemony and domination, thus opening the path to a more realist approach. The report used the word “power” when mentioning “soft” and “hard power”, but did not deliver any analysis of the balance of power and of its changing nature, an ambiguity that has already been noted in the scholarly literature (Kaltofen and Acuto, 2018a; Rungius et al., 2018).

SD is not always as a tool for progress and peace. Central in the discourse is the capacity of international scientific cooperation to build bridges and to maintain dialog between countries experiencing difficult political relations. Without a doubt, SD can improve international relations, of which examples and case studies provided by the literature give evidence. But in some

cases, certainly much less numerous, SD can create conflict rather than appeasement. Early in the discourse it was asserted that “not all science diplomacy is devoted to the achievement of pacific ends” (Copeland, 2011, p. 2) and that SD could be viewed as a “double-edged sword” (Copeland, 2015, p. 9). The use of contemporary technologies for monitoring communications in the context of covert operations and spying show that “there are often situations that fall under the banner of Science for Diplomacy in which the notion of science diplomacy has not produced the desired outcomes” (Davis and Patman, 2015, p. 266). Accusations of espionage surrounding the US Naval Medical Research Unit 2 (NAMRU-2), which operated in Indonesia for more than 40 years, give evidence that “science diplomacy itself may heighten conflict or reduce trust and transparency” (Smith, 2014, p. 828). Another illustration is given by the anchoring by Russian scientists of their national flag on the seabed of the North Pole, in August 2007, which could be seen by other bordering states as the expression of a territorial claim; in that case, science and scientists were indeed used for advancing national interests, but not as a facilitator of diplomacy and rather at the source of a diplomatic tension (Ruffini, 2017, pp. 102–103). These examples would logically open to the question of the politicization of science through SD. However, the dominant discourse has avoided going deeper into this troublesome question with sweeping statements such as “science is neither inherently political nor ideological” (Turekian et al., 2015, p. 4) and more generally, by waving the very convenient reference to the universal values of science.

The rationale of competition in SD is underestimated. Unlike the widely-used words “cooperation” and “collaboration”, the word “competition” rarely appears in the writings devoted to SD. True, the concept of competition may seem at first foreign to diplomacy, which essence is based on dialog and mutuality. However, we note that competition finds more easily its place in policy documents in view of framing states’ SD strategies. Above all, competition is present in *practices* of science diplomacy, as illustrated with the following contemporary examples.

Japan started to use SD as a policy concept in 2008. While recognizing the importance of strengthening ties of scientific cooperation (in particular with East-Asian countries) and of the need to take part in solving global issues, the “Science and Technology Diplomacy Initiative” was spurred on by other policy goals such as tapping into the growing science base abroad, strengthening the domestic R&D system, revitalizing the country’s innovation system, with the view that diplomacy “shouldn’t just be establishing good relationships with other nations, but should also be achieving the realization of national interests and strengthening the industry’s international competitiveness” (Sunami et al., 2013). Among the policy goals set by the Government of Spain for its Science, Technology and Innovation Diplomacy, next to the need to “strengthen research and technology cooperation” were injunctions such as “create a solid base for stepping up the country’s competitiveness” and “attract talent and foreign investment” (Gobierno de España, 2016). In its strategic approach to international scientific cooperation, the European Commission set the goal of “Strengthening the Union’s excellence and attractiveness in research and innovation, as well as its economic and industrial competitiveness” (European Commission, 2012, p. 4). The EU discourse “strongly indicates an interest in using science for strengthening the Union’s competitiveness in general terms” (Lopez de San Roman and Schunz, 2017, p. 257).

The impression that is left when reading these strategy papers is that the watchwords and policy goals of the states (or the European Union) are much broader than those of cooperation

and of participation in global issues. More generally, there are practices which are hardly, if at all, inspired by the desire for cooperation. Let's point to some of these unilateral and competitive science-related foreign policy actions. Diplomatic structures support national researchers by facilitating their access to international research networks and infrastructures. Through their specifically dedicated agents in the field (scientific attachés at embassies), they implement the national policy of attractiveness of scientific resources and promote the incoming mobility of foreign doctoral students and researchers, and generate influence by branding scientific and technological achievements of the country they represent. Ministries of foreign affairs engage in organizing or supervising the appointment of national scientific experts abroad, and in preparing for entrance exams to international organizations. Because of the active involvement of diplomatic agents they require, such actions deserve to be placed under the umbrella of SD. At best, however, they remain on the periphery of the dominant discourse. While the support of diplomatic apparatuses to scientific cooperation illustrates the collaborative aspect of SD, their commitment to attractiveness and influence policies clearly illustrates its competitive aspect.

These examples, taken among others, should alert on this: in SD as it is practiced by states (or by the European Union), alongside seeking mutually beneficial cooperation, there is room for strategies driven by the will of taking advantage over others—and this is the very spirit of competition. Cooperation is not all that is involved in SD practices. The rationales of cooperation coexist with those of competition. An illustration is given by the international definition of technical standards, an area in which scientists have a say but which is also crucial for the acquisition of competitive advantages. In the related negotiations, the logics of commercial competition between countries can defeat agreements on standards. On the example of food safety, this tension partly explained the failure of TTIP free trade agreement between the EU and the US.

It is striking that the cooperation-competition axis, which allows for a relevant although very common reading in many areas and has been used in numerous science policy studies, has been of little use in the practitioners' writings dedicated to SD. It is only in passing that the words "competition" and "competitiveness" are pronounced in the reference texts, whereas the affirmation of the play of national interests seemed to open a royal way towards the consideration of strategies other than cooperative. This remark, however, does not apply to scholarly literature, where it was noted early that "S&T have gained an important and ever-increasing role in the competitive quarrel for market shares, power, and influence", thus emphasizing a "strong tension between cooperation and competition" in SD (Flink and Schreiterer, 2010, p. 665, 675). This insightful assertion was reaffirmed more recently from the description of "strategies to tap into competitive innovation markets worldwide" as one of the drivers of science diplomacy, allowing to affirm that "science diplomacy is embedded in logics of global collaboration and competition" (Flink and Rüffin, 2019, p. 117).

Finally, these gray areas in the mainstream approach to SD reflect a kind of paradox: the interplay of national interests has been recognized, but still, the assigned scope of SD has remained that of harmonization of national interests and of consideration of common interests. This vision of a SD "for the good" leaves aside unilateral actions and practices such as the ones which this section has mentioned. We need to try to understand why.

Hypotheses about the discrepancy between the discourse and the reality of SD

How to explain the gap between the conception of SD which emerges from dominant narratives and the reality of its practices?

Table 1 Science and Diplomacy Journal: professional positions of authors 2012–2019.

| Professional positions of authors | Number | % |
|---|--------|-------|
| Researchers, scholars | 83 | 29,2 |
| Research administrators | 40 | 14,1 |
| Other experts, consultants, NGO, think tanks | 31 | 10,9 |
| Scientific advisors at ministries and public agencies | 27 | 9,5 |
| <i>Science and Diplomacy</i> and AAAS fellows and staff | 25 | 8,8 |
| Members of academies and other scientific societies | 19 | 6,7 |
| Ministry staff | 18 | 6,3 |
| Science attachés and other representatives abroad | 15 | 5,3 |
| Ambassadors and other career diplomats | 10 | 3,5 |
| Miscellaneous | 16 | 5,6 |
| Total | 284 | 100,0 |

We hypothesize that the reason may well lie in the profile of those who have built the concepts: they are scientists, and they are actors of SD.

Who are the practitioners who built the discourse on science diplomacy? We have analyzed the profile of authors of articles published by the quarterly journal *Science & Diplomacy*. This journal was created in 2012 with the intention of being a "platform where scientists, policy makers, diplomats, and other thought leaders could share their perspectives, insights, and stories on issues at the nexus of science and international affairs" (Mesfin and Shifflette, 2018). It is, to our knowledge, the only fully specialized journal on the subject of SD. It is not an academic but a policy review privileging concrete approaches to the convergence of science and diplomacy. It is published by the Center for Science Diplomacy of the AAAS, and has been influential since its origin in the shaping of the concept of SD.

We have identified the professional positions of all authors who wrote in *Science & Diplomacy* between 2012 and 2019 (Table 1 above)¹. By the time the articles were written, the vast majority of authors were practicing scholars and scientists, research administrators or science diplomats such as government advisers or embassy attachés, the latter being generally former scholars or scientists. Comparatively, the contributions of career diplomats were marginal.

This is an essential point: in this practitioner's literature, the vast majority of authors does not originate from the world of diplomacy, but from that of science and research. This authorship conforms well to what we know about the actors of SD, among which dominate individuals from the sphere of science and research. Without claiming to be representative of the total population of science diplomats, a survey conducted as part of the S4D4C H2020 project has provided data which support our observations: based on 130 responses from the "group of professionals working at the interface of science and foreign policy and whose members understand themselves as science diplomats", 38% of respondents assessed their self-responsibility as scientists (38%) or research administrators (38%), but only 13% considered themselves diplomats (Degelsegger-Márquez et al., 2019).

This could suggest that SD is more a matter of scientists than a matter of diplomats, thus opening up broad perspectives for reflection. Who are those that can be recognized as "science diplomats" among authors of *Science and Diplomacy* articles—bearing in mind that many of them are not regular practitioners, but report on SD cases and experiences? If SD envisions interactions between diplomats and scientists—or even a co-construction of practices—why such an inspiration does not reflect in authorship? Would scientists have more legitimacy to

talk about SD than diplomats? Developing such questions is beyond the scope of this article. We reflect here on the link between the profile of prominent authors and the mediatized vision of SD.

The cultural bias hypothesis. Typically, the leading authors on science diplomacy were—and still are—practitioners having made a career in research, before holding positions in the administration of research, in science advice to the government or in diplomacy. We hypothesize that this dominant authorship could generate a cultural bias, that is, a particular view shaped by the habits of mind and modes of thinking specific to the epistemic community of scientists. We assume that as scientists, most if not all of the authors share the belief that scientific discoveries can improve the well-being—all the more so for those coming from the natural sciences sector, as it was the case for those who authored the definitions and taxonomies of science diplomacy. It may be assumed that they transferred their belief in science as a source of progress to the field of international relations: a royal path for improving the human condition, science would also be able to improve relations between nations. The ubiquitous reference to the “universal values of science” in the usual advocacy of SD confirms this normative and somewhat idealistic view. Steeped in the universalism of science, practitioners tend to highlight the prisms of cooperation and common interests rather than those of competition and national interests. Such character traits specific to the world of science give SD its uniqueness. Less care is taken when it comes, for example, to economic diplomacy, which clearly displays its objectives of attracting foreign direct investment and supporting the interests of national exporters in the global competitive game. We hypothesize that the intellectual and professional origins of authors matter: different would undoubtedly have been the discourse if diplomats, as realist-minded agents, had occupied an important position in authorship.

SD is a normative concept embedding policy objectives. The prevailing definitions of SD are inspired by a normative intention. As a tool for progress and peace, SD ought to exercise its beneficial influence on international relations, with no other purpose than that of softening international tensions and facilitating collective approaches to global issues, international scientific cooperation being the instrument par excellence of the virtuous sequencings of science “for” and science “in” diplomacy. We hypothesize that this normative, or instrumental, view of SD is explained by another aspect of the profile of authors who advocate the concept and have set the usual definitions: they are opinion leaders, influencers, actors or even activists of SD. They are or they feel committed to the implementation of SD in its capacity to improve the world order. They operate along two main lines of action: enhancing the global science-policy interface and informing policy at all levels of government (Gluckman, 2016; Turekian and Kishi, 2017) and building common interests in the approach of global issues (Berkman, 2019). All these authors-practitioners have agendas, to which definitions of what SD is about have been subordinated. Among the great diversity of practices at the intersection of science and foreign policy, they favor those that correspond to the objectives they have assigned to SD, thus paying less or no attention to more trivial aspects of competition between national strategies. The discourse on SD is thus legitimized by the policy goals of those who produce it. Definitions do not describe SD as it is in its diversity, but as it should be with regard to its missions considered as priorities. It is only within this normative framework that it is acceptable to say

that there are “limitations to SD” (Patman and Davis, 2017, p. 262), when it fails to achieve the objectives assigned to it.

When considered through the prism of the benefits which more science and scientific cooperation can bring to international relations, SD, in its mainstream version, focuses on practices which contribute to the achievement of these positive objectives. In terms of action and from a practitioner’s perspective, this vision is perfectly consistent: the alternative taxonomy aims at being pragmatic and more utilitarian (Gluckman et al., 2017) and the narratives are instruments at the service of action. The difference between the practitioner perspective and the scholarly perspective is patent. While the first frames SD and its definitions for the needs of actions to be carried out, the second should address all practices located at the intersection of science and foreign policy, whether inspired by the spirit of cooperation and the common good, or by the one of the competitive advantage. What is ultimately at stake with this discussion is the questions of the perimeter assigned to SD and of the practices which are or should be labeled accordingly.

Concluding remarks

The literature on SD has been greatly influenced by the writings of practitioners who have produced definitions, taxonomies and concepts which irrigate the mainstream discourse. We have proposed a critical reading of these writings and questioned their capacity to take into account the diversity of practices at the intersection of science and diplomacy. Pieces of the practitioners’ driven literature converge on a vision that SD can help reduce political tensions between countries, improve mutual understanding between peoples, enhance the international order and work towards the satisfaction of common interests—international scientific cooperation and sound scientific advice to policy-making being the royal paths to reach these goals.

Although the discourse has moved overtime toward an explicit recognition of the role played by national interests in SD strategies, it did not question the bases of the conceptualization nor the scope of the actions to be labeled as SD. Since its inception, it has been reluctant to account for situations where a country uses SD to pursue its own interest at the expense of other countries or at the expense of the common interest. However, there are practices such as attracting scientific talents, seeking to weigh in the debates in international arenas, or using scientific assets for influence purposes that are not inspired by the spirit of collaboration, but rather of competition. The missing reference to competition is the strongest manifestation of the gap that exists between the reality of SD and the way it is most often talked about.

We tried to explain this gap by assuming that there exists a cultural bias in the conceptualization of SD: most of the practitioners who authored the mainstream writings are former or acting scientists, having as such a universalist and often optimistic vision of the virtues of science to bring progress in the international order. Their understanding of SD was more inspired by the values of science than the values of diplomacy. As SD actors, they have framed their definitions and concepts according to the needs of their agenda and favored the prisms of cooperation and common interests rather than those of competition and national interests.

From a practitioner’s perspective, such a discourse fulfills its purpose, which is to arm actors with a rhetoric magnifying the transformative power of SD. But from a scholarly perspective, its inability to frame without exclusive the diversity of practices at the intersection of science and diplomacy may be seen as a limit. Regarding the conceptualization of SD, the practitioner and the analytical scholar do not have the same needs. For the first, the

conceptual discourse must be a tool serving the objectives of action, and a good definition is one that is operational. For the second, SD is an object of study, the conceptual framing is a tool for knowledge and a good definition is one that encompasses all of the complexity of the practices. What is needed is a conceptualization of SD that would account for the tensions between the idealism of science and the realism of diplomacy, and between international cooperation for the common good and competition driven by national interests. Researchers can be expected to explore facets of SD which remained in the shadows and ask questions that the author-practitioners do not ask, and which could therefore enrich the research agenda. What the analysis of the dominant discourse ultimately reveals is that there is a need for more science of science diplomacy.

Data availability

Data sharing not applicable to this article as no datasets were generated or analyzed during this study.

Received: 14 January 2020; Accepted: 25 August 2020;

Published online: 14 October 2020

Note

1 All summaries (excepted September 2012) have been tabulated from the first issue of the journal to the December 2019 issue. Introductory editorials by editors have not been counted. In the most represented category, that of researchers and scholars, the authors came in roughly equal proportions from the fields of natural or medical sciences, and from that of human and social sciences.

References

- Berkman PA (2019) Evolution of science diplomacy and its local-global applications. *Eur Foreign Affairs Rev Special Issue* 24:63–80
- Colglazier EW (2017) Optimism, Pessimism, and Science Diplomacy. *Science and Diplomacy* 6(2). <https://www.sciencediplomacy.org/editorial/2017/optimism-pessimism-and-science-diplomacy>. Accessed 22 Aug 2020
- Copeland D (2011) Science diplomacy: what's it all about? CEPI-CIPS Policy Brief 13:1–4
- Copeland D (2015) Bridging the chasm. Why science and Technology Must Become Priorities for Diplomacy and International Policy. *Science and Diplomacy* 4(3). <http://www.sciencediplomacy.org/perspective/2015/bridging-chasm>. Accessed 22 Aug 2020
- Copeland D (2016) Science Diplomacy. In: Constantinou CM, Kerr P, Sharp P (eds) *The SAGE handbook of diplomacy*. SAGE Publications Ltd, London. pp. 628–640
- CORDIS (2009). Science as a tool for international diplomacy. <https://cordis.europa.eu/article/id/30532-science-as-a-tool-for-international-diplomacy>. Accessed 22 Aug 2020
- Davis LS, Patman RG (2015) New day or false dawn? In: Davis LS, Patman RG (eds) *Science diplomacy: new day or false dawn?* World Scientific Publishing Company, Singapore, p 261–275
- Department of State (1950) *Science and foreign relations*. Department of State Publications. p. 3860
- Degelsegger-Márquez A, Flink T, Rungius R (2019) What it takes to do science diplomacy. Practices, identities, needs and challenges of science diplomacy practitioners. Baseline analysis and needs assessment, Deliverable 2.3. S4D4C, Vienna
- European Commission (2012). Enhancing and focusing EU international cooperation in research and innovation: a strategic approach. COM(2012) 497 final. https://ec.europa.eu/research/iscp/pdf/policy/com_2012_497_communication_from_commission_to_inst_en.pdf. Accessed 22 Aug 2020
- Fedoroff N (2009) Science diplomacy in the 21st century. *Cell* 136(1):9–11
- Flink T, Rüffin N (2019) The current state of the *art* of science diplomacy, In Simon D, Kuhlmann S, Stamm J and Canzler W (eds) *Handbook on science and public policy*. Cheltenham, Edward Elgar. pp. 104–121
- Flink T, Schreiterer U (2010) Science diplomacy at the intersection of S&T policies and foreign affairs: toward a typology of national approaches. *Sci Public Policy* 37(9):665–677. <https://doi.org/10.3152/030234210x12778118264530>
- Gluckman PD (2016) Science advice to governments: an emerging dimension of science diplomacy. *Science and Diplomacy* 5(2). https://www.sciencediplomacy.org/sites/default/files/science_advice_to_governments_0.pdf. Accessed 22 Aug 2020
- Gluckman PD, Turekian VC, Grimes RW, Kishi T (2017) Science diplomacy: a pragmatic perspective from the inside. *Sci Diplomacy* 6(4):1–13
- Gobierno de España (2016) Report on science, technology and innovation diplomacy.
- Hsu J (2011). Backdoor diplomacy: how U.S. Scientists Reach Out to Frenemies. *InnovationNewsDaily*, April 8. <https://www.livescience.com/13638-science-diplomacy-soft-power.html>. Accessed 22 Aug 2020
- Kaltofen C, Acuto M (2018a) Rebalancing the encounter between science diplomacy and international relations theory. *Global Policy* 9(3):15–22. <https://doi.org/10.1111/1758-5899.12620>
- Kaltofen C, Acuto M (2018b) Science diplomacy: introduction to a boundary problem. *Global Policy* 9(3):8–14
- Krige J (2006) *American hegemony and the postwar reconstruction of science in Europe*. MIT Press, Cambridge, Massachusetts
- Krige J, Barth KH (2006) Introduction: science, technology, and international affairs. *Osiris* 21(1):1–21
- Lopez de San Roman A, Schunz S (2017) Understanding European union science diplomacy. *J Common Market Stud* 56(2):247–266
- Lord KM, Turekian VC (2007) Time for a new era of science diplomacy. *Science* 315(581):769–770. <https://doi.org/10.1126/science.1139880>
- MacLeod R (Ed.) (2000) *Nature and empire: science and the colonial enterprise*. Osiris 15
- Mesfin NM, Shifflette A (2018) Introduction to the Special Issue. *Science and Diplomacy*, September. <https://www.sciencediplomacy.org/editorial/2018/introduction-special-issue>. Accessed 22 Aug 2020
- Merton RK (1942) The normative structure of science. In: Merton RK (ed) *The sociology of science: theoretical and empirical investigations*. University of Chicago Press, Chicago, p 267–278. 1973
- Oreskes N, Krige J (2014) *Science and technology in the global cold war*. MIT Press, Cambridge
- Patman RG, Davis LS (2017) Science diplomacy in the Indo-pacific region: a mixed but promising experience. *Polit Policy* 45.5:862–878. <https://doi.org/10.1111/polp.12228>
- Penca J (2018) The rhetoric of “science diplomacy”: Innovation for the EU’s Scientific cooperation?. The EL-CSID Project. Institute for European Studies. Working Paper 2018/16: 1–16
- Ruffini PB (2017) *Science and diplomacy: a new dimension of international relations*. Springer International Publishing, Cham
- Rungius C, Flink T, Degelsegger-Márquez A (2018) State-of-the-art report: summarizing literature on science diplomacy cases and concepts. Deliverable 2.2. S4D4C, Vienna
- Skolnikoff E (1993) *The elusive transformation: science, technology, and the evolution of international politics*. Princeton University Press, Princeton
- Smith FL (2014) Advancing science diplomacy: Indonesia and the US Naval Medical Research Unit. *Soc Stud Sci* 44(6):825–847. <https://doi.org/10.1177/0306312714535864>
- Sunami A, Hamachi T, Kitaba S (2013) The rise of science and technology diplomacy in Japan. *Science and Diplomacy*. 2(1). <https://www.sciencediplomacy.org/article/2013/rise-science-and-technology-diplomacy-in-japan>. Accessed 22 Aug 2020
- The Royal Society, The American Association for the Advancement of Science (2010). *New frontiers in science diplomacy*. The Royal Society, London
- Turekian VC, Neureiter NP (2012) Science and diplomacy: the past as prologue. *Science and Diplomacy* 1(1). <http://www.sciencediplomacy.org/editorial/2012/science-and-diplomacy> Accessed 22 Aug 2020
- Turekian VC, Macindoe S, Copeland D, Davis LS, Patman RG, Pozza M (2015) The emergence of science diplomacy. In: Davis LS, Patman RG (eds) *Science diplomacy: new day or false dawn?* World Scientific Publishing Company, Singapore, pp. 3–24
- Turekian VC, Kishi T (2017) Science and technology advising in today’s foreign policy. *Science and Diplomacy*. March. <https://www.sciencediplomacy.org/perspective/2017/science-and-technology-advising-in-todays-foreign-policy>. Accessed 22 Aug 2020
- Weiss C (2005) Science, technology and international relations. *Technol Soc* 27(3):295–313
- Wolfe AJ (2018) *Freedom’s laboratory: the cold war struggle for the soul of science*. Johns Hopkins University Press, Baltimore

Acknowledgements

This publication has received financial support from the European Union’s Horizon 2020 research program InsSciDE (“Inventing a Shared Science Diplomacy for Europe”) under grant agreement No. 770523.

Competing interests

The author declares no competing interests.

Additional information

Correspondence and requests for materials should be addressed to P.-B.R.

Reprints and permission information is available at <http://www.nature.com/reprints>

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>.

© The Author(s) 2020