THE REALISTIC EMPIRICISM of Mach, James, and Russell

Neutral Monism Reconceived

ERIK C. BANKS

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In the early twentieth century, Ernst Mach, William James, and Bertrand Russell founded a philosophical and scientific movement known as "neutral monism," based on the view that minds and physical objects are constructed out of elements or events which are neither mental nor physical, but neutral between the two. This movement offers a unified scientific outlook which includes sensations in human experience and events in the world of physics under one roof. In this book Erik C. Banks discusses this important movement as a whole for the first time. He explores the ways in which the three philosophers can be connected, and applies their ideas to contemporary problems in the philosophy of mind and the philosophy of science – in particular the relation of sensations to brain processes, and the problem of constructing extended bodies in space and time from particular events and causal relations.

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Preface and acknowledgments

This book is an historico-critical look at a realistic form of empiricism which one finds in the philosophy and science of Ernst Mach, William James, and Bertrand Russell. Some of the research in these chapters has appeared in my 2003 book *Ernst Mach's World Elements*, my 2005 article "Kant, Herbart and Riemann" in *Kant-Studien*, my 2010 article "Neutral Monism Reconsidered" in *Philosophical Psychology*, and my 2013 articles "Extension and Measurement: A Constructivist Program from Leibniz to Grassmann" in *Studies in the History and Philosophy of Science A* and "William James' Direct Realism: A Reconstruction" in *History of Philosophy Quarterly*.

Work on this book began during a Fulbright year in 2004–2005 in Germany, when I was a guest at the Max Planck Institute for the History of Science in Berlin. The first drafts of Chapter 6 were written there and I gave a talk which outlined my construction of extended quantities. After I started thinking about William James again, I ran into Michael Levin, waiting for tickets to Shakespeare in the Park, and we discussed my Jamesian version of direct realism in epistemology. His criticism, delivered on the spot, made me think harder about those ideas. In summer 2011, Jirí Wackermann invited me to work on the book during a stay at the Psychophysics Department of the Institute for Frontier Areas in Psychology, Freiburg im Breisgau, and Jirí, Harald Atmansprecher, and Roemer Hartmann gave me feedback on my presentation "Enhanced Physicalism," which I gave at the Institute's Theory Colloquium. Jirí's writings on Mach from the perspective of a working psychophysicist have deeply influenced my understanding of these issues. In 2012, Jordi Cat and Amit Hagar gave me the chance to present the talk "Extended Magnitudes" at the Indiana University Department of History and Philosophy of Science colloquium, where they provided strong feedback and critical comments. I gave another talk on "The Problem of Extension" at the 2012 meeting of the History of Philosophy of Science (HOPOS) society in Halifax and I benefited from

those comments in the preparation of the final chapter. Anonymous reviewers for the publisher, and the journals named above, helped me improve the manuscript. Finally, thanks, as always, to my mother Laurene Buckley, art historian, for teaching me how to do research, and for those long ago book sales at the New Fairfield Public Library and at the Strand when I was young, and to my father Richard T. Banks, architect, who taught me how to teach. I will always be grateful for their confidence in me.

I am a naturalist philosopher; for me, philosophy without science is empty and science without philosophy is blind. I see philosophy and science as continuous: methodological and speculative ideas that originate in philosophy, over many years, are gradually refined until they can be articulated quantitatively and tested and so become part of empirical science, at which point their origins are usually forgotten. We'll see several examples in this book. Most of my ideas and source materials come from rooting around in the history of science and following my interests there. Consequently, I think, those who will get the most out of the book are historico-philosophically minded scientists and naturalist philosophers who look to the history of science for their source material.

Conceptually, this book is about "what happens when something happens." It is about *events* in the natural world: events in physical science and events in the brain, which are gathered together under the common term of "elements." I use the historico-critical method to investigate the elements and their relation to science and philosophy. This method, which I learned from Mach's books, broadens and enriches the spectrum of contemporary philosophical ideas and vocabulary, while reconstructing concepts in a rigorous way. I have tried to keep the historical and conceptual goals separate as much as possible in the exposition, but I do hold that my realistic empiricist view is a direct descendent of its historical ancestor in the three original authors of the tradition. The reader can judge if I have been successful. I think the job of philosophy should be to look at the *whole* historical-conceptual spectrum of ideas and ask: what are the possibilities? I hope to show that realistic empiricism is not only an historically significant view, it is also well worth reconsidering today.

Introduction: An overview of realistic empiricism

Introduction

Realistic empiricism is a view of science and philosophy that got its start in the work of Ernst Mach, William James, and Bertrand Russell. The view is also known as neutral monism, radical empiricism, or empirio-criticism. These three authors, for all their differences, share a common historical and conceptual framework, which justifies treating their views as part of the same movement, as I will show in the first three chapters of the book. In the second part, I will redevelop the view for application to contemporary problems. In the present introduction, I will characterize the main ideas of realistic empiricism before entering onto the detailed history of its development and my own additions.

The original authors: Mach, James, and Russell

Ernst Mach (1838–1916) was an Austrian physicist and philosopher who worked in Graz, Prague, and Vienna during the late nineteenth and early twentieth centuries. He is known in physics for his critique of Newtonian absolute space, the principle of inertia, and the mechanical world view, critiques which influenced Einstein, Heisenberg, and many other scientists of the following generation. These criticisms can be found sharply articulated in his *History and Root of the Principle of the Conservation of Energy* (1872/1910) and his *The Science of Mechanics* (1883/1960). As is well known, Mach was skeptical of atoms for most of his career and was one of the last scientists to convert to the atomic theory around 1903 (Blackmore 1992, Banks 2003, pp. 12–14).

Mach was also a pioneer in the area of psychophysics, the scientific measurement of sensations, presenting his results in the *Analysis of Sensations* in 1886. It appears that this double professional competence in physics and psychology pushed him to develop a monistic, umbrella framework for

the natural sciences capable of handling human experience and physics under one roof. In accord with this view, Mach stripped down empirical theories into what he called "elements," ordered in spare functions or causal–functional connections of various sorts. Within this framework, sensations were taken to be as real as physical events involving bodies and forces. Others, such as the English mathematician W. K. Clifford and the philosopher Richard Avenarius, were developing similar monist views at the time (see Banks 2003, ch. 9).

In philosophy, Mach is best known for influencing the logical positivists Philipp Frank, Moritz Schlick, Rudolf Carnap, Otto Neurath, and Hans Reichenbach. As I have argued elsewhere (Banks 2003, pp. 9–16 and 2013a) I feel this link is tenuous because Mach's views were much more realistic than is commonly realized. In addition, the logical positivists were preoccupied with second-order questions about logico-linguistic frameworks, analytic versus synthetic truths, and the role of a priori knowledge, which only began to surface after the rise to prominence of modern logic, questions that are alien, and in some ways even antithetical, to Mach's realistic first-order project to reform physics, as Paul Feyerabend pointed out (1970, 1984).

William James (1842–1910) was an American psychologist and philosopher, the author of the famous textbook *The Principles of Psychology* and one of the founding American pragmatists. James and Mach knew each other through their common interest in the sensations of movement and they met personally in 1883 in Prague to exchange ideas. Around the turn of the century, James outlined a view he called "radical empiricism" that owes a great deal to Mach's *Analysis of Sensations*. James also worked out his own direct realist theory of perception, which we will examine in this book, and which turns out, I believe, to have much in common with the empirical realism of Kant (see Banks 2013b).

Bertrand Russell (1872–1970) was the great English philosopher and logician who, with Alfred North Whitehead, placed logic on a firm basis with *Principia Mathematica* and who, with G. E. Moore and Gottlob Frege, founded what we now call analytic philosophy. After his work in "On Denoting" and *Principia*, Russell continued to develop, turning increasingly to questions in the foundations of science and psychology. Russell knew the views of Mach and James very well, and referred to them under the name of "neutral monism," a term he coined in a series of articles for the *Monist* in 1913. Russell began as a skeptic but later converted to the view himself in an essay called "On Propositions" in 1919. In Russell's subsequent works, the *Analysis of Mind* (1921) and the

Analysis of Matter (1927), he further developed neutral monism in a realistic direction, adopting what he called "event particulars" as the basic happenings in nature, encompassing both sensations and physical events. Russell's neutral monism is perhaps the best-known development of what I call the realistic empiricist view, although it is often misread as a form of phenomenalism; and it is often assumed that Russell only held the view for a short time, from around 1919 to 1927, even though Russell strongly denied this (Eames 1967), and recent scholarship bears him out (in particular Lockwood 1981 and Tully 1993). This language about a neutral monist 'movement' inaugurated by Mach stems from Russell himself (Russell 1921, p. 16).

As we shall see, each thinker contributed something unique to the movement, which we miss by treating them in isolation. A unified treatment can show where the movement was headed, and a contemporary update of the position can show how it is useful today. There are, I believe, two important problems in contemporary philosophy where realistic empiricism is relevant: the question of how human sensations relate to physical processes in the brain, and the question of how to construct extended objects and regions from elementary events in the philosophy of physics. These are the subjects of Chapters 5 and 6.

Relation to traditional empiricism and logical positivism

Empiricism is often parodied as the view that "If you can't observe it, it doesn't exist," or that entities not observable in principle are to be expunged from science. The focus is on the sensations of a human observer, or on interactions between an object and a measuring device. This sort of classroom empiricism can be a useful fiction to motivate debate about what is really observed in a certain experiment. These questions can then be used as an entering wedge to introduce more fundamental ideas. In truth, however, empiricism covers a very broad spectrum of views, from the nominalism of William of Ockham to British empiricism, to logical positivism, to W. V. Quine and Bas van Fraassen. Each incarnation is worthy of study, and, as recent scholarship demonstrates, there are often surprises behind the historical stereotypes (on logical positivism, see especially Stadler 1997/2001, Friedman 1999, Uebel 2007, Richardson and Uebel 2007, Banks 2013a). I will not seek to compare and contrast all of these varieties of empiricism in this book, or try to define empiricism in general. Nor will I deal with every author and movement that might be brought into consideration, such as Clifford, Avenarius, the

American Realists, and other figures. I will characterize only what I call the realistic empiricist movement from Mach to Russell (from about 1872 to 1927) and distinguish it from other views only when I think significant differences with traditional empiricism should be pointed out. Some of these differences are so great, however, that they should be stated immediately:

1. Traditional empiricism emphasizes a class of observed events and privileges these events over others. Realistic empiricism gradually broadens the area of interest to include all events or interactions in nature so long as they are causally continuous with observation. But it does not insist on a fundamental distinction between observed and unobserved events. Nor does it insist on a fundamental order of experienced givens, from which to logically construct the unobserved external world. The neutral elements of realistic empiricism are real natural events expressing dynamical force in causal relations to each other, not passive sense data, or loosely associated Humean impressions. Realistic empiricism thus broadens the traditional empiricist category of object and observer interaction, and extends it to the rest of nature, while keeping the continuous causal link to human observation which is empiricism's great strength.
2. Realistic empiricism is *not* a second-order study of the methods, language, or structure of what "science says." It does not offer models of explanation, canons of methodology, or a rational reconstruction of theories and methods in use in science. Instead, we get a first-order theory of real events and causal–functional connections, an ontology of the world that is intended to frame a program for designing specific empiricist theories in science that can then be tested.
3. Realistic empiricism is a theory of the empirical content of a science, based on its austere element-and-function ontology. It is not a theory of a priori structural or linguistic frameworks. The view has little to say about the abstract conceptual framework of science, which is unquestionably part of the enterprise, but which I think belongs within the study of the formal sciences, not empiricism per se. Mach and James avoided the linguistic turn by pre-dating it, and Russell, it seems, had wearied of linguistic analysis by the time of his neutral monist period, when he was headed in a naturalistic direction.
4. Realistic empiricism proposes a working "umbrella theory" of the sciences, or a theory schema for constructing empirical theories in physics and perceptual psychology. This theory schema is an engine of

> analysis for eliminating extraneous content, or mental imagery, from science and predicts the general form of empirical theories, just as specific theories predict data. The theory schema is a naturalistic philosophy continuous with science, but at the general, metascientific, level of theory design, and does not pronounce on specific empirical questions, or claim to be a first philosophy. Any value for the schema has to come through the specific theories it predicts.

There are three crucial historical stages in which realistic empiricism advances beyond traditional empiricism: (1) Mach's broadening of sensation to the notion of the neutral element which is also something physical (Chapters 1 and 2); (2) James's push beyond restricted empiricist epistemology to a directly realistic perception of mind-external objects (Chapter 3); and (3) Russell's adoption of neutral event particulars as a common basis for constructing physical space-time and sensory manifolds in psychology (Chapter 4).

Neutral elementary events

Realistic empiricists hold that the natural world is made up of individualized events embedded in real causal–functional relations to each other. These events and causal–functional relations are what really exist, and the rest (objects, extended bodies, fields, space-time, brains, and minds) are constructed out of them. These events are called "elements" by Mach, "event particulars" by Russell, and "pure experiences" by James. I will use the terms "elementary event" or "element" to cover them all.

Elementary events constantly change and are immediately replaced by others, so we must distinguish them from enduring objects, element-types, or properties. For example, one can call "John's stroll" different every time he takes it, or one can describe "John's stroll" as a repeating type of event that takes place every morning at 9 a.m. Elementary events are absolutely unique and non-repeating. Mach famously said that "nature has but an individual existence" (1883/1960, p. 580). For the realistic empiricist, as for the traditional empiricist, existence is always of *particular* matters of fact, and whatever exists at all does so as a concrete particular *event*, nature being just the sum total of these events and particular causal relations between them.

I think that events in realistic empiricism are further to be understood as the manifestations of dynamical powers and I think all three original authors do actually make some commitment to this view that events are

caused by powers. This is most clearly stated by Mach, whose elements were akin to the manifestations of "potential differences" or forces in physics (see Mach 1883/1960, pp. 598–599 and Banks 2003, chs. 3, 7, 9). But Russell, too, speaks about his event particulars as the disembodied "interactions" or "effects" of objects and observers on each other (Russell 1921, pp. 101–102), and James talks about the "energetic" relations between his elements of pure experience, including mental events and "mental work" which he sees as no different from physical work or energy (James 1977, pp. 181, 289). Mach, James, and Russell thus made it very clear in their writings that elementary events are dynamical and forceful, or that these events *are* the manifested effects of causal powers of some sort. In realistic empiricism, nothing simply happens; every concrete particular event in nature happens because something makes it happen—or prevents it from happening. Events are always the concrete "token" manifestations of powers, including powers that completely block or equilibrate each other, seemingly leading to no effect at all, as in seemingly stable objects or force-free trajectories.

Since this theory is not about the linguistic meaning of the term "event," we need not accept that everything a philosopher might call an event really is one; nor do naturalists need to canvass all of the possibilities for what the word "event" might mean to a philosopher of language or an analytic metaphysician reconstructing linguistic usage. The natural-language description of events and powers and manifestations is usually superficial and must be broken down until the real natural powers manifesting in the event are identified, in the potentials and forces of the physical world, as Mach suggested. Indeed, I believe we can eventually drop the talk of "powers" and "manifestations" and speak directly about individualized physical potentials and manifestations of force in Chapter 6.

Finally, in realistic empiricism, powers are directly manifested in events by their concrete *qualities*, or what Mach actually calls 'physical' qualities (1905/1976, p. 15). Every natural event exhibits these qualities, or what Russell calls the "intrinsic character" of matter. These qualities are not mental, nor are they an extension of mentality to the rest of the universe, as in panpsychism. Qualities are simply the concrete empirical manifestations of powers in events, observed or not, that occur around us all the time. They are not restricted exclusively to the qualities of our sensations, which are very special and complexly configured natural events in the human brain. This idea, that mind-independent qualities occur in physical events, which seems so strange at first, can actually be found throughout much of the history of philosophy, even in such hard-nosed works as Moritz

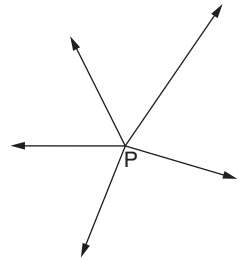

Fig 0.1 A physical point-event and its individual qualities

Schlick's *Allgemeine Erkenntnislehre* (1925/1985, p. 284),[1] Herbert Feigl's essay *The "Mental" and the "Physical"* (1958), and in contemporary philosophy of mind (Maxwell 1978, Lockwood 1989, Unger 1999, Chalmers 1996, 2002, Stoljar 2001, Rosenberg 2004, Banks 2003, 2010, and many others).

As Russell held, these manifested qualities serve to identify individual events. Elementary events are identified one by one, as particulars, and do not require further anchors, whether objects, properties, or universals, for their identity conditions (Russell 1947/1997). In Chapter 6, I will reconstruct these events and qualities using Grassmann's point-algebra, where the events are treated as points and the various qualities are like "spokes" sticking out of the point in a variety of directions, representing interactions from each possible causal point of view one can take on the event (see Figure 0.1).

Realistic empiricism is thus a kind of physicalism, with a description of natural events in terms of powers, manifestations, and concrete qualities, completely continuous with natural science. Within this enhanced view of the physical world, realistic empiricists offer a solution to the problem of how the realm of human experience (colors, pains, sounds) relates to physics. Russell called his view "neutral monism" meaning that neutral elementary events should be taken *neither* exclusively as mental *nor* as physical, at least not in the customary sense of the "physical," which

[1] In the quoted passage Schlick admits an array of natural qualities associated with individual events, but he says they are of no interest to science, which concentrates on the formal structure of events and not on individual events themselves, of which he thinks we can have no knowledge. He *then* adopts the view that phenomenal qualities are only met with in human observation and are therefore epistemologically privileged, in apparent contradiction to what he has said before. I do not seek to unravel this knot, but I think it shows that Mach's neutral view of sensations and physical events has already been lost. Schlick does not even see it as a possibility.

excludes psychology. Mach stated this clearly in a well-known passage from his *Analysis of Sensations*:

> It is only in their functional dependence that the elements are sensations. In another functional relation they are at the same time physical objects. We only use the additional term "sensations" to describe the elements because most people are more familiar with the elements in question as sensations. (Mach 1886/1959, p. 16)

Similar quotes can be found heading up James's radical empiricist essays and Russell's *Analysis of Mind* (see Banks 2003, chs. 7, 9). According to Mach, who made the initial breakthrough, the same event in the brain (**s/e**) can be considered a mental event (**s**), by associating it functionally with memories, mental images, trains of association, and other psychological variations, but it can also be considered a physical event (**e**) by relating it to physical objects by physical laws, such as those of brain physiology (see Figure 0.2).

Just as there is no inner dualism in the elements themselves, there is no dualism of functions or variations either. Even the terms "psychological" and "physical" only refer to provisional differences in the variations which happen to fall under different departments of study. For example, the sensation of a freely falling red ball may participate in the following variations

(M) All strong red sensations x are followed by green after-images y

which may be of more interest to those studying the human nervous system, than another variation

(P) All physical objects x freely fall in the visual field at 9.8 m/s^2

which is explained by the physics of free fall, and not at all by the organization of the sense organs and the brain. A sensation (**s/e**), however, can be substituted for x in both orders indifferently and it obeys both kinds of variations. What we explore in science and philosophy, therefore,

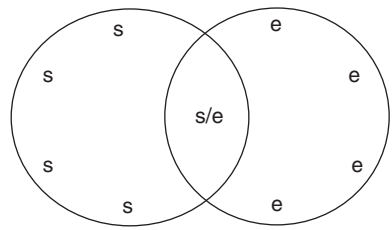

Fig 0.2 Sensations and elements

according to Mach, is events that belong to the whole unified fabric of experience-reality and not just one department of it. We can thus call the elements and variations "natural" or we can even call them all "physical," in anticipation of some future science of what the physical world really encompasses: sensations *and* physical events in one realm. So, unless I am specifically separating psychology from physics, I will use the term "physical" in this broader sense of a physics which includes psychology. Russell also does this quite often, as we shall see below.

The conscious ego

Mach and James both emphasized the fact that the red patch of a sensation does not get the quality of being red from an act of awareness or representation by the conscious mind. The red patch is also red in its purely physical variations, which do not involve the psychological variations of memory, attention, perception, and so forth. The red patch is a physical event in the human nervous system, and would remain red even if the patch were not being attended to consciously. For Mach and James, the conscious ego is regarded as a second-order "functional" connection among sensations, mental images, feelings, and other phenomena, and has no independent existence as a substance or stage or embedding circumambient medium, required for these other items to exist. For Mach and James, what we seem to be aware of in the unity of consciousness and its many acts is simply the unity of the many different functions carried out in our nervous systems, the composite result of levels of unconscious processing (see especially Ratliff 1965 and Banks 2001), and not some kind of mental theatre in which the contents achieve consciousness simply by being viewed by the internal spectator. Instead, what happens is that already-present contents become conscious by being functionally related to other contents such as mental images in functions of memory, time and space perception, judgment, and imagination. Or as Mach puts it in *Knowledge and Error*:

> Consciousness is not a special mental quality or class of qualities different from physical ones; nor is it a special quality that would have to be added to physical ones to make the unconscious conscious . . . A single sensation is neither conscious nor unconscious: it becomes conscious by being ranged among the experiences of the present. (Mach 1905/1976, pp. 31–32)

Hence the ego delimiting mental from physical events simply does not exist, beyond a collection of functions ultimately realized in the

physiological activity of the brain. As Mach provocatively put it, "the ego cannot be saved" (*Das Ich ist unrettbar*).

I suppose this is a major difference between realistic empiricism and many contemporary views of consciousness, including phenomenological views that derive from Franz Brentano (see Smith 1994, Harman 1990). James and Mach were both very harsh critics of Brentano's notion of the "intentional inexistence" of objects embedded in consciousness. Russell was only able to become a neutral monist in the style of Mach and James when he gave up on the idea that there had to be a fundamental, irreducible relation of acquaintance between a mind on one hand and its contents on the other (Russell 1959/1997, pp. 134–135). Once Russell realized such an act was neither necessary, nor introspectively observable, he abandoned it, although as we will see in Chapter 4, the issue is complicated by Russell's theory of knowledge, which remained a kind of representative theory of mental images unlike the naturalistic causal theory of "knowledge and error" held by Mach and James.

Functions and causal–functional dependence

Mach and James both strongly emphasized the fact that the causal–functional relations between the elements were as real as the elements themselves. The most basic sort of link is the causal relation between a particular token event and another particular token event. If we think of events as empirical manifestations of powers, as I suggest we should, it is natural that these power manifestations will affect and constrain each other and that this interplay is what is manifested in their causal relations to each other. So what we end up with is an interconnected causal mesh of events related to one another in real complexes, not isolated atomic occurrences associated with one another loosely or subjectively, as in the traditional British empiricism of Locke, Berkeley, and Hume.

Mach, James, and Russell all held this kind of dynamical view of their elements and, consequently, they also asserted some kind of explicit principle by which the elements are bound to each other in causal relations, or "causal laws" as Russell says. Mach asserted a general principle of the "functional, reciprocal dependence of elements on each other" (1872/1910, pp. 69–71; 1883/1960, p. 604) and James even defined his radical empiricism as entailing a belief in real, particular relations between events:

> The relations between things, conjunctive as well as disjunctive, are just as much matters of direct particular experience, neither more so nor less so than the things themselves. The generalized conclusion is that therefore the parts of experience hold together from next to next by relations that are themselves parts of experience. (1977, p. 136)

Hume claimed never to directly observe any connection between his impressions. In realistic empiricism, we observe the connection and the causal dependence between events directly, even if we cannot predict which particular event will occur next to, or after, another particular event. Mach declared that his elements *always* occurred bound up in functional complexes, and that elements were mutually dependent on each other. They were not little atomic sensations or sense data. Mach adopted the neutral language of "causal–functional" dependence to replace the language of causation, which he thought was a relic of the mechanical philosophy of nature, and implicitly contained the assumption that a mechanism of some kind was responsible for every natural regularity or dependence. Mach's elements (Mach 1896/1986, pp. 328–329), as he says, simply 'abut upon each other' without any underlying support or mechanical system somehow lurking behind the manifested events. Thus Mach did hold to a robust realism about relations and real causal dependencies between elements; he just did not *call* it causation.

More must still be said about this peculiar language of "causal–functional" connections or variations intended to replace the mechanistic causation that Mach so deplored. Mere "mathematical functions" are notoriously vague since anything is *some* function of anything: the price of bread and rising water levels in Venice. There has to be a way to restrict the possible functions under discussion while leaving enough flexibility for different kinds of function to exist over the same elements, the two psychological and physical orders for example, but also micro- and macro-levels of functional dependence, polyadic dependences, and even a variety of different ways to order the same physical events into objects, law-like regularities, or perhaps even abstract tabular or matrix-like arrangements, as we shall see below. But too much latitude and anything goes. This is why it is so essential to see the elements as manifestations of powers, and their individual causal connections as the real effects one event has on another. Particular causal–functional connections are grounded in the causal behavior of the events themselves and their qualities, and are not subject to arbitrary choice (see Banks 2004).

It is, of course, very rare that we can isolate an "elementary event" from the rest of experience. As Mach says, nature "does not know" elements of

experience but only complexes, and the vast majority of the time we, too, are dealing with complexes and objects which are epistemologically basic for us, not the individual elements and functions which make them up. The actual evanescent elements and their qualities that occur around us are too fleeting to be apprehended directly, and they are quickly replaced by new ones. It is, rather, the repeating patterns or functions that make up the objects, laws, and systems present to us in experience, not atomic "given" elements. For this reason, the functional relations, at least in the physical world, must be very strong and permanent, equal in durability to any object. Someone might scoff at that by pointing out that the Himalayan mountains are *objects*, not flimsy functions of still flimsier evanescent events. The human mind seems to grasp out instinctively for permanent objects, an instinct Mach especially tried to discourage. But, as Mach and Russell both insisted, what *is* an object that would make it any stronger than a permanent law or function? For them, the solid, causal–functional law, or invariant function, of the elements does not require the further existence of a substance, or substratum, in which to anchor effects or qualities. Elements are already anchored as well as anything could be simply by abutting upon each other causally and they are grounded directly in their manifested individual qualities. These functions cannot be just formal or arbitrary combinatorial relations. Rather, it seems the function expresses some kind of embedded relation realized in the causal behavior of the elements.

We have, just as Mach and James both insist, *real* functions embedded in the manifested qualities of the elements, and their causal behavior, and backing up the solidity of objects, which is not present at all in Humean empiricism with its passive sensations and mental associations of ideas, or in the concocted "remembered similarity relations" of Carnap's *Aufbau*, which are obviously subjective and mentalistic. As I have pointed out before (Banks 2003, pp. 10–12, 2013a) there is thus no true philosophical similarity at all between the elements and functions of Mach or Russell and positivistic constructivist projects like the *Aufbau*, which are much more traditionally empiricist in spirit. It is true that Carnap, Schlick, and Neurath considered a physicalistic protocol language (see Uebel 2007 on this point) and it is well known that Carnap even considered a parallel physicalist version of the *Aufbau*, but the Vienna Circle thinkers remained dualists about the conflict between a "physical" language and a "phenomenal" language for observation reports, or *Protokollsätze*, and never adopted a truly neutral view à la Mach, for whom

the problem simply vanishes. Hence the whole *Protokollsatz* debate took place on a much lower level philosophically.

Mind-independent world elements

A question that arises naturally is what to do about completely mind-independent events and their qualities. If any sensation (**s/e**) can be interpreted in another context as a physical event, does it follow that all elements are also sensations (**e/s**) under some interpretation? Some will still defend that reading, but it seems to me to be far too phenomenalistic, as I will show. Should we then admit other elements (pure "e-elements") that are not anyone's sensations, and not even anyone's *possible* sensations? This question has plagued the literature on Mach, James, and Russell and was a major cause of confusion at the time when they first advanced their positions, but I think it is now possible to give a definitive answer. For Mach and Russell, the sensation-elements (**s/e**) are only a *special class* of the mind-independent e-elements, or what I have elsewhere called "world elements" (Banks 2003). There is no question, for either author, that the vast majority of events in nature do not occur in a human nervous system and there is no way to represent the external world, or our theories about it, as a mere "catalogue" of present human sensations or even purely observable contents of scientific theories. Russell was quite explicit about the existence of mind-independent "sensibilia" at one point in his career, when he still believed in the theory of acquaintance, and later just neutral "event particulars," after his neutral monist conversion. Mach and James tended to emphasize that (**s/e**) elements were *already* physical events causally linked to other physical events, and that the barrier had already been breached in the realm of sensations, which are already something physical, but they both advanced further still.

Mach often spoke of the need to "add elements in thought" (*hinzudenken*) in order to connect up the fragmentary experience of our sensations into a real experience of objects in space and time. Even when we observe the path of a parabola, for example, we add in thought the past and future stages to what we presently sense in order to complete the experience. We likewise add unobserved backs and sides to chairs and other objects to fill them in as three-dimensional objects in perspectives, even if no observer is presently situated at those other perspectives to observe them, or could even possibly occupy them all at once from an egocentric perspective. And of course we really mean when we look at a chair, and not a collection of colored blobs, that those missing perspectives are occupied by real, but