Chapter 13
Trading Plans

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One might think that architecture and planning are as far from the history, sociology, and philosophy of science as one could get. What could negotiations over construction in a wooden village in Tampere (Finland), contested parking spaces in Naples, and struggles over façade renovation in Mafia-confronted Bagheria (Sicily) possibly have to do with coordinating action and belief in science? A great deal—As the authors of this volume illustrate vividly through their exploration of city planning in twenty-first century Italy and Finland. Passageways between science studies and planning studies are subtle and productive—as it turns out, they began almost a hundred years ago.

In the hothouse environment of interwar Vienna, for instance, issues of science, planning, and philosophy entered hand in hand. Born in the aftermath of the hugely destructive Great War, Red Vienna, as it was soon known, had an unparalleled housing problem to solve—exacerbated by the cascade of rural population that descended on the capital along with disoriented and recently furloughed soldiers. Before 1917, Vienna, not Petersburg, was the city most socialists thought would be the first to lead a country to a revolution. By the war's end, Vienna was a turbulent political cauldron of conflicting socialisms, nationalisms, and ethnic-linguistic divides constantly threatening to rip the taped-together Habsburg Empire into fragments. With the peace accords, Vienna became the center of a rump version of the former empire. A world had collapsed, and ambitions to construct something fundamentally new—intellectual, political, and urban—ran riot.

In the midst of this world, a hodgepodge assembly of philosophically inclined thinkers began to make common cause. Their organizing center, the one truly certified philosopher, though one with very solid scientific credentials, was Moritz Schlick. Around him, forming what came to be known as the Vienna Circle, the beginning of modern philosophy of science, was the physicist-turned-philosopher/logician Rudolf

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Carnap, the sociologist-economist-philosopher Otto Neurath, and the mathematician-philosophers Hans Hahn and Philipp Frank, joined by others, ranging from a dubious Karl Popper to an even more uneasy ally opponent Ludwig Wittgenstein. It was a group whose left wing was as interested in Freudian psychoanalysis, the new sociology, and Austro-Marxism as it was in special relativity and relation of mind to brain. Out of their meetings came a manifesto, the *Wissenschaftliche Weltauffassung*, a stirring call for a nonphilosophical philosophy that would be broadly systematic and scientific, discarding traditional metaphysics like so much chaff while keeping the wheat of psychology, sociology, and physics (Galison 1990).

Though the original Circle had to flee Vienna or die, by the mid-twentieth century, analytic philosophy was not just ascendant; it had ascended in many countries. But in the United States and Britain, victory came at a price: the imported work was heralded as a model of technical, unpolitical philosophy. Generations of students were taught that logical positivism stood for the core of philosophy: the new predicate logic coupled with simple observation statements—a protective shield against nonsense. So I remember reading Carnap's *Logische Aufbau der Welt*, one of the most celebrated works of twentieth century philosophy, and being shocked by the preface. It begins, as one might expect, with the spirit of cleansing—here was a book to strike down the demon of metaphysics:

> We do not deceive ourselves about the fact that movements in metaphysical philosophy and religion which are critical of such [a scientific] orientation have again become very influential of late. Whence then our confidence that our call for clarity, for a science that is free from metaphysics, will be heard? It stems from the knowledge or, to put it somewhat more carefully, from the belief that these opposing powers belong to the past (Carnap 1928 [2003], p. xvii-xviii).

But then Carnap's Preface takes a sharp turn, one that, if you expect logic and scientific observations inexorably disported, is utterly surprising:

> We feel that there is an inner kinship between the attitude on which our philosophical work is founded and the intellectual attitude which presently manifests itself in entirely different walks of life; we feel this orientation in artistic movements, especially in architecture, and in movements which strive for meaningful forms of personal and collective life, of education, and of external organization in general. We feel all around us the same basic orientation, the same style of thinking and doing (Carnap 1928 [2003], p. xvii-xviii).

Carnap went on to say that this new orientation would be attentive both to detail and to the whole, to a search to instantiate a clarity everywhere, for the binding ties of society while granting freedom to the individual—all while recognizing that "the fabric of life can never quite be comprehended." "Our work," the somewhat dour if nonconformist minister's son Carnap concluded, "is carried by the faith that this attitude will win the future" (Carnap 1928 [2003], p. xvii-xviii). Otto Neurath was even more involved with architects and planners—on the board of a journal, "Der Aufbau," he and his colleagues wanted to clear the old, dark Vienna of horse-drawn carriages and gaslights, using engineering principles. They wanted more light, more common areas, and more engineering—Neurath personally was involved with a myriad of attempts to get communities to engage in the bottom-up renovation of their built world. Planning and philosophy of science may be closer than they appear.

Both Carnap and Neurath saw the built environment as an embodiment of all they stood for—a change in the form of life from hypocrisy, pointless decoration, and destructive ideologies to one built on rational, intelligible shared experience. In philosophy, though Schlick, Neurath, and Carnap disagreed about certain points, they concurred that they wanted to ground knowledge in immediate, scientific experience. Their enemy?—All that was nationalistic, spiritualist, and clerical as well as all that could not be shared, understood, and dispassionately evaluated. Their tools?—A stripped-down allowable vocabulary and syntax for reliable knowledge. Aiming to avoid phrases like "unity of the soul and Germaneness," they much preferred logical-empirical utterances of the form "if these electrodes spark, then smell of ozone in the generator plant, 12:45am." Here was a hunt for an anti-philosophical philosophy, a unified science, and a transnational form of language. Material politics was never far from the scene—in post-World War I Vienna, the battle was always engaged over who controlled the right way to grapple with mass housing, public transport, worker education, and public space; all the while, they engaged with the upheavals in science then underway. Communicative universalism was not for that inter-war generation an arcane piece of school philosophy. The Unity of Science movement, as it came to be known in the 1930s, was all at once a reorientation toward knowledge and an antifascist infrastructure.

On the other side, through the long 1960s, the study of science shifted unrecognizably. Logical positivism, in the 1920s hoisted as a banner of the Central European left, had become an established philosophy. Science itself in the 1960s felt to many in a new generation of Anglo-American students and faculty not a liberating secularism but instead the instrumental arm of weaponry. Whatever their own politics, Thomas S. Kuhn's *Structure of Scientific Revolutions* (1962) and Paul Feyerabend's *Against Method* (1975) by the 1970s were celebrated across the disciplines (anthropology, sociology, philosophy, history…). To many in those years, the new talk of rankless paradigms blasted the logical positivists, creating room for a new realm of equal, autonomous cultures of knowledge, without hierarchy or universal means of assessment. On the reading of Kuhn and Feyerabend, Einsteinian physics was not a better (more verified, more confirmable, more falsifiable) theory of physics than Newton's mechanics. Instead, two different scientific cultures spoke two incommensurable scientific languages: Einsteinian and Newtonian. Each picked out both its own concepts and its own experimental worlds. To say that the "space" and "time" spoken of by Newton (part of the sensorium of God) was the same or even a limiting form "space" and "time" uttered by Einstein (procedurally coordinated, identical clocks and rulers), was simply to pun. *Translation* between the theories of x and t might be possible, but it was as awkward and incomplete as translating a poem from Chinese to Dutch. So it was, too, in anthropology, where Clifford Geertz used the notion of "thick description" to point to the autonomy, equality, and fundamental otherness of cultures—to understand another culture was to grasp its intricate web of symbols, values, and meanings.

The contrasting pictures of scientific language were as different as they could be. While the logical positivists thought there could be one language of science—observations and their connections—universally intelligible protocol sentences logically arranged, the anti-positivists thought there was not even the possibility of

a single translation from one scientific theory to another. Both understood language as fundamental; both agreed that there was no direct access to the world without it. But the disposition of language was radically different. The logical positivists hoped communication could join sciences and peoples. Anti-positivists hoped the language specificity of science would model a liberating relativism: all or nothing, universalism or nominalism. For several decades, the battle continued. Indeed, it progressed to the point where a new generation of science studies work began to ask questions skew to what was becoming more an incantation about truth, relativism, and authority than a substantive engagement with the practice of science.

In the 1980s, my main aim was to develop an account of science (mainly physics) that would recognize that knowledge was not just a top-down affair run by different incommensurable theory and fact-checked by the lab (anti-positivism) nor building-up affair from observations (logical positivism). The Annales School and sociocultural historians seemed onto something when they recognized that changes in politics did not always coincide with shifts in social structure or cultural activities. My goal was to capture the knowledge-generating work of experimentalists and instrument makers as historians and sociologists had for centuries put on theorists. More precisely, I wanted to depict physics as having three very different, but coequal subcultures (patterns of handling practices, values, symbols, meanings)—without making experimental work merely a support or generating factory for theory. There would be theoretical practices—diagrammatic routines, for example, as well as practices of tracking and amplifying signals on the laboratory bench. In *How Experiments End* (Galison 1987), one point was to show how these varied practices of physics could be well understood by treating all three subcultures as epistemically equal. "Observation" was not first philosophy (logical positivism) nor were the fragmented paradigms of theory (anti-positivism).

Epistemic subcultures in overlapping periodization appeared to solve a problem that had long troubled me: the logical positivist program was clearly unfit to capture scientific practice—it woefully underestimated the weight of theory, reducing it to a mere summing up of observations. General relativity and quantum field theory were clearly far more than that. But the relativist anti-positivist program suggested that scientists lived in a fragmented world, while physicists felt the long continuity of their discipline. The anti-positivist metaphors, "ships passing in the night," "radical, translation," "religious conversion," and "Gestalt switches," seemed utterly incompetent to capture the felt experience of doing science. Indeed, Bohr and Einstein worked tirelessly to show precisely how the novel elements of their theory connected to theories before them—the idea of utter rupture felt imposed on the sciences from the outside.

The picture I was working on had these three subcultures, each finite, and each had its own breaks (no magic thread of observation to hold all together). But they were *intercalated*; the breaks at one level were sutured by the continuities at another. The central idea was that the continuity as a whole was formed out of finite bits, one layer of continuity covering breaks in another—the way fibers make up a string or the stones that compose the Great Wall of China.

So far, so good. But here was the rub. If experimentalists really did have different ways of coming to agreement than theorists (as I was arguing)—if the two groups really did have different convictions about the objects in the world (the ontological), how we got knowledge about them (the epistemological), and the laws that governed nature (the nomological), then what could hold these layers together? Instead of making the problem of incommensurability better through intercalation, it was worse. These were just the criteria that had propelled Kuhn and Feyerabend to claim incommensurability between successive theories. Where before there was incommensurability over time (Newton to Einstein), now I had that and worse: incommensurability among strata (subcultures of experiment, theory, instruments) even *within* the Einstein world.

By 1988–1989, I knew how to phrase the problem in a better way: we in science studies knew that practices in science should be studied locally, laboratory by laboratory, but we had continued to speak as if language was global. This mismatch between *local* scientific practices and *global* language practices made an account of change over time and communication across space incoherent. In the fall of 1989, I learned from linguists at the Center for Advanced Studies in the Behavioral Sciences in Stanford about the field of anthropological linguistics—and more particularly about the specialty within it that researched jargons and pidgins in areas of trade and other contact. Here was an example of language treated locally. It avoided both Van Orman Quine's worry that there would be *too many* global translations from one language to another and Kuhn's concern that there was *not even one* adequate translation.

Instead, here was a study of jargons, pidgins, and creoles worked out in specific times and places: in Indonesian prisons, in the trading ports where Europeans swapped goods for fresh food, and on the coasts where wheat was exchanged for fish. Three aspects struck me as immediately applicable: using the model of "natural" interlanguage development, we could see a *local*, *contextual*, and *diachronic* evolution, one that could take, for example, a few words of a jargon, follow it into an activity-specific pidgin, and sometimes even track its evolution into a full-blown creole, sufficiently articulated to allow one to grow up within it.

Here we have a messier constellation of partial and hybrid technical subcultures bound by constantly changing inter-languages, not the neat, universal protocol language and not the tidy, articulated paradigm of individual island empires on which were spoken the pure tongues of Einsteinian or Newtonian.

My original studies involved hybrid techniques used to bind experimentalists, theorists, and instrument makers—in particle physics, what was shared, and what held back? Or how, say, the engineers at DuPont spoke with the theoretical nuclear physicists on the Manhattan Project—or how in the radar labs of MIT, radio engineers managed to forge a common arena of calculational and diagrammatic techniques by which they could communicate with physicists who were familiar with the mathematical physics of classical electrodynamics. Even the pure dominion of algebraic geometry wore its prior hybridity on its sleeve, even if by the mid-twentieth century it stood as the very example of purity.

Over the last years, I have admired how scholars, activists, and regulators have used the idea of the trading zone to explore the ways that fishers and fisheries have hammered out agreements, soil scientists and farmers, and the multiple actors engaged with the future of the Everglades. A striking example of a trading zone, however, is one not drawn from the scholarly literature but instead from a film on the preservation of a particular wetland not far from New York City. Two otherwise warring groups—duck hunters and conservationists—formed common cause around a particular body of land to preserve it from development. Though they disagreed about the overarching philosophical status of land, hunting, and "nature," they found a way to get on with the job of keeping the complex wetland in a state where ducks, plants, and fish could flourish. By putting aside their global concerns, the two groups actually found that they could grapple with the complex economic, regulatory, and ecological structures of this land in the context of fast-moving suburbanization. Was this a full-bore *consensus*? Not at all. Politics, culture, and even class identification were in conflict. Was the outcome a *compromise* between conservationists and hunters? No, here a complex of politics, preservation, and values—here, the value of keeping a wetland system intact—could be hammered out only by thinning the normative description of why it should be done.

The authors whose work appears in this volume use the idea of a trading zone in variety of ways, and it would violate the spirit of the whole enterprise for me to act as some kind of adjudicator. Instead, I have learned from this process of taking up, using, and extending this complex of ideas in the domain of places and plans—in a field already rich with theoretical and pragmatic engagement. I have, in fact, learned a great deal working with this group. Though they overlap, let me oversimplify by indicating three promising lessons one might draw from these studies for the theory of trading zones.

13.1 Trading Space for Place

The studies in this volume show clearly that places are not just reassigned; they are actually produced by the process of thin coordination. Take, for example, the production of parking spaces in the old Spanish Quarters of that Laura Lieto follows in Chap. 9. The micro-sites—those seven or so square meters singled out in the twenty-first century for an automobile—quite obviously did not exist for that purpose back in the fifteenth century grid layout of the city. Instead, as the author puts it, these "recesses in the sidewalks, or small spaces in front of the entrance of abandoned or underutilized ground-floor rooms opening onto the street" came to have a new, contested, and valued significance in recent years. Carved out of other spaces by a confrontation of forces, these newly articulated bits of land gained a power of their own.   Here converged: an economically deprived people who lived adjacent to the street space in question, a population's urgent need for parking, the municipality's failure to provide public transportation, a sometimes violent surveillance of the proprietary "owners" of the space, and an utterly acquiescent police force.

Did a common set of values, symbols, and meanings define and preserve these new micro-parking spaces?—not at all. Here was a thinly picked-out coordination that produced spaces of a geometry and location that had never before been identified as a place, as such. Or take Helena Leino's (Chap. 7) examination of Pispala Ridge, a 19th older wooden workers' district built as each settler found best, now host to artists, writers, and musicians. Interestingly, what picks out this place are concerns that oscillate in scale—local residents, to be sure, but aided in their production of their position by a German facilitator, alongside alliances with other wooden villages elsewhere in the country. Even the attribute "wooden village" re-individuates the object in question: now it is not just "Pispala Ridge" but an instance of this species. Politicians want to see to governance, some residents to viable development, and others to recreation or preservation—all themes that are local, national, and European. If the participants had waited until they all agreed on the ultimate significance of "preservation" or "underdeveloped," if they had demanded total clarity about the relation of governmental planning and local deliberation, and if any of a myriad fundamentals had had to be cleared up, everyone would have grown old and died before action could take place. A thinness of exchange—this time among (sub) cultures of different scales—produces a new place out of a site.

In Chap. 8, Daniela De Leo applies the trading zone approach to an extreme case of nonconsensual cultures in conflictual coordination in Bagheria and Villabate, Sicily. Here, civil society is far from the deliberative, participatory model of Pispala; in Bagheria and Villabate, the Mafia looms large, corruption is rife, and the city governments are barely functional. And yet, two projects emerged with success—the modification of plans for an outsize mall and the successful management of a program to remake the facades of many buildings. Key to these developments was not a wholesale dismantling of the Mafia in Sicily—obviously—but also not a retreat into isolated islands with no coordination. Instead, De Leo shows how *nonspatial* interventions actually permitted the (re) creation of these spaces. These included quite temporal (rather than spatial local coordination), speedier evaluation of permits to build, more transparent responses as to why a permit was rejected and what had to be done for it to be approved, amnesty for earlier illegal construction and the involvement of groups not previously addressed: women and young people. All these agreed-upon, "thin" accords were more than mere technicalities. By expanding the public, by rendering regulations more transparent and timely, relations of trust and identification could advance. Thinness of accord can well involve crucial issues of value and symbolic meaning. Thinness of accord can produce much more than the specification of a pipe diameter.

Valeria Fedeli (Chap. 3) takes the trading zone one step further: not in the production of the parking space, wooden village, or mall but to the spatialization of the planning process itself. Here was the production of what one might call a "space of spaces"—a single gathering point where the ten plans would stand in juxtaposition. Her case study includes Milan and Paris; on the French side, she follows the call for ten teams to imagine a new plan for the greater Parisian area—"Grand Pari(s) de l'agglomeration parisienne," a planning enterprise that was explicitly *not* political in the narrow sense of governance. Instead, the ten teams concentrated on objectives

(like sustainable development)—and presented their results in March 2009 at an exhibit in the renewed *Citè de l'Architecture* (to be followed by another phase on specific sites at the "Atelier International Du Grand Paris"). Here one has an iterated trading production of space: first, the trading zone implicit in each of the ten plans, with all their tensions and coordinations; and second, the exhibitions themselves which made a space out of the juxtaposed, necessarily imagined future spaces. Perhaps one should describe this production of space as a recursive trading zone: from individual plans, to the March 2009 exhibit of ten plans, to the future Atelier revising and extending to the original plans, and eventually to the interlanguage constructed out of the Atelier results.

13.2   Limits of Trade

One of the features of physics that is most striking is that theories very frequently carry over to other theories in particular limits. Einstein's general relativity yields his special theory in the limit where acceleration is small; the special theory of relativity produces a version of Newtonian theory when velocities are small compared with the speed of light; Newton's gravitational theory produces Galileo's laws of fall if one strays not too far from the surface of the earth. In the spirit, though not the letter of such correspondence, it has been productive to explore what happens in various limits of the trading zone—what happens if the trading subcultures are roughly equal in power? What happens if they are maximally unequal? What would it look like if the shared domain was as minimal as possible—or as wide as a discipline?

It is in this spirit that I have been intrigued by Star and Griesemer's (1989) important reflections on boundary objects—objects that are part of two worlds of activity, but are nonetheless recognizable as carrying enough of their own weight for us to consider them individuated. These can be understood as a double-limit of a trading zone. First, the boundary object tends to be static—not changing in time. Second, the boundary object is a thing—an archeological artifact, a bacterium, or, here, perhaps a bridge—a language game stripped down to a designating noun, without the rules of combination that we use in a full-up language. If a creole has enough linguistic flexibility to grow up in (including metaphor and more elaborate metalinguistic utterances), a pidgin is a restricted, more functional exchange language, and a jargon, a highly restricted set of utterances, the boundary object is the limiting case: "hammer," "ladder," or "bridge." On this reading, there is no clash between trading zones/trading languages and boundary objects; the latter is a limit case of the former.

There are other limits, too. Simon Schaffer and Bruno Latour have, in different ways, studied the reimposition of a whole system of work, a laboratory, for example, transported or replicated on other shores. Schaffer (1991) calls this a "multiplication of context"—and there are very interesting cases where one sees the process at work, for example, in highly unequal colonial moments, where people, equipment,

procedures, and materials are reestablished in the conquered territory. This too is a form of limit—the limit of power being (almost) entirely one-sided: a colonial observatory sent from Greenwich or Paris to map a conquered territory. On the other extreme would be a relation of almost complete equality: one might think here of the string theorists in tough argument and coordination with the algebraic geometers, disagreeing about fundamentals (what constitutes a proof, e.g., or what properties an acceptable theoretical object should have). Nonetheless, the two groups found themselves agreeing on a tiny bit of theory-territory: a number that counted the curves on a surface that both, for very different reasons, desperately needed to assess. What became a major trading zone with joint university appointments, conferences, and myriad publications began as an accord about a single number.

Collins, Evans, and Gorman have, very productively, extended this kind of reasoning in their two-by-two matrix in which the vertical direction grades power from cooperation to coercion and the horizontal axis marks similarity of the groups from homonogeneous to heterogeneous. I find the chapters included here (Chaps. 4, 5, 6, interalia) to probe other limit cases—this is important because as we push on the number and variety of actors, their authority, and their modes of interaction, we advance understanding of what a trading zone is and where it can be useful.

Relevant here are Raine Mäntysalo and Vesa Kanninen (Chap. 4), who address the relation between trading zone and boundary object, as they develop and further articulate the highly influential Kuopio model that reenvisions the city as composed not as isolated geographical pieces but as three overlapping zones (pedestrian, public transport, and automobile). In their formulation, the trading zone functions on two levels: in the relation of the zones to one another through physical points of interaction (such as the Särkisilta Bridge which allows only buses, bicycles, and pedestrians and so shapes the connectivity of those Kuopio zones) *and* in the planning process itself. That the trading zone occurs on this second (planning level) is explicit—in their words, "when studying interaction between land use and transportation planners, we are dealing with two autonomous disciplines in a relatively balanced relationship. They are autonomous with their own elaborate 'worlds' of conceptualizing, analysing and modelling their planning object, yet mutually dependent in their need to exchange information and contribute mutually to the production of feasible urban and regional plans." This doubling of trading zone structure between object and analysis is a crucial democratizing move; it brings the planners into the same discourse that they are encouraging citizens to engage in as they participate in the planning process.

Mäntysalo and Vesa Kanninen raise a further question about locality: do the actors engaging in a trading zone themselves have to be local to the interaction? I would say this. As we saw in the case of Pispala Ridge, the interaction is local, but the categories and groupings were not. Ideas of "nature conservation," "economic underdevelopment," and even "wooden villages" are not local—but their point of contact was. In physics, such delocalization is ever more the case. After all, the 3,000 or so physicists involved in the discovery of the Higgs Boson "at CERN" most surely will never meet in one place. They represent laboratories from all over the world, their work more frequently joined by email, Skype, file sharing, electronic

and bulletin boards than by town meetings the old fashion way. The categories of their analysis draw on 500 years of physics—not to speak of cryogenic, structural, electronic, and computer engineering. But, at the end of the day, this immense group must come to accord and say either "yes we have seen the Higgs Boson at 125 GeV" or not.

What exactly is shared in the trading zone? This is an essential question that both Claudio Calvaresi and Linda Cossa (Chap. 6) and Maarit Kahila-Tani (Chap. 5) explore. For the former, the focus is on the Neighborhood Laboratory in the Ponte Lambro (a marginalized area of Milan), where they follow the construction of locally shared management and social relations (e.g., procedures for admission to the housing complex) as well as physical or technical elements. The conjoint social and physical dimensions are more than a physical object—they become, in the long run, a way of life, a lived, not artificial, language game. Crucial is the imbrication of these elements with one another. As Calvaresi and Cossa write, "integration … matters, more than participation. The latter is a condition to pursue the former. The integrated dimension of the urban policy … changes the policy design process: no more a pure technical process, but rather a social learning process, where the different actors exchange knowledge, a potential for innovation. That is exactly the scope of a trading zone." I agree completely. Their swift disposal of "participation" as an end in itself parallels my view that sociologists of science have spoken too easily, too loosely about "collaboration" or "symbiosis." Such locutions are useless—the question is *who* brings *what* to the table and how are the parts integrated?

Integration gets worked out in what at first glance might appear to be a technical apparatus, SoftGIS, but which (as Kahila-Tani shows) soon becomes more: a toolkit to create a zone of exchange. She also wants to examine the limit cases of trading zones and does so very productively. One place where I found the example highly illuminating was in her thinking about the interface—after all, this is *precisely* how one would describe a trading zone written into software. Maarit Kahila-Tani's analysis captures the problem. Insofar as the interface was seen as one-way, as what the anthropological linguists call "out-talk" (a native speaker regularizing speech so as to make it accessible for nonnative speakers or children), it is at the very limit of *non*reciprocity in a trading zone. What is needed is clear: more feedback from the intended users in formulating this interface. Here too is an important contribution to the trading zone in a planning context—an explicitly *normative* use of the trading zone that encourages the expert group to build its tools incorporating attention to the patterns of use that the non-planners bring to the table.

13.3　Complexity and the Trading Zone

In different ways, three authors point to the complexity that planners face; all are important. Alessandro Balducci (Chap. 2) points to the heterogeneity of actors implicated in a major urban planning exercise, Jonna Kangasoja (Chap. 11) recognizes the heterogeneity of modes of application of the concept of a

trading zone and aims to set its register as a "sensitizing concept" rather than a "definitive" one, and finally, Vesa Kanninen, Pia Bäcklund, and Raine Mäntysalo rightly want to point out that there are political situations so heterogeneous that no exchange is possible.

Alessandro Balducci begins with his own experience in the planning process for Milan and the surrounding province, noting that this was a situation marked by a complexity on many levels, not least that it involved a myriad of actors (groups) and no central or even clearly defined decentralized line of authority. Some groups appeared and disappeared, even the process itself was in debate—but above all, the commitments of the participants clashed to such a degree that it seemed nothing could move forward.

To take one of Balducci's vivid examples of an impasse, it seems that the President wanted a road (the long-sought Pedemonta motorway) to demonstrate authority and gain votes. Planners, working with grassroots organizations, designers, as well as local and regional authorities wanted a greenway (the Northern Green Dorsal). Green design and Presidential self-interest—looking for a *consensus* seemed a fool's errand, and, at the same time, there was no governing authority that could command the dissensus to conform to a plan from above. In a way, the very complexity of the situation may have made the task of finding a zone of exchange easier—in the end, the planners managed to join presidential, regional, and local concerns through a plan to make a green road—valued differently by the different stakeholders, but valued by enough of them to free funds and achieve a resolution. Road engineers, urban planners, landscape architects, and grassroots groups all joined, but did so without legal command, fundamental consensus, or a technical compromise. As Balducci puts it: "Without convincing each other we had developed an inter-language and had identified a boundary object which allowed us and him each to pursue our different strategies with a common project."

Jonna Kangasoja has in mind another kind of complexity: she is interested parsing the kind of thing the trading zone concept is. Back in the bad old days of a rather doctrinal logical empiricism, texts on theories used to speak about the hypothetical-deductive model in which a theory stood as a universally intelligible object that, with specification of a local circumstance or conditions, issued in a series of deductions that could be tested. This misses so much about the actual practice of science that one hardly knows how to begin, and for the last 50 years or so, a more subtle picture has been emerging. For a start, concepts are not fixed by necessary and sufficient conditions—already Wittgenstein made it clear that even "number" and "game" have no such properties. Instead, concepts work like a chain of partially overlapping or family resemblances. Theories, which include concepts, are even more subtle in the way they move—Newton's or Maxwell's or Darwin's theories shift emphasis, add and drop concepts, and redefine their domain of applicability.

All this is very well known, of course, but it is all too easy, especially given the theory hunger of the interpretive social sciences, to act as if our concepts are indeed "definitive," articulated outside time, place, and pragmatic field. It is against this rigidifying tendency that Kangasoja (building on Blumer) is working. I am entirely on their side. Concepts (and objects) are quasi-stable configurations of practices,

sometimes theoretical, sometimes material, and sometimes a hybrid of the two. But they are not frozen even in the highest reaches of abstract mathematics, let alone on the ground, in our grasp of cities, streets, and transport. Indeed, as Jonna Kangasoja says, "objects draw actors together, as well as mobilize considerable resources. The objects embody meaning and moral commitments of what is important and valuable, what should or ought to happen." Indeed, I am glad that this piece is in the volume, for it is against everything I believe to want the trading zone to be treated like a universal, transhistorical machine for "solving" any problem in planning (or anywhere else). Instead, as Kangasoja suggests, the idea of the trading zone is to push us to ask questions—when we hear "participation" we have to push back: "Who participates?" "With what means?" "What is to be coordinated?" "What regularities emerge in the process of coordination?" "Does the coordination stagnate, eviscerate, or expand?" (Not every jargon becomes a pidgin and morphs into a fully formed creole). If we can put aside the "obvious" drive to come to agreement through command, consensus, or compromise, that would be good. If we can allow that a very partial, thin, nonetheless aesthetic, political, and ethical content can emerge, that would be a great good thing.

This takes me to a final consideration. Any theoretical account without limits of applicability must be vacuous. One cannot use special relativity near the horizon of a black hole, and one cannot use classical physics for systems much smaller than a billionth of a meter. Those restrictions are more than signs that say *ne plus ultra*—they also tell us something about what the theories *are*. In several of the essays here, authors have productively begun to probe horizons of where the trading zone can function.

Vesa Kanninen, Pia Bäcklund, and Raine Mäntysalo (Chap. 10) discuss the limitations of the trading zone when political conflict comes to loggerheads. An example: residents of *the Kruununhaka district in downtown Helsinki* wanted elevators—conservation ordinances forbade alteration of the historical stairwells, and the suggestion that the inhabitants strap elevators on the outside of their building or run them through their apartments met with (understandable) resistance. This, Kanninen, Bäcklund, and Mäntysalo rightly point out, is *not* a communication problem. It is a clash of incompatible objectives. Wanting a trading zone is not a promise one will exist—you can want a number greater than five and less than two, but that does not make one exist.

In science too, the desire for a trading zone has, in important cases, also proven impossible. Albert Einstein wanted to find a theory that would join electromagnetism to gravity and spent, fruitlessly, more than two decades on the task; no one since then has been able to do what he could not. In the eighteenth century, dazzled by the success of Newton's gravitational theory, chemists wanted to join Sir Isaac's inverse power laws to chemistry to create a new account of matter. It failed then, since, and now. Doctors wanted a science of the body based on classical physics—iatromechanics—it died. There simply is no doubt that the trading zone is not a passe-partout to every closed door. On this point, I quite agree with Kanninen, Bäcklund, and Mäntysalo. I agree on a further point: as Mäntysalo and others point out elsewhere in this volume, the trading zone frequently involves the coordination

of action and belief, material dispositions of space, and equipment with (local, even provisional) concord about beliefs.

I am less sure that we can sharply separate applicability from inapplicability of the trading zone into the bins of descriptive (where the trading zone works) and normative accounts (where it fails). In restricted cases—like the SoftGIS interface, a normative application seems quite plausible as a way to get feedback from the user groups in a way that makes a (restricted) normative trading zone plausible. But one of the urgent questions raised by this volume is that we need a better understanding of when we might plausibly expect a trading zone to work—and when not. Because, as this exceptional group of theoretical/practical planners has shown, the trading zone is a tool for work, not magical medicine.

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