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**Abstract:**

The importance of commons in the “hidden integration of Europe” during the 19<sup>th</sup> and 20<sup>th</sup> centuries has been chronically understated to say the least. This version of the introduction to a book that seeks to redress this neglect emphasizes how efforts to manage and conserve different kinds of transnational “common pool resources” have played a key role in European integration. It also takes the first steps in considering how technology plays a role in creating and managing commons and how commons theory might contribute to history of technology. Finally the book’s chapters are summarily described under four section headings: spaces, flows, infrastructures, and information.

**PLEASE NOTE:**

The text that follows is an intermediate version of the introduction to a book currently being written by the Eurocommons “shadow project” of the Inventing Europe program. This version is a rewrite based on extensive discussion at a project meeting at the University of Lisbon in May 2009.

It should be emphasized that this text is a snapshot of an ongoing process and that the current version of the introduction extrapolates significantly from this document. Nonetheless it contains a number of important insights and provides a general sense of where our project is heading.

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Cornelis Disco  
Eda Kranakis  
editors

## **NEW INDUSTRIAL COMMONS IN EUROPE**

**Introduction - version May 27, 2009**

- 1) keep the dual focus:**
  - a) on making and sustaining transnational commons as part of “hidden integration of Europe” over long duree.**
  - b) on the key role of science and technology in this commons-making process.**
  - c) value added for history of technology of commons approach**
- 2) introduce idea of “industrial” commons as historical phase of commons making between traditional local community commons and the current explosion of digital commons. Commons (and commons research) has practical history antedating current information commons hype. between Elinor and Linus.**
- 3) sharpen the definition of transnational commons by including explicit discussion of how resources may be organized in different property regimes and by explicating the role of the state as commoner in relation to other actors. State as arbitrator and representative. State as mitigator of risk.**
- 4) historicize commons-making and the role of technology by seeing the making of TC as an emergent solution to perceived problems of suboptimal or risky use of resources. Technologies and transnational coordination improve efficiencies and/or safety. Turning the wasteland into a resource.**
- 5) Theorize the forces holding a commons together: expectations, moral economy, punishments for deviance or abuse. Look for pirates and punishments. What is the place of technologies of surveillance, control, punishment?**
- 6) say more about managing risk and the specific notion of risk commons.**
- 7) articulate the specific nature of TCs on the basis of resources embedded in specifically spaces, flows, infrastructures and information.**

### **Introduction: Transnational Commons in Europe**

Europe’s commons are pillars of the lived experience of integration; they are also associated with multilevel, transnational governance regimes that have in many cases predated the signposts of high political integration. More than a century before the birth of the Common Market and other heralded structures of European political integration, four of the six states that would later form the EEC created an international organization to govern navigation of the Rhine River. It remains the oldest extant intergovernmental organization in the world.<sup>i</sup> And decades before Communism collapsed and Eastern European states started joining the EU, East and West Europe were already interlinked through shared use (and abuse) of transnational commons. A continuous flow of music and ideas circulated through the Iron Curtain by way of Europe’s etherspace commons, while a cooperative system of airspace governance allowed civil aircraft to fly regularly between cities on opposite sides of the Iron Curtain. These commons-mediated flows, and the cooperative regimes that made them possible, laid the groundwork for subsequent political change.<sup>ii</sup> On the abuse side, the Chernobyl disaster, which caused radiation to drift far beyond both the USSR and the Iron Curtain, engendered a host of new transnational efforts to monitor and control such risks, adding to the existing regime of governance of transboundary air pollution. The list could go on. European commons are surprising in number, diversity, and in

the variety of their uses. Yet in many cases, the transnational regimes that govern these commons—that allow them to function beneficially while helping minimize collective risks associated with their use—remain invisible to most Europeans.<sup>iii</sup> Nevertheless, Europeans make use of them every day, whether to enjoy a Portuguese wine in Norway, attend Fashion Week in Berlin, fill the Fiat’s gas tank with petrol from the North Sea, prepare for a weekend of good or bad weather, listen to the latest hits on the radio, get some Greek sun after an Estonian winter, or fill a glass in the Netherlands with potable tap water that has flowed down the Rhine from Switzerland. The EU’s ‘Single European Space’ depends immeasurably on the transnational governance of European commons. In our view, commons are the authentic building blocks of European integration.

This volume seeks to bring these sometimes obscure, frequently camouflaged commons regimes into the spotlight, to explore connections between European commons, the integration process, and the broader trend of globalization. To accomplish this aim, this book will have to engage with two discourses: first, the theory and history of European integration by showing that European integration has fundamentally embodied a quest to find sustainable, peaceful means to govern shared resources and manage common risks;<sup>iv</sup> and second, commons scholarship by showing that the study of commons must extend to the transnational, technology-influenced commons that dominate industrialized societies like Europe. In fact, the former critique presupposes the latter. To understand European integration as a history of building and sustaining commons, we must revise standard approaches to commons, which tend to focus either on commons in the setting of traditional local communities or on the new global post-modern information commons, and hence lack a perception of commons as a regional, transnational, phenomenon and as an essential part of 19<sup>th</sup> and 20<sup>th</sup> century industrial society. Our “industrial commons;” like the border-spanning flows of raw materials, capital, labor and knowledge that made industrial society itself possible; are inherently *regional* formations - i.e. transnational without necessarily being global. This also forces us to break out of the mold of seeing only people (individuals) as commoners, with states performing only as legal guarantors of rights and contracts. In this book, in contrast, European nation-states themselves often figure as the salient commoners in transnational commons of diverse scope. While doing so they willy-nilly produce new *Leviathans*—new centers of power, action, and authority—in the form of transnational or even European rules, treaties, institutions and agencies.

Our view of the history of European integration as a process of technologically shaped, transnational commons-making is at root inspired by the observation that Europe’s nation states are small compared to the scale of the geomorphologic features and emergent technological infrastructures which have come to harbor and distribute the continent’s resources. Consequently, these features and networks (and particularly the resources and risks embedded in them) have often been claimed by several nation states simultaneously. Big rivers like the Rhine and Danube, interstitial seas like the Baltic and North Seas, air, airwaves and airspace, gene stocks, weather systems, electricity grids and peripheral spaces like the Arctic, have been – at least in Europe – too big, diffuse or mobile for any single state to monopolize them as national resources. The use (and abuse) of these resources rapidly became hotspots of international contestation which has in the long run – despite catastrophic “hot” wars and a prolonged Cold War – encouraged cooperation in constructing transnational “common resource regimes.”

This book is far from professing an “Edenic” notion of commons, i.e. the trope of commons as some originary “state of nature” which modernity has despoiled.<sup>v</sup> This pathos is endemic to much commons scholarship, and it has tended to restrict research on commons to

traditional, local and non-urban communities, with the result that some of the most politically, economically, and socially important commons of contemporary society have been largely ignored or inadequately analyzed by commons scholars. In our view commons are made, not born. Of course it is possible to imagine a pristine entity—like a sea—as it might have existed in pre-human times. But in the human world, a commons implies commoners (users), and usage patterns which continually evolve and always depend on technology and organization. In some cases, like the radio frequency spectrum, a commons has no meaningful existence for humans before the technology to exploit it emerges. Moreover, commons, whether common property regimes or other forms of open access to resources, are always strenuous achievements, prone to disruption, even when they are “embedded” in cultural traditions and laws. This applies *a fortiori* to transnational commons in Europe. Even where European political and physical geography placed a premium on creating arrangements among nations for regulating international access to common resources, there have been no fixed prescriptions or outcomes. A commons – especially a transnational commons – is never simply a default arrangement, a self-evident one best way, but always an agonistic accomplishment requiring continual upkeep.

### **Technology in history of commons - commons in history of technology**

It is hard to overemphasize how important technologies and their associated knowledges are in the making, upkeep and of course the unmaking of commons. As a principle this is hardly contested in mainstream commons scholarship, even though in practice it has still received short shrift. And while this failing too is recognized, the recognition in itself does not yet seem to have generated a transcendent impulse. So, we see “technological change” being characterized in 2002 by the editors of watershed volume in commons research as “an important part of the context of resource management institutions” and as not being “exogenous to social institutions.” At the same time it is also listed prominently in a list of “Key Understudied Issues.” (Ostrom et al. 2002) The diagnosis is made again in 2006 in *The Commons Digest*, now emphasizing the constitutive role of technologies in literally producing *common* resources:

One of the findings in the study of new types of commons is that the introduction of new technologies can play a huge role in the robustness or vulnerability of a commons. New technologies can enable the capture of what were once free and open public goods. This has been the case with the development of most “global commons,” such as the deep seas, the atmosphere, and outer space, for example. This ability to capture the previously uncapturable creates a fundamental change in the nature of the resource, with the resource being converted from a nonrivalrous nonexclusionary public good into a common-pool resource that needs to be managed, monitored, and protected in order to ensure sustainability and preservation. (Hess and Meinzen-Dick 2006)

so history of technology with its constructivist leanings is an important resource.

HERE A SECTION ON IMPORTANCE OF COMMONS TO HISTORY OF TECHNOLOGY

## Conceptual Foundations: On Commons and Resources

What is a commons? Though definitions vary widely, the bottom line is a regime of “open access” to a given resource for some designated set of commoners. This right of access is inherent to membership in some “community” of commoners. In a commons, no member of the community may be (or perhaps can be) *a priori* excluded from deriving a just share of value from the (common) resource. It is important to note, however, that “open access” does not in practice mean completely free and unhindered access. There may well be costs to access a commons (a deep-sea fisherman must have a boat), and there may be various, necessary usage restrictions placed on commons. In the case of airspace, for example, licenses and approvals are required to access the commons, for safety reasons. But in principle these cannot amount to a form of monopolization of access. The specific parameters of open access may be rooted in tradition, in laws, or in the very nature of the resource relative to the technological state of the art.

There is a long and involved relationship between notions of “property” and commons. In the simplest version, “common property” is seen as the antithesis of “private property.” Instead of the canonic liberal idea of private property as the unfettered exclusive right to “rivalrous” use of some good, common property is defined by unfettered open access to some good by a definite set of “common owners.”<sup>vi</sup> Whereas a private owner can exclude others from access to the benefits of his or her property, i.e. claim these benefits as sole beneficiary, common property is necessarily open to all “commoners” to use or abuse as they see fit. This, as the story goes, leaves common property – particularly of the “subtractable” kind – open to all kinds of degenerative dilemmas.<sup>vii</sup> This simple story has serious shortcomings which plagued early debates in the field, but which have since been articulated in more recent commons literature. (Hardin 1968);(Ostrom et al. 2002); (Ostrom 1977); (Rose 1986); (Frischmann 2005).

In 2006, after four years of vigorous debate, the members of the *International Association for the Study of Common Property* (founded in 1989) voted to drop the “P” and change the association’s name to the *International Association for the Study of Commons*. At the same time, the association’s quarterly was renamed from *The Common Property Resource Digest* to simply *The Commons Digest*. The move away from property as the defining criterion for commons was justified in the light of new insights into the variety of commons and especially of regimes regulating use and access. It was recognized that “property” regimes, whether private, public, or “common” were only one of the modes whereby access to and use of resources were regulated. And it was precisely this *regulation* of access and use that came to be recognized as the core of a sustainable commons. Property rights themselves, for that matter, were increasingly seen to define shared resources in multiple and ambiguous ways, being applicable, for example, to underlying resources and to their “harvests” in different ways.

In this volume we therefore adopt a supple stance on “property.” The key underlying criterion for a commons is therefore not “common ownership” as such, but the much more general notions of controlling *access* to a resource and establishing and enforcing *norms for its use*. (Frischmann 2005) To be sure, access to and use of resources can be, and often are, regulated by property rights, but they can also be regulated by such binding forces as custom, political power, notions of reciprocity and fair play (a moral economy), sovereignty claims, contracts or treaties. Grounding commons in these more generic types of institutions not only enables us to think about commons at scales larger than the local community, it also frees discourse on commons from the liberal stranglehold of private property as the default mode of regulating access to societal resources. From this point of view, ambiguously political-economic

concepts like “disposition” or “dominion” are much preferable to “property.”

We understand “resources” in a relatively straightforward way as means for producing societal and economic use-values. Resources are diverse, ranging from conventional natural resources like, air, fertile soil, the experience of pristine solitude, deposits of hydrocarbon fuels, or forests to more hybrid constructions like navigable rivers, hydropower, the ether, the internet, gene banks, or weather reports. Some resources are simply raw materials that can be more or less directly used in the production of commodities. Others require considerable labor, processing, parallel construction, or organization before they can produce value. Still others are infrastructures in the sense that they themselves first have to be constructed before they can be harnessed to the production of a whole host of “downstream” values.<sup>viii</sup> In all cases, however, whether a thing is a resource or not depends on the social and historical context. In any society, there is a circumscribed set of needs as well as a specific capacity to actuate resources to satisfy needs. Resources, in other words, are socially constructed through time, albeit not arbitrarily so. Uranium ore only became a resource when social needs like atomic bombs and nuclear energy were recognized and could be materially addressed.

Resources are in varying measure scarce, or can become scarce, always relative to a given level of demand. This feature makes resources interesting both as objects of privatization and as targets for societal management. They are interesting as objects of privatization because excessive scarcity (with as a limit monopolization) tends to increase the rents accruing to the owner. They are interesting as objects of societal management precisely in order to prevent the excessive dependencies and skewed accumulations of wealth that monopolization brings with it. For some resources, like the air or the fish in the sea, scarcity was never an issue and neither privatization nor societal management was considered relevant. Everyone had access to the “public good” of (clean) air and it was consequently as near a “natural commons” as could be imagined. But this was not the case for a myriad of other resources burdened with greater or lesser degrees of scarcity. In such cases, it was a matter of social strife whether resources would be exploited under a regime of “open access” or of “privatization.” In any case, scarcity presupposed a complex set of legal, economic and political institutions to regulate access to the resources. The outcome might be “open access,” even if hemmed in by all kinds of rules and regulations aimed at sustaining the resource (to prevent it from becoming even more scarce or disappearing altogether) – for example the rules governing access to and use of wilderness preserves. But the outcome might equally be privatization or some hybrid form like public ownership, which not only produced rents, but precisely for this reason might also motivate the owners to engage in sustainable practices.

The question of scarcity and the management of resources also ties into another feature of resources, namely their spatiality. [i.e. commons are more than infrastructures, especially spaces and “natural” flows] This aspect is particularly salient for the thesis of this book. Like different degrees of scarcity, the particular spatiality or geography of a resource may be conducive to either privatization, public ownership or to open access. It is evident that in a crowded continent like Europe, where territory has been parcelled up into a great number of relatively small states and markets, the geography of resources creates gradients of abundance and scarcity across nations. These gradients can either foster competition and conflict, or cooperation and common access. It is our contention that despite ruinous examples of the former, the latter tendency has also doggedly grubbed away like Marx’s old mole—less visible to the casual observer, but with ever growing depth and breadth—to become embedded in a plethora of European institutions that not only regulate common access to many of the continent’s resources but also produce new

ones in the form of transnational infrastructures.

It comes down to this. What has evolved into Europe once started out as a geographical space endowed with physical features that had the potential to become resources (or threats). As societies developed, the geographical space was divided and re-divided by states and markets; some of this followed the spatial logic of resources like water and waterways, comfortable gradients through the landscape, forests, harbors etc. For the rest, the accidents of politics and history now lie like a random jigsaw puzzle of borders and trade routes on top of the geography of (emergent) resources. Because many (though by no means all) of the resources are physically large compared to the states – though less so in respect to the markets which tend to transcend national borders – there are numerous instances in which different states can either compete or cooperate in accessing resources. The average size of sovereign states compared to many of the continent's resources is manifestly nowhere as small as in Europe and the consequent prevalence of transnational-scale resources alone goes a long way toward explaining both Europe's dismal record of internal conflict as well as its simultaneously advanced state of economic, cultural, and political integration.

Many of these resources were of a local, situated, nature and could be easily monopolized by local inhabitants or states. Resources like ore and mineral deposits, energy sources, riverbanks, natural harbors, forests, game and raw materials generally fit into this mold. Some resources were not, however, easily monopolized by locals at all. Some of them have been too mobile or ubiquitous to be associated with any definable space: marine and riverine fish stocks as well as air have defied assignment to any specific locality or group of users. Yet other resources have been so physically extensive that they are in themselves continental features, transcending localities and even regions: examples are a number of international seas: the North, Baltic, Mediterranean and Black Seas; major rivers; airspace; the ether, gene stocks; and technological knowledge.

[now section on sovereignty and transnational commons.]

### **“Inverted” Commons**

Aside from stretching the idea of resources beyond the traditional scope of commons research, i.e. into the realm of what have been called “new commons,” rooted more profoundly in technology and knowledge, we are also interested in looking at close, though perhaps estranged, cousins of open access commons regimes, like “anticommons” and what we call “risk commons.” What is their role in the checkered process of European integration? Anticommons have come out of the closet since Michael Heller's discussion of Moscow storefronts in the transition from “Marx to markets.”<sup>ix</sup> The basic idea is that multiple ownership – “dominion” might be a more inclusive concept – of a resource need not result in open access and the efficient realization of social value. Multiple dominion can also lead to total paralysis and utter failure to realize value. In the case of the Moscow storefronts, legal rights over storefront properties were diffused among multiple owners in such a way that each of the numerous “players” had the ability to prevent others from extracting value from the resource. So in this case multiple dominion became a structural weakness rather than a value-generating asset. This is recognizable as a pattern at the transnational level as well. For example, claims to territorial integrity threatened to hinder the development of a European airspace attuned to the developing technological capabilities of aircraft. Similarly, “Robber barons” along the Rhine, each claiming dominion over a stretch of the river and extracting tolls from passing ships by force, long hindered the full realization of the river as a valuable transnational shipping artery. Though



these two examples had “happy endings,” numerous anticommons have plagued and still plague European integration, which make them important phenomena to be considered.

We would also like to explore a second inversion of the classical idea of commons: those based not on resources, but rather on risks. Here, we are tempted to say, the situation is one of “open access” or more correctly, “open exposure” to risks. A risk commons is not about the extraction of value from a collective resource, but about avoiding costs in the face of a collective risk. What we have in mind are risks relating primarily to flows that either follow “natural” features like rivers, or ocean and air currents, or that are borne by “artificial” channels like infrastructures, whether material or informational. Pollution, overload (e.g. anything from flooding to power outages and website attacks), and under-utilization are some of the risks involved here. While these can be addressed to some degree at local and national levels, again, Europe’s modest political scale rapidly turns these into transnational problems. The thesis is that European integration has been fostered not only by the pursuit of value inherent in common resources, but also by the pursuit of cost-avoidance in the face of common risks. Just like conventional commons, risk commons like the flood management programs on the Rhine or the fight against “acid rain,” were socially constructed and have required intensive political and technological effort for their creation and maintenance.

## **Technology**

While we want to expand on the theme of “commons” by including anti-commons and risk commons in our analysis, we also want to contribute to developing new resources for the study of commons, specifically a focus on technology as a constitutive factor in all kinds of commons. This has been a relatively neglected *explanans* in commons studies up till now, even though technology does frequently appear as a *deus ex machina* to fill in some blank spaces, but without questioning the fact or forms of its existence or the particular ways it is used. Given the crucial role of technologies in defining and exploiting resources as well as in the quotidian management of sustainable commons, the lack of attention in mainstream commons research is surprising. In order to indicate where we think technology fits in, a brief excursion into contemporary commons theory is necessary.

“Commons” or “common resources” are currently defined as resources for which exclusion is impossible or extremely costly. Any member of a community can use them. Private or public resources, by contrast, allow for easy exclusion. Only the legal owner is entitled by law to enjoy the benefits (or hold them in trust for others to enjoy). These two extreme “access” conditions are the poles of an “entitlement” axis. A second axis orthogonal to the first is defined by the degree of “subtractability,” i.e. the degree to which the resource is depleted or damaged by use. The extreme poles of this second axis are “public goods” which are regarded as limitless and impervious to the wear and tear of use (e.g. the air in former days) and “common pool resources” which are “subtractable,” i.e. consumed or damaged by use and hence vulnerable to degradation and depletion when they are overused or inadequately maintained (oil, fish, internet, Alpine meadows, the arctic, airspace).<sup>x</sup> Recent commons scholarship acknowledges that resources can in fact move along these axes through time, depending on shifts in entitlements and subtractability. The most tragedy-prone type of resources are those classically described by Garret Hardin: “common pool resources,” but though the term itself is of later date. “Common pool resources” are open access but also subtractable. Conventional wisdom now says that there are two possible routes of escape from tragedy in the case of common pool resources: either alter the conditions of entitlement to the resource, i.e. regulate access, or alter the terms of its

subtractability, i.e. regulate use. Again, mainstream commons scholarship has concentrated on cultural, political and legal possibilities for effecting these escapes and has virtually ignored technology.

However, newer trends in commons scholarship have perforce begun revising the existing parochial view of the role of technologies. That said, it is also evident that no coherent perspective has as yet emerged. In an important watershed volume published in 2002, “technological change” is listed as one of the “Key Understudied Issues.” It is ruefully noted that “technological change is an important part of the context of resource management institutions” and, sagely, that “technological change is not exogenous to social institutions.”<sup>xi</sup> Contemporary histories of technology – and the authors of this book – have long been committed to “contextual” and “constructivist” approaches that view technologies as inherently social (and economic and political phenomena).

We see technology as having basically three different roles in the constitution and management of commons. First, technologies are the medium through which natural phenomena become resources in the first place. Airspace became a mobility resource only after aircraft became capable of regular flights; weather reports became a resource only after measurement technologies and communications networks could guarantee reliable predictions, and people could organize their activities on the basis of this trust. In many cases, the technical infrastructures that allow commons to develop and function exist parallel to the commons themselves. Radios and radio transmitters are not in the etherspace commons, but the latter could not function without them. Likewise, key structures that control the use of airspace, notably airports, are not technically part of airspace, although legally they often function as if they are.

Second, technologies (but also scientific knowledge) have been instrumental in moving common resources along the “subtractability” axis, i.e. in the first place in transforming limitless “public goods” into scarce and threatened “common pool resources.” This had an “objective” and a “subjective” modality. “Improved” technologies of exploitation objectively increased pressure on public goods by increasing crowding and degradation of resources. More capacious and faster ski-lifts in the Alps inevitably hastened the destruction of Alpine slopes. The mechanization of offshore fisheries and new technologies for the localization and conservation of fish have transformed marine fish populations from inexhaustible “public goods” to worrisome and non-renewable “common pool resources.” On the “subjective” side, improved scientific models and more subtle measurement techniques made people aware that resources previously thought to be public goods were in fact limited and vulnerable common pool resources. The “discovery” of transnational air pollution is a case in point.

Third, technologies have been crucial components of all regimes to regulate access to (entitlement) and use (subtractability) of problematic common pool resources, i.e. of all reflexive strategies to escape tragedies of the commons. Technologies of monitoring, surveillance and apprehension are crucial for regulating access to commons, that is, for enforcing authoritative regimes of limited entitlement. Counter-technologies of stealth and evasion may also be cultivated, of course, by those with no interest in the prevailing order, resulting in a kind of “arms race.” Likewise, manipulating the subtractability of a common pool resource to mitigate tragic outcomes is heavily dependent on innovations in technologies of exploitation. For example new flight control technologies have consistently allowed closer spacing of airplanes in air corridors and around airports, hence effectively increasing the capacity of the local airspace commons and effectively reducing crowding and the risk of accidents.

In sum, even a cursory examination makes evident that technology has figured ubiquitously in the creation, exploitation, and management of European and global commons, and in the evolution of their accessibility and subtractability characteristics. The studies in this volume will begin to delineate technology's roles in this regard with greater clarity and precision.

### **Spaces, Flows, Infrastructures, Information**

Our book is divided into four main sections, each highlighting and exploring a particular facet, variety, or feature of European commons. Part one, "Spaces", looks at two multifunctional, spatial commons, the Arctic and the North Sea. "The Uncommon Arctic" by Bruce Hevly, explores tensions surrounding control of the Arctic, focusing on the Spitzbergen Archipelago. The League of Nations granted Norway conditional sovereignty over the sharply contested region in 1925, and its history manifests the tensions that accompanied the creation of an Arctic commons. In particular, Hevly examines tensions involving the roles of technology, scientific knowledge, and national vs. international authority in governing the Spitzbergen region during three key periods: 1) the interwar period of nationalist control by Norway; 2) Norway's postwar management of its Arctic realm within the framework of NATO alliances; and 3) the most recent period of resource exploitation within a global ocean governance regime.

In "Changing Technology, Changing Commons: Freight, Fish and Oil in the North Sea," Håkon W. Andersen takes up the theme of technology as an element of resource creation and commons management. The North Sea, which has long been a rich resource for its bordering countries, comprises at least three different commons connecting economic activity, technological knowledge, and national policies across the region. Andersen analyzes the North Sea as fishing commons, transport commons, and "mining" commons (oil and gas), exploring how technology and knowledge have shaped the evolution, use, interaction, and governance of these commons, and highlighting some of the key tensions that have accompanied these developments.

Part two, "Flows," looks at flow commons—the Rhine River, the Vuoksi River, and airspace as a pollution flow zone—exploring these flow commons particularly as objects of risk management or resource development, but also as contested sites of ecological meaning. Nil Disco considers the multiple threats and resource possibilities of the Rhine River in "Fish, Floods and Phenol. Managing the Rhine as a Common Threat and Resource. 1800-2000." The Rhine stretches through and along several northwest European countries on its course to the sea. Using its resources and managing its threats inevitably involve the nations of its watershed in complicated commons dynamics, characterized by upstream-downstream asymmetries, issue linkage and by a central role for technologies and shared knowledge of the river. Disco describes these dynamics as they pertain to riverine fishing, flood management and pollution control.

Kristiina Korjonen-Kuusipuro, in "Myths and Power: Narratives of the Vuoksi river," considers the example of a river that was not always a transnational commons. The Vuoksi River runs a course of 150 kilometers, from Finland to Russia, and today it is a transnational resource with four power plants, but before 1945 it belonged to Finland and was part of a strong nation-building process of a young state. Korjonen-Kuusipuro focuses on the national and ecological mythologies that attached to the Vuoksi. She explores the relationship among the different, competing narratives or "myths" of the Vuoksi River as a pristine commons, an Eden; as an emblem of the nation-state (the Finnish Ruhr); and as a transnational ecological space.

These competing and conflicting myths are explored in relation to the changing political economy of the river, and particularly the fundamental change of 1945, when Finland ceded most of the river valley to the Soviet Union.

In the final chapter of this section, “Under Acid Skies: Negotiating Air-Borne Pollution in Europe,” Arne Kaijser investigates the “discovery” and mapping of long-range transboundary air pollution flows in Europe in the 1960s and 1970s, as well as the international negotiations leading to the Geneva Convention on Long-range Transboundary Air Pollution, signed in 1979. Kaijser’s analysis considers the role of scientific knowledge in defining a new “risk commons” through scientific analysis of the spread and impact of air pollution. He also looks at the role of technology in managing and decreasing this risk through pollution abatement.

Part three, “Infrastructures,” considers two examples of commons that emerged in a practical sense, as resources, through technological change: airspace (as transport medium) and etherspace (the radio frequency spectrum). “Fights or Flights? National Sovereignty and the Emergence of a European Airspace Commons, 1919-2008” explores the creation and governance of one of the defining locations of 20th century European mobility: airspace. Although usually considered merely as empty space beyond human society, the airspace commons has played a significant role in making the “single European space” a reality. In strict legal terms, European airspace was not a transnational commons, because each nation-state claimed absolute sovereignty over its airspace. However, the value of airspace as a mobility resource required a transnational system of use and governance, both of which emerged following WWI. Eda Kranakis traces the major stages in the development of this commons, its system of transnational governance, and the role of technology in exploiting and managing this commons as well as in minimizing the risks associated with its use.

Like airspace, the radio spectrum is a natural resource accessible only through technology. In “Invisible with Global Reach: Radio Spectrum for Broadcasting in Europe,” Nina Wormbs discusses the spectrum as a commons by examining frequency plans for broadcasting in Europe between the wars, an activity that resulted in a spectrum regime fundamentally different from the US one. The European radio station boom of the 1920s resulted in unwanted interference and chaos because the reach of medium, long and later short wave broadcasting extended beyond national frontiers. The need for transnational regulation was therefore urgent. Although “efficiency” has often been held synonymous with market solutions, this case shows an alternative way of managing this resource, one that resonates with today’s “idealism”, manifested, e.g., in Webb 2.0, open source and the Creative Commons movement.

The final section of the book, “Knowledge,” analyzes knowledge-based commons or commons that depend on advanced knowledge systems. Tiago Saraiva looks at the interaction between technology, farming practices, and the emergence of genebanks in “Banking the Commons: Genebanks, Crop Diversity and European Food Supply.” The opening in 2008 of the Global Seed Vault inside an arctic mountain was intended to save crop diversity from natural and human-made disasters. In spite of its futuristic image, this green version of Noah’s ark has a genealogy dating back to national collections developed in the first decades of the twentieth century. The new Arctic infrastructure now promises viable management and preservation of the genepool commons, but ironically, these very gene banks are also implicated in the erosion of crop diversity in European fields, since they have also supported the design of highly productive varieties that replaced local landraces. By tracing the history of European gene banks, Saraiva is able to follow the different interactions between technology, knowledge, and commons at the

national, European and global scales, and to offer insight into the crucial role of technology in saving, managing and destroying the commons.

While Saraiva's study explores a "natural" commons whose perceived need for risk management was created by advanced knowledge systems (knowledge of genetics and genetic manipulation techniques), Karl-Erik Michelsen, takes up the case of a bonafide knowledge commons in "'It is Not the Wind, Not the Flag, but Mind That is Moving'—Weather Information as Knowledge Commons." Information required for weather forecasts is built from a complex system of scientific information that is collected 24/7 around the globe by high-technology instruments and processed by super computers in certified weather stations. Before the collected data is turned into weather forecasts, it is 'translated' by experts into a common symbolic language, which is then relayed via modern media to a diverse range of users. Michelsen argues that the concept of commons helps to conceptualize problems that have been observed in the evolution of credible weather forecasting. His study traces the history of this crucial knowledge commons over the twentieth century, exploring the role of science, technology, and national and international politics and regulation in this development.

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<sup>i</sup> According to its website, at: <http://www.ccr-zkr.org/>.

<sup>ii</sup> Gorbachev once asserted that music—specifically the Beatles—“more than any religion, more than Vietnam or any war or nuclear bomb” constituted “the single most important reason” for the end of the Cold War. The point is that this music crossed the Iron Curtain primarily by way of the etherspace commons.

<sup>iii</sup> This thesis of a “hidden-integration” of Europe in which technological artifacts and networks play a key role is the Leitmotif of the “Tensions of Europe” project and the ESF-funded Eurocores project Inventing Europe. See (Misa and Schot 2005) for a programmatic statement. Published volumes exemplifying this approach include (Vleuten and Kaijser 2006; Hård and Misa 2008) (Oldenziel and Zachmann 2009).

<sup>iv</sup> (Rose 1986) (Frischmann 2005)

<sup>v</sup> Note that this trope is endemic in classical sociology, which was in some sense an intellectual effort to come to terms with the twin modernisms of the French Revolution and the industrial revolution. Durkheim’s organic vs. mechanical solidarity, Tönnies’ distinction between *Gemeinschaft* and *Gesellschaft*, Weber’s “Iron Cage” all express this biblical concept. Even Marx, the renegade sociologist, is not free of this pathos. In his writings he often exhibits a romanticized conception of traditional society held together by human bonds which the icy calculations of capitalism have rent asunder. [citations]

<sup>vi</sup> This is the view implicitly taken by Garret Hardin in his canonic formulation of the “tragedy of the commons” in which he focussed on abuse of shared property in the form of overuse and free riding. See (Hardin 1968). In response to critics he reformulated his position nearly a decade later, now focussing on management of common resources, rather than on the consequences of abstract property rights (Hardin and Baden 1977).

<sup>vii</sup> “Subtractability” refers to the condition whereby one actor’s use of a common resource (or common property) diminishes or “subtracts” from another actor’s use. I.e. the “pie” has a fixed volume and each user’s take diminishes what’s left for other users. See (Ostrom 1977).

<sup>viii</sup> (Frischmann 2005)

<sup>ix</sup> (Heller 1998).

<sup>x</sup> (Keohane and Ostrom 1995) Ostrom, 1977.

<sup>xi</sup> Ostrom et al., 2002: 477.