

Science Diplomacy: Introduction to a Boundary Problem

Carolyn Kaltofen

Department of Science, Technology, Engineering and Public Policy,
University College London

Michele Acuto

Melbourne School of Design, University of Melbourne

Abstract

Scientific advancements, their application through technological development, and world politics have been long acknowledged as affecting each other, and are today more than ever at the heart of global policy. Speaking of ‘science diplomacy’ as the encounter of world politics and the world of science at the heart of these advancements might be a unique window into our time. This potential is what prompts this special issue to gather views from a variety of scholarly and practical viewpoints, linking the well-established world of reflective practitioners in science diplomacy to the growing field of international relations (IR) scholars theorising this realm. Can speaking of ‘science diplomacy’ situate our attention at the crossroads of science and international relations, and spur greater appreciation for their intersections? This introduction to the special issue summarises the rise of science diplomacy as field of inquiry, and casts questions as to the need to advance, where not reform, these conceptualisations. It defines science diplomacy as a ‘boundary problem’ par excellence and emphasises its ‘productive tension’ that emerges between the various ways of knowing of actors belonging to ‘different social worlds’, seeking to gather a productive tension of views on this theme in the issue.

‘There is no doubt that international politics is quite different, in almost all dimensions, then it has been, or than it will be’ (Skolnikoff, 1993, p. 239). Scientific advancements, their application through technological development, and world politics have been long acknowledged as affecting each other (Rosenau and Singh 2002; Weiss, 2005). Indeed, their ‘mutual influence’ is variously recognised as so important and pervasive that the field should be recognised as an independent sub-discipline’ within the study of international relations (IR; Weiss, 2005; Leese, this issue). Yet, despite the imperative to better understand the relation of science, technology and world politics, little territory is still granted in mainstream avenues of the discipline to such an important matter. According to scholars of International Relations theory (IR) this is surprising as the scholarship neither lacks interest nor engagement with actors and issues of science or technology (e.g. Kaltofen et al., 2018; ; Mayer and Acuto, 2015; Salter, 2015). In fact, for the latter half of the twentieth century science has been routinely at the heart of IR literature. More appropriately, some international historians have even gone in so far as arguing that science made ‘international’ as a space and ‘international system’ in the first place (Cawood, 1979). Whether as chasm between epistemologies, the backbone of transforming warfare or as cure for virulent pandemics, the knowledge, application and practice of science inspires, exacerbates and accelerates international competition, division, dissent, poverty and discontent, as much as international agreement, development, cooperation and aspirations. Grasping the gamut of phenomena in which science and world politics converge is one challenge, the systematic analysis and conceptualisation of the relationship between them is a different problem. ‘Science diplomacy’ is, in the broadest sense, a possible response to both challenges. This potential is what prompts us to gather views from a variety of

scholarly and practical viewpoints in this special issue. Can speaking of 'science diplomacy' situate our attention at the crossroads of science and international relations, and spur greater appreciation for their intersections?

In search for definition(s)

'Science diplomacy' could, in practice, refer to two things in the discussions that follows. First, the term often designates a set of relations between two or more actors that identify and/or are identified as representing distinct legitimate political entities; these relations are maintained through practices that are firmly scientific in purpose, process or objective (or all) while diplomatic in their quality and/or effects (unanticipated and unintended as well as intended); which can be either direct diplomatic relations or indirect by presentation of cross-border, international or global dimensions. Second, science diplomacy can also refer to simply the study of such phenomena. A bit like with international relations, we could speak of science diplomacy as both practice and scholarship that unpacks that practice and where both inextricably intertwine but without agreeing what is and isn't part of the study. In the Anglophone world, the specific term 'science diplomacy' first appeared

two decades ago giving rise to a multitude of meanings, agendas, relations and practices (Dreifus, 2008; Gluckman et al., 2017; Lord and Turekian, 2007). During this time, some have attempted to develop a definition or taxonomy of science diplomacy. Coined by Nina V. Fedoroff, the Science and Technology Adviser to the then US Secretary of State Condoleezza Rice, and fostered by her successor, William Colglazier, during the new Obama Administration, Science diplomacy was introduced as referring to new foreign policy activities that serve 'humanity' as well as 'build constructive international partnerships' (Fedoroff, 2009). Science diplomacy's image as innovating foreign policy quickly made it a hot topic among the policy communities of 'Anglosphere' foreign ministries (in particular, of the United States, Great

Britain and New Zealand). This foreign policy approach to understanding science diplomacy has been and still is the one most common though as this special issue highlights not the only one.

Without much explicit upfront theoretical grounding, the term relied on the emerging practitioner discourse for meaning and, as such, became synonymous with the state-centric aspects of the interface between science and world politics as well as shaped by the converging experiences of foreign policy practitioners and esteemed members of reputable institutions representing science. Among these are, of course, the American Association for the Advancement of Science (AAAS) and the Royal Society of London (RS). The newly established AAAS 'Center for Science Diplomacy' and subsequent inauguration of the Center's journal *Science & Diplomacy* were not only significant steps in the evolution of Science diplomacy, but also a central expression of this pragmatic foreign policy approach that found further outlet in the seminal 2010 report by the AAAS and the Royal Society of London (RSAAAS).

New Frontiers of Science diplomacy is, undoubtedly, the most influential 'declaration' and classification of this largely Anglo-American position and the central point of reference for any subsequent publications and official statements of this view. '[B]ased on the evidence gathered at a 2-day meeting' in which 'government ministers, scientists, diplomats, policy makers, business leaders and journalists' explored said frontiers—remarkably without consultation of research evidence—the report proposes Science diplomacy as 'the fluid concept' that articulates the 'role of science, technology and innovation in three dimensions of policy' (RS-AAAS 2010, pp. v–vi):

- informing foreign policy objectives with scientific advice (science in diplomacy);
- facilitating international science cooperation (diplomacy for science); and
- using science cooperation to improve international relations between

countries (science for diplomacy).

The report gains its influence from its illustrative exposition of this three part classification of Science diplomacy, which made its study accessible while mainstreaming the foreign policy approach. Yet within due course it became evident, however, that Science diplomacy was given its broad mix of science intensive activities only a foreign policy option for governments of 'rich industrial countries' (Flink and Schreiterer, 2010). Despite the widely shared view among science diplomacy advocates that political and cultural difference can be overcome by appealing to 'scientific values of rationality, transparency and universality [that] are the same the world over' (RS-AAAS 2010, p. vi), Science diplomacy was politically contentious as well as relatively limited in its sphere of influence. At the same time the absence of more explicit theoretical development, the likes of which characterised the study of international relations in the 1920s, 1930s and 1950s, left science diplomacy highly fragmented to the present day.

The world of science diplomacy 'thinking' (if we can't exactly call it 'theory') has been splintered into practitioner expertise, as with the development of the Foreign Ministries' Science and Technology Advisors Network (FMSTAN), but also at AAAS, their flagship projects like the jointly held Science Diplomacy summer courses for professionals that is exceedingly popular in demand, needs and opportunity-based networks around the broader issue of scientific 'advice' like the International Network of Government Scientific Advisors (INGSA), but also emerging educational initiatives like the science diplomacy program at Tufts University, as well as, of course, the Royal Society and academic research projects as with the European Commission funded 'Inventing a shared Science Diplomacy for Europe'.

Recognising that 'science' alone cannot achieve the desired wide spread of diplomatic relations and regional integration, science diplomacy needed to be

actively inclusive. Its foreign policy rationale of advancing 'national interest' was broadened to include what is, effectively, a simplified variation of the 'collective action' theory, suggesting science diplomacy as a way of responding to international challenges and global good problems. Science diplomacy also became increasingly associated with the building of science capacities in less developed countries (including education, enterprise, industry as well as research), which, in turn, would enable their governments to participate in the international collective action of science diplomacy, especially in areas of environmental protection and health. Science diplomacy's added normative responsibilities were supported by several international initiatives 'on the ground' which worked to manifest and extend science diplomacy's reach (popularly referred to as 'soft power') and formal relations. In other words, the implementation of science diplomacy understood as foreign policy to 'directly advance a country's national needs,' depends on international schemes 'designed to address [broader] cross-border interests', whereas much of its justification hinges upon the integration of science diplomacy activities into collective initiatives 'designed to meet global needs and challenges' (Gluckman et al., 2017).

Acknowledging our limitation in unlocking the complexity of 'science and politics in global action' here, this is, nonetheless, what the proposed study of science diplomacy is concerned with generally (Mayer et al., 2014; Skolnikoff, 1993). The large breadth of literature dealing with this concern, explicitly and implicitly, is what we refer to as the second phase or generation of science diplomacy scholarship. This includes many approaches that are not explicitly framed in particularly theoretical terms, which are either asking about very specific aspects and workings of the international politics science interface (Flink and Schreiterer, 2010; Wagner, 2002) or analyse this interface in specific empirical contexts (Elbe and Buckland-Merrett, 2017; F€ahnrich, 2015). While, we as authors identify with the second heat in the science diplomacy's

evolution, our work and this special issue evolves through a continuous dialogue with the earlier- mentioned first generation. The latter is mainly comprised of case studies, biographical accounts and some limited theorisations, with the now well established AAAS journal of Science & Diplomacy been the main centre point of this specialist literature, with scattered discussions of science diplomacy across the wider field of more traditional (and popular) 'IR' outlets.

Where empirical work has been done, it has mostly concentrated on specific topics, analysing the relationship of scientific contributions and experts to specific diplomatic or policy objectives (e.g. Davis and Patman, 2015). The domains of security and the environment have been the most commonly explored along these lines, closely followed by trade, cyber governance and health. Effectively, science diplomacy, has emerged organically as an area of study for it is primarily documented by those working in areas of global policy and through mechanisms of science diplomacy. While it is generally acknowledged that science diplomacy has been an international practice for some time without having been specifically referred to as such, it is thought to be a particularly prominent phenomenon of modern societies (Turekian et al. 2014). As such, science diplomacy not only designates an emerging practice and concept but is often understood as reflecting a period of increased global change.

Attempts to theorise science diplomacy beyond its operational mechanisms and possible applications marks a second phase in the growing literature. This is increasingly driven by IR scholars who not only respond to the need of structuring the immense breath and diversity of the phenomena the term refers to, but also recognise science diplomacy as an invaluable unifying concept and analytic tool in the study of global affairs (F€ahnrich, 2015; Turekian and Wang, 2014). Inevitably, this raises the question of how science diplomacy fits within IR theory and, hence, what it says about the

relationship between science and IR more generally. However, integrating science diplomacy into the theoretical landscape of IR is an extremely challenging task. Essentially, IR is concerned with the problem of order and the modern state, which are two key components of the international problematique (Patom€aki, 2002) and, therefore, indispensable for any theory or framework in IR. Individual traditions perceive and explain the international problematique differently, and in order for science diplomacy to make sense as concept in IR, it would need to identify with one of the existing traditions.

Indeed, it can be argued that the reason science diplomacy has not yet made a name for itself as a field in IR has much to do with its highly ambiguous stance towards key IR traditions, which as discussed further below is most prominent in the 2010 Royal Society Report, but also in the carefully edited 2015 volume *Science Diplomacy: New Day or False Dawn?* by Davis and Patman. While this categorising exercise may seem petty for some, it determines how science diplomacy is understood as a global phenomenon and put into practice in turn. Even though occasional encounters have emerged in journals such as *Social Study of Science* and *Science and Public Policy* or events like the annual convention of the International Studies Association, it is hard to find extensive and theoretically explicit interaction with current IR theorising (e.g. debates on ‘new materialism’ or discussions of global governance) and a coherent program of science diplomacy studies. Consequently, science diplomacy still neither has a concept nor theory, but is used as a frame of reference for an array of different interactions taking place within the global politics-science interphase and, more importantly, as a heuristic tool to navigate and distinguish between different types of interactions.

Who would have thought science diplomacy is so deep?

Science diplomacy is underpinned by a subtle dialectic, which requires the study despite all pragmatic intensions to address its meta-theoretical foundations. The view that science diplomacy has evolved through the 'erosion' of previous misconceptions between scientific communities and national diplomatic services develops further through the recognition of shared vulnerabilities and mutual benefits between states. This view serves the discourse to style science diplomacy as an urgent, arguably, inevitable strategy for governments to continue 'to serve the global public good' (Miller, 2001, p. 478). The increasing recognition of national interests guiding the foreign policy of science diplomacy diverge from this view, however, by arguing that the cross-border mobilisation of scientific and technological expertise had provided traditional actors of international relations with means for maintaining influence by enabling their collective action with non-traditional actors, at a time when fundamental aspects of the global order were in question, and state power undermined. The assumptions underpinning science diplomacy's collective purpose are in stark contrast, if not irreconcilable, with those of power politics; they diverge over principle ideas concerning, for example, the 'nature' of states, state behaviour, rational and interest, the structure and dynamics international system, the conduct and actors of international relations, the limits, purpose, and value science and, the behaviour and agency of scientists. In short, the discourse of science diplomacy is caught between Idealist aspirations and Realist necessities (Smith, 2014), revealing the fragmented understanding of science and world politics, respectively.

Given the fundamental conflicts underpinning current efforts to formally integrate science diplomacy into the foreign policy repertoire of states and the architecture of the international system, Colglazier's editorial remarks in the June 2017 issue of *Science & Diplomacy* are pivotal and timely, surprising with an unerring reflection on science diplomacy that is both sincere warning

and appraisal. He addresses precisely science diplomacy's double-edged nature, whereby, it offers ways for 'continual upward progress' in global human affairs, on the one hand, and most prominently in the pursuit of the United Nations' Sustainable Development Goals (SDGs), yet on the other provides the means to 'destructive' ends 'that run counter the optimistic narrative' of science diplomacy (Colglazier, 2017, pp. 5, 7). The role of science during the Cold War is a classic example for demonstrating the variety of ways in which science can be leveraged in the pursuit of (super)power and cultural hegemony, as well as peaceful relations, which took the form of a series of disarmament and non-proliferation treaties that would have been inconceivable without scientific and technical advice informing diplomatic relations and negotiations (Ruffini, 2017) – but so would have been 'mutually assured destruction' (MAD). Reminiscent of Jacob Bronowski, Colglazier tames unwarranted optimism about science diplomacy's ability to navigate the changing balance of power based on the ideology free, transparent and neutral environment it provides (Colglazier, 2017; RS-AAAS 2010): 'while the values that come from the conduct of science remain strong [. . .] "Those who think that science is ethically neutral confuse the findings of science, which are, with the activity of science, which is not"' (Colglazier quoting Bronowski 2017, p. 7). His remembrance of realism by remarking that 'politics is a more powerful force than science, at least in the short run' is interrupting idealist slumber of the Science & Diplomacy discourse (Colglazier quoting Bronowski 2017, p. 6). Here we would agree with Colglazier insofar as that in order to develop the project of science diplomacy further, we not only need to be 'clear about what we can realistically expect from science diplomacy' (Colglazier quoting Bronowski 2017, p. 6), but also revisit questions concerning the relationship between the application of science and human values.

Consistently, there is a real need to probe science diplomacy with regard to a host of contextual sociopolitical values and narratives as well as the ways in

which it either reflects or realises public values and interest across borders. However, thus far academic and practitioner interest remain focused science diplomacy's instrumental merit of harnessing scientific findings for the purpose of conducting global politics, with strikingly little attention to the creation and negotiation of boundary problems its practice implies. Therefore, our special issue takes a wider approach to what 'science' stands for and broadly construes it to include not only its range of expertise, systems and institutions, but also their deeper cultural and political values and influences. In short, we problematise the global politics of Western science as well as science's cultural boundaries in the discourse of science diplomacy while putting the discussion of these features of science at the heart of science diplomacy in general.

Investigating a boundary problem

Drawing on the riches of Susan Leigh Star and James Griesemer's boundary work, we could then argue that science diplomacy is a 'boundary problem' par excellence and emphasise its 'productive tension' that emerges between the various ways of knowing of actors belonging to 'different social worlds' (Miller, 2001, p. 481; Star and Griesemer, 1998, p. 388). We do so by adopting a similar ecological approach for 'it does not presuppose an epistemological primacy for any one view point' (Star and Griesemer, 1998, p. 389). Thus, we are able to convene eminent practitioners, scholars and students of science diplomacy that collectively reflect the diverse views on science diplomacy without 'funnelling' the authority of one particular meaning (Star and Griesemer, 1998, p. 390). In this sense, we take the statement that 'consensus is not necessary for cooperation' (Star and Griesemer, 1998, p. 388), as underpinning the study as well as practice of science diplomacy. We envisage that across levels of debate (whether at the level of policy decision-making, theory or 'meta-theory') science diplomacy convenes difference in scale and kind with the purpose of cross-fertilisation

and/or co-production, yet without consensus as the final objective.

Science diplomacy is a *practice* that aims to maintain, cultivate, deepen and prolong relations. Whether considered from a first or second-generation perspective science diplomacy initiates a process or a series of events. Given the foreign policy 'nature' of the first generation, the literature puts emphasis on science diplomacy's many 'treaties', 'agreements', 'guidelines' and 'goals' which are the fruits of the collaborative interaction between political and scientific authority. We argue that the second generation's research interest can be summarised and explained as the broadening of science diplomacy from its scientific and political purposes to include the very processes and means that underpin the concluding of international agreements. In fact, the latter merely symbolise the process that is diplomacy. The contributors to this issue each analyse a different aspect or layer of this abstract process and foster our understanding of science diplomacy in action through the exploration of illustrative case studies.

When scanning the articles, it stands out that despite (or perhaps in spite) of their diversity, authors move across disciplines freely and with little urgency to justify the need to venture further than the boundary of IR. Remarkably, articles operate according to the imperative set by their case study and what it tells us about science diplomacy, instead of deriving their imperative from the IR knowledge gap that science diplomacy implies. Very much in favour of a boundary crossing analysis for a boundary spanning theorisation, we suggest that the pursuit of this broadening of science diplomacy could be structured by deepening our understanding of both diplomacy as well as science, better their respective studies.

Taking the study of science¹ and diplomatic studies more seriously in analysing the process of science diplomacy broadens our focus to include the professions, professional practices and institutions that underpin these. We have a keen interest in making the methods and insights offered by diplomatic

studies central to the analysis of science diplomacy's professional practices and routines. Diplomacy, as we argue in our analytical paper in this issue too, remains rarely defined either in the contributions of our authors or indeed in the two generations of 'science diplomacy' scholarship. Understood as the mediated practice of international relations (e.g. Kerr and Wiseman, 2013), 'diplomacy' opens up more explicitly the attention to the 'doing' of IR and foreign policy, to its negotiation practices, patterns and organisations, and to the politics of mediated relationships. More specifically, we put a primer on the need to understand how scientific diplomats and diplomatic scientists are actually working when they work across a boundary. Most of the contributions speak directly to this question and have generated an insight that highlight that the operations of science diplomacy are hugely under-appreciated and under-researched. What emerges for us, then, is that science diplomacy follows diplomacy in so far as this working across the boundary is 'mediating estrangement' (Der Derian, 1987, p. 92). Translating James Der Derian's proposition that 'Diplomatic theory is needed if we are to understand the relationship between power and diplomacy, [. . .] in the attempt to govern the ungovernable' – which 1987 was 'the anarchical society' – into a statement that holds over thirty years later then science diplomacy theory 'is needed if we are to understand the relationship between power, [science,] and diplomacy, [. . .] in the attempt to govern the ungovernable' (Der Derian 1987, pp. 93–4) – which in today's world are 'wicked', though not necessarily global challenges.

The special issue is organised to reflect our starting observation that science diplomacy, conceptualised as a range of boundary issues, translates into practice by means of co-production. Thus, we showcase practitioner commentaries in conjunction with survey articles. This structure also allows us to illustrate science diplomacy's productive tension in the feedback, lessons, gaps and ruptures between its study and practice. Ultimately, the

order of the structure parallels the co-productive relationship between diverse types of knowing and decision-making as discussed by scholars and encountered by practitioners. Moreover, the issue is organised into two main analytic clusters, which typically emerge around frequent tensions or constellations thereof and which sketch some preliminary conclusion in our outline of a science diplomacy framework of study and the challenges and issue areas of its practice. In this sense we divide here contributions pertaining more explicitly to the settings and production (i.e. the actors, values, regions and scope) of science diplomacy and to the drivers and organisations (i.e. the 'collective', 'common' and 'national' motives for diplomacy, as much as the organisation of relations and knowledge) that determine the shape of science diplomacy. As the reader will note, questions of power and knowledge feature in the issue throughout though authors highlight these in relation to the problem of their focus of analysis, which are difficult to compare especially in those cases that are also charged by ethical concerns that cross reference to ongoing debates on social and global justice for example. The variety of viewpoints and discussions gathered here take their stance on questions of power and knowledge to the object of study, respectively, but are not extrapolating their assessments to science diplomacy at large. We second this stance, as we do not intent to standardise for the point of drawing a red line across them or a conclusion here. However, we can see that irrespective of context, science diplomacy implies a boundary problem in both theory and also practice. Subsequently, we suggest adopting the language of the Stern's boundary to engender more discussions across cases of science diplomacy and problem structuring and work in practice directly. The talk of boundary helps to emphasise the range of contextual tensions that can be brought about by the same type of problem, set of actors or settings of science diplomacy but at the same time also allows for an easier communication across.

Further, we suggest the pragmatic variation of the notion of 'constellation'

to express and mediate challenges stemming from the unsettled nature of meaning attached to any given concept, whether in science diplomacy broadly or specific cases. It follows, for the discussion of science diplomacy, boundary 'talk' draws attention to context while the constellation deals with meanings. A boundary issue is binding to any lessons drawn from it, the boundary "case sensitive" and works as its own disclaimer, 'boundary lessons are not recommended for decontextualised use'. The issue can be further characterised as being interlaced with a number of constellations, our disclaimer that 'actors vary' and require further attention to 'the use of terms attached' as the same conceptual expression uttered and echoed by various actors refers to different things. 'Uncertainty' demonstrates another of these small words with large, inconvenient ripples that can offset or destabilise communication especially in the predominantly multicultural international playing field that is science diplomacy, as well as impact content via in numbers even further, and especially the flurry of examples from both across and within disciplines, boundaries, types of knowledge. While this is too obvious to point out for the social and political scientist, in putting together this special issue we were reminded just how subjective conceptual connotations are, how normal and frequent they are to us in IR and by comparison how this is a very different case in scientific and technical areas of professions and experts, while diplomats have been caricatured for this 'flexibility' in meaning being paramount to the very way of conducting diplomacy.

From caricatures to stereotypes to watertight definitions, to 'too inclusive to mean anything essential anymore, boundary work is frequently upset by poor communication as interpretative flexibility is neither "until settled" nor "free for all"' (Star 2010, p. 601; Star and Griesemer 1998, p. 387). The decision for and against the use of certain words over others the boundary object and constellation overlap a space of decision-making that we argue is principally

of political nature to which opting for the scientifically neutral is but one stance, equally imbricated by individual, professional or national identity imperatives and aspirations (i.e. agenda setting and problem framing) or used to speak on behalf of others. Besides the immense expert literature that are integral to the foundations of diplomatic practice and study one just has to think of the term 'mother tongue' to understand language is loaded. The trend since science diplomacy has been 'a thing' (unlikely related nonetheless) that have seen the UK and the US diplomatic services outsourcing or cutting back language training for diplomatic personnel, are said to have increased security risks not only in the several many countries for reasons not limited to terrorism alone, while fragmented operations substantially (Codrea-Rado, 2013). We take this invitation to emphasise that science diplomacy is taking science and diplomacy seriously in equal measure and the need to identify the space of operation for science diplomats specifically, not least because the diplomat is the profession of tactful and thoughtful communication abroad.

The scope for capacity building by learning from those experienced and versed well in 'science diplomacy communication' is heavily underexplored from the point of professional education offered outside the diplomatic service although scientists, experts and academics are said to habitually get lost in 'translation' of meaning (British Academy 2014). Which is made worse presumably by adding for example, 'national interest', 'public value', 'authoritative knowledge', 'diplomacy', 'discourse' or 'common' to the mix. After two years of lengthy discussions we were many times reminded that the language used across boundaries and borders is a far cry from neutral and rarely pragmatic only, neither mundane. In what follows, we suggest querying or putting to the test said 'fact' or its meaning, unpacking the intended meaning of the use of 'evidence', or problematising if we can use truth after all while discussing the limits of "jargon" in international interdisciplinary practices, as seen in the likes of 'balance of power', 'soft

power', 'collective action', etc. Last but not least foundational overarching but densely packed terms, 'science' and 'diplomacy' are a stellar case in point, but also discussed ad initium for which we suggest the 'constellation' as a pragmatic middle way (a diplomatic tool one may say) to facilitate discussions and practice alike. Essentially, to move on. Whether qualitatively, quantitatively or both, we leave the decision of how to address these boundaries and constellations to our fellow collaborators, current and future.

Notes

1. The 'study of science' includes several different areas ranging from the history and philosophy of science to the social study of science, also including science and technology studies, operational research and disciplinary sub-fields with a firm science focus or key dimension, such as medical anthropology and science communication.

2. Any given concept can be seen as varying even if actors broadly align in their understanding of it. Variation emerges from a concept's fluidity of content itself puts its relations with other concepts in flux too. Both the content of a concept and the relations it shares with others are subjective to the individual's use of them (Kaltofen, 2013).

References

British Academy. (2014) 'Lost for Words: The Need for Languages in Security and Diplomacy', *European Journal of Language Policy*. 6 (2), pp. 244–249.

Cawood, J. (1979) 'The Magnetic Crusade: Science and Politics in Early Victorian Britain', *Isis*, 70 (4), pp. 493–518.

Codrea-Rado, A. (2013) Languages, Diplomacy and National Security: Five Key Issues Education, *The Guardian*. Available from: <https://www.theguardian.com/education/2013/dec/05/languages-for-diplomacykey-points> [Accessed: 28 August 2018].

Colglazier, W. (2017) 'Optimism', Pessimism, and Science Diplomacy'

- Science & Diplomacy, 6 (2), pp. 5–8. Davis, L. S. and Patman, R. G. (2015) *Science Diplomacy: New Day or False Dawn?* Singapore: World Scientific.
- Der Derian, J. (1987) 'Mediating Estrangement: A Theory for Diplomacy', *Review of International Studies*, 13 (2), pp. 91–110.
- Dreifus, C. (2008) 'Nina Fedoroff, Advocate for Science Diplomacy', *The New York Times*, 18 August 2008 [online]. Available from: <https://www.nytimes.com/2008/08/19/science/19conv.html> [Accessed 29 October 2018].
- Elbe, S. and Buckland-Merrett, G. (2017) 'Data, Disease and Diplomacy: GISAID's Innovative Contribution to Global Health', *Global Challenges*, 1 (1), pp. 33–46.
- F€ahnrich, B. (2015) 'Science Diplomacy: Investigating the Perspective of Scholars on Politics – Science Collaboration in International Affairs', *Public Understanding of Science*, 26 (6), pp. 688–703.
- Fedoroff, N. V. (2009) 'Science Diplomacy in the 21st Century,' *Cell*. 136 (1), pp. 9–11.
- Flink, T. and Schreiterer, U. (2010) 'Science Diplomacy at the Intersection of S&T Policies and Foreign Affairs: Toward a Typology of National Approaches', *Science and Public Policy*, 37 (9), pp. 665–677.
- Gluckman, P. D., Turekian, V. C., Grimes, R. W. and Kishi, T. (2017) 'Science Diplomacy: A Pragmatic Perspective from the Inside', *Science & Diplomacy*, 6 (4) [online]. Available from: <http://www.sciencediplomacy.org/article/2018/pragmatic-perspective> [Accessed 29 October 2018].
- Kaltofen, C. (2013) 'Engaging Adorno: Critical Security Studies after Emancipation', *Security Dialogue*, 44 (1), pp. 37–51.
- Kaltofen, C., Carr, M. and Acuto, M. (eds.) (2018) *Technologies of International Relations*. London: Palgrave.
- Kerr, P. and Wiseman, G. (eds.) (2013) *Diplomacy in a Globalizing World: Theories and Practices*. New York: Oxford University Press.
- Lord, K. M. and Turekian, V. C. (2007) 'Science and Society: Time for a New Era of Science Diplomacy', *Science*, 315 (5813), pp. 769–770.
- Mayer, M. and Acuto, M. (2015) 'The Global Governance of Large Technical Systems', *Millennium*, 43 (2), pp. 660–683.
- Mayer, M., Carpes, M. and Knoblich, R. (eds.) (2014) *The Global Politics of Science and Technology - Vol. 2: Perspectives, Cases and Methods*,. Bonn:

Springer.

Miller, C. (2001) 'Hybrid Management: Boundary Organizations Science Policy, and Environmental Governance in the Climate Regime', *Science, Technology & Human Values*, 26 (4), pp. 478–500.

Patom€aki, H. (2002) *After International Relations: Critical Realism and the (re)construction of World Politics*. London: Routledge.

Rosenau, J. N. and Singh, J. P. (eds) (2002) *Information Technologies and Global Politics: The Changing Scope of Power and Governance*. SUNY Press.

Royal Society of London (2010) 'New Frontiers in Science Diplomacy: Navigating the changing balance of power' American Association for the Advancement of Science (AAAS) and the Royal Society of London. Document 01/10.

Ruffini, P. (2017) *Science and Diplomacy: A New Relationship of International Relations*. London: Berlin, Springer.

Salter, M. B. (2015) *Making Things International 1*. Minneapolis, MN: University of Minnesota Press.

Skolnikoff, E. B. (1993) *The Elusive Transformation: Science, Technology, and the Evolution of International Politics*. Princeton, NJ: Princeton University Press.

Smith, F. (2014) 'Advancing Science Diplomacy: Indonesia and the US Naval Medical Research Unit', *Social Studies of Science*, 44 (6), pp. 825–847.

Star, S. L. (2010) 'This is not a Boundary Object: Reflections on the Origin of a Concept', *Science Technology and Human Values*, 35 (5), pp. 601–617.

Star, S. L. and Griesemer, J. R. (1998) 'Institutional Ecology, "Translations", and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907–1939', *Social Studies of Science*, 19 (3), pp. 387–420.

Turekian, V. C. and Wang, T. C. (2014) 'Educating for Science Diplomacy', *Science & Diplomacy*, 3 (1) [online]. Available from: <http://www.sciencediplomacy.org/editorial/2014/educating-for-science-diplomacy> [Accessed 29 October 2018].

Turekian, V. M., S. Copeland, D., Davis, L., Patman, R. and Pozza, R. (2014) 'The Emergence of Science Diplomacy', in L. Davis and R. Patman (eds.), *Science Diplomacy: New Day or False Dawn?*. Singapore: World Scientific, pp. 10–24.

Wagner, C. (2002) 'The elusive Partnership: Science and Foreign Policy',

Science and Public Policy, 29 (6), pp. 409–417. <https://doi.org/10.3152/147154302781780741>

Weiss, C. (2005) 'Science, Technology and International Relations', *Technology in Society*, 27 (3), pp. 295–313.