Utility spots: science policy, knowledge transfer and the politics of proximity

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6. Conclusion.

History and Future of Utility Spots

In this dissertation, I have situated the usefulness of scientific research in the history of post-war science, in the geopolitics of the Atlantic world, and in concrete places for knowledge exchange. Focusing on utility spots instead of prominent scientists, dominant disciplines or powerful organisations has proved to be a fruitful way to highlight the intersection of political, societal, economic, cultural and scientific developments. In this concluding chapter, I pass by these different spots once more to reflect on (dis)continuities in the utility concept with respect to different political-economic regimes and geographic regions (6.1). An important conclusion from the historical narrative is the existence of a politics of proximity. For knowledge transfer—or the relations between science and society more generally—it matters where different actors in a network are situated. To refine the utility spot concept, I will elaborate the politics of proximity with respect to literature

on the importance of trust and geography for successful innovation (6.2). Consecutively, I reflect on the implications of the applied spatio-historical approach for the study of science policy (6.3). Besides recollecting how spatial issues and solutions related to various policy decisions, I will also return to the valorisation concept. Viewed through the lens of utility spots, valorisation appears in relation to the currently paradigmatic spatial model of useful knowledge production: *the science park*. In the last part of the conclusion (6.4), I turn the historical-epistemological findings towards the future: what potential does this offer to organise research in alternative ways, in response to the criticisms raised about the valorisation concept? Ultimately, this leads to a reformulation of the utility spot definition and a call for alternative spatial imaginations of useful knowledge production.

6.1 Utility Spots in Post-War History of Science, Policy and Society

At the beginning of this dissertation, I introduced the utility spot in a dialectical fashion to cover the common ground between the *utility* and the *spatiality* of scientific research. More particularly, I proposed utility spot as *heuristic* concept to uncover this intersection in historical reconstructions of the policy and practice of publicly funded research. In section 1.7, I formulated a preliminary definition to enable the identification and interpretation of such spots in post-war history of science, policy and society:

> Utility spots consist of the spatial arrangements that facilitate and stimulate the political-epistemic interactions between heterogeneous actors, which actively shape the significance of research, with the public aim of creating and circulating useful scientific knowledge.

As I mentioned at the conclusion of the historiographical survey of post-war US science, the concept functions on an analytical level different from that of terms coined to characterise a specific, localised phenomenon. Instead, 'utility spot' stands for a methodological approach to study the history of science, universities and their societal meaning in space. As methodology, it implies both historical and philosophical hypotheses. Historically, it suggests not only that such spots existed but also that they played roles of importance in the organisation and legitimation of science, in the post-war period specifically. Philosophically, utility spots assume that there exists a relation between the spatial organisation of research, the network of actors involved, and the possible kinds of knowledge created. In the next three sections I will

discuss both these philosophical and historical consequences to arrive at a more refined definition. First, I discuss the historical results from the spatial approach to utility.

My survey of spots has not aimed to be comprehensive, and I had to limit myself to discussing a handful of examples that exemplified diverse aspects of utility. Still, it seems warranted to claim that in the second half of the twentieth century there was a remarkable increase of hybrid spaces between academic research, extra-academic research, industry and society more generally. Such spaces both emerged from the bottom up and were purposively built and implemented from the top down. Abstractly, these two contexts of origin also represent two ideal-type reasons for existence of utility spots: either *in response to* increased interactions between different actors and practices in existing epistemic spaces, or *as stimulation of* new interactions between different actors and practices in a new epistemic space. A utility spot can therefore resemble both the *displacement* and the *establishment* of useful research. In the first analytical case, the study of utility spots not only is instructive for our understanding of the historically changing concept of utility, but also can highlight developments within the mother institution(s) and wider society. For example, the study of the Delft Technical-Physical Service highlighted the spatial frictions caused by 'sponsored research' within Dutch and European universities and polytechnics in the 1950s. The second analytic category of utility spots concerns places that are established from the top down to demand an increase in a specific type of interaction. The 1980s transfer points that aimed to stimulate contact between SME and university science are a case in point.

Most utility spots are of course not instances of either ideal type. Rather, in most cases a particular space is the result of existing relations between heterogeneous actors as well as of political, societal and economic arrangements that maintain or stimulate them. The science park type of utility spot is perhaps the most telling illustration. In the Leiden case, the science park allowed space for already occurring interactions between biochemists and entrepreneurs and was increasingly vindicated by investors as well as stimulated by local, regional and national political actors. There is no simple bottom-up or top-down causality to be uncovered. It was locally situated scientists who tapped ideas for new hybrid spaces for useful knowledge production from their international networks, which they then sold successfully to governments at different levels, so that they could structurally enable and stimulate the development. But the eventual realisation of such utility spots again relied heavily on local political-epistemic alliances. Many utility spots that I have identified in the post-war period are hybrid not only because

of their situation in the liminal space between science and society, but also in the sense that they are the result of, and an active element in, political-economic, societal and scientific relations.

Utility spots are not just local nodes in a global network; the models of utility spots also circulate themselves. How this works out, emerged from the three historical reconstructions of utility spots in Europe and the Netherlands. The circulation of exemplary models from the US was indeed almost omnipresent in this period. But perfect imitation was rarely possible or even desired by European actors. As models, these utility spots are mutable mobiles: they change significantly because of the displacement. And, as particular place, they often turn out to be very 'regional', i.e. functional because of local circumstances and infrastructures that are difficult to understand and/or transfer. Also the circulation of circulation models thus takes place in both geographical and network space: it can change content, meaning and appeal in the process of displacement. Whenever a utility spot appears to travel, in the form of (published) personal experiences, consultancy reports, science policy meetings or floor plans, we need to be aware of the contextual aspects both of its origin and of its destination. Spatial models for useful knowledge production can thus function as a distorting mirror. From different angles, the mirror reflects different contexts, places and histories. For the case of the science park, for example, the mirror reflects intermittently the American geography of the military-industrial-academic complex, the changing appreciation of fundamental research in industry, the appeal of American entrepreneurial culture to Europeans, and the spatial politics in Dutch cities and provinces.

Although utility is typically associated with technological wonders and scientific breakthroughs, my study of utility spots demonstrated how it also shapes the humanities and the social sciences. The description of the historical origins of NIAS in discussions about a European university demonstrated that the same paradigmatic examples—like the industrial research laboratory—informed their organisation, image and appreciation. Two notable insights about the historicity of utility ensued. First of all, there is a geopolitical dimension to diverse meanings of utility. The (international) political forum on which utility spots are discussed imply, for example, economic, cultural, or military connotations of possible usefulness. In addition, these meanings have a geographical dimension, based on which countries are included in the discussion, from Atlantic or 'western' to European (with or without the UK)—and many more could be added. Second, the connection between concepts of utility and a particular spot, either existing or planned, is fluid. We have seen how the utility embodied by various virtual European universities fluctuated over time and

resulted in a Dutch plan that progressively dropped most of these connotations. And although the finally established NIAS responded to all these concerns, and legitimised itself in terms of complementary utility, it was ultimately a reproduction of an isolated, rather than an open and interactive, ideal of knowledge production. Through the study of utility spots we thus learn that the imagination of a relation between research and usefulness can have counterintuitive effects.

This brings me to the historical result that utility spots function not only as places but also as plans. That is, already the idea of a potential place brings together diverse actors. We could observe this in the case of business technology centres in the 1980s, the European universities in the 1960s and the para-university institutes in the 1950s. I call this the political-epistemic effect of *virtual* utility spots (as opposed to mere *potential* spots, which would have real effects only once realised). Spatial planning and design are intrinsically speculative but also produce real effects by projecting a possible future. The perspective on spots as spatial imaginaries of the relations between science and society fits within the concept of relational space: 'to think of places as ongoing negations of possibilities', constituted in ongoing collective and individual imaginations.[699] Just like a physical building, a spatial imaginary of useful research can have political-epistemic effect on the socio-political network that supports the production and exchange of scientific knowledge. In the negotiation and imagination of these virtual places, similar bundles of relations and processes between scientific and societal actors arise that were imagined to be housed in the planned spot. The role of spatial imaginaries in science policy and broader culture is an important justification for the use of the utility spot concept: it is not *just another* approach to bring into view the many contexts of organised science, but it brings out a tangible trait of this period, namely, that many tend to think *spatially* about the appropriate relations within society. In this sense, it resonates with Michel Foucault's speculation that our current epoch is one of space, in the twentieth century more specifically defined by 'relations of proximity'.[700]

6.2 Utility Spots and the Politics of Proximity

As historical phenomenon and heuristic concept, utility spots are ambiguous. They are at once static and dynamic, as spots that harbour precisely the transfer, exchange and circulation of knowledge for the benefit of society. As 'relational space' they are the intersections of epistemic, social, political and cultural processes so that place becomes deeply intertwined with power, both in real processes and imagined relations. This applies to the places of knowledge production, and only more so to the

699 Massey, *For Space*; Claudia Matus and Susan Talburt, "Spatial Imaginaries: Universities, Internationalization, and Feminist Geographies," *Discourse: Studies in the Cultural Politics of Education* 30, no. 4 (2009): 517–18.

700 Michel Foucault, "Of Other Spaces," *Diacritics* 16, no. 1 (1986): 22–27.

sites geared at knowledge transfer. Relations of power make these places possible and effective, and the power effects they generate are intertwined with knowledge circulation. Situated in between demarcated zones of the scientific and the non-scientific (societal, economic, industrial), they are spaces of mediation where interests, languages and practices are translated in such a way that actors from different 'worlds' get to see, understand and act in a shared world. As mediation spaces these places have to generate trust on multiple levels. On the abstract level of policy, it is about trust in the institutions and communities that support the place. On the concrete level of knowledge exchange, it is more about trust in the reliability and usefulness of certain knowledge and experts, as well as the (scientific) potential of the concerns and problems which require solution.

Trust is tied up with proximity. Both are often considered central to processes of knowledge exchange, and it is not uncommon to think that trust increases as distance decreases. AnnaLee Saxenian, in her study of Silicon Valley and Route 128, states for example:

> Geographic proximity promotes the repeated interaction and mutual trust needed to sustain collaboration and to speed the continual recombination of technology and skill. When production is embedded in these regional social structures and institutions, firms compete by translating local knowledge and relationships into innovative products and services …[701]

Also in historical studies of science, 'relationships of trust' inscribed in space are considered conditions for routine knowledge transfer and scientific sites are interpreted as 'locales for co-presence'.[702] Utility spots can thus be understood as places that mediate existing or stimulate new relationships of trust by creating locales that enable the co-presence of diverse actors. In the historical reconstructions, the importance of proximity expressed itself on (sometimes overlapping) regional and local scales. First, there was the concern about concentration or dispersion of scientific activities, and second the question about the appropriate and optimal distance between academic and extra-academic actors. These two issues together make up the 'politics of proximity'.

Both geographical concentration and dispersion of resources for scientific research were controversial topics in the debates about the organisation of research in Europe and the Netherlands. Concentration of research in national or transnational institutes was always seen by universities as posing a threat. Such plans were motivated by epistemic arguments about the benefits of centralising scientific activities: it would stimulate creativity and enable work on larger and more expensive instruments. But the academic establishment typically

701 Saxenian, *Regional Advantage*, 161.

702 David N. Livingstone, "The Spaces of Knowledge: Contributions towards a Historical Geography of Science," *Environment and Planning D: Society and Space* 13, no. 1 (1995): 20–21; Shapin, "Placing the View from Nowhere," 7–8.

feared that such places would become (perceived as) centres of excellence that hijacked precious scientific and technological manpower. Consequently, this would degrade universities from being *the* place for scientific research to mere teaching institutions. University rectors and representatives therefore preferred to organise a national research council, or a utility spot like the European University, in a 'decentralised' manner—meaning that (inter)nationally funded research would be housed in selected, existing academic institutions. If *concentration* was motivated by scientific concerns, and *decentralisation* often mirrored established academic interests, geographical *dispersion* of scientific activity related to political and societal concerns for regional economic development. As we have seen in the Dutch case, this could again be opposed by academic actors who preferred expansion of their own institutes, now motivated by the benefits of centralisation. These spatial models for the practical organisation of research—local concentration or geographical dispersion—intersected with institutional arguments about (de)centralisation. Because concentration and dispersion were employed differently as arguments in various situations, they always require situation in particular spatial and political-economic contexts.

Still, concentration and dispersion as analytical categories entail different epistemologies of research. Where concentration emphasizes the importance of intra-scientific interactions, dispersion puts more stress on the relations between scientific activities and broader social and economic contexts. Both, however, imply the importance of proximity. Concentrating research in particular places assumes that this brings actors from the same (or different) disciplinary cultures close together, that this increases activity and thereby heightens the quality of the results. Dispersing research to diverse regions, especially ones that lack scientific institutions, at the same time assumes that it makes a difference where research is located for the intensity of interactions with heterogeneous actors in society. In practice, a utility spot can also be a hybrid of concentration and dispersion, in the sense that such spots concentrate resources in one place to enable increased activity, but also locate themselves outside the university and in peripheral regions to specifically stimulate new types of interactions. The possibility of overlapping dispersion and concentration helps explain the appeal of the science park utility spot. Although it decentralises scientific activities, its proximity to the university makes it more a trait than a threat, because it simultaneously represents the logic of concentration, putting entrepreneurs and scientists together to boost creativity, and the logic of dispersion, promising increased local interactions and regional benefits.

Proximity as relevant political-epistemic category is thus presupposed in these debates about the geographical organisation of scientific research. Ultimately, this also plays out

spatially at the local level, as we have seen in various historical cases described in this dissertation. The plan for para-university institutes for contract research, coined by the Kronig committee in 1963, is a good illustration. The concern for the appropriate character of university research originated in the lack of spatial separation between different types of research—both in orientation and funding. This was most tangible in spaces of the Delft polytechnic, but also turned out to apply to many natural scientific and medical laboratories at general universities. The 'architectural' solution of a para-university institute rearranged diffuse activities into separate but proximate spaces and redirected interactions with external parties through this in-between building, also to make professors aware of the difference between their 'vital and derivative' tasks. Proximity was a matter not so much of decreasing the distance between academic and industrial spheres as fully as possible, but rather of finding a spatial compromise between freedom and utility. In space, one thus finds the concrete, physical expression of abstract goals and categories of research. One professor expressed the appropriate relation between academic and extra-academic activities aptly, when he proposed that a new utility spot close to the university was preferably established at *cycling distance*.

The same applied, of course, for the non-academic organisations with which the university scientists collaborated. In the 1960s, TNO for example had a geographically different concept of proximity from that of most professors: rather than a location close to a university campus, it aspired to a location central within the Netherlands. They regarded the so-called 'techno-scientific atmosphere' of university towns as mere subjective factors, which would not enhance their contribution to the industrialisation of the Dutch economy. Industries with the most advanced research laboratories, like Philips and Shell, did not consider physical proximity the most important aspect of their relations to academic science either. Instead, they relied on a tightly knit social network and created similar 'atmospheres' in their labs. Special professorships and recent graduates circulated between the corporate laboratories, academic institutions and research organisations (especially the boards of ZWO and TNO), so that interests, results and organisational models were easily shared. The industrial focus on cultural affinity, rather than physical proximity changed around 1980 when corporate research was downsized and outsourced, and TNO was remodelled into a contract research organisation. Up to that point, physical proximity had mattered more *within* multinational, vertically integrated companies—between research, development and production—than *between* the company and external sources of knowledge, like the university. The science park model therefore resembles the ambiguous revival of the proximity argument at the beginning

of a globalised and digital era, which both erased the primacy of place. Thus, science park enthusiast Witholt could present peripheral Groningen as a tapping point from an epistemically integrated globe.

The historical study of proximity relations in knowledge production could be a promising and fruitful direction for future research. Most historical studies of science that take note of it understand it merely in terms of 'co-presence' and physical distance. Recent social studies of science take proximity serious but limit the transfer of (tacit) knowledge and skills to the exchanges between scientists.[703] Although I have already provided thick descriptions of the meaning of proximity and its importance to concepts and places of utility, it would have to be developed more analytically in order to employ it as central category in future research. Recent social studies of the geography of innovation could be informative in this respect. They have pointed out that just physical or geographical proximity is not sufficient to explain the functioning of creative regions. The success of Silicon Valley, for example, is not based on spatial clustering of industries and science alone. Other relevant factors are the adaptive capacity in those firms, a culture of cooperation, creativity and entrepreneurship, and shared discourse, knowledge and practices between academic and industrial actors.[704]

To understand why knowledge exchange and cooperation do or do not take place between (economic) actors and organisations, economic geographer Ron Boschma has distinguished five dimensions of proximity: geographical, cognitive, organisational, social and institutional.[705] Cognitive proximity concerns the similarity of the knowledge base and is considered the most important condition for effective knowledge transfer; social proximity equals the overlap in personal networks of the various actors, which typically increases trust; organisational proximity describes the matter of belonging to the same (formal) 'groups', which does not create, but does lower the barriers for, interactions; institutional proximity denotes the degree to which formal and informal rules (including laws, norms and values) are shared.[706] Processes of innovation and knowledge transfer flourish when these different dimensions are in balance—both too much and too little proximity can be detrimental. More importantly, the diversification of proximity exposes the fact that geographical proximity, although perhaps theoretically sufficient in combination with a shared knowledge base, is not a sine qua non for knowledge transfer. Rather, increasing distances can be bridged when two organisations or actors are sufficiently proximate in the other dimensions.

To connect the diversification of proximity to specific places of knowledge exchange, like utility spots, we could subsequently turn to studies of socio-technical transitions. The multi-dimensional concept of proximity has namely been

703 Koen Frenken, "Geography of Scientific Knowledge: A Proximity Approach," *Quantitative Science Studies* 1, no. 3 (2020): 1007–1016. It should be noted that Frenken's approach also differs in principle from mine: where he studies the diffusion of knowledge claims (sociology of scientific knowledge), I have focused on the historical, cultural and social conditions for such diffusion (sociology of science).

704 Saxenian, *Regional Advantage*; Kenney, *Understanding Silicon Valley*; Weiler, "Proximity and Affinity"; Lécuyer, *Making Silicon Valley*; Roger L. Geiger, "The Riddle of the Valley," *Minerva* 46, no. 1 (2008): 127–32.

705 Ron Boschma, "Proximity and Innovation: A Critical Assessment," *Regional Studies* 39, no. 1 (2005): 61–74.

706 Boschma; Ron Boschma, Pierre-Alexandre Balland, and Mathijs de Vaan, "The Formation of Economic Networks: A Proximity Approach," in *Regional Development and Proximity Relations*, ed. André Torre and Frédéric Wallet, New Horizons in Regional Science (Cheltenham, Northampton: Edward Elgar Publishing, 2014), 243–66.

embraced also by advocates of the Multi-Level Perspective approach (MLP), a heuristic device to study stability and change in socio-technical systems. MLP distinguishes between the levels of landscape, regime and niche which, although they ring spatially, are originally understood primarily in temporal terms: the sociotechnical *landscape* is the relatively stable, long-term context against which a transition takes place, the *regime* consists of established practices and rules, while the *niche* is a new, more unstable 'locus for radical innovations'.[707] To achieve 'spatially sensitive niche management', Rob Raven, Johan Schot and Frans Berkhout have related the relative temporality of socio-technical levels to levels of relative proximity.[708] Basically, they define a correlation between stability and proximity: the longer a network has developed, the 'closer' the different actors are—especially in cognitive, organisational and social terms. Niches, therefore, have the lowest level of proximity. This suggests that the prominence of the proximity argument in a debate about a particular new niche, or utility spot, is above all an expression of a lack of, an obstacle to, or friction in relations between diverse actors.

The MLP approach to innovation processes focuses on economic actors, while my emphasis has been mainly on scientific institutions and policy bodies. The concept of utility spot could, nevertheless, be perceived to function on the same analytical level as niche—and sometimes they overlap in particular places. Niches are, namely, understood as 'derived concepts': they exist *because of* a (perceived) lack or obstacle in existing structures or institutions (at the regime or landscape level). And niches are characterised as 'protected spaces' that provide 'the seeds for systemic change', by creating an environment and vision through which new actors can be enrolled, resources can be attracted and learning processes can occur.[709] Similarly, I have repeatedly situated the emergence of utility spots in contrast to existing institutional cultures, regulations or political economies, and described them as eccentric sites in which existing socio-material networks are reimagined and reshaped. The science park is a primary example of an overlap between niche and utility spot—while the fact that I was able to include NIAS in my discussion exemplifies the difference.

This association of the utility spot concept with multidimensional proximity and the MLP niche allows translation of my spatio-historical approach to the present. Yet, it also allows me to stress a historical point that MLP and the geography of innovation tend to overlook. From an abstract analytical viewpoint, MLP views proximity as an ahistorical category to explain historical change. The 'dynamic' conception of proximity, advocated by Boschma, does take into account that the *effect* of proximity in a network can change over time.[710] But, based on my historical exploration of utility spots, I would instead like to argue also for the historicization of proximity itself.

707 Frank W. Geels, "The Multi-Level Perspective on Sustainability Transitions: Responses to Seven Criticisms," *Environmental Innovation and Societal Transitions* 1, no. 1 (2011): 24–40.

708 Rob Raven, Johan Schot, and Frans Berkhout, "Space and Scale in Socio-Technical Transitions," *Environmental Innovation and Societal Transitions* 4 (2012): 70.

709 Geels, "The Multi-Level Perspective on Sustainability Transitions," 26–28.

710 Boschma, "Proximity and Innovation," 72.

For the relation between science and society, it would be relevant to study, at various sites and times, different types and meanings of proximity and their effects on the organisation and image of useful research.

6.3 Spatiality of Science Policy: The Case of Valorisation

Throughout the historical reconstructions of utility spots, it came to the fore that the abstract issues and concepts of the organisation of publicly funded scientific research often have very concrete spatial origins. And new science policy interventions usually have concrete spatial effects. The combination of these developments is what I called, at the end of chapter 3, the spatiality of science policy. Described in terms of MLP, one could say that utility spots can function as *niches* that have effects at the *regime* level—and the ensuing rules and regulations at regime level can stimulate the establishment of new niches (and so on). In the case of the TNO issue in the 1950s, for example, two concrete spaces that organised the interactions between academic and extra-academic actors were occasion for action at the university, interuniversity and ministerial levels. The science park, as well as the related utility spots of transfer point and academic business centre, also functioned as niches for new utility practices and policies. At the end of chapter 5, I already pointed in this direction. The knowledge transfer legislation of 1985 is, I argued, an example of how a utility spot can have structural effects (at the regime level). In this section, I jump a decade ahead in my historical narrative to flesh out this claim with respect to the policy concept of valorisation, by viewing it through the lens of utility spots. To do so, I return to its definition as it emerged after years of debate:

> Valorisation is the process of creating value from knowledge by making it suitable and/or available for economic and/or societal use and translating it into [competitive] products, services, processes and entrepreneurial activity.[711]

Presenting valorisation as 'process' is a way to steer away from a 'product' approach, in which the concept of useful knowledge becomes limited to artefacts, tools or patents that can be sold at a profit. In one attempt to clear up the meaning of valorisation, minister Van der Hoeven drew a list of concrete activities from an advisory report by policy consultant Dialogic. This contained processes such as the production of skilled workforce, contract research, cooperative research, publication of results, informal networks and science communication. This process approach seems to mirror a broader shift in the field of science studies from the study of the outcomes of scientific

711 van Drooge et al., *Waardevol.*

research—a finished theory, a completed book, a published article—towards the process of their coming about.[712] But at the same time it states that value is created only 'from knowledge', or the results of research, which reifies research into formalised scientific knowledge. This actually allows the imagination of two spatially separated activities: knowledge production and valorisation. This implies that stable, reliable, true knowledge and the process of becoming valuable to others, of being valorised, are distinct.

The three modalities of value creation consist of the alteration of knowledge to fit the interests of non-academic, external actors. By implication this means that these interests and actors are excluded from the chronologically primary research process. The three qualifications—available, suitable, translated—imply different interaction mechanisms between scientific and societal actors. 'Making available' suggests that it may be sufficient to share formalised knowledge with external parties, without modifying it for a different context of use. When interpreted as the spread of immutable mobiles in society, however, this consists of more work because the configuration of production would have to travel along. 'Making suitable' already suggests that the use of knowledge is a more localised phenomenon: research results need to be fitted to the particular situations, problems and questions of the actors who want to use it. That is, knowledge circulates as mutable mobile. Also the third modality of valorisation, the 'translation' of scientific knowledge into competitive products, services, processes and entrepreneurial activity, can be understood in terms of a mutable mobile. Translation suggests that knowledge, to be of use to others, has to be made *into* something else (either an artefact or activity) and in most cases *by* something or someone else: a translator, mediator or modulator. Viewed from a constructivist perspective, the modalities of availability, suitability and translation of knowledge appeared as (im)mutable mobiles. The reliability and utility of scientific knowledge then result from the same displacement (or translation) process: adapting general claims, specialised skills and theoretical understanding to a local, particular problem to mobilise the interests of others.

Lastly, there is the difference between value creation through economic or societal use. Obviously, societal could include economic, and sometimes society is reduced to the economy, but in the case of valorisation they are separated explicitly to mark off different goals for scientific research, basically in terms of either a profit or non-profit orientation. This does not necessarily map onto a disciplinary division. Also social sciences and humanities could play 'an important role in economic valorisation … for example with respect to the non-technological aspects of innovation … that are of importance for the successful introduction of new products and processes.'[713]

712 From this perspective, criticisms have been aired of scientometrics and bibliometrics because they reduce the complexity of scientific practice to easily calculable and comparable outcomes.

713 Minister and state-secretary of OCW to university boards, 'Valorisatie van onderzoek als taak van de universiteiten', 27 January 2005 (OWB/AI/04–57055).

In a way reminiscent of the 1960s discussions on the subservient, or complementary, utility of the humanities, these scholars were now mobilised to support the acceptance of new inventions into society. Or, if natural sciences transferred knowledge to entrepreneurs to develop products, the humanities and social sciences could transfer these products into wider society—transposing the controlled environment of the laboratory and the science park, onto the world out there.

Many critics of valorisation policy fear that it can lead to the commercialisation of academic research, and that this in turn has a limiting impact on the content and kind of knowledge produced. But whether the modalities of valorisation also affect the production of knowledge ultimately depends on the epistemological viewpoint one takes. The concept itself could be interpreted as allowing both separation and integration of research and knowledge transfer. And whether either of these also leads to societal *orientation* of the research-agenda (or the significance and form of research on a meta-level) is another aspect that could be understood either way. The enduring resistance against valorisation does not follow directly from its definition. To understand this, we need to turn to the spatial models of useful research on which it was based.

In November 2003, the Dutch Minister of Education, Culture and Science (OCW), Maria van der Hoeven, introduced valorisation in the agenda-setting Science Budget in response to the 'European paradox': an abundance of high-quality scientific knowledge, but too little utilisation.[714] By doing so, she followed the diagnosis set by the European Commission that the 'translation' of 'fundamental' research into economic activity trailed in comparison to the US. This observation was not new; rather, it had motivated European attempts at organising the exchange and interactions between science and society in the entire second half of the twentieth century. Applied to the Netherlands, Van der Hoeven observed that the universities indeed teemed with excellent science, but she did not agree that results were not transferred into society to a sufficient extent. To support the claim that Dutch university research was quite useful, she presented a notable source: a consultancy report about the appreciation by industrial managers of university knowledge transfer. Still, she introduced 'valorisation policy' to tinker with the interactions between academic research and society: 'valorisation is the transformation of research results into economic value.' What spatial model of useful knowledge production she had in mind was no secret:

> Effective collaboration with companies usually requires larger research groups that cooperate closely with companies. This is the basis of innovative clusters with a Silicon Valley character.[715]

714 "Wetenschapsbudget 2004. Focus op excellentie en meer waarde," Parliamentary Papers 2003–2004, 29 338 (1).

715 Ibid.

Furthermore, Van der Hoeven tied valorisation strongly to the knowledge transfer article in the Scientific Education Act, which had been introduced in 1985. In Dutch policy contexts, valorisation also related directly to the spatial models introduced in the 1980s. Valorisation first appeared at the National Genomics Initiative, which was established in 2000 to coordinate, and invest in, research at the intersection of health and genetics research.[716] This public coordination body was imagined to fit into a national 'knowledge infrastructure' between Dutch universities, public research institutes and biotech industries and as a 'pioneer' in the 'Europe of knowledge & innovation'. Part of the initiative was a specialised, and centralised, *valorisation office*, in cooperation with organisations, like BioPartner, that had experience with life sciences incubators on university campuses. The successor of the Academic Business Centre in Leiden was, for example, rebranded as BioPartner. Furthermore, valorisation support consisted of protection and exploitation of new findings and the stimulation of new knowledge-intensive industries. Importantly, the National Genomics Initiative distinguished valorisation from the societal orientation of its research, which would be studied 'empirically and normatively' by social scientists and humanities scholars.

The displacement of valorisation from a national coordination initiative in one specific field, to the entire realm of publicly funded research, caused controversy. Two aspects of the initial proposal for valorisation policy received most criticism, especially in combination: the limitation to economic value and the inclusion of the social sciences and humanities. In 2005, the minister explained in a letter to university boards what the 'economic and societal added value of social sciences and humanities for the knowledge society' consisted in.[717] She explicitly broadened the definition of valorisation, in response to parliamentary debate, to include also 'non-economic societal added value', so that it could explicitly apply to all academic fields. Valorisation included two types of activity, namely *orientation* of academic research to societal questions and industrial needs as well as concrete knowledge *transfer* practices. Whereas these had been institutionally separated in the Genomics Initiative, we have encountered in various utility spots this double-edged sword of transfer and orientation: the assumption that increased interactions with extra-academic actors do not lead only to useful applications in the short term, but also to a larger field of *possible* utility in the long term. Or to rephrase that in more philosophical terms, valorisation deals not only with the *content*, but also with the *form* or *significance* of research.[718]

As we have seen throughout this dissertation, all these valorisation activities already existed in the practice and legitimations of concrete and virtual utility spots at universities. Why, then, did valorisation remain controversial for a decade,

716 Nationaal Regie-Orgaan Genomics, *De Nationale Genomics Strategie: Strategisch Plan 2002–2006* (Den Haag: Nationaal Regie-Orgaan Genomics, 2002).

717 Minister and state-secretary of OCW to university boards, 'Valorisatie van onderzoek als taak van de universiteiten', 27 January 2005 (OWB/AI/04–57055).

718 Rouse, *Engaging Science*; Hacking, "Weapons Research"; Kitcher, *Science, Truth, and Democracy*.

and was it replaced by *impact* by 2019? My answer to this question is twofold: valorisation was historically tied up with specific spatial models of useful knowledge production that embodied a limited economic utility concept, and in this model there was no space (made) for social sciences and humanities, nor did they demand it. The controversy was thus rooted in the generalisation of one type of hybrid space on campus—the science park, and the associated transfer point and business centre—to the entire academic atmosphere. Today, Utrecht University is not joking when it dubs the entire Uithof, which houses most of its buildings for natural, medical and social sciences, a 'science park'.[719] This utility spot originally organised the relations between upcoming fields like biotechnology and small-scale high-tech business, but has become the overall norm by now. The science park as concrete reality and spatial imaginary of useful research also prohibits an easy alteration of a science policy concept, like valorisation or knowledge transfer. Conceptually, it might seem unproblematic to include societal value and the humanities, but this has no referent in the spatial organisation of epistemic and entrepreneurial practices at the science park. The historical connections between valorisation and science parks are on the one hand a demonstration of the spatiality of science policy, as well as an indication of the limitations that this produces. In the next and closing section, I argue that alternative spatial imaginaries might be powerful instruments to stretch the space for plural scientific practices on campus, in the city, on this globe.

6.4 Spatial Imaginaries of Useful Research

> Scientists know that, just as birds in an environment devoid of air would fall to the ground, their own practice would be impossible without what is simplified away when we represent … scientific research as indifferent to its social valorization.[720]

Place and usefulness matter to the practice of scientific research and thus to theories that aim to describe and explain the production of knowledge. In a frictionless world—one without material and social context, outside geographic, spatial and political-economic relations—scientific research cannot exist or function; it would fall to the ground. In this last section, I collect and reflect upon the conceptual implications of the spatio-historical approach to useful research by proposing a reformulated definition of utility spot.

In the introduction, I proposed to understand utility as meta-scientific concept that shaped the practice and politics of research. This allowed the historicisation of the utility concept by situating it in societal, physical and geographic space.

719 A. C. Flipse, "De opkomst van de universitaire campus in Nederland, 1945–2020," *Shells and Pebbles* (blog), June 18, 2020.

720 Isabelle Stengers, "The Need for a Public Understanding of Sciences," in *Topics and Trends in Current Science Education: 9th ESERA Conference Selected Contributions* (Dordrecht: Springer Science & Business Media, 2014), 26.

At different times, for different fields, and in different societies, the proclaimed, expected or demanded utility of scientific research has varied. This is, in itself, not a surprising outcome. But the study of utility spots in the second half of the twentieth century produced two additional insights that underlined the importance of utility as historical-epistemological category. First, one apparently stable concept of utility can change meaning and function. For example, the use of research to create new products and more profit, in order to support national industries, meant different things in the 1950s and the 1980s. In the Netherlands, the meaning of this type of utility co-evolved with its political-economic context—from a concern with industrialisation and catch-up with the US to a concern with industrial renewal in SME and globalisation. Utility spots like the science park and the transfer point, or in the US the UIRC and the TTO, provide a window on the entanglement of this changing meaning. Second, the different social and political consequences of the historicity of utility implies historical variations in the organisation of research. Ultimately, utility as historical category structures the practice of research, or to be more precise, the modal significance of research fields.

The main epistemological issue that inspired this study was whose values, goals and interests (can or should) inform the conduct and organisation of research. This relates to debates about the social construction of scientific knowledge, political philosophies of science and the epistemic justification of science policy. Taking utility and space seriously has not been, however, a move towards a relativism with respect to science. Indeed, my study namely has not attempted to reduce the content of research simply to the particularities of a spatial context. Rather, I have tried to make visible how spatial structures for research embody ideals of utility that affect the 'enacted narrative fields' or 'significance graphs' that shape the 'form' of research.[721] This epistemic function of utility spots follows from the fact that these structural arrangements enable or exclude particular kinds of social and political relations. These places are the result of a diverse set of social, cultural and political relations as well as values, and they stimulate explicitly the interaction of scientific practices with a plurality of other practices in the world. By inviting heterogeneous actors to contribute to the rewriting of the significance of past and present research, they shape what future research is considered possible, valuable and useful.[722]

In chapters 2 to 5, which reconstructed post-war organisation of research, I tied pronunciations of these philosophical questions to concrete and imaginary spatial arrangements for the conduct and exchange of research. In utility spots, epistemic distinctions and developments became manifest in architectural, geographic and geopolitical ways. Science

721 Rouse, *Engaging Science*; Kitcher, *Science, Truth, and Democracy*.

722 This could also be understood as an 'ecology of practices'. Isabelle Stengers, "An Ecology of Practices," *Cultural Studies Review* 11, no. 1 (2005): 183–96.

shops and transfer points, for example, positioned themselves as half-way houses between the university and (parts of) society, with the aim of reorienting academic research into more relevant directions, and the Technical-Physical Service in Delft allotted separated space to the orientation of research by external parties. The case of the European University plans showed how there is also a geopolitical side to the inclusion of actors and organisations in scientific research. At the Dutch science parks we saw, lastly, a shift in the geography of the political-epistemic alliances around useful research, with a stronger focus on local and regional actors in the production and circulation of scientific knowledge. These displacements and structures impinged on the significance of university science in general, which translated into policies and funding in support of particular types of research and topics.

What does the spatial and historical situation of utility as meta-scientific concept mean for theories of scientific practice? In the introduction, I alluded to the diverse set of concepts that have popped up in the last two to three decades in attempts to conceptualise scientific research: mode-2 knowledge production, responsible research and innovation (RRI), technoscience, post-normal science, triple helix and so on. Without exception, these concepts de- and prescribed blurred boundaries between formerly strictly distinguished actors and emphasized the networked, interlinked or ecological nature of scientific research. My exploration into various utility spots has been partly informed by these approaches, in the sense that I have been aware of the diverse relations that made such a place possible. At some points, theories of scientific practice again leaked back into the organisation of useful research: NIAS understood itself in relation to Kuhnian paradigms and sociological studies of the industrial laboratory, while the knowledge transfer clause in the Scientific Education Act was legitimised with reference to contemporary science studies that understood it as an integral part of research. Taking a step back, many of these concepts are themselves based on very specific spatial models of useful knowledge production—ones that blur boundaries between formerly heterogeneous actors.

There is a political risk implied by too strong interrelations between research concepts and dominant spatial imaginaries of useful knowledge: such a connection tends to legitimise current practices uncritically and might lead to a lack of awareness of alternatives. This applies both to images of isolated academic research and for the maligned 'commodification of scientific research' at the science park. But instead of opposing this 'naturalistic tendency' in science studies with a normative philosophical approach about 'good science', as Hans Radder proposes, I have advanced above all a critical empirical method to map shifting political-epistemic coalitions

723 Hans Radder, "The Commodification of Academic Research," in *The Commodification of Academic Research: Science and the Modern University* (Pittsburgh, PA: University of Pittsburgh Press, 2010), 2.

and utility concepts in specific spatial settings.[723] Both the exclusion and inclusion of non-academic actors, as well as the drawing and blurring of purified boundaries between science and society, can come to the fore as relevant factors in the organisation of research and thus the shaping of possible knowledges. Further work could explore in more detail the feedback loops between places, policies and theories of useful knowledge production and exchange.

From my critical empirical approach to the spatiality and utility of scientific research, it follows that no two sites of scientific research are the same, even when imitation is purposively attempted. In a stronger sense, I advocate spatial pluralism and heterogeneity in the organisation of useful scientific practices; some places should dare to become or remain different. Alternative organisation of the relations around scientific research, to transform the significance and possible knowledge of specific fields, requires new spatial imaginaries. A main result of this dissertation is that in science, society and politics alike, virtual utility spots are productive: they bring together diverse actors to imagine what new kinds of knowledge are possible, where these should be organised and in what way. Just like spatial models, abstractions of real places, travelled the world, concrete abstractions of virtual places, or utopias, should be proposed to proceed towards alternative forms of knowledge productions. Actually, spatial imaginaries can be considered to lie at the root of science policy: the main progenitor of the utility of modern science, Francis Bacon, also produced the 'first report on science policy … written as a fable'.[724] His utopian novel *New Atlantis*, of 1627, describes a group of European explorers who, by coincidence, arrive at an 'undiscovered' island where they disembark in the city of Bensalem to learn about the scientifically advanced society. The visitors are especially awed by the island's most powerful institution, the House of Solomon, which resembled Bacon's ideal of science: a highly organised, scientific community that cooperatively produced new phenomena and control over nature, so as to produce 'things of use and practice for man's life'.[725]

New Atlantis relates to the history of utility spots in two ways. Firstly, Bacon's philosophy of science policy, forcefully summarised as utopia, arguably informed the organisation as well as the ethos of modern science, starting with the Royal Society of London. Secondly, many scientists as well as historical and philosophical analysts of science in the last four centuries have reinterpreted and referred to this spatial model. On that level, the historical hermeneutics of *New Atlantis* allows one to follow changing appreciations of Solomon's House as utility spot. This works especially well, because many use the spatial model in comparison with their

724 Kitcher, *Science, Truth, and Democracy*, 137–46.

725 Francis Bacon, *New Atlantis and The Great Instauration* (Wheeling, IL: Harlan Davidson, 1989).

contemporary situation: in relation to the military use of science, for example with the use of the atomic bombs in the 1940s or the criticism of the military-industrial complex in the 1970s, Bacon's utopia was a premonition of the shortcomings of the social responsibility of a science without public safeguards;[726] or in the golden age of basic research in the 1960s it represented the isolation of the college, the autonomy of the scholars and the lack of attention for knowledge transfer.[727] Later scholars who historicised *New Atlantis* as well as its interpreters found space for criticism of the imperialist, elitist or capitalist assumptions in this spatial model of knowledge production.[728] In its own times and to this day, *New Atlantis* has functioned as spatial imaginary of useful scientific research.

The elitist imagination of *New Atlantis* isolated scholars from a society that appeared to have extensive, and grounded, trust in their utility and responsibility. This is an image that has repeatedly appeared also in twentieth-century organisation of science and has as often been challenged by niche-like utility spots. Ultimately, we should wonder not only who are, and should be, involved in the practice of research, but also who we want to imagine what spatial alternatives for significant science might exist. Do we leave this to elite think-tanks, policy officers, and university governors, as in the first decades after the Second World War, or to local business communities, entrepreneurial professors and management consultants, as was more typical from the 1980s onwards? Following Bacon, utopian fiction might be an inspiring resource to re-think knowledge production beyond a mere extrapolation, and thereby legitimation, of the present. As my spatio-historical approach to utility highlighted also the importance of virtual proposals for the place of scientific research in society, I would like to propose (speculative) science fiction as a potential field for further study. This art form namely produces 'new environments that arouse wonder', in which geographical and architectural aspects self-evidently receive elaboration. The unnaturalistic portrayal of worlds and knowledges produces *cognitive estrangement* which opens a space for reflection and critical thought.[729] These fictional utility spots could prove to be rich resources for both future speculations and historical understanding, as these works of art both express the concerns of their times and stretch the boundaries of the possible. Ultimately, science fiction can arouse in the reader an experience of the historical contingency of present science and society, as well as its geographical relations.

To make such future inquiries and speculations possible, I present an updated definition of the utility spot concept that includes the central theoretical and empirical findings that I have presented in this dissertation:

726 Robert P. Adams, "The Social Responsibilities of Science in Utopia, New Atlantis and After," *Journal of the History of Ideas*, 10, no. 3 (1949): 374–398. Judah Bierman, "New Atlantis Revisited," *Studies in the Literary Imagination* 4, no. 1 (1971): 121–41.

727 Judah Bierman, "Science and Society in the New Atlantis and Other Renaissance Utopias," *Publications of the Modern Language Association of America*, 1963, 492–500.

728 Denise Albanese, "The New Atlantis and the Uses of Utopia," *ELH* 57, no. 3 (1990): 503–528; Attie, "Selling Science."

729 James Kneale and Rob Kitchin, *Lost in Space: Geographies of Science Fiction* (London: Continuum, 2002); Matthew W. Wilson, "Cyborg Geographies: Towards Hybrid Epistemologies." *Gender, Place and Culture* 16, no. 5 (2009): 499–516.

> Utility spots consist of **actual and virtual** spatial arrangements that facilitate and stimulate the political-epistemic interactions between heterogeneous actors, which actively shape the significance of research, with the public aim of creating and circulating useful scientific knowledge. They **emerge at the intersection** of international ideals, national policy and local contingencies, where they **function as distorting mirrors** that reflect current problems and provide speculative solutions.

The power of place and fiction intersect in spatial imaginaries of the science-society relationship. Both policy plans and science fiction offer a window on historical varieties of the organisation of useful research, but only the latter also provide the speculative potential to imagine the world otherwise.