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Stud. Hist. Phil. Sci. 37 (2006) 469–488

Studies in History  
and Philosophy  
of Science[www.elsevier.com/locate/shpsa](http://www.elsevier.com/locate/shpsa)

# Revisiting Galison's 'Aufbau/Bauhaus' in light of Neurath's philosophical projects

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Received 22 July 2005; received in revised form 22 November 2005

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## Abstract

In his article entitled 'Aufbau/Bauhaus' and related work, Peter Galison explores the connections between the Vienna Circle and the Dessau Bauhaus. Historically, these groups were related, with members of each group familiar with the ideas of the other. Galison argues that their projects are related as well, through shared political views and methodological approach. The two main figures that connect the Vienna Circle to the Bauhaus—and the figures upon which Galison focuses—are Rudolf Carnap and Otto Neurath. Yet, in our view, the connections that Galison develops do not properly capture the common themes between the Bauhaus and Neurath's philosophical projects. In this paper, we will examine a few of the historical connections between the Dessau Bauhaus and the Vienna Circle, as well as the philosophical connections that Galison draws between these two groups. By examining in greater depth Neurath's philosophical commitments, we aim to demonstrate that some of these philosophical connections fail to resonate with Neurath's projects. And, finally, we develop different connections between Neurath's projects and the Bauhaus. In our view, these new connections between Neurath and the Dessau Bauhaus are both substantive and philosophically interesting.

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*Keywords:* Otto Neurath; Rudolf Carnap; Peter Galison; Bauhaus; Aufbau; Vienna Circle

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doi:10.1016/j.shpsa.2005.11.001

## 1. Bauhaus and Vienna Circle: historical connections

### 1.1. *The Dessau Bauhaus*

On April 1, 1925, Walter Gropius's Bauhaus school was turned out of Weimar, and it was reopened that autumn in Dessau. Negotiations between the school and the Weimar government had failed, and the government of Dessau promised the Bauhaus an entire group of school buildings which Gropius himself would be able to design. It was in Dessau, then, during the last half of the 1920s, that the Bauhaus took a particular intellectual turn, one reflective of a general trend in architecture at the time. Indeed, Galison points out that one of the factors influencing this change was the Dutch De Stijl group, which found the Weimar Bauhaus overly decorative and individualistic (Galison, 1990, p. 715; Willett, 1978, p. 81).

Another precipitator of this turn must have been the industrial environment in Dessau itself. Even before the move to Dessau, the Bauhaus had been associated with large scale housing projects and, in particular, with mass accommodation for workers. But Dessau was principally an industrial city, and the strong technological influence due to its large manufacturing plants and factories must have been palpable. The new school buildings designed for the Bauhaus reflected this influence. The school was grouped in several asymmetrical blocks, with glass-curtained workshops and teachers' houses equipped with new domestic devices to increase efficiency. Such design ideals fell under the new Bauhaus concept of 'Art and Technology - a new unity' (Willett, 1978, pp.118–119). A few years after the school's move to Dessau, Gropius was involved in the design and construction of a large estate just south of the city. Even the process of building this complex of houses reflected careful, rational planning, as well as the use of technological advances, such as the on-site preparation of breezeblocks and concrete beams.

We can see these values expressed by Gropius in a sheet entitled 'Dessau Bauhaus—principles of Bauhaus production', published in 1926:

Only by constant contact with advanced technology, with the diversity of new materials and with new methods of construction, is the creative individual able to bring objects into a vital relationship with the past, and to develop from that a new attitude to design, namely:

Determined acceptance of the living environment of vehicles and machines.

Organic design of objects in terms of their own laws and determined by their contemporaneity, without Romantic beautification and whimsy.

Exclusive use of primary forms and colours comprehensible to everyone.

Simplicity in multiplicity, economical use of space, material, time, and money.

The creation of standard types for all objects in daily use is a social necessity.

For most people the necessities of life are the same. The home, its furnishings, and equipment are required by everybody, and their design is more a matter of reason than of passion. (Reproduced in Whitford, 1984, p. 206)

This outlook led to the decision that every house on the estate would be virtually identical. Since the only purpose of a house is to meet the living requirements of its inhabitants, and most individuals have similar living requirements, there is no need to emphasize individuality in the construction of houses. For the houses of individuals whose requirements are the same ought also to be the same. One could look at building as a way of facilitating

the organization of modern life: houses need to fulfill certain requirements, workplaces other requirements. These buildings do not need any embellishments which do not serve better to ensure the fulfillment of those requirements (Gropius & Schultze-Naumberg, 1994).

In 1928, Gropius resigned from the directorship of the Bauhaus, naming Hannes Meyer as his successor. Meyer possessed many of the same ideals as Gropius, but was more politically active and wanted to bring the school's activities into even closer alignment with everyday life. Meyer believed that the school had become too inbred and too concerned with its own particular style. For that reason, he wanted to direct it towards 'popular necessities', rather than luxuries like paintings and decorative wallpaper. This shift in focus was intended to 'wean it away from idealism to "the one reality we control: that which can be measured, seen, weighed"' (Willett, 1978, p. 123).

Another change effected by Meyer in early 1929 was the practice of bringing in guest lecturers in subjects such as philosophy and the social sciences. On October 15, 1929, Rudolf Carnap gave a lecture at the Bauhaus in Dessau, having recently finished his book, *Der logische Aufbau der Welt*, or *The logical construction of the world*. This book came to be seen as representative of the Vienna Circle, an intellectual group of which Carnap was a key member. The title of Carnap's lecture at the Bauhaus was 'Wissenschaft und Leben' ('Science and life'), and he addressed the audience with the statement, 'I work in science, and you in visible forms; the two are only different sides of a single life' (Galison, 1990, p. 710).

### 1.2. Carnap, Neurath, Bauhaus

Carnap was a logician, mathematical physicist and philosopher who studied logic and philosophy under Frege and Bruno Bauch at the University of Jena. In 1924, Carnap was introduced by Hans Reichenbach to Moritz Schlick, who was at the time a professor in Vienna. Carnap visited the Schlick Circle several times, presenting an early version of his *Aufbau* to members of the Circle. Soon after, Schlick and Hahn secured a position for Carnap at the University in Vienna, where he lived from 1926 until 1931, and where he continued to work on his *Der logische Aufbau der Welt* (Carnap, 1963; Geier, 1998). The philosophical task of this work is often characterized as the reconstruction of the entire sensible world out of simple perceptual elements. This reconstruction leads to a conception of the world adequate for the development of science.

In Galison's view, the term *Aufbau* had a very specific cultural meaning at the time Carnap was writing, which Galison refers to as the 'left-technocratic' period of interest in the notion of *Aufbau*. Generally, Galison takes *Aufbau* to be a process of reconstruction or rebuilding, though on his view neither of these words fully captures the meaning of the German word. In the left-technocratic period in particular, Galison takes the idea of the reconstruction to be as follows:

On new, and for the first time firm, foundations, they would erect a political, philosophical, and aesthetic world separate from everything that had come before. It would (in most instances) be socialist, internationalist, practical, and deeply scientific and technological. (Galison, 1996, p. 17)

So we ought to think of *Aufbau* as related to the reformation of life and a restructuring of values away from the traditional. In this historical period in particular, *Aufbau* meant a shift away from the merely decorative and superfluous and toward the practical, in order

to develop a rational, ordered form of life. All this is part of what we will call the left-technocratic meaning of *Aufbau*—its primarily social and political significance.

Carnap had just such a left-technocratic inclination, for he was identified with the *neue Sachlichkeit* cultural movement, which was committed to internationalism, some version of socialism, and the use of technology to aid in the organization of public life.<sup>1</sup> Carnap, however, was not as politically involved as another key member of the Vienna Circle—Otto Neurath. Neurath was an economist, active in education and in left-wing politics. He had served as president of the Central Economic Administration in Bavaria after its socialist revolution and had also developed a system of picture statistics, known as ISO-TYPE (International System Of TYpographic Picture Education), for use in museums. Neurath was keenly interested in the housing projects in which the Bauhaus was involved, and he was very pleased by the school's gradual shift towards a more scientific, practical, and technological education.

Neurath was present at the opening of the new Dessau Bauhaus in 1926. He wrote an article commemorating the occasion called 'Das Neue Bauhaus in Dessau' ('The New Bauhaus in Dessau'), which was published in a journal also entitled *Der Aufbau*. His reaction to the new orientation of the Bauhaus looks somewhat similar to Meyer's criticism of the Bauhaus some years later. As Galison summarizes Neurath's article:

Celebrating the renunciation of ornamentation and decoration of every sort, he gently chided the Bauhaus for relying too much on the style of modernism and not sufficiently on its practical implications: 'When will the modern engineers run the Bauhaus?' (1990, p. 716)

After Meyer took over the directorship, the logical positivists came often to speak at the Bauhaus. In July 1929, Herbert Feigl spent a week at the school as the official representative of the Vienna Circle, and we have already mentioned Carnap's lecture in October of that same year. Neurath lectured there several times as well, both in 1929 and in 1930.

In his article 'Aufbau/Bauhaus', and also in 'Constructing modernism: Cultural location of Aufbau', Galison explores the connections between the Vienna Circle and the Bauhaus. As Carnap said during his lecture at the Bauhaus, science and the visual forms were supposed to be two sides of a single life. So it is worth seeing what the Vienna Circle and the Bauhaus took to be the connections between the two. The particular connections Galison takes himself to be investigating are related to the cultural meaning of the term *Aufbau*. Galison writes:

in the German-speaking world during the 1920s, a vocabulary and reservoir of images evolved that were shared by both the positivists and the *Bauhäusler*. This repository included a notion of transparent construction in which each element had its place and function. It included the aspiration of both groups to harmonize their own discipline (and interior life more generally) with the rationalism each saw embodied in what they perceived as the regularity, intelligibility, and functionality of contemporary technology. It included an emphasis on the role of the collective action of peoples. (Galison, 1996, p. 41)

<sup>1</sup> See Friedman (1996, pp. 50–51). For more on the connection between the Vienna Circle and the Bauhaus in terms of the *neue Sachlichkeit*, see Dahms (2004).

Thus Galison takes there to be commonalities between the Vienna Circle and the Bauhaus in virtue of the groups' similar goals, goals connected to the particular notion of *Aufbau* then in play.

In the paragraph quoted above, we can in fact distinguish two meanings of *Aufbau*. The first is a more general cultural meaning, what we have been calling the left-technocratic meaning of *Aufbau*. This is related to the idea of modernism and the use of technology to help create a rationally ordered form of life. The second meaning, however, is more directly related to the title of Carnap's *Der logische Aufbau der Welt*. This notion, which we will refer to as the procedural meaning of *Aufbau*, is the idea of a transparent construction from simple elements. It is important that the left-technocratic and procedural meanings be kept distinct, for reasons that will be made clear below.

That the left-technocratic meaning of *Aufbau* can be used to link Carnap and Neurath with the Bauhaus is quite clear. Carnap and Neurath are often said to be part of the 'Left Vienna Circle,' taken as a political designation. And both the Bauhaus and the Left Vienna Circle had the same political enemies: 'the religious right, nationalist, anthroposophist, *völkisch*, and Nazi opponents' (Galison, 1990, p. 710), the opposition to which naturally drew them together. The geometrical style of the Bauhaus was particularly criticized by the Nazis as being too 'international'. For instance, their flat geometrical roofs were not seen to be appropriate for northern climates, and were considered too 'oriental'. In general, this geometrical style was thought to be incapable of capturing the 'German essence', or any kind of nationalistic spirit.

Members of the Vienna Circle denied the possibility of a 'German essence' even more explicitly than the Bauhaus. Even Schlick—one of the less left-wing members of the Vienna Circle—explicitly opposed the idea of the *Deutschtum*, *Nation*, or *Volk* having any kind of transcendent reality (ibid., p. 744). So unsurprisingly, many Vienna Circle academics and their intellectual allies found themselves in a very difficult position with the rise of Nazism. Neurath wrote to Carnap several times in 1933, describing the atmosphere of desperation in Vienna, recalling those he knew who had already been arrested, or even killed. Everyone he knew, he wrote, was trying to escape (ibid., pp. 744–745). Carnap had already left for Prague two years earlier, and in 1935, he fled Europe altogether. Most members of the Vienna Circle did similarly.

Galison is certainly sensitive to the relevance of the left-technocratic meaning of *Aufbau* to both the Vienna Circle and the Bauhaus. However, particularly in 'Aufbau/Bauhaus', he emphasizes the procedural meaning of *Aufbau* as a means of connecting the Vienna Circle and the Bauhaus. He takes this connection to exist between the Bauhaus philosophy and that of Carnap and Neurath in particular. More specifically, Galison relates the type of constructive project in which Carnap is engaged in the *Aufbau* to the architectural methodology of the Bauhaus. He writes:

Both enterprises sought to instantiate a modernism emphasizing what I will call 'transparent construction', a manifest building up from simple elements to all higher forms that would, by virtue of the systematic constructional program itself, guarantee the exclusion of the decorative, mystical, or metaphysical. (Ibid., p. 710)

On the Bauhaus side of this connection, Galison cites the use of basic geometrical forms, as well as the use of glass fixtures which made visible the inner workings of the lamp. He also cites Bauhaus teachers like Kandinsky on their notions regarding form:

the work has to begin with the simplest shapes and systematically progress to more complicated ones. Hence, in the first part of the investigation of form the plane is reduced to three fundamental elements—triangle, square, and circle—and space is reduced to the resulting fundamental space elements—pyramid, cube, and sphere. (Ibid., p. 738)

Thus constructed from basic elements, nothing merely decorative could possibly find its way into the work.

On the Vienna Circle side of this connection, Galison cites Carnap's *Aufbau* as representative of the Vienna Circle's 'scientific world-conception'. An early version of this view also appears in the Vienna Circle's manifesto, their *Wissenschaftliche Weltauffassung*, to which both Carnap and Neurath contributed (Hahn et al., 1929). Galison points out the empiricist commitments of this work, that the only source of knowledge is experience and, in particular, the immediately given. The Vienna Circle divided statements into two categories, the first being those of empirical science, the meaning of which can be determined through the method of logical analysis, while the second class of statements are the meaningless statements of metaphysics. Naturally, the latter have no place in scientific philosophy.

Furthermore, Galison takes the Vienna Circle's interest in the logical analysis of science to have the goal of '[reaching] a unified science by "constituting" all scientific theories out of the elementary bits of perception' (Galison, 1990, p. 732). By this kind of construction, that is, out of only those basic elements which are immediately given, nothing metaphysical could find its way into science. Just as the form of a glass lamp is to be transparent and free of the ornate and decorative, the form of such a unified science is to be transparent as well, free of the metaphysical.

Carnap is not the only one with strong intellectual connections to the Bauhaus. When Meyer resigned his directorship of the Dessau Bauhaus under pressure from the Nazis, his letter of protest included a list of his accomplishments. Among these was the list of visitors whom he had brought to the Bauhaus, and Neurath's name appears first on the list (ibid., p. 745). And in 'Aufbau/Bauhaus', Galison takes Neurath's physicalism to be something akin to the construction process of Carnap's *Aufbau*. Neurath's physicalism is, according to Galison, '[his] doctrine of building up from simple elements of experience' (ibid., p. 746).

So Galison takes the Vienna Circle's empiricist commitments, Carnap's method of logical analysis to the end of unifying science, and Neurath's physicalism to evoke the procedural meaning of *Aufbau*. In this philosophical context, this procedural meaning involves the epistemological construction out of simple perceptual elements. For Galison, this is analogous to the constructivist curriculum of the Bauhaus, exemplified by Kandinsky, which emphasizes architectural construction out of simple geometrical elements. The careful nature of these constructions was intended to ensure that no metaphysical or decorative elements found their way into that which was being constructed, so that the inner workings of the structure would be transparent.

## 2. Neurath's philosophy of science

Above we detailed the connection that Galison draws between the Bauhaus and the Vienna Circle and, in particular, the relevance of the procedural meaning of *Aufbau* to

the projects of both groups. Yet many argue that the caricatured version of logical empiricism as ‘logistically fortified traditional foundationalism’<sup>2</sup> fails to capture the nuanced philosophical views of the Vienna Circle. Galison may not have such a caricature in mind—the notion of transparent construction does not in itself seem to be a commitment to foundationalism. Yet it is worth investigating the degree to which the philosophical commitments that Galison takes to constitute the Vienna Circle’s connection to the Bauhaus are themselves truly shared by the members of the Circle, and in particular by Neurath. For in our view, it is at least the case that the project of transparent construction from simple elements did not belong to Neurath.

Here we outline some of Neurath’s views on epistemology and philosophy of science. The picture that emerges is clearly distinct from the stereotypical version of logical empiricism. A discussion of Neurath’s account of unified science will serve to ground his notion of the role in science played by what he calls *Ballungen*, as well as his epistemological views and, finally, Neurath’s peculiar form of physicalism. This investigation into Neurath’s philosophical commitments will serve to ground our claim that the connection between the Bauhaus and Neurath cannot have a basis in their shared commitment to the procedural meaning of *Aufbau*, for at least with regards to his philosophical views, Neurath had no such commitment.

### 2.1. Unified science and encyclopedism

Working toward a unified science (*Einheitswissenschaft*), especially through his encyclopedia project, was a central and permanent aim of Neurath’s philosophical engagement. Our phrasing is deliberate: Neurath saw this more as a project to be pursued than as a philosophical stance. Unified science is not the instantiation of a ‘grand metaphysical view’. Rather:

instead of aiming at a synthesis of the different sciences on the basis of a prior and independent philosophy, the special sciences will themselves supply their own synthesizing glue. (Neurath, 1983f, p. 172)

Thus unified science was a practical aim, namely the bringing together of scientists and thereby distinct sciences in the name of interconnection and communication. What the product of this collaboration would look like was not for Neurath or anyone else to stipulate.

Neurath makes the same point in other places by distinguishing between a system and systematization. The former is prescriptive, aiming for completion and correctness. Systematization, in contrast, yields an encyclopedia. And an encyclopedia is nothing but ‘a preliminary assemblage of knowledge ... the totality of scientific matter now at our disposal’ (Neurath, 1983c, p. 146). The systematization of science, in Neurath’s sense, begins with simply the bringing together of diverse scientific endeavors. Later, Neurath follows Kallen in describing this process of systematization as ‘orchestration’ (Neurath, 1983g, p. 242).

In what, though, does this systematization consist? One goal is the unification of scientific language, that is, ensuring that terminology and symbolism is as consistent as possible among all disciplines. Note that by this Neurath does not mean that all sciences will be

<sup>2</sup> This phrasing comes from Uebel (1992, p. ix).

formulated in terms of microphysics or anything like that. Indeed, he specifies that ‘one will have to refrain ... from concealing the ambiguity of certain pronouncements and from attempting to design a unitary system’ (Neurath, 1983e, p. 140). Yet he does have in mind a basic terminology that can be used in all of the sciences; more will be said regarding this in Section 2.2 below.

Second, unified science should aim for and emphasize the unity of auxiliary procedures. This includes detailing the stock of scientific instruments available and shown to be effective, including ‘logical instruments’ such as probability theory (*ibid.*, pp. 141, 155). Relatedly, Neurath aims for unity in graphic representation. As he puts it, ‘curves and other figures are also instruments of scientific expression’ (*ibid.*, p. 142). Neurath had in mind that the ISOTYPE picture language that he had developed would provide the standardized elements from which scientific figures could be constructed.

As far as the subject matter of the various sciences is concerned, Neurath writes that ‘of greatest importance also is the linking of disciplines among themselves by the establishment of “cross-connections”’ (1983c, p. 155). Neurath provides an example of such a cross-connection by posing the question, ‘to what degree can biology and physics be presented from a unified point of view?’ (*ibid.*). Further, cross-connections are forced upon us by the application of scientific tools to particular problems. Neurath writes:

We avoid pseudo-problems of all kinds if, in the analysis of sciences, we set out from predictions, their formulation and their control. But it is precisely this starting point that is little suited for the delimitation of special disciplines. One does not arrive at individual disciplines of stars, stones, plants, animals during the deduction of certain predictions, because time and again the conjunction of statements of different origin becomes necessary. (1983d, p. 132)

Thus the working of science itself forces upon us connections among the individual parts of science. This is because predicting and accounting for phenomena in the natural and social world requires us to put to work many sciences simultaneously and in conjunction. This can be seen as the impetus for the unified vocabulary, instrumentation, representation of science, as well as the cross-connections among its parts. In short, science’s applicability creates the need for its systematization.

The unity of science thesis is often characterized as the reduction of all sciences to the domain of microphysics. Yet it is obvious that Neurath’s vision of unified science is far from that. According to Neurath, the sciences themselves are to dictate their interconnections, and many different systematizations are possible. The result is ‘a far-reaching unity that can *not* be deduced logically’ (Neurath, 1983b, p. 116; emphasis in original). Thus, unified science is a systematization of the language, procedures, and representations of science in order to increase our ability to generate good predictions. Different such systematizations are possible, and we are to take our lead from scientific practice itself. Neurath says:

The unity we have before us, as a goal for the encyclopedism of logical empiricism, is based on the actual store of expressions which people have in common all over the world. Its evolution would be based on conventions which could never be definite or authoritative as far as the aspirations of conscientious logical empiricists are concerned. Pluralism is the aura of this scientific world community of the common man. The encyclopedism of logical empiricism ... with the unified science encyclope-



dia are the children of the tolerant approach of democratic cooperation. It competes with no philosophy, and is anti-totalitarian through and through. (Neurath, 1983g, p. 242)

## 2.2. *Ballungen*

We said above that Neurath's notion of unified science includes the unity of the language of science. He envisions a basic terminology that is applicable throughout science. Yet, as we noted, this terminological unity will not bring the end of ambiguity; far from it. Indeed, it is just this ambiguity that ensures the stability of discourse across times and places and speakers. Such stability is necessary for scientific discourse, as well as for the wide, borderless participation in science envisioned by Neurath.

Neurath takes as an example of this stabilizing ambiguity the sentence, 'In a certain year B.C. a ship moved up the waters of the Tiber in the direction of Rome'. He points out that

The terms of this statement can be used today in about the same way as some centuries ago, although what corresponds in science to the common term 'water' has today a definition that is different from that of some centuries ago and even of a very short time ago when one did not know the difference between 'heavy' and 'light' water. The terms of science must adapt themselves much more to the new theories than a cluster. (Neurath, 1983c, p. 149)

The very ambiguity of such *Ballungen*, or conglomerations, makes possible the reinterpretation and translation that allows their stability. Thus terms from ordinary life such as 'water', 'tree', and 'cave' hold their meaning across cultures and among individuals much more successfully than theoretical terms (be they magical, theological, metaphysical, or scientific) such as 'taboo', 'nirvana', 'thing in itself', and 'heat'.<sup>3</sup>

Yet *Ballungen* have their drawbacks. For their ambiguity and lack of theoretical commitment make them ill-suited to offer firm, scientific predictions. We need theoretical terms to generate scientific progress, and the precise formulation of the concepts to which they apply is very important. Yet there will always be a base of commonsense notions grounding theoretical constructs. We cannot eliminate *Ballungen*, and it would be the death of scientific progress—and communication—if we could. Thus:

Our whole life consists in two opposite movements: in the one we tend to acquire always new concepts and to modify those that tradition has left us; but in the other we are obliged to take the traditional statements as the basis for our departure. (Ibid., p. 150)

Ambiguity and the resulting stability are thus opposed to precision and the resulting predictive power. Simple observation statements are the common currency in science and in life, while theoretical terminology yields predictions and can lead to scientific progress.

We should note in passing that it is this common vocabulary rife with ambiguity upon which, on Neurath's view, protocol statements are based. Indeed, Neurath specifies that protocol statements are 'of medium complexity and uncertainty like those familiar to us

<sup>3</sup> These examples come from Neurath (1983c, p. 150). See Cartwright et al. (1996) on the importance of *Ballungen* to Neurath's philosophical views.

in current language' (ibid., pp. 152–153). This seems to follow from his conception of the purpose of common language and its *Ballungen*, for it is this language that is inter-translatable among observers, cultures, and epochs.

### 2.3. Naturalized epistemology

The ambiguities of common language that are ineliminable from science make necessary the science of science. This 'behaviouristic study of the actions of men of science' is necessary if we are to understand the relationships linking scientific theory to everyday terminology (ibid., p. 149). Further, the science of science, along with the sociology, history, and philosophy of science and in general, as *Geisteswissenschaften*, are legitimate components of unified science. Thus there is no privileged perspective from which philosophy can work—it is in amongst all the sciences.

A consequence of this view is a form of naturalized epistemology, that is, the view that the study of in what knowledge consists, how science proceeds, etc., is an empirical investigation, indeed part of science itself. Philosophy is replaced by empirical and logical studies that are themselves part of unified science. Neurath writes of his and his colleagues' aims for unified science that

We would establish the 'cross connections' from science to science and thus create a structure that knows no 'philosophy', no 'epistemology' with special propositions—whichever one of these two is applicable has found its place either in the 'logic of science' or in 'behaviouristics'. (Neurath, 1983b, p. 115)

The *a priori* disciplines of philosophy and epistemology are thus replaced by a combination of logic and empirical study of the actual development of science.

This latter component cannot be done in advance, but must take account of what scientists *in fact* decide. We mentioned above that many different systematizations of science are possible. Which one is pursued is a matter of historical accident—it simply turns out that we pursue one path or the other. Thus we are ourselves part of the data of unified science; our responses and decisions are data determining the form of science (Neurath, 1983c, p. 157). And this is the replacement of *a priori* epistemology.

Thus Neurath has naturalized epistemology, replacing philosophy with unified science. Anything that is 'isolated' and thus 'scientifically useless' is merely metaphysical and, it seems, useless more broadly (Neurath, 1983d, p. 137). In contrast, the science of science is a worthwhile and promising endeavor. The degree to which it will succeed Neurath, in characteristic form, leaves as an open question. But the social scientist in him certainly seems optimistic.<sup>4</sup>

### 2.4. Neurath's brand of physicalism

Just as Neurath's notion of unified science is far different from the typical reductionistic picture, so too is his brand of physicalism other than one might at first think. However, after the discussion above, Neurath's version of physicalism should now seem to fall neatly

<sup>4</sup> See Uebel (1992, 1996) for a more in-depth examination of Neurath's naturalized epistemology and his related position in the protocol sentence debates.

into place. For in his view, physicalism amounts to the idea that the everyday language of perceptible objects can be used throughout the scientific enterprise.

We have discussed how all of science is (or should be) unified and how ordinary language is needed to ground science. This systematized language of all science—Neurath calls it a ‘universal jargon’—is, as we saw above, full of imprecision and ambiguity. It is important that this universal jargon is used in a consistent manner throughout science and, further, that the theoretical language that develops is consistent with this jargon. It is here that physicalism comes in.

In various places, Neurath cashes out what he means by physicalism in slightly different ways. Yet these ways seem consistent with one another.<sup>5</sup> Early on, he writes that physicalism is the view that ‘what matters is that all statements contain references to the spatio-temporal order, the order we know from physics’ (Neurath, 1983a, p. 54). Thus ‘I see blue’, for example, is a statement taken to indicate spatio-temporal changes outside of the person or, if hallucinatory, certain changes within the person herself. Relatedly, Neurath later claims that physicalism is the practice of using a universal jargon that corresponds to the language of physics. Here to get at what he means by this correspondence, he points out that indexical terms can be replaced by explicit references to place and time. The important aspect of physicalism thus remains that all statements relate back to the spatio-temporal ordering. And finally, in another formulation, Neurath claims that physicalism is the view that ordinary language can be used in all scientific discussions. The picture of his physicalism perhaps emerges best here. He begins by discussing again how statements like ‘I see something red floating in front of me’ are to be translated into statements with direct references to times, people, and places. This

[seems] to have the advantage that the ‘when, where and how’ attitude could be maintained from the bottom to the top. This I call the ‘physicalist’ approach, which has nothing to do with ‘mechanism’ or anything like that; it only pretends that we can use the everyday language which we use when we talk of cows and calves throughout the empiricist discussions. (Neurath, 1983g, p. 233)

Unified science begins with a universal jargon full of *Ballungen* that is accessible to different people, at different times, and in different places. This Neurath takes to be possible because of his version of physicalism: the ability to formulate observations and so on, in terms of the spatio-temporal framework used in physics. This physicalism ensures the universality of our jargon and, thus, the possibility of a science unified across individuals, cultures, and disciplines.

### 3. Neurath and Bauhaus: rethinking the connections

We take Section 2 above to demonstrate the extent to which Neurath’s philosophical views fail to line up with a program of transparent construction from simples. Indeed, on our view, the philosophical differences between Carnap and Neurath are sizable enough

<sup>5</sup> Throughout this discussion of Neurath’s philosophy, the issue of how Neurath’s views developed over time has been neglected. We think this is unproblematic, for the success of our thesis will not hinge upon one or another version of the general views outlined here. Important is only the fact that at no point did Neurath hold the views that one must ascribe to him in order for the procedural meaning of *Aufbau* to apply. We take this depiction of Neurath’s general philosophical views to illustrate this. See note 8 below for more on this point.

to make problematic the idea that we can center a connection between the Bauhaus and the Vienna Circle on Carnap's *Aufbau*. Yet, at least in 'Aufbau/Bauhaus', the idea of *Aufbau* as transparent construction from simple elements is a very significant part of the repository of common vocabulary that Galison takes to be shared by the Bauhaus and the Vienna Circle. In reality, though, this connection fits Carnap's early philosophical projects better than those of Neurath. Here we will argue for this claim, as well as outline some distinct connections between Neurath and the Bauhaus.

### 3.1. Carnap's *Aufbau* and the Bauhaus

First of all, the common themes in the Bauhaus's architectural work and Carnap's philosophical work bear emphasizing. As we discussed in Section 1, Carnap and the Bauhaus were not merely unified by their leftist political tendencies. The two also subscribed to parallel methodological commitments. One of these is a commitment to a form of unity that springs from the building up of a structure from simple elements. For the Bauhaus, this commitment meant that structures and fixtures were built up out of a few simple shapes, with forms and colors limited to the typical (Willett, 1978, p. 119). Thus the simplest elements were combined to produce functional buildings and objects.

Carnap's commitment to this structural building up from simples is manifested in the very nature of his project in the *Aufbau*. In the Preface to the second edition, he states that

The main problem concerns the possibility of the rational reconstruction of the concepts of all fields of knowledge on the basis of concepts that refer to the immediately given. (Carnap, 1969, p. v)

If the project of the *Aufbau* succeeds, then, all science will be constructed on the basis of sense experience. So where the Bauhaus built up structures physically out of simple design elements, Carnap built up the conceptual structure of experience logically, starting from immediate perception.

This commitment to the construction of complex edifices from simple elements provides the occasion for a second parallel between Carnap's and the Bauhaus's programs. Both are committed to a form of transparency in virtue of this construction process. Architecturally, the transparency results from the formulaic combination of simple shapes and colors, as well as the commitment to structures that differ only insofar as they are to be put to different uses. Recall from above that if spaces were to be used by similar people for similar purposes, Gropius saw no reason for them to be distinct. This would be a 'wasteful and a misplaced emphasis on individuality' (Willett, 1978, p. 121).

Through his *Aufbau* project, Carnap intended to show how scientific claims can be traced back to perceptual facts.<sup>6</sup> This rational reconstruction allows for its own sort of transparency, insofar as scientific claims can then be understood based upon their relationship to

<sup>6</sup> Whether or not the Carnap of the *Aufbau* is committed to foundationalism is a disputed matter. See, for instance Richardson (1998), Friedman (1999). In our view, Galison (1990, 1996) suggests a foundationalist interpretation of the *Aufbau*. However, he may not be committed to this interpretation of Carnap, and our arguments here do not depend upon such a commitment. Regardless of whether or not Carnap's transparent construction from simple elements is taken to be foundationalist in nature, what is at issue here is Galison's idea that a commitment to this philosophical transparent construction unites both Carnap and Neurath to the Bauhaus. On our view, it does not.

perceptual facts. In this way, Carnap attempts to make transparent all scientific statements, that is, all legitimate, non-metaphysical claims about the world. He argues that the relationship obtaining between higher and lower levels of complexity in science is that of logical complexes and their elements. When a scientific concept is shown to be merely a logical complex, it follows that ‘all statements about it can be transformed into statements about its elements’ (Carnap, 1969, p. 7). Thus this logical construction of scientific concepts from a basis in the immediately given makes possible a certain perspicuity in science. For ultimately, if Carnap is right, all scientific claims derive from—and can be traced back to—simple claims about sense experience.

### 3.2. Neurath and Carnap: philosophical differences

These commonalities between the Bauhaus and Carnap’s *Aufbau* in particular make salient some key philosophical differences between Carnap and Neurath. Neurath would not have undertaken a quest for transparent logical construction, at least in part because of his notion of *Ballungen*. Recall that *Ballungen* are not only irremovable from science, but even essential to its success. *Ballungen*—common, imprecise terms that are somewhat vague in meaning—ensure that different individuals with different backgrounds can communicate with each other; that observations remain stable with the passing of time; and in general, that science can be shared among all manner of people, cultures, and times.

The residual ambiguity that accompanies *Ballungen* makes impossible the Carnapian ideal of transparency. For Carnap, this transparency stems from the logical construction of science from immediate sense experience or other basic elements. But in Neurath’s view, the common words for middle-sized objects are the basis for science, and the very thing that makes them suitable for this job is that they cannot be defined away, fully cashed out in more precise terms. Neurath writes:

The fiction of an ideal language constructed out of pure atomic sentences is no less metaphysical than the fiction of Laplace’s demon. The language of science, with its ever increasing development of symbolic systems, cannot be regarded as an approximation to such an ideal language. (Neurath, 1959; p. 199)

We are stuck with the ambiguities of common language.

The vagueness and ambiguity of *Ballungen* mean that there are different directions in which science can proceed, different ways for theory to accommodate empirical observations. Recall from Section 2.3 that, for Neurath, the study of science is in part sociological, a matter of looking to see in what direction scientists have in fact proceeded. This is because science starts with an ambiguous language that makes crystal-clear, logical progression impossible. As Neurath said in his famous boat metaphor, ‘we are like sailors who have to rebuild their ship on the open sea, without ever being able to dismantle it in dry dock’. And rather than striving for transparency, we should appreciate the importance of *Ballungen*, of the ‘conglomerations’ that solidly frame our ship.

Neurath’s position on protocol sentences is, naturally, closely related to his notion of *Ballungen*.<sup>7</sup> He offers as an example of a protocol sentence the statement, ‘Otto is observing an angry person’ (Neurath, 1959, p. 199). An essential feature of this statement, and of protocol sentences in general, is the reference to the person who makes the observation—this is

<sup>7</sup> See Uebel (1992) for an in-depth discussion of this issue.

in contrast to, for example, Schlick's notion of protocol sentences like 'Here blue now'. Indeed, in Neurath's view, the above sentence should be even further expanded to incorporate its time-index. The revised sentence would read something like, 'At 12:00 p.m. Otto noted that Otto is observing an angry person'. But even in this more fully specified version of the statement, the appeal to the vague concept of 'angry person' remains.

The explicit reference to time and observer in Neurath's version of protocol sentences serves to emphasize a key aspect of his philosophical position. For Neurath, science is interpersonal to its core. The immediately given is not the proper foundation for science. Instead, even protocol sentences are formulated in the third-person, with indexicals replaced with explicit reference to times, places, and people. Protocol sentences and the *Ballungen* comprising them are formulated in a way that ensures that people can understand one another. It is this opportunity for communication that grounds science, not the individualistic formulation of statements capturing immediate sense experience.

Another significant difference between Neurath and Carnap is in their disparate ideas of unity of science. We showed in Section 2.1 how Neurath's vision of unified science was exemplified by encyclopedism and the systematization of science, instead of the construction of a single scientific system. We are to reject the notion of 'a philosophical system which is to legislate for the sciences' and 'the rationalistic anticipation of the system of the sciences' (Neurath, 1983f, pp. 176–177). Instead, the progression of science itself demonstrates the ways in which it can be unified. Neurath writes that 'The whole of science is basically always under discussion' (1983b, p. 118). The unity of science is an ongoing task, not something which can be accomplished once and for all. The crucial role of *Ballungen* and the pluralism of the scientific community make a preordained, constructional system impossible even in principle. What is more, this pluralism is essential to the anti-totalitarian and fundamentally democratic character of encyclopedism.

Carnap's notion of unity of science, on the other hand, has much more to do with a system than Neurathian systematization. It is true that Carnap did not commit himself to a single basis for science. The system that he constructs in his *Aufbau* has an 'autopsychological' basis, which takes 'elementary experiences' as basic elements. Yet Carnap explicitly considers other bases which could have served to ground the rational reconstruction of the *Aufbau*—some are physical, others psychological (Carnap, 1969, pp. 99–100). Carnap is not seeking *the* system of science. Yet in spite of this pluralism regarding the basis of reconstruction, he still seems to be advocating something akin to a 'system view' of the unity of science. In his view, 'the formation of the constructional system is the first aim of science' (ibid., p. 288). Now, Carnap means this in a logical, not a temporal sense; he is not suggesting that science must stop until the foundational project is completed. But he does believe that demonstrating the manner in which an object is constructed out of the basic elements of experience is what gives statements about that object a verifiable meaning (ibid., p. 289). Thus, even though different bases are possible for the constructional system, the (logically) first task of science is to fix one and proceed from there. For 'by placing the objects of science in one unified constructional system, the different "sciences" are at the same time recognized as branches of the one science and are themselves brought into a system' (ibid., p. 288).

There is no sense in the *Aufbau*, then, of the unity of science as an ongoing task. In a way, science actually begins when the system is completed. What gives science unity is unified language and the resulting ability to translate statements in any domain of science into the unified language. This language, the constructional system, and its basic elements determine what statements are scientific. They are logically prior to the rest of science.

Furthermore, it appears to be quite consistent with the *Aufbau* that we might *choose* a single constructional system for science, though we acknowledge that it is not the only possible one. It thus seems that diversity does not play an essential role in scientific practice for Carnap. In contrast to this, Neurath takes diversity to be an essential aspect of scientific practice:

*Multiplicity* and *uncertainty* are essential. From the data at our disposal we can, in more than one way, deduce predictions that are in harmony with science; the multiplicity of predicting cannot be excluded by any method; no degree of systematic procedure can alter this. One can, so to speak, not agree on a ‘machine’ that unambiguously produces ‘inductions’ in the wider sense. The progress of science consists, as it were, in constantly changing the machine and in advancing on the basis of new decisions. (Neurath, 1983b, p. 116)

Neurath and Carnap both emphasize the importance of the scientific community and the role of the encyclopedia project in furthering communication within it. Yet why is pluralism in that community so important for Neurath? Carnap certainly does not oppose it, but he does not make a case, as Neurath does, for fostering it. The difference is in the emphasis of their respective projects. In the *Aufbau*, at least, the aim is to rationally reconstruct scientific claims using sense-experience as a basis. For Neurath, however, we take science as it is, and science is a social activity. As can be seen from his views on matters ranging from *Ballungen* to naturalized epistemology, Neurath is very conscious of the nature of science as a social practice.

### 3.3. Neurath/Bauhaus

Thus far in this section we have discussed in more detail the parallels between Carnap’s philosophical views and the Bauhaus project (Section 3.1) and some central philosophical differences between Carnap and Neurath (Section 3.2). From this it is clear that Carnap and Neurath’s differences are such that the procedural meaning of *Aufbau* that is commonly held by Carnap and the Bauhaus is not shared by Neurath. In this final section, we will explicitly develop the differences between Neurath’s philosophical commitments on the one hand and the commonalities between Carnap and the Bauhaus on the other. We will then discuss what Neurath does have in common with the Bauhaus. Some of these connections are also shared with Carnap and other members of the Vienna Circle. Others are more particular to Neurath.

We have emphasized that Neurath’s conception of the role of *Ballungen* in science runs counter to the project of mechanical composition from simple components and to the transparency that is the aim of this compositionality. Yet these are the method and aim, respectively, that connect Carnap’s and the Bauhaus’s respective projects. Thus, whereas the Bauhaus’s commitment to architecture composed of simple components put together in a mechanical way is mirrored in Carnap’s notion of the unity of science as a logical reconstruction from the immediately given, this is not so for what Neurath means by the unity of science. *Ballungen* are ill-suited for the role of the simple elements of construction. They are not few and known, but various and vague.

It thus seems as if Neurath would not have recognized a project parallel to his for science in the mechanistic architecture of the Bauhaus—at least not in the way that Carnap could have. Neurath’s project of unifying science is not an *Aufbau* in the sense of a trans-

parent construction from simple elements. There would not even be a starting point for such a construction, since for Neurath, we are epistemically always as if on a ship already at sea. There is no process of building more complex forms from the simple, that is, no building an edifice that comprises all of science. Unified science is not an edifice—not a system—but an ongoing project that arises organically from the directions that scientists themselves decide to take. For these reasons, rather than a process of construction, Neurath's notion of unified science is more like haphazard renovation. We start from our current epistemic position, and we are without advance plan or particular end goal.

Relatedly, the commitment to physicalism that Galison takes to unite the Vienna Circle and the Bauhaus does not line up with Neurath's notion of physicalism. In Section 1.2, we mentioned that Galison refers to Neurath's physicalism as his 'doctrine of building up from simple elements of experience' (Galison, 1990, p. 746), which is aligned with the procedural meaning of *Aufbau*. Yet we have argued that characterizing Neurath's philosophical project as a process of construction is misleading. Further, the protocol sentences that serve as the taking-off points for science are, for Neurath, not 'the given', but third-person intersubjective statements formulated in ordinary language.

For Neurath, physicalism amounts to something like the thesis that everyday language—language that refers to perceptible objects—suffices for science. Whatever follows from this thesis, it does not entail that science is built up from the simple elements of experience. Protocol sentences refer to sensible objects; that much is clear. And it is the *Ballungen* found in protocol sentences that ground science. But Neurath cashes these claims out in a way that undermines the very idea of a construction project that starts with immediate experience.<sup>8</sup> Thus the connection that Galison draws between the Vienna Circle and the Bauhaus that centers on the procedural meaning of *Aufbau* does not fit Neurath's philosophical views. Neurath's philosophical methodology simply does not mirror the Bauhaus's architectural methodology. While Neurath may have considered a construction process leading to transparency of form to be an admirable architectural goal, he certainly did not see its analog as a warranted philosophical goal.<sup>9</sup>

However, as was discussed above, the procedural meaning of *Aufbau* is not all that Galison has in mind. In 'Constructing modernism', he also discusses the emphasis that both the Vienna Circle and the Bauhaus place on collaboration, which has more to do with the left-technocratic meaning of *Aufbau*. This emphasis on collaboration is something

<sup>8</sup> Galison points out that cultural meanings such as those that he takes to connect the Vienna Circle and the Bauhaus are artifacts of a particular historical period. So it may be argued that it is unfair to cite Neurath's later work as evidence against his engagement with the procedural meaning of *Aufbau*. Yet in our view, these later writings only help to clarify a persisting feature of Neurath's general viewpoint. Neurath was not a proponent of physicalism as transparent construction from simples in 1928, when Carnap's *Aufbau* was written, any more than he was a decade later. This can be seen from his review of Carnap's *Aufbau* (Neurath, 1981), despite the fact that in this work he emphasizes the points of agreement between him and Carnap. In the review, Neurath remarks that Carnap deals principally with physics and natural sciences. He suggests that the picture would be more complicated if Carnap had also considered the social sciences. In particular, Carnap would have had to address the question of how knowledge can be furthered when science must use both clean (*saubere*) and unclean (*unsaubere*) ways of thinking, a situation which Neurath remarks might be necessary. Such *unsaubere Denkweisen* seem quite similar to his *Ballungen*.

<sup>9</sup> The idea of construction from simples undoubtedly resonated with Neurath on another level. His ISOTYPE was a system of pictorially communicating information without relying upon words. This system relied upon bringing together in a single picture various representations with which viewers were previously familiar. Thus, this might be considered to be an instance of construction from simples. Thanks to an anonymous referee for this point.



which is clear in Neurath's philosophical writing, and it is also one of Carnap's methodological values. Though the notion of collaboration is not as central to the *Aufbau* as the nature of the constructional system, Neurath does point out in his review of the book that Carnap emphasizes the collectivistic nature of scientific research (Neurath, 1981, p. 297).

The importance of collaboration to Neurath's own encyclopedia project, as well as to the methods of the Bauhaus, can hardly be overstated. Indeed, collaboration was one of the most important features of the encyclopedia. This can be seen from its very title, *International encyclopedia of unified science*. It was to engage scientists from a variety of disciplines and a variety of countries, so that the encyclopedia could become a vast survey of the state of science. Neurath intended it to be 'the symbol of a developed scientific cooperation, of the unity of the sciences, and of the fraternity between the new encyclopedists' (Neurath, 1983c, p. 158).

For the Dessau Bauhaus, architecture was also a matter of cooperation. Gropius writes, 'The art of building is contingent on the coordinated team-work of a band of active collaborators whose orchestral cooperation symbolizes the cooperative organism we call society' (Gropius, 1965, p. 57). So even though Neurath's scientific unity and the Bauhaus's architectural methods differ, they are united insofar as both crucially depend upon the coordination and cooperation of individuals.

Furthermore, even though Neurath does not think that unified science is to be brought about through an *Aufbau*-style constructional system, his own methods have somewhat similar aims. Galison points out that 'in both Bauhaus and *Aufbau*, construction from the intelligible simples eliminated the metaphysics of the unnecessary, the merely decorative' (Galison, 1990, p. 738). Neurath and Carnap are united in advocating the elimination of that which is merely decorative or metaphysical, and it is their physicalism that assures this elimination.<sup>10</sup> This is closely linked to the Bauhaus's elimination of the purely decorative.

Perhaps related to their opposition to metaphysical ideas such as a 'national essence', the Bauhaus and the Left Vienna Circle shared similar political inclinations. In Meyer, we see not only statements about the importance of cooperation,<sup>11</sup> but also views about the international character of his approach to building: 'The constructivist form knows no fatherland; it is stateless and the expression of an internationalized way of thought. Internationalism is one of the virtues of our age' (Meyer, 1994, p. 448). The encyclopedia project of the Vienna Circle was explicitly international; its emphasis on collaboration clearly advocated communication between scientists of all nationalities and was aimed to eliminate nationalistic bias from science.

Another shared aspect of these groups' leftist politics was the importance that each placed on a close relationship between science and modern life. After all, 'Science and life' was the title of Carnap's initial lecture at the Bauhaus, in which he spoke of the roles of both science and visual art in modern life. Neurath also supported the technologically driven aspect of the Bauhaus, as well as its use of new synthetic materials in the construction of their products (Neurath, 1929; Galison 1990). This tying together of modern technology

<sup>10</sup> Neurath was probably the member of the Vienna Circle most vigilant in his guard against metaphysics. Metaphysical claims were, for the logical empiricists, meaningless. They served merely to obfuscate matters. In this sense, then, Neurath was committed to furthering the transparency of language as much as possible. However, the pursuit of this sort of transparency is wholly distinct from the notion of construction from simples and, thus, does not align with Galison's explication of the notion. Thanks to an anonymous referee for pointing out how Neurath's elimination of the metaphysical is a commitment to a particular form of transparency.

<sup>11</sup> For instance, 'Cooperation rules all the world. *Community rules over individual being*' (Meyer, 1994, p. 447).

and modern life was a direction in which the Bauhaus was moving, as were many other architects of the time. In Galison's words:

Indeed, the claims for a reformation of life based on modern principles of science became a common slogan of the left-leaning architects of post-World War I Germany—and an irritant to those on the right, who were determined to preserve a *völkisch* life form, imbued with history, nationalism, and racial identity. (1990, p. 717)

These two parallels—the role of collaboration and leftist political commitments—are rather general, shared by many progressive thinkers between the wars. Hence the prominence of the left-technocratic meaning of *Aufbau*. But the ideological connections between Neurath and the Bauhaus are more extensive. To begin with, Neurath was acutely conscious of science as a social practice; a belief shared by Carnap but not as central to his philosophical views. Neurath makes clear that the elimination of metaphysics is not simply an end in itself, but is for the sake of science. On his view, metaphysical idealism can lead to undesirable consequences in science, as well as other social practices. Neurath writes that metaphysical idealism has allowed for the justification of oppressive social practices, and even the acceptance of totalitarianism. He argues that the Nazis found arguments for persecution in Plato's Republic and that Fichte's idealism caused him to ask for the expulsion of the Jews (Neurath, 1983g, p. 238). These reprehensible social practices result from the adoption of some artificial authority. The moral that Neurath draws is that no absolute authority should be accepted in science or similar institutions.

In our view, then, the most significant intellectual connection between Neurath and the Bauhaus is not in their methods but in their overarching aims. Neurath's views about scientific practice are incompatible with a view of science as a Carnap-style *Aufbau*. Yet these methodological differences are perhaps less important than the shared aims of Neurath's and the Bauhaus's respective projects. In fact, with respect to their broad aims, Neurath and the Bauhaus architects were engaging in two versions of the same project: each sought to organize and improve life through science and technology. To place too great an emphasis on the comparison of their methods would be a mistake. For both Neurath and the Bauhaus, these methods were clearly subordinate to their overarching social aims.

Neurath's unified science is motivated at least in part by its instrumental value. In practical tasks which involve the sciences, such as architecture or city planning, many different sciences are involved. The effective application of science thus requires the coordination of its parts. Unified language and scientific cross-connections are important insofar as they are needed for the use of science in the pursuit of practical ends and social goods. Further, his empiricist philosophy is not designed to take the place of a metaphysical higher authority. Indeed, pluralism in science is meant to ensure that science will remain non-totalitarian. If science itself were to replace the totalitarian metaphysical authorities, something would certainly be wrong. For without collaboration and democratic cooperation, science would be ill-suited to benefit society.

Similarly, to focus only on the Bauhaus's use of technology and non-decorative style would neglect the goal that this technology was designed to serve. The Bauhaus developed its doctrine of freeing architecture from excessive ornament because of its influence on human life:

rationalization, which many people imagine to be [the New Architecture's] cardinal principle, is really only its purifying agency. The liberation of architecture from a

welter of ornament, the emphasis on its structural functions, and the concentration on concise and economical solutions, represent the purely material side of that formalizing process on which the practical value of the New Architecture depends. The other, the aesthetic satisfaction of the human soul, is just as important as the material. (Gropius, 1965, pp. 23–24)

Not only is the elimination of the decorative and the metaphysical instrumental, but it seems as though science and technology are as well. The use of technology is not in itself an end for the Bauhaus, just as the betterment of science is not wholly an end by itself for Neurath. Gropius is quite explicit about this. He writes that mechanization and other industrial tools are extremely useful for building but should not be taken to be things which ought to be pursued independently of the ways in which they can improve life. For:

were mechanization an end in itself it would be an unmitigated calamity, robbing life of half its fullness and variety by stunting men and women into sub-human, robot-like automatons ... But in the last resort mechanization can have only one object: to abolish the individual's physical toil of providing himself with the necessities of existence in order that hand and brain may be set free for some higher order of activity. (Ibid., p. 33)

For the Bauhaus, as for Neurath, method was always subordinate to the ultimate aim of improving life through science and technology.

### Acknowledgements

This paper has benefited from the helpful comments of Michael Friedman, Hannes Leitgeb, Sarah Richardson, and two anonymous referees for *Studies in History and Philosophy of Science*. We presented this material to the Logical Methods in the Humanities group at Stanford University, and we are grateful to the audience for helpful comments and questions.

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