The *Problems of Modern Societies* – Epistemic Design around 1970

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Historians characterise the years around 1970 as a period of multiple contradictions in modern societies, as the beginning of an era of fundamental transformations and sea-change – with long-term effects on societal, political and cultural developments in many parts of the world (Brick 2000; Judt 2005; Agar 2008; Suri 2009; Wirsching et al. 2011). The post-World War II economic expansion, the 'long boom', the 'trente glorieuses' or 'Wirtschaftswunder', which was based on cheap energy, enormous investments in science, technology and infrastructure, and productivity gains in many sectors, had reached critical limits – physical, ecological and ethical. High-modernist confidence, faith and optimism seemed exhausted and clashed – and sometimes coalesced – with waves of late- or postmodernist scepticism and doubts, but also with the activism and counterculture that had swollen throughout the 1960s. Some have identified the period as the beginning of our era due to emerging leitmotifs still relevant today, but also as an age of fracture, the seedbed of future crisis, and a landslide into uncertainty and ambiguity (Hobsbawm 1994; Jarausch 2008; Rodgers 2011; Ferguson et al. 2011). Deeply embedded convictions and beliefs of the preceding heyday of the Cold War became fragile, political conduct was questioned, and the meaning of distinctly modern key concepts such as progress and growth became less evident (Philp 2007: 169-213; Seefried 2015b; Andersson 2018: 122-150). Long-standing thought patterns of historical development – such as Marxism or modernisation theory – were challenged both on an ideological level and on the level of theoretical structure, as they were perceived as static, retrogressive, teleological and dichotomous. The idea that future developments and innovations in modern societies proceeded in progressive stages that were predicated on earlier ones and could thus be predicted seemed in-

creasingly outdated. In the case of modernisation theory, such epistemological doubts matched with the growing qualms about the normativity of the West as a model for a completed and stable modernity (Gilman 2003: 203-276). And in the East the 'actually existing' state socialism entered a state of crisis as it missed launching the next phase of societal development. As an alternative to these competing models of political system development a new wave of interdisciplinary systems thinking gained momentum, imbued with motifs of complexity and interdependence, and focusing on the historical dependencies of societies, on new constellations of increasingly numerous actors in politics, the future as a potentially open-ended horizon of change, and global environmental interconnectedness and boundedness (Taylor 2001; Leendertz/Meteling 2016). In this context, the idea of the environment became a central discursive category at the time – particularly on an abstract system-theoretical level – as open systems are conceived as being reciprocally situated in a dynamic environment, but also on a practical level with regard to specific environmental problems receiving widespread public attention (Warde et al. 2018; Sprenger 2019). Intellectuals engaged with the complex dynamics of political change and the temporality of history as such in new ways. On the one hand, the long-term view of global change came into focus and increasingly sophisticated future projections, scenarios and imaginations gained new forms of agency on the present (Andersson/Rindzevičiūtė 2015). On the other hand, it was not only the nature and temporality of the future, but also the idea of history that changed, as the plural historicities of societies, knowledges and times as such were discovered and theorised in the humanities and the social sciences (Lorenz/Bevernage 2013; Esposito 2017). Consequently, these intellectual debates, conceptual innovations and semantic shifts indicate that the years around 1970 also need to be understood as an epistemic turning point (Leendertz/Meteling 2016; Rohde 2017; Heymann 2017). Following up from these observations, this paper seeks to bring together several mutually enforcing political, cultural and intellectual trends of the period and trace some characteristics of this broader epistemic shift, which fostered new modes of knowledge production, established various new fields of research and promoted new contexts for scientific collaboration: first, the political context of an abating Cold War and the development of more complex international relations; second, the rise of social movements that mobilised novel forms of expertise and critique; and third, an epistemological revolution that opened up new topics

for inquiry, introduced new methodologies, forms of reflexivity and frames of analysis, and that made provisions for new roles of science. The notion of the 'problem' – from the *problematique* to the *wicked problem* – which occurs strikingly often in the period in public debates as well as in endeavours in the fields of systems science, future studies and theories of planning and design, will be analysed in its capacity to provide an 'epistemic design' for situations that call for a change, a transformation, specific interventions in a present state to actively envision a potential future.[1] This paper seeks to discuss the years around 1970 as a moment of transition in the history of modern societies by looking at how the notion of the problem became an operational term around which new modes of knowledge production, fields of research and interdisciplinary collaborations have emerged, and to trace aspects of the inventive epistemology of the 'problematic' as thematised in this volume in these contexts.

The historical context: an abating Cold War, the rise of social movements and new roles for science

During the 1960s, the key features of the Cold War – the arms race, the binary logic of the US-Soviet geostrategic rivalry and the ideological battle over whether authoritarian communism or liberal capitalism represented the preferable form of modern political economy – began to abate in intensity. Nuclear weapons appeared more and more as an 'ideology killer' because the physical stakes they produced seemed higher than the ideological ones, and resourceful, military-based conflict theories and the doctrine of deterrence didn't seem to make the world a predictably safer place any more (Gilman 2016). The 13 days of the Cuban Missile Crisis of October 1962, when there 'was a higher probability that more human lives would end suddenly than ever before in history' (Allison 1969: 689) reverberated for a long time and gave rise to strategic reconsideration. One lesson that came out of it was the extent to which the adversaries had failed to think similarly going into it. What had appeared to be 'rational' behaviour in Moscow had come across as

1 While Scopus tracks a constant increase in the occurrence of the term 'problem' in article titles between the years 1950 and 2000, the increase between 1970 (5,381 article titles) and 1974 (8,338 article titles) is at 55 per cent by far the largest over the whole period.

dangerously 'irrational' behaviour in Washington, and vice versa. Hence, in practice there were sharp limits to the unilateral rationalisation and solution of critical situations through game-theoretical exercises or rational choice frameworks promoted by the so-called defence intellectuals. The 1960s held a number of developments – the Sino-Soviet split, Ostpolitik, decolonisation and the political rise of the 'Third World'[2] – that further complicated the dualistic framing and opened up opportunities for – or perhaps exerted pressure on – other forms and layers of international relations and diplomacies, multipolarity and the forging of complex interdependence that would mark the next period of international history.

Those were also the years in which social movements made themselves heard globally and became highly visible features of politics and culture beyond the turn of the decade. In many ways they reflected the larger implications of the aforementioned political shifts. Discord in the communist world prompted ideological crisis, while Western civil societies began to question their own values, integrity and righteousness. New social movements – pacifism, feminism, environmentalism – drew attention towards various issues previously neglected or suppressed, from democratic participation to civil rights and problems of the environment. Most emblematically, the turmoil culminated in the events of 1968 – the worldwide protests against the war in Vietnam, the student movements in France, West Germany, Poland, Japan, the USA, Mexico, Tunisia and other places, the Prague spring liberalisation in Czechoslovakia, and the civil rights and environmental movements (Suri 2009). An essential characteristic of these movements was the appropriation of new forms of public expression and communication, educational practices and global solidarity. In the light of détente, looming environmental crisis, the computer and communication revolution, global protest movements and educational revolts, heretofore unquestioned modes of governance, ideas of order and control, patterns of thought, policy cultures and epistemologies were challenged in various ways. Calls for greater political participation and the developments of fields of political engagement at communal and national levels – but also within the United Nations – indicate that the shifts of the years around 1970 opened up paths into less hierarchical societal developments and polycentric orders (Cox 1981; Christiansen/Scarlett 2013). It

2 During each year from 1960 through 1970 an average of three states gained their sovereignty, most of the new states being in Africa.

became apparent that the sources of power in society and international relations had begun to diversify at an unprecedented scale. Various supranational organisations emerged as influential political actors, introducing a greater diversity of goals pursued internationally and producing greater complexity in the modes of interaction and the institutions within which action takes place (Cox/Jacobson 1973). The future of modern, industrialised societies became a major concern, and knowledge was increasingly conceptualised as an important resource in these cultural and political transformations.

Accordingly, these political shifts had a distinctive impact on science, both as a model of inquiry and as a modern tool for progress as the relationships between science and the questions it sought to answer were fundamentally transformed. We can understand the intense debates on epistemology and inter- and transdisciplinarity at the time as manifestations of these transformations. The contemporary struggles over epistemology in France, for example, are evaluated today as instances of an important mutual exchange between the sciences, philosophy and society, providing novel techniques and tools for argumentation, thought and action and a specific mode to reflect on the role of science in society (Erdur 2018). Scholars from different fields were also increasingly concerned about how to bring science closer to real-world problems and find solutions to pressing social, political and environmental issues, as well as with the future of universities and education as such. These issues were often thematised as problems of disciplinary boundaries and how to transgress them.[3] Varieties of (post-) structuralism, systems theory and cybernetics, with their transdisciplinary conceptualisations, provided important frames of reference for engagement with a less universalist and more situated understanding of science as a social process and vital resource for problematisation and cultural change.[4]

3 The notion of 'transdisciplinarity' was introduced at a meeting on interdisciplinarity in universities held at the University of Nice and jointly sponsored by the Organisation of Economic Co-operation and Development (OECD) and the French Ministry of Education. The Swiss psychologist Jean Piaget, the French mathematician André Lichnerowicz, the Austrian astrophysicist Erich Jantsch and the British media historian Asa Briggs were among the participants. See Apostel et al. 1972; and for historical and analytical accounts on inter- and transdisciplinarity see Barry/Born 2013; Schaffer 2013; Klein 2014.

4 Osborne (2015: 14-15) claims that 'the disciplinarily disruptive and transformative forces' of the great books from the European humanities – many of which this volume discusses – provided the ground for inter- and transdisciplinarity movements.

The promotion of new constellations between scientific communities and increasingly transnational publics, and of unprecedented forms of scientific collaboration within newly formed international institutions, can be understood in this context. Another manifestation of the transformation of the intellectual landscape at the time was the diversification of the scientific persona: action intellectuals, technocrats, institutional entrepreneurs, the radical science movement, scientific activists, engaged intellectuals, science policy experts – all began to interact with one another, and many emerged from hidden committees into the public eye (Agar 2008; Shapin 2009; see also White 1967; Nelkin 1979).

The epistemological revolution

To a large extent accounts of the history of science during the Cold War have focused on instances that reveal how the Cold War drove scientists and science policy ideologically and 'distorted' the evolution of science. The question of how emerging ideas about the global environment and an interconnected and interdependent world system, eroding epistemic certainties and shifting values, might have challenged binary world-views, the self-evidence of particular ideologies, models of society or the possibility of an objective science at all, is only recently being posed. The same applies to the overall plausibility of national security imperatives or the competition and rivalry between the systems as comprehensive frames of reference for developments in science policy during the Cold War. There is a growing demand and interest in contextualising emerging fields of research within longer-term intellectual trends, changing research infrastructures and innovative institutional environments (Engerman 2010).[5] Additionally, the developments outlined so far indicate that the years around 1970 marked a transition in the post-World War II history of science. Besides the aforementioned greater diversity among the scientific personnel, emerging inter- and transdisci-

5 Histories of interdisciplinary fields such as cybernetics, futures studies, policy sciences, science studies, peace studies or environmental sciences have provided instructive examples that complicated overly simplistic and exploitative ideas of the relationship between power and knowledge (Gestwa/Rohdewald 2009; Thomas 2015; Seefried 2015a; Rindzevičiūtė 2016; Gilman 2016; Graf 2017; Rohde 2017; Andersson 2018).

plinary perspectives and movements, new forms of international collaboration, and the processes of renewal many existing disciplines and institutions went through, we should acknowledge the fact that scientists and intellectuals often played an active role in imagining a global, non-apocalyptic post-Cold War world. They posted different sets of objectives for human development and thematised issues in ways that challenged some of the operating conditions of modern societies and the status quo of international relations. They sought to influence future developments by creating new institutional set-ups or through specific problematisations around which new fields of research emerged. A distinctive characteristic of the social and human sciences around 1970 was an orientation towards greater reflexivity, autonomy and new forms of intellectual engagement, which opened up the 'closed world' of Cold War science (Edwards 1996). Many fields went through what historian Peter Novick described in 1988 as an 'epistemological revolution', that is, a break with the prevalent post-World War II model of social and human sciences inquiry. Up to the 1960s the philosophy of the social and human sciences rested on the belief that they were, in the main, value-free disciplines and 'an extension of the dominant positivist and empiricist philosophy of the natural sciences' (Novick 1988: 546). One of the common visions between such diverse enterprises as rational choice theory, structural-functional sociology, information theory or operations research, among others, was the study of 'systems' behaviours, the causal chains within systems of variables whose interrelations could be formally stated and studied in technical terms (Isaac 2012a: 9; Heyck 2015). Joel Isaac has discussed the problem of 'epistemic design' in this context, that is, how in post-World War II American social science empirical knowledge was constituted within the framework of a scientific theory through particular arrangements of data and techniques of representation (models, diagrams, tables) 'so as to make them undergird the theoretical claims about the social world they wished to make' (Isaac 2012b: 80). And for various reasons that are obviously connected to the early Cold war setting this world was rendered knowable, predictable and controllable. Such arrangements served the purpose to claim an 'objectivism' and 'scientism' for the social sciences in the post-World War II context. In the years around 1970 however, some of these objectivist claims and assumptions came to be undermined. According to Novick, 'in one field after another distinctions between fact and value and between theory and observation were called into question' as the 'notion of a determinate and unitary truth about

the physical or social world' came to be seen by a growing number of scholars as a 'chimaera'. For him the 'meaning of *progress* in science and scholarship became problematic'. While Novick suggested that it was 'for the most part "strictly academic" considerations which initiated debates, and contributed the categories in which heterodox views were advanced', so far this paper has delivered some reasons to rethink the 'epistemological revolution' as a primarily 'academic' endeavour (Novick 1988: 523, 546). It should rather be understood as a complex and co-evolutionary process in which the procedures of science interacted more intensely with the social, political, technological and intellectual environment than before and that challenged the prevailing positivist problem-solving mentality in many disciplines. Novick's monumental effort to examine the 'objectivity question' in the historical profession is in itself a result of these broader transformations.

In order to support his argument on the epistemological revolution as a mostly academic endeavour, Novick draws largely on the cross-disciplinary circulation and adoption of Thomas Kuhn's 1962 *The Structure of Scientific Revolutions*. Recent accounts of Kuhn's work, however, have positioned him in an elitist and prestigious Harvard context during the Cold War, where he was challenged to formulate a theory of science that represented a 'distinctive response to the pressing problems of epistemology and society' at the time (Isaac 2012a: 193).[6] Kuhn's *Structure* was indeed an important point of reference and provided a conceptual framework within which to discuss the practical and evolving nature of scientific inquiry for a wide range of actors at the time – including the sociologists, philosophers, systems thinkers, natural scientists, international relations scholars, policy advisors and institutional entrepreneurs mentioned in this paper.[7] The book introduced the broader academic world to a non-teleological, evolutionary, historical view of scientific development as a sequence of incommensurable but nevertheless internally consistent periods of 'normal science', operating within

6 For a comprehensive historical contextualisation of Kuhn's *Structure* see Fuller 2000; Reisch 2016.

7 Novick, just like many other American intellectual historians, largely draws on Kuhn for an early historical and situated conceptualisation of scientific development. But there is a much richer French historical-epistemological tradition, which Novick mentioned only briefly. Authors like Gaston Bachelard, Georges Canguilhem, Michel Foucault or Gilles Deleuze have much to say about inventiveness and the sources of the new in scientific inquiry (cf. Rheinberger 2010).

the conceptual framework of a 'paradigm'. From time to time 'puzzle-solving' normal science is turned upside down, 'gestalt switches' occur, and a choice has to be made 'between incompatible modes of community life' – a paradigm shift takes place (Kuhn 1962: 94, 117). This view of normal science inverted the image of the scientist in an interesting way: in its suggestion that 'dogma was the precondition, not the antithesis, of scientific advance, and in its corollary – the "normal" scientist as tradition-bound puzzle-solver, rather than bold adventurer – it fundamentally contradicted the orthodox Promethean image' of the scientist (Novick 1988: 529). While Kuhn himself was probably more concerned with the question of how paradigms are actually stabilised and ultimately embraced a pedagogical theory of science[8], the epistemological adventurers of the late 1960s – systems thinkers, policy experts, futurologists, engaged intellectuals, institutional innovators – embraced the revolutionary moment and strove for the establishment of new paradigmatic frameworks, perspectives that would help to open up the world for malleability and active intervention. These dynamics became visible in the processes of renewal many existing disciplines went through, but also in emerging fields of research that resonated with the social, political and environmental situation at the time. The notion of the *problem* – ubiquitously applied and famously pored over at the time from debates at students' kitchen tables over the Club of Rome's talk on the 'world problematique' (Özbekhan 1970) to the discovery of 'wicked problems' (Churchman 1967; Rittel/Webber 1973) – is understood here as a marker of this revolutionary atmosphere.

Branches of contemporary social science started to question their commitment to objectivity and related ideals as well as the preference for quantitative analysis as opposed to historical or other 'soft' forms of social research at the time. The idea of value-neutrality was rejected and a reorientation of the social sciences toward normative analysis was discussed (Solovey 2001). The crucial importance of values as *dynamic* factors in societal processes was re-discovered during the 1970s, and studies on value shifts – for instance the orientation towards post-materialism in Western societies – became a central field of research (Galtung 1970; Schumacher 1973; Inglehart 1977). Furthermore,

8 According to Kuhn paradigms are stabilised through exemplary scientific achievements or model experiments, theoretical and ontological assumptions (amounting to a disciplinary *Weltanschauung*), professional training, methodology, instrumentation and research agenda; (Kuhn 1962: 35-42).

the rise of new media, the rapid spread of computers and the unprecedented technological possibilities of communicating across the globe gave reason to study the structural transformation of the public sphere and cultural dynamics in relation to communication and media (Habermas 1962; McLuhan 1964). Influential media theories such as the agenda-setting theory, the knowledge gap hypothesis and framing theories were developed in the years around 1970 (Tichenor et al. 1970; McCombs/Shaw 1972; Goffman 1974). In addition to these new or strengthened fields of social science several historians marked that at the peak time of the space age the unprecedented and iconic global environmental images of the blue marble shaped a newly global environmental consciousness, resulting in an 'ecological revolution' (Radkau 2014; Seefried 2015b). Consequently, the 'vast machine' of the environmental sciences emerged as a global knowledge infrastructure, a large-scale sociotechnical system collecting environmental data and modelling and projecting planetary processes (Jasanoff 2001; Edwards 2010; Cosgrove 2001). In particular, climate science changed at the time, from a mostly descriptive and heuristic research programme into an interdisciplinary programme in which interactions between humans and the Earth system were studied and predicted via computer simulations (Heymann 2009). Research on planet Earth and its systemic properties and interactions gave rise also to new ideas on the politics and economics of the planet, its limited resources, boundaries and how to legislate its use (Boulding 1966; Hardin 1968; Georgescu-Roegen 1971; Daly 1974).

The years between 1964 and 1973 were also the high point of futures research. Distinct from the 1950s and early 1960s futurology that studied foreseeable laws of social development with a positivist mindset, futures studies' point of departure was the 'historically specific understanding that the present was a far from stable structure' that cannot be predicted in a positivist sense. It was in several ways a form of 'counter-expertise to the project of Cold War prediction', with strong links to international activist movements, as Jenny Andersson has recently argued (Andersson 2018: 3, 47; see also Seefried 2015a). Predicting the future based on a status quo was considered to primarily serve the elites, as it perpetuated this status. Thus, new forms of futures techniques were developed that allowed people to actively shape and develop alternative futures. Approaches such as the Argentinian philosopher Paulo Freire's critical pedagogy aimed to help Latin America's poor people reach self-consciousness and inspired a whole generation of European social workers from the late 1960s on (Freire 1970; Andersson 2018: 151-183).

At the same time in Europe, Robert Jungk developed the future workshop technique (*Zukunftswerkstatt*) in the context of specific controversial public policy issues, which was conceived as a process lasting several days that aimed to unleash the social imagination of the (non-expert) participants by using the tools of radical and dialectical deconstruction and psychotherapy (Jungk 1987; Andersson 2018, 151-183). Compared with methods of governmental future planning, such as systems analysis and operations research, these alternative and activist futures techniques held utopian and emancipatory aspirations, as they aimed at an open process in which problems were to be constructed and a set of objectives for social and personal development was to be established. At the same time, however, it was a period in which the application of systems analysis and operations research was widely expanded: initially developed in military contexts to improve defence efficiency and to underscore the rationality of decision-making (Hughes/Hughes 2000), systems thinking became more important in engineering and in the hard sciences, as they provided powerful tools for the control, optimisation and prediction of complex systems. During the 1960s, systems analysis was increasingly expanded to public policy, social issues, and urban and environmental planning (Jardini 1996; Light 2004). The design and results of such policy processes were widely criticised at the time, for example by the sociologist Ida Hoos from Berkeley and Robert Boguslaw from the RAND Corporation. Hoos emphasised that the current practice of systems analysis techniques such as cost/benefit ratios or programme budgeting led to technocratic forms of governance, because policies were often crafted by outside consultants and experts 'armed with solutions and in search of problems', specialised in managerial efficiency, but not political problem consideration. Hoos saw growing incidences of 'government-by-contract' situations that removed responsibility for the decisions made from public officials (Hoos 1972: 86, 243). Boguslaw argued in a similar manner that systems analysts built models that, as a result of the experts' attempts to be value neutral and objective, reified the values of the ruling elite and implicitly supported the status quo (Boguslaw 1965). Towards the end of the 1960s, Boguslaw left RAND and took a position at the progressive sociology department of Washington University in St. Louis, where he developed – in the eyes of his former colleagues – a rather obscure interest for French existentialist philosophy, referring to authors such as Jean-Paul Sartre, Louis Althusser and Jacques Ellul in his evaluations of solutions to the problems of modern soci-

ety proposed by contemporary social science and other expert panels (Rohde 2013: 53-59). However, such profound criticism and debates led to a more reflexive understanding, experimental opening up and further modification of systems methods. Boguslaw, Hoos and others certainly placed high expectations on the potential of systems analysis as a 'social technology' (c.f. Helmer et al. 1966) and as a 'phenomenon fraught with social significance, perhaps all the more because it is characterized by contradictions, internal and external' (Hoos 1972: 241). Thus, more situated frameworks for systems approaches have been developed in the context of specific problem areas such as environmental assessment, urban planning, public policy and other design challenges where systems techniques have been further developed into a rich and interdisciplinary field of increasingly reflexive, more situated and post-positivist policy, decision and management sciences (see for instance Anderson 1968; Rittel/Webber 1973; Holling 1978). A new generation of scholars and practitioners in different fields questioned previous hyperbolic notions of controllability, knowability and rationality. Instead, they were increasingly interested in the 'epistemology mediating between organizations and the welter of experience surrounding them' (Dery 1984: 118), in more adaptive and participatory processes of planning, in shaping more carefully the processes of constructing a problem and more generally the role of knowledge production in public policy in the light of debates about increased social 'complexity' (Leendertz 2019). Many scholars began to understand systems approaches as a means to construct and invent problems in the first place – not to solve prescribed ones. A contemporary observer commented on the conjuncture of systems science as an ongoing 'social experiment' with an open outcome (Churchman 1978). The problem of epistemic design thus shifted at the time – or rather, it was regularly complemented by the idea that systems approaches can be applied to pose and construct problems so as to make them create images of change or suggest particular policy options.

Finally, the years around 1970 were also a foundational period for what was to become probably one of the most innovative and growing fields of reflexive and critical social and human science inquiry of the last third of the 20th century, that is, the various versions of studies of science – the philosophy, history and sociology of science and technology. The establishment of science studies at the time can be understood both as an effect of the aforementioned developments and debates and a symptom of an epistemic turning point. These studies conceptualised science and technology as essential

drivers of social, political and environmental change and as constitutive for the future of modern societies. Early versions of meta-studies of science emerged from different contexts, for instance from debates on the ethical implications of advances in particular fields such as molecular biology or on the risks and side effects of new technology such as nuclear energy, but also from transnational debates about the impacts, governance and role of science and technology both in history and for the future of industrialised societies, as new global challenges began to emerge. These debates were, as Elena Aronova has shown, thoroughly embedded in the 'political economy, cultural anxieties, and ideological dimensions of the post-World War II social and political order'.[9] But at the same time many debates reveal that in those years an intellectual space opened up in which science as a complex cultural phenomenon was conceptualised and advanced in new ways. Based on experiences with the numerous roles international scientific cooperation had played in the normalisation of relations after World War II, science policy practitioners envisioned new areas of science diplomacy and international knowledge co-production. While historians have shown how early Cold War US-American science policy was embedded in the projection of American political and ideological interests in postwar continental Europe, and how cooperation served as a means of fostering a consensual or co-produced hegemony in order to consolidate a liberal, democratic, capitalist regime in Europe (Krige 2006; Doel/Wang 2001), the role and prospects of science in international relations began to change towards the end of the 1960s. Even though the world was divided, it was also perceived as being increasingly interdependent, meaning that the autonomy of nations was becoming limited by transnational flows of energy and goods, of money and ideas, and even of pollution and diseases – and scientific and technological collaboration were discussed not only in US foreign policy as ways of shaping a mutual understanding of the problems and concerns that modern societies had in common (Rosenau 1969). We find numerous examples for these changing relationships between science and power in an interdependent world, emerging collaborative organisations and also the debates concerning the political,

9 These studies had different names in different places: 'science studies' in the USA and UK, 'naukovedenie' in the Soviet Union, 'naukoznawstwo' in Poland, 'naukoznanie' in Bulgaria, 'natural dialectics' in China, 'Wissenschaftswissenschaft' in East Germany and in West Germany the 'Finalisierungsdebatte' has to be mentioned (Aronova 2012a; Leendertz 2013).

ethical and social implications of science and technology more generally. The perceived urgency to navigate the interdependencies and future paths of these relationships fostered novel forms of expertise, advanced scientific internationalism and promoted closer relationships between science and policy.

The future of modern societies

In these shifting political, cultural and epistemological terrains of the late 1960s, transnational debates began to emerge, in which deeper concerns about the future development of modern, industrialised societies in the context of rapidly changing techno-scientific environments, ecological limits, interdependent economies and shifting values came to the fore. At the core of these debates was the observation that as a result of the rise of technical and scientific expertise in modern societies, and its growing importance in the realm of public affairs, ideology was losing its revolutionary potential and organisational power. Neither Marxian theory of historical development nor the Western counterparts such as Rostow's modernisation theory seemed to provide convincing theoretical devices to confront the profound changes looming ahead. Both offered teleological ideas of societal progress as an essentially predictable process of social change (Gilman 2003; Andersson 2018: 49). These frameworks have been replaced by theories of 'convergence' and the 'post-industrial society', developed independently with different foci and nuances by diverse authors such as Raymond Aron, Daniel Bell, Alain Touraine, Peter Drucker, Pitirim Sorokin, Jan Tinbergen, Kenneth Galbraith, Samuel Huntington and Jacques Ellul. These authors envisioned that industrial economies around the world would be converging in terms of social, economic and political structure. Additionally, social and political thought would be converging on a remarkably widespread agreement over advanced societies' fundamental aims, and the focus would shift onto the *problem* of achieving such aims.[10] In light of the perceived challenges of peacekeeping at the time, the global population boom, sustenance, energy demand, over-

10 Drucker 1950; Ellul 1954; Sorokin 1960; Tinbergen 1961; Aron 1963; Brzezinski/Huntington 1964; Galbraith 1968; Touraine 1971; Bell 1973; on the political contexts of these debates see Aronova 2012b; Andersson 2018: 49-74.

exploitation, automation and the biological revolution, numerous authors began to theorise the temporality of historical dynamics, the governability of societal developments and the question of how to bring about desired change (Buchholz 1968; Huntington 1971; Luhmann 1972; c.f. Esposito 2017).

Closely related to these ideas, an emerging network of influential policy experts on both sides of the Atlantic was concerned with the impact of the 'scientific-technological revolution' (in the East), the 'technetronic era' or the 'post-industrial society' (in the West) as a revolutionary challenge to both paradigms of historical development. The Czech philosopher Radovan Richta, one of the minds behind the 'socialism with a human face' reform movement, for example, published *Civilization at the Crossroads* in 1966, in which he suggested that the revolution was not a matter of a future endpoint, but a continuous process in the present with an open horizon of change in a highly technological and science-based society that would require new forms of participation (Richta 1969; Sommer 2017; Andersson 2018: 128-129). In 1969 the Italian industrial consultant and founder of the Club of Rome, Aurelio Peccei, analysed in *The Chasm Ahead* the 'menacing technological gap that now separates the United States and Europe'. He described a 'world in convulsion' due to 'the unprecedented complex of explosive problems', 'technological acceleration' and 'exponential growths' in population, pollution, automation etc. Similarly to Richta, he perceived the present as a 'period of revolutionary and even metamorphic change' that required collaborative and interdisciplinary efforts in order to master the future (Peccei 1969: 104). In a similar vein, Zbigniew Brzezinski, éminence grise of US-American foreign policy, in his 1970 *Between Two Ages: America's Role in the Technetronic Era*, cautioned against a cognitive crisis between and within modern societies. He saw a 'threat of intellectual fragmentation, posed by the gap between the pace in the expansion of knowledge and the rate of its assimilation', which would 'raise a perplexing question concerning the prospects for mankind's intellectual unity. It has generally been assumed that the modern world, shaped increasingly by the industrial and urban revolutions, will become more homogeneous in its outlook. This may be so, but it could be the homogeneity of insecurity, of uncertainty, and of intellectual anarchy. The result, therefore, would not necessarily be a more stable environment.' (Brzezinski 1970: 23) On the other hand, Brzezinski also observed that an emerging 'planetary consciousness' and the 'availability of the means to cooperate globally' intensified the 'sense of proximity' and the 'sense of obligation to act' (Brzezinski 1970: 60).

These rhetorics of fractures, chasms and crossroads paved the way for greater international interest in similar systemic characteristics and outlooks of the future of modern societies, and they became a point of departure for critical debates on the common problems, direction and governability of these developments (Leendertz/Meteling 2016). Even though these engagements had been developed in quite different political contexts, they shared a sense of urgency and being present at a turning point in the history of modern societies – demanding new theoretical devices, interdisciplinary perspectives and methodologies. The novelty of the problems associated with the political and cultural shifts, the advances in science and technology making these problems discernible, global interdependence and the environmental crisis looming ahead were widely perceived as challenges for high modernist self-perceptions, approaches and expectations.

A post-positivist conception of problems

In the following I argue that the intellectual impact of this epistemological revolution and the transition towards post-positivism can be understood through the conjuncture and the changing status of the notion of the *problem* in intellectual endeavours at the time. Before I turn to exemplary cases, let me briefly recall the etymology. The word *problem* stems from the Greek verb *probállo* (to put forward, to propose, to outperform somebody) and the noun *próblema* (cliff, obstacle, question, exercise). From the meaning it becomes clear that problems can be spontaneously emergent in a situation or they can be purposefully posed to a counterpart. They can be concrete and tangible but also conceptual and abstract. The prefix *pro-* can be understood temporally as something that lies *ahead* and demands a reaction or a strategy. On the other hand, it points towards a strategy of empowerment or authorisation through which someone can pose a problem *for* someone else. It is both a prefix of priority in space or time, having a meaning of advancing or projecting forward or outward, and/or it indicates substitution. In a positivist understanding of science[11] the concept of the problem functions as some

11 Positivist conceptions of science are usually bound to a combination of the following accounts: *realism*: truths about the world are true regardless of what people think and there is a unique best description of any chosen aspect of the world; *demarcation*: there is a dis-

kind of placeholder for the time span needed to find the solution. Problems are obstacles to be removed, means to implement specific solutions, negative states of uncertainty, ignorance and methodological imperfection bound to dissipate with the solutions that scientific and technological progress yield. Consequently, traditions like logical positivism rejected the 'great questions': philosophical, metaphysical, vital and singular problems 'are in fact *pseudo-problems*, which are incapable of solution not because of their profundity but because they pose nothing to be solved' (Kaplan 1968). In a positivist understanding problems are conceptualised negatively in the sense that they are meant to disappear. They are chosen precisely because nothing will be left from them – just like a puzzle. In a post-positivist understanding, it is particularly this aspect that is different. Problems are actively constructed as matters of concern in order to intervene in the present and to create agency and images of change. They are devices to open up and assure us of some creative leeway and measure of control over an uncertain future. The particular ways problems are constructed imply how they function as political or social technologies.[12]

In the light of the aforementioned developments and transnational debates on the challenges of modern societies, many institutional entrepreneurs, policy advisors and systems thinkers engaged with this particular understanding of the problem – both on an institutional level and as an intellectual agenda but also in methodological and theoretical writings. They

tinction between scientific theories and other kinds of beliefs or knowledges; *axiomatisation*: the content of a theory is analysed as a given set of axioms from which the remaining content of the theory can be derived deductively as theorems; *reductionism*: phenomena can be described in terms of other simpler or more fundamental phenomena; the *unity* and *universality* of science: both hypothesis and working programme, this claim states that all scientific disciplines are part of the same endeavour and that less profound sciences are reducible to more profound ones; and the *cumulative* character of science, the Whiggish narrative of continuous scientific progress through an elimination of falsehoods by the discovery, verification and systematisation of empirical truths or facts (c.f. Mittelstraß et al. 2005-2016).

12 The concepts of 'social technology' and 'political technology' describe how forms of applied knowledge can be used in pragmatic and intentional ways to transform states or societies have been used by different authors with varied nuances throughout the 20th century, among them Thorstein Veblen, Karl Polanyi, Karl Popper, Olaf Helmer and Michel Foucault. For a critical review see Leibetseder 2011; for the Soviet debate see Rindzevičiūtė 2015.

deployed the notion in the sense of a post-positivist 'epistemic design'[13] in order to address the procedural criticality, complexity, uncertainty and openness of recent societal developments in modern societies and their increasingly critical relationships to a globalised environment as a continuous epistemic and political challenge that requires innovative institutions, and novel frameworks and approaches, but also to suggest particular policy options over others. The notion of the problem became a politically operational and performative concept, not a mere placeholder within a clearly defined scientific task. In many cases the ambition to construct problems in order to leverage systems into a different state became apparent. In that sense, problematisations provided an epistemic design that could be used to engage with the question of the future development of modern societies, a procedure that allowed the gathering and arranging of data, modelling issues, defining their aspects and boundaries, and deriving options for action. The particular ways in which problems became thematic in programmatic writings and institutional agendas can be understood as a conceptual turning point and an epistemological effort in this transitional period in the history of modernity.

In the French epistemological tradition, a similar understanding of the notion of the problem has been substantially theorised. Based on the philosophy of Henri Bergson, Gilles Deleuze, for instance, has provided a useful evaluation of the truth or falsity of problems. A true problem is one that is intrinsically productive, a kind of ongoing, groping and experimental process that forces the transformation of the subject's thought (During 2014). A false problem, by contrast, is one whose determination depends on something external, an extrinsic conditioning as opposed to an intrinsic genesis. Here the substituting, instrumental meaning of the word is addressed, which gives reason to carefully distinguish between problematisations that are chosen because they allow the implementation of extrinsic pre-defined measures and solutions and those that allow an intrinsic differential evolution of a problematic situation (Deleuze 1968; Bowden 2018). For an epistemological

13 On 'epistemic design' see Isaac (2012b, 80, 88), who defines epistemic design as the concern with the problem of 'how to arrange [the social scientist's] data so as to make them represent and undergird the theoretical claims about the social world they wished to make' and the challenge of how 'to arrange the data so that they could serve as instruments for investigating and perhaps even manipulating value systems in actually existing social systems'.

assessment of post-positivist scientific approaches in specific historical contexts, and for analysing how problematisations provide an epistemic design of specific matters of concern, this might be a helpful distinction to make. It helps to recognise critical approaches that are truly productive and transformative in character but also to identify cases where problems are used in rather instrumental terms, which also resembles the criticism voiced by Hoos and Boguslaw.

Researching through the problematique: institutions, issues and designs

Among the more radical adopters of the notion was the Armenian, Turkey-born, systems scientist Hasan Özbekhan, who had studied at the London School of Economics, then worked for RAND and the Systems Development Corporation in Santa Monica. He was the author of a number of influential writings in which he outlined theoretical approaches around the notion of the 'problematique' that circulated between the Organisation for Economic Co-operation and Development (OECD), RAND, the Club of Rome and the network of futurists from the late 1960s. Özbekhan argued that 'the all-pervasive analytic or positivistic methodologies' modern planning processes rely on 'failed to provide us with an ethos, a morality, ideals, institutions, a vision of man and of mankind and a politics which are in consonance with the way of life that has evolved as the expression of our success'. At the OECD Working Symposium in Bellagio on long-range forecasting and planning in 1968, with an illustrious group of participants such as Jay Forrester, Erich Jantsch, René Dubos, Stafford Beer, Aurelio Peccei and others, Özbekhan outlined a 'General Theory of Planning' in which he rejected the idea of value-free approaches. Recognising the current 'problematical situation' means that 'there exists a dissonance between the situation and the value system: […] If planning is viewed as a problem-solving device, then the emphasis of action is to bring changes in the environment while leaving the value system untouched and thus to achieve consonance between the two. If planning is viewed as a continuous organisation of progress throughout the environment, then it becomes necessary to effect changes in the value system as well as in the environment to achieve consonance between the two.' (Özbekhan 1969: 152) Consequently, his first technical and methodological proposal for

the Club of Rome was designed to 'cognize and investigate the all-pervasive *problematique* which is built into our situation, through some new leap of inventiveness'. Özbekhan's generalised problematique was a 'system-wide, interdependent, interactive and intersensitive [complex], immune to linear or sequential resolution, [and] ecosystemic in character' – it posed nothing solvable, but something 'that inheres in our situation'. In order to understand and intervene in the dynamics and to reach 'ecological balance' he suggested a 'coarse graining' of the complex problematique by identifying a set of 'continuous critical problems' covering the 'biological, physiological, physical, psychological, ethical, religious, technological, economic, political, national, international, communal, attitudinal, intellectual, institutional' aspects of it. A combination of conceptual and axiomatic work and a cybernetic system would allow study of the behaviours of different set-ups and exploration of both the 'logical, normal future (forecast)' and a 'normative future, imagined in the light of the value-base of ecological balance'. In that sense, the aim of Özbekhan's proposal was 'not research in the traditional sense but *invention*' (Özbekhan 1970).

The activities of the Club of Rome were organised for some time around Özbekhan's idea of a highly relational or interdependent 'world problematique' as the 'complex of problems […that] occur to some degree in all societies; they contain technical, social, economic, and political elements'.[14] The call for inventiveness was heard by Jay Forrester at the Massachusetts Institute of Technology (MIT), who together with his team translated the structure of the problematique into a computer model, which the famous *Limits to Growth* study was based on. However, many aspects of Özbekhan's comprehensive, ambitious and reflexive proposal were neglected in Forrester's systems dynamics approach. The criticism *Limits to Growth* received, particularly

14 '[T]he complex of problems troubling men of all nations: poverty in the midst of plenty; degradation of the environment; loss of faith in institutions; uncontrolled urban spread; insecurity of employment; alienation of youth; rejection of traditional values; and inflation and other monetary and economic disruptions. […] It is the predicament of mankind that man can perceive the problematique, yet, despite his considerable knowledge and skills, he does not understand the origins, significance, and interrelationships of its many components and thus is unable to devise effective responses. This failure occurs in large part because we continue to examine single items in the problematique without understanding that the whole is more than the sum of its parts, that change in one element means change in the others.' (Meadows et al. 1972: 10-11)

because of the methodologically closed approach, the lack of data, the computer fetishism and the doomsday mentality, became an iconic tale on the ethical and epistemological challenges of experimenting with high ambition in the realm of the problematique (Vieille Blanchard 2010).

At the same time, within the OECD, initially founded to coordinate economic policies among the Western nations and first and foremost seen as a technocratic institution implementing the paradigm of economic growth in the Cold War setting, an ecologically oriented and growth-critical discourse on what were called the 'problems of modern society' was launched. At the centre of the debate were some high-level OECD bureaucrats with strong ties to the Club of Rome, such as the Secretaries-General Thorkil Kristensen and Emile van Lennep, and the Director of Scientific Affairs Alexander King. Driven by the events of 1968 and the seemingly interrelated phenomena of social, political and environmental crises and the negative by-products of technology and industrialisation, they questioned the potential of existing political institutions to catalyse a global debate on the detrimental social and ecological effects of uncontrolled growth, the spread of technology, and individual and social alienation, which they deemed necessary. They regarded many of the existing institutions as 'guardians of the status quo and hence the enemies of change', simply because they had only 'post-facto mechanisms' available, a statement that underlines the perceived necessity of interdisciplinary systems perspectives and futures research as political technology. They were not only sceptical about the readiness of political institutions but also criticised disciplinary attitudes, 'the extraordinary arrogance of the economist, the naïvety of the natural scientist, the ignorance of the politician, and the bloody-mindedness of the bureaucrat', all unable to tackle the ensemble of problems they had identified (Alexander King 1970, c.f. Schmelzer 2017, 248). While the Club of Rome would choose global modelling as a tool for public intervention and discussion of the problematique, the OECD set up a directorate for environmental policies, at a time when no member country had an environmental ministry, and started an ambitious programme to develop alternative indicators intended to measure progress towards increasing the 'quality of life' (Schmelzer 2017, 308). Yet, while the latter failed and the OECD would – during the backlash of the 1970s – launch environmental policies that were ultimately compatible with the growth paradigm, these heterodox debates within the OECD provide an instructive case about the possibilities of autonomous supranational bureaucracies and

their ability to form a platform for critical intellectual and political intervention through problematisations that challenge existing orders and paradigms (Cox 1981). Historical research can reveal the unexpected contexts of some of these proposed alternative and heterodox views and contribute an analysis of how critical interventions have been made and the reasons for if they could, or could not, prevail.

Another initiative that deserves to be mentioned here as an example of a specifically new 'détente mode' of scientific internationalism was the establishment of the International Institute for Applied Systems Analysis (IIASA). The non-governmental, international think tank opened its doors in 1973 in Laxenburg, Vienna and was funded initially by 12 national member organisations (mostly the science academies) from both sides of the Iron Curtain.[15] The initiative dated back to the mid 1960s, when President Lyndon B. Johnson launched the policies of *bridge-building* towards the Soviet Union and Eastern Europe, designed to resolve international tensions and to develop transnational relations throughout the (post-)industrialised world. Among the initiatives pursued was the establishment of a joint research centre as a site for practical, scientific collaboration between scientists and policy experts with the goal of developing mutually compatible policy expertise. As mentioned above, transnational scientific and intellectual networks have been characteristic features in the intellectual landscape at a time when various protagonists shared deeper concerns about the future development of modern, industrialised societies in rapidly changing techno-scientific environments, interdependent economies and shifting values. The establishment of IIASA is perhaps one of the most obvious examples of these emergent discussions and the development of international approaches to the co-production of knowledge and expertise. The initiative was launched at a press conference at the White House in December 1966, when the idea of a joint institute with the Soviet Union and other 'industrialised nations in East and West Europe and elsewhere' was presented to a wider public by the president of the Ford Foundation, McGeorge Bundy, who was commissioned by President Johnson

15 These 12 included the USA, the Soviet Union, the UK, France, Italy, Poland, Czechoslovakia, Bulgaria, West Germany, East Germany, Canada and Japan. During the 1970s five more countries were to join: Austria in 1973, Hungary in 1974, and Sweden, Finland and the Netherlands in 1976. On the history of IIASA see Riska-Campbell 2011 and Rindzevičiūtė 2016; on détente science see Graf 2017.

to pursue the project. He told the press: 'The kind of problem we are dealing with here is that all advanced economies share the problems of efficiently managing large and complicated enterprises […] We do think that […] if we could quietly make progress in this kind of exchange of knowledge and know-how and have exploration in these fields of peaceful activity in advanced societies, it would be a contribution […] to the wider cause of international understanding and of peace. […] The problem is to take this clear fact of great common concern in matters that have to do with the business of living in an advanced society, or an advancing society, and see whether there aren't ways of setting up a new framework or a new institution or a new focus in which more progress can be made for the benefit of all.'[16] What we can understand from the wording is that the joint research centre was to be designed as an institutional response to the emerging new worldview of multifaceted power and interdependency. Collaborative research would help to develop common understandings through the study of problems arising from increasingly interdependent societies in a globalising environment. And while some of the protagonists certainly envisioned IIASA to become some kind of Cold War tool that would allow the exertion of a rather unilateral influence and transfer of systems expertise and management knowledge in order to maintain the prerogative of interpretation – or even to erode and dissolve communist ideology – the actual coproduction of 'common problems of advanced societies' unfolding at IIASA through collaborative, interdisciplinary work allowed scientific internationalism to evolve into something new.

It took six years for IIASA to open its doors, during which the initiative had been developed further in politically delicate negotiations. The notion of the 'common problems of advanced societies' provided a sustainable if abstract rationale, but the focus on problems and applied research would later also structure the institute's research matrix. Research projects at IIASA conducted by multidisciplinary teams of social and natural scientists, systems analysts, mathematicians and policy experts from both sides of the Iron Curtain would focus on complex long-term problems that similarly occurred in all advanced societies, such as problems of transboundary environmental pollution, sustainable energy supply, and urban and infrastructure plan-

16 Bundy, McGeorge, George Christian, and Francis M. Bator. 'News Conference at the White House 673-A', December 15, 1966. NSF Subject File: East-West Institute. Lyndon B. Johnson Presidential Library, Austin, TX; Johnson 1966.

ning, but also on the interdisciplinary co-production of frameworks to shape knowledge and expertise on newly emerging global issues such as climate change and world population. The institute became a central spot where the systems approach was developed further into an innovative and increasingly reflexive, performative and post-positivist policy science. It was combined with more profound research from various disciplines as a large number of internationally renowned scientists – ecologists, physicists, economists, sociologists, etc. – worked at IIASA. At the institute systems analysis met a complex institutional structure and the objectives were usually not defined by a single client. The projects often had multilateral and even global dimensions and the conflict potential was obvious. The actual conflicts, however, often didn't manifest themselves along the ideological lines between East and West, but rather between different disciplinary perspectives, epistemologies, attitudes towards the future and towards the properties and status of systems. On the project level such inconsistency could be turned into an asset. IIASA researchers developed, for example, methodologies such as multi-objective decision-making, participatory methods, integrated modelling approaches and comparative case studies. In contrast to previous systems approaches they attempted to take the social, political and institutional aspects of systems analysis more seriously into account, for instance the plural rationalities of the various stakeholders affected by policy-making and transformation processes or the importance of previously neglected issues such as risk and uncertainty (Duller 2016). IIASA's lasting impact and legacy lies in the provision of a sometimes contested but often innovative environment for the collaborative coproduction of common problems. A depoliticised systems approach allowed for international collaboration, mutual learning and varieties of boundary transgressions, in which disciplinary perspectives, trainings and subjectivities were made explicit and sometimes put aside in order to generate novel responses to the challenges of late modern societies (Rindzevičiūtė 2016). As a result of these collaborations numerous novel interdisciplinary and multilateral perspectives emerged at IIASA – among other places – that broadened the scope of questions to be dealt with on a scientific basis: especially, as there was often no exchange or joint problematisation at a political level on issues such as transboundary pollution, the challenges of technological change and associated risks and the problem of sustainable development.

Conclusion

Egle Rindzevičiūtė has recently argued that the mobilisation of complex systems perspectives and the 'smuggling' of policy sciences developed at IIASA, entailing notions of uncertainty and limits to knowing, had a liberalising impact on Soviet governance in the sense that they challenged totalitarian notions of control (Rindzevičiūtė 2016: 206-209). In a similar vein we can describe how these joint research initiatives opened up an international space for the construction and governance of transboundary problems in Europe, or how particular problematisations and the enactment of more ambiguous epistemologies and proposed frameworks to think about sustainable future pathways of modern societies both confirmed and challenged values, epistemic ideologies and imaginations of modernity (Schrickel 2017). In that sense we can evaluate problem-oriented research and interdisciplinary thinking at IIASA and other places in terms of the questions and futures perspectives generated and the interventions and differences they made (Barry/Born 2013). In any case, they represent various ways of actively creating and engaging with the future outlooks of modern societies in the light of emerging global challenges.

This paper presented an integrative historical approach to the study of changing conceptual frameworks and epistemological developments in interdisciplinary scientific fields such as systems science, futures research and policy sciences, which have been traced through the making of novel institutions in the years around 1970. It attempted to embed conceptual developments in the scholarly world in a broader intellectual and political environment fostering increasingly reflexive and constructive approaches. The positivist approach to progress, growth and development, which had been carefully constructed in the 19th and early 20th centuries, was called into question. The same applies to teleological ideas about the future and societal progress. It has been suggested to study these epistemic shifts through the changing notion of the *problem*, which was brought forward in various contexts at the time as a post-positivist operational concept. The conjuncture of and 'problem-talk' has been discussed as a marker for a questioning situation in the international history of modern societies, and it has been argued that through the construction of problems broader intellectual debates on the perceived challenges for modern societies, in the light of social, political and technological developments, have been enacted. In a historical moment

of post-Cold War uncertainty, complexity and openness that came to the fore in the writings and discussions of various scholars, institutional entrepreneurs and policy advisors, the high-modernist problem-solving mentality of the previous era had lost its epistemic appeal.

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