An “ecological” view of styles of science and of art: Alois Riegl's explorations of the style concept

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1. Introduction

"Each style determines in its own way what qualifies as truth. Or falsity, as criteria for falsity are established along with criteria for truth, without which a statement would not be recognized as ‘scientific’", Ian Hacking ([2000 [1982]]) famously observed. Hacking (2011) added thirty years later that “there is no question of providing a definition or a demarcation a priori of a style of scientific reasoning [of the six in existence, ChlK].” These two observations are not in contradiction to each other: styles of science can not be derived from a principle, yet they are specific enough to be demarcated from each other. In this article, I want to explore some features of styles of science tentatively. I will take guidance from some art historians’ ways of conceptualizing style, notably Alois Riegls. Art history appears to be the only domain, apart from science, where more rigorous attempts to conceptualize styles have been undertaken. We can thus make a start on an inventory of some of the most important characteristics of each of the styles. At the same time, we should not allow a process of abstraction to yield (pseudo) essences. “Ideas exist in irreducible multiplicity”, as Walter Benjamin (1977, p. 43) remarked. But they can be arranged and ordered, he added.

It was Alistair Crombie who first proposed that there are six different styles of science in his magnum opus Styles of Scientific Thinking in the European Tradition (1994). He differentiates them as follows: the deductive (in which science is built on first principles), the experimental, the analogical-hypothetical, the taxonomic, the statistical, and the evolutionary. The claim that there are six styles is the result of historical investigation, of surveying and categorizing the many forms in which the sciences have been practiced through history. Seen from a historical perspective, the six styles are ideal types in the sense of Max Weber, uniting many thousands of situational rationalities operating in concrete historical cases. The historian’s claim that six styles exist is open to empirical scrutiny, in the sense that he needs to demonstrate that similarities within one style are more important than differences, and that plausible and insightful histories of the styles taken separately can be constructed.
From a philosophical perspective it is the other way round. Styles are “autonomous and self-authenticating”, Hacking remarked. The philosopher’s burden is to show that the rationality of one style cannot be reduced to the rationality of another. The statistical style is not a special case of the experimental style (even if important combinations of these two styles are in existence), and neither can both be meaningfully reduced to an ‘experiential style’ or something of the sort. Similar arguments can be made for the theoretical styles: the deductive style of the ancient Greeks (still in operation in several fields of mathematics and attractive to a number of physicists), is very different from the analogical-hypothetical style. Missing from the list of six is the hypothetico-deductive model of science, which reigned during much of the twentieth century. It was in several respects the analogical-hypothetical style in conjunction with the experimental style. The difference is that the H-D model reduced experiment to mere hypothesis testing, whereas with six autonomous styles, the experimental style has been liberated and acknowledged for having a rationality of itself (Hacking, 1982). Adopting taxonomical terminology, we could say that with six styles in hand, the philosopher has been “splitting”, whereas the historian has been “lumping”.

Last but not least, the idea of six styles also unites a philosophical with a historical perspective. While Hacking’s characterization stresses the rationalist side of the styles of science, it leaves room for the historically contingent conditions that produced the styles. Indeed, the claim that six different rationalities exist, implies that not one of these can be derived from a generalized notion of rationality existing outside of history.

Crombie (1994, p. 6) used the term “style” in reference to the “cultural ecology” of a society: its views, convictions, and sacred cows, as well as its methods of problem-solving. Each of the six styles of science is historically formed around three clusters of convictions. The first consists of views about nature and its knowability. The second relates to science itself, the organization of inquiry, argument, and explanation. The third has to do with social conceptions of what is desirable and possible: the moral, social, and technical dimensions of human intervention in nature, and the tension between conservation and innovation. Crombie summarized this issue with the metaphor of a style as an ecology. According to the ecological view, a style is a whole composed of many heterogeneous parts. At this point, a position might emerge from which I would like to distance myself. Specifying the historical ecology out of which the six styles of science emerged does not imply that the six forms of scientific rationality were historically derived from metaphysical assumptions or societal practices. Rather, the scientific styles which in the history of science were recognized as valid emerged in a bootstrapping process as part of more broadly conceived ways of arguing and doing. Likewise, art historian Michael Baxandall’s (1972, pp. 29-30) concept of “cognitive style” embraces more than just modes of representation. To interpret an image, he says, you need categories, model patterns, and “habits of inference and analogy.” Sociologist of science Nico Stehr (1981) called it the symmetrical interdependence of epistemology, sociology and ethics. A further pre-emptive remark is that I will not suggest a one-to-one relationship between styles of science and styles of art. One obvious problem is that styles of art are usually tied to periodization. The styles of science emerged in specific historical periods, but once established, they continued to exist side-by-side. Many art theorists, though, have argued for the persistence of several styles through the history of art up until the present, with the baroque as an often named example (Buci-Glucksmann, 1984; Ndalianis, 2004). And as we will see below, several art historians around 1900 construed period styles as containing elements that were recurrent through history.

2. The origin of the ‘style’ concept in the history of art

Crombie said nothing about the origins of the term “style” as he used it. It is reasonable to assume that he did not have Ludwik Fleck’s (1980 [1935]) Denkstil in mind. Fleck’s concept simply would not have brought him very far. As Hacking (2007) points out, Fleck ties styles of thinking to thought collectives of a comparatively brief duration. Fleck’s Denkstil is also quite specific: his main example concerns the collective ability to “see”, as a Gestalt, the variability of a bacteria strain. Thomas Kuhn (1970, p. vi-vii) famously acknowledged Fleck’s work in the preface to the first edition of the Structure of Scientific Revolutions, as a precursor of the notion of paradigm in the limited sense of exemplar. Crombie’s discovery of the usefulness of the ‘style’ concept may very well have been independent from previous ways of conceptualizing style. At this point, it is useful to remind oneself that, by itself, the word ‘style’ does not lead one automatically to important commitments. In common parlance, there are different styles of playing soccer and different styles of driving a car, or indeed: the style of holding one’s pencil (stilus). Within science, mathematicians discerned different ways of doing mathematics long before Fleck, in 1935, used the word Denkstil.

Yet, it is worthwhile to delve somewhat deeper in the intellectual history of the early twentieth Century. Fleck was not the first to use the concept of Denkstil in German-language sociology. For our purposes more interesting is Karl Mannheim (1976 [1929]), who used the concept in a less narrow sociological sense and with a much wider purpose in mind than did Fleck. Mannheim, in the 1920s, was in search of something more fundamental than schools of thought. Schools of thought differ in that they make use of different theories, but the differences between styles of thought have to do with what Mannheim called the Weltanschauungs totalität (internal unity of a world view). Furthermore, each style of thought is associated with a different seinsmäßige Beziehung (existential relationship) to the objects of knowledge. Mannheim also used the compound word Weltwollen (will to the world) to make this point. It is clear that Mannheim meant that style involves more than a Gestalt-like cognitive understanding of the world. In his view, the heterogeneity of styles goes even further than in Baxandall’s. Styles draw connections between the criteria for calling things true, rational, possible, desirable, acceptable, and plausible.

The essence of Mannheim’s contribution can be captured by the word “ethics” (Pels, 1996). Mannheim contested the “positivist prejudice” that we can free ourselves of metaphysical presuppositions and distinguish between facts and values. Every Weltanschauungs totalität, every style of thought, has its own way of connecting methodological and metaphysical assumptions (Kwa,

1 This I hold to be Crombie’s implicit view on the rationality of styles, a view which in more explicit form has been defended by Hacking (1990) and Netz (1999). About Netz’s book see also Latour (2008) and Hacking (2007).

2 But insofar as the baroque is a useful term in science (and I believe that it is), it is best described as a grouping of views within the analogical-hypothetical and the taxonomical styles in science. Of the latter, Linnaeus is the most important example (his derivation of the system of genera in the Philosophi Botanica), of the former Maupertuis’ version of epigenesis. See Kwa (2011a, 2002).

3 “Hiemit ist Gestaltsehen ausgesprochener Denkstilangelegenheit” (Fleck, 1980, p 121).

4 Fleck was Polish, living and working in Lwow. His primary occupation was in medical research but he was well versed in philosophical and sociological literature. It is unclear why Fleck never cited Mannheim; see on this topic Pels (1996).

5 The word Denkstil appears in Mannheim’s publications since 1921.

6 The translation renders Weltwollen less than perfectly, as “set of values.”
Mannheim did not apply his postulate of Seinsrelativität to the natural sciences. He was later criticized for this omission, but according to the sociologist Dick Pels (1996), we should understand that Mannheim's first priority was to free the humanities from the objectivist claims of the logical positivists. His education had not brought the natural sciences prominently within his horizon. He therefore simply never got around addressing them. This explains why Fleck, Mannheim's contemporary, much later found a much more sympathetic audience among practitioners of social studies of science than Mannheim.

Mannheim had derived Weltwollen from the word Kunstwollen (will to art, also rendered in English as artistic volition), a term coined by the Austrian art historian Alois Riegl in his 1893 Stilfragen (Questions of Style), and later on elaborated by him notably in his Spätromische Kunstindustrie (Late Roman Art Industry) which was published in 1901. Riegl is generally acknowledged as one of the so-called founding fathers of the modern academic discipline of art history, along with Heinrich Wölflin, student and successor of Jacob Burckhardt in Basel, and a few others.7 The posthumous reputations of both have gone through a series of remarkable ups and downs. In the decades after his death in 1905, Riegl served as source of inspiration to several cultural theorists. Next to Mannheim, we should mention Walter Benjamin (1977 [1928]), whose study on German baroque drama owes much to Riegl's analysis of the baroque and on the concept of Kunstwollen as well (see also Peaker, 2001). But after World War II, the tables were turned on Riegl, especially in British and American history of art. Wölflin and Riegl were referred to many times by Erwin Panofsky and Ernst Gombrich, who, after the rise of the Nazis fled to the US and the UK respectively. They both became very influential art historians and art theorists, mainly through their writings in English. But Panofsky's (1964 [1920]) positive appraisal of Riegl, originally written in German, became available in English in 1981 only. Gombrich's judgment, however, was extremely negative. He did not have much use for the Riegl's Kunstwollen, the collective overtones of which Gombrich, a life-long friend and follower of Karl Popper, deeply distrusted. He criticized all holistic views that turned a style into an imaginary super-artist and that considered this method a sure way of gaining insight into the mentality of a period. Looked at in this way, style and Zeitgeist are one and the same. Instead, Gombrich advocated Popper's methodological individualism. No doubt formed by his war experiences, he too eagerly drew a link between Riegl and totalitarian thinking. In fact, Gombrich (1962) declared Riegl guilty by association, mentioning that Hans Sedlmayr, an Austrian art historian who had later joined the NSDAP, at one point had written an introduction to a collection of essays by Riegl. This was doubly unfair. Riegl cannot be held responsible for any of Sedlmayr's views, as there could have been no personal relation between them. And Sedlmayr's introduction deserves more careful examination than Gombrich's too easy dismissal, as we will see below. At any rate, the verdict by Gombrich helps explain why most art historical scholarship on Riegl is of fairly recent origin (Farago, 1995; Holly, 1984; Iversen, 1993; Payne, 2010; Podro, 1982).8 As mentioned above, Panofsky's essay was finally translated into English in 1981, and the translations of Riegl's own works are currently underway.

Gombrich's own view of style is not without merit, however. His emphasis on the individual artist reminds us of the fact that every style has to be appropriated, that there is always a dynamical relationship between an individual and the collective of which he is a part. The weakness of Gombrich's elaboration of the style concept is that he confined it to its cognitive aspects, but his remarks on them are very useful. Taking styles as notational systems, Gombrich (1962) approvingly quoted Wölflin, who called art history "the history of seeing." Gombrich's view draws a link between style and Thomas Kuhn's notion of a paradigm. The similarity between paradigm (as "world view") and style in Gombrich's representational sense, is striking. Theories are, as it were, different notational systems for reality, just as Impressionists and Cubists represent trees in a landscape in different ways. In both cases, the "truth" of the notation is bracketed. While this is an important insight, it omits Riegl's more encompassing ethical point of view.

In order to investigate the many philosophical dimensions of the concept of style of science, it is worthwhile to examine Kunstwollen in some detail. Yet nobody should expect a well-developed theoretical concept. During his short life (he died in 1905, at the age of 47), Riegl wrote detailed monographs on ancient oriental rugs, the development of ornamental motifs from the ancient Egyptians to the early Muslims, late Roman art industry, the development of baroque art from Michelangelo to Bernini and the 17th Century Dutch group portrait. In contrast to Panofsky, whose indebtedness to Ernst Cassirer is well known, we are not very well informed about Riegl's philosophical sources, and his philosophical point of view has been variously described as Hegelian, neo-Kantian, positivist and close to Dilthey's hermeneutic philosophy.9 We have to make do with the various side comments Riegl jotted sparsely through his art history writings, the richest source for which is, as already pointed out, his book on late roman art industry. Mostly on the basis of the reading of this book and on his book on the Dutch group portrait as well, I would like to discuss four major aspects of the concept of Kunstwollen: the autonomy of styles vis-à-vis each other, the collective nature of style, the role of the spectator, and the relationship of artistic volition to philosophical volition (including scientific volition) and ethical volition. In the second half of the paper, I will explore various aspects of the idea of styles of science inspired by Riegl's multi-faceted concept of Kunstwollen.

3. The autonomy of styles in art

When Riegl as a young student studied art history in nineteenth Century Vienna, the discipline was still very much guided by its early commitment to just two grand periods in the history of art: classical Greece and the Italian Renaissance. Even when the taste of collectors and the general public had gone in entirely new directions, the professional academic art historians held on to just these two periods during which art had reached its absolute apogee, or so it was claimed. Other periods, but especially the artistic approaches that historically just came after these two periods, were considered as decadent styles or styles of decline (Verfallsstile). Jacob Burckhardt in his Cicerone guided his readers to discern the ugliness of the baroque while the decadent nature of late Roman art was generally attributed to the barbaric peoples that eventually would bring the Roman empire to its fall.

Riegl, however, showed that late Roman art showed important innovations in comparison to classical Greek art, notably in its treatment of space. The most visible feature of late Roman art is, in sculpture, a much more pronounced open space behind the figures. This makes for sculpture groups that want to be looked at from further away than the sculptures of the classical style. According to Riegl, late Roman art achieved a “modern” three-dimensional space. Moreover, Riegl made it plausible that the

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7 Notably at the University of Vienna. See Bakos (1996) and also Podro (1982).
8 On Podro's and Iversen's ground-breaking studies of Riegl, see Hopkins (2010).
9 Among Riegl's teachers was art historian Robert Zimmermann, himself a student of Johann Friedrich Herbart, a neo-Kantian philosopher, see Podro (1982, p. 71). Not anywhere I have seen Lebensphilosophie mentioned as a possible source of inspiration, despite the fact that some of the words Riegl uses to describe Kunstwollen (Trieb, Kraft) does make one think of Lebensphilosophie. But Riegl nowhere mentions Nietzsche. His indebtedness could have been equally to Goethe!
new direction in artistic orientation predated the influence of the ‘barbaric’ peoples. The new direction in art can therefore be seen as coming from a will to proceed differently, from a discontent with the previous style, as it were. The late Romans (in fact: the Greeks and some other peoples in the eastern part of the Roman empire) must have liked their new art better than the classical style. They expected their new art to accomplish something different, which it did. It was the product of a new Kunstwollen. In a word: late Roman art established a new rationality, different from its predecessor.

Hans Sedlmayr (1929, p. 20 note 1), a Viennese art historian of a later generation, who in 1929 advocated a return to Riegl, put it as follows (and note the similarity with Hacking’s characterization of styles in science, quoted at the beginning of this article!): “Every new style carries within itself its own criteria for discerning good from bad art, accomplished from non-accomplished and beautiful from ugly. (...) There are no quality criteria between styles, “bad” styles do not exist and, in a historical sense, there are no decadent styles (Verfallstile).”

A further analysis of Sedlmayr’s introduction is not the task of this paper. I confine myself to expressing the conviction that Riegl could not have agreed more with this perceptive characterization of one of his main ideas.

4. The collective nature of a style

To Wölflin and Riegl it was evident that styles were collective in nature. In their days, it was customary to call these collectivities Volk (nation). Gombrich seized on Riegl’s (not Wölflin’s!) use of the concept of nation to associate Riegl with racialism.11 Undeservingly, as it now appears. Claire Farago has freed Riegl from this association persuasively in a perceptive essay in which she shows how much the nascent disciplines of history and art history during the nineteenth century had been shaped in and by the new nation states and had borrowed much of the nationalistic discourse. In some cases, notably Wölflin’s, the word ‘race’ was used, too. Farago (1995) reminds us of the fact that we shouldn’t take that word lightly, as it could acquire a sinister meaning when put together with a Spencerian evolutionary theory of cultural development.

Riegl (1966, p. 118), too, occasionally used the word Rasse.12 But, as Farago points out, Riegl opposed applying biological evolutionary theories to the history of art. Riegl sometimes used essentialist phrasings about peoples, such as about the Greeks and the Romans. The latter’s talents, according to Riegl, were merely organizationally and in the domains of art and philosophy they followed the leading Greeks. Yet, in numerous passages, Riegl has the Greeks exchanging artistic ideas with other peoples. Hence, it is unlikely that Riegl held a biologistic view about the Greeks.

In reference to European art between the high Middle Ages to Romanticism, no art historian from since the time of Winckelmann to the present has been able to escape distinguishing between the North and the South, or between Flanders/Holland and Italy, or between Germanic and Romanic or Mediterranean as was customary at the end of the nineteenth Century, including Gombrich (1961).13

5. The role of the spectator

A biological theory of nation or race would treat the audience of art as a given, once and for all. Non-biological theories of the concept of nation point with some justification to a shared history and hence, a shared cultural background from which art is appreciated. But the notion of nation can itself be historicized, and segmented. A dynamical and reciprocal approach between art as practiced at a particular time and place and the collectivity that sustains it, is apparent in numerous places in Riegl’s work. Any work of art, according to Riegl, asks for a certain way to be viewed. A role for the spectator in art presupposes that an appreciative public exists (a public that also, to some extent, allows itself to be educated by new developments in art), from which new young artistic producers can be recruited.

Ancient Egyptian art, for instance, wants to be looked at from nearby, so that the spectator might also have the feeling of touching it (which makes for “haptic” art).14 The spectator himself is like an object of a similar kind as the object of art that he looks at: Riegl called this “subjective art”. Late Roman art wants to be seen from further away, so that the spectator can view a larger piece as one whole (“optic”). The spectator is made conscious of himself qua spectator: “subjective art”. In the past, the opposition haptic/optic was usually considered as the essence of what Riegl had to say. In his later work, however, Riegl would emphasize the objective/subjective distinction.

There are other important aspects to the role of the spectator. Late Roman art, in architecture as well as in sculpture and painting, suggests more depth than does classical Greek art. Objects not only stand in a plane, but imply space in front and behind. In order to achieve this suggestion, late Roman art has to leave out, to obliterate. By suggesting what is not there, it requests from the spectator to fill it in herself. Late Roman art could not exist without a certain level of artistic education of the onlooker. This was the reason why the classical style remained in place to a certain extent. It stayed on as the art of the less educated, while true late Roman art was in fact higher class culture.15

(Similarly, when the baroque came to dominate, a renaissance style continued to be practiced. Periodization, therefore, never need be strict. We may note in passing that a distinction between styles of art and styles of science, existing side by side in the latter case while purportedly successive to each other in the former, is less important than it seems).

6. The “ethical” aspect of style, as opposed to a mere “cognitive” view

Kunstwollen is, according to Riegl, only one of several types of Wollen of any society. There is also philosophical/scientific Wollen and ethical/political Wollen. In the final analysis, they all amount to the same, that is, they want to achieve a satisfactory relationship between humans and the world in the most encompassing way (“internally”, meaning the internal coherence of a piece of art, and “externally”, the reaching out of a piece of art to the audience).
gl distinguished between two basic attitudes of Kunstwollen, one passive and receptive, the other active and desiring.

With Riegl spending so few pages on the subject, it is tempting to reduce his view on the various Wollens as existing in pairs of binary oppositions only: haptic/optic, objective/subjective, passive/active. But their conjunction introduces a dynamics aspect that goes beyond the going back and forth between phases. As we have seen earlier, for Riegl there seemed to be indeed a back-and-forth succession of haptic and optic phases in the history of art. While the ‘optical’ point of view may seem as artistically more developed than haptic art, during various phases in history artists apparently have good reasons to reintroduce a haptic point of view, or to give up threedimensional space in painting, emphasizing the plane instead. Rembrandt is an example of an artist who chose not to use the accomplished form of threedimensionality of Italian history painting. But Riegl saw a steady development of the ‘subjective’ position through history. The Renaissance and the Baroque were more ‘subjective’ than was Classical Greece, and the modern period in turn more subjective than were the 17th and 18th Century. Hence, the distinctions between optic and haptic and between active and passive acquire new meanings: haptic in the 17th Century is different from haptic in the 3rd Century and the same is true for the active/passive pair.

While the optic/haptic pair is specific to forms of art, the subjective/objective and the passive/active pairs are loaded with metaphysical, philosophical and ethical implications. Here we can begin to look for links uniting the artistic production of a period and its systems of thought. One such link is provided by the concept of ‘activity’ in the Late-Roman period. At the very end of Spätromische Kunstdenkerie, Riegl surprises his readers with a very interesting, albeit somewhat fantastic speculation about the relationship between Kunstwollen and scientific Wollien. (Unfortunately, his choice of words totally failed to convince Gombrich.)

Riegl draws attention once again to a feature of late Roman art: figures (in a painting, or in sculpture, noting that they are placed in greater distance from each other than in classical Greek art. In the latter, they are in a mechanical push-and-pull relationship, while in late Roman art the relative isolation of the figures suggests a different kind of relationship. Here Riegl invokes the new art of magic. All major religious systems of late Antiquity, late pagan, neoplato-

16 Strangely not commented upon in recent Riegl scholarship but noted with disgust by Gombrich (1996).

17 The general plan of the Amiens cathedral is “a basilica having a tripartite nave; a transept, likewise tripartite and distinctly projecting from the nave but merging, as it were, into the quinquepartite fore-choir, a concentric chevet with ambulatory and radiating chapels; and only two towers in front.”

The 'optic’ position is that magic and alchemy, in the writings of Iamblichus, for instance, have internalized the conventions in question. Bourdieu called a style of this kind a “habitus.”

Panofsky's argument has been read as implying a “causal” relationship between Scholasticism and Gothic architecture (see Recht, 2008, p. 26). But a causal relationship dwarfs in importance when compared to the conditions needed to make that causal relationship possible. These conditions are to be found in the culture that gave rise to both Scholasticism and Gothic architecture. Panofsky tried to establish a part-whole relationship, he tried to “contextualize” Gothic architecture. There is a similarity here with discussions around Max Weber's thesis on the relationship between Protestantism and capitalism. Weber has often been charged with invoking a causal relationship, whereas he himself saw the relationship as one of affinity (Wahlverwandtschaft). “Affinity”, as a concept, is not weaker than “causal”, it is different. It allows for the inclusion of many other terms. We may note in passing that the concept of “affinity” squares well with the notion of a “cultural ecology” around styles of science (or styles of art).

7. The role of the spectator - revisited

The sculpture and painting of the Renaissance had shown figures in action, dominated by the will. “Will”, as Riegl sees it, is a typical Renaissance attitude, a will to dominate the world, more
specific than the generic term Kunstmollen which may stand for a variety of attitudes to the world. The new element in the Baroque is sensibility (Empfindung), but not sensibility only. Rather, sensibility combines with will in peculiar ways. A particularly telling example Riegl finds in a sculpture by Michelangelo, the artist who during his lifetime achieved the transition from Renaissance to baroque style. The memorial grave of Giuliano de’ Medici in the San Lorenzo in Florence has a pair of allegorical figures laying on the coffin, Night and Day, at the feet of a third figure, sitting on a chair, who represents Giuliano himself. Notably in Night and in Giuliano, will and sensibility enter into competition with each other, some of their body parts displaying action, other parts sensibility. The spectator experiences different reactions: cast in an objective mode by the “will” parts, in a subjective mode by the “sensibility” parts (Riegl, 1923, p. 34).

In his analysis of the seventeenth Century Dutch group portrait, a restrained form of baroque compared to the Italians, Riegl developed his views on the role of the spectator further. In this work, he identified a third position halfway between passive and active: attention (Aufmerksamkeit).

Die Aufmerksamkeit ist passiv, denn sie läßt die Aussendinge auf sich wirken und sucht sie nicht zu überwinden; sie ist zugleich aktiv, denn sie sucht die Dinge auf, ohne sich gleichwohl der selbstischen Lust dienstbar zu machen wollen (Riegl, 1931, p. 14).

(Attention is passive, because it allows to be impressed by things and does not try to master them; attention is at the same time active because it looks for things, without, however, making them subservient to selfish lust.)

The typical Dutch group portrait brings together a number of individuals, each absorbed in his/her own Aufmerksamkeit, and hence, neither in a relationship of hierarchy, nor obviously united in a common action. Riegl ascribed to the Dutch a Kunstwollen that wanted to achieve both “internal unity” (i.e. a plausible unity between the figures painted on the canvas) and “external unity” (between the individuals on the canvas and the viewer of the painting). However, the combination of external and internal unity in the genre of group painting was accomplished only after more than a hundred years of practice. The early Amsterdam group portraits, for instance, seem to have no internal unity at all. For instance in Aert Pietersz’ portrait of six cloth masters (1599), the individuals are brought together in the scene in such a way that it is unlikely to encounter them like that in real life. The spectator has to do the work of pulling the various individuals together in a meaningful unity.

8. Styles of science: collectivities and their “will to the world”

What have we learned from the discussion of styles of art for the understanding of styles of science? The historian of science may feel that historians of art face similar problems as they do themselves when trying to establish meaningful connections with the object of study and culture and society at large. But I believe that Riegl invites us to think the collectivity that not only practices a certain style but also, in a wider sense, that sustains it. Riegl’s view implies a close relationship between a style and its “public”, the public not understood as an amorphous mass of individuals but real people involved in cultural and societal practices that bear relevance to the practiced style, whether in art or in science. The “public” also appears as the “implied reader” or “implied viewer” of cultural and scientific products. Cultural and societal practices share a certain form of rationality, which at one point or another becomes “crystallized” in a style of art or a style of science.19

A number of historians of science have developed very similar thoughts. (In the 1970s and the 1980s, so-called externalist historians of science started to think of the “audiences” of scientist and they set out to investigate science-patron relationships; of more recent origin are concepts like “co-construction”). In the remaining sections of the article, on the basis of a few cases, I will offer some hints on how we may understand collectivities around styles of science, and on the heterogeneous nature of the “ecology” inhabiting the rationality of a style. I will do so briefly for all the six styles, asking the reader forgiveness for the sketchy manner without proper historical proof.

RevieL Netz (1999) analyzes the structure and form of Greek mathematics, notably the unique Greek invention of (mathematical) proof which is central to the deductive argument. Deduction has two elements, according to Netz: necessity and generality. The Greeks were able to achieve generality by showing the possibility of repeating a necessary argument in a variety of cases. It is for this reason that Netz (who writes without any apparent allegiance to Crombie’s or Hacking’s style concept) considers Greek mathematics a style: form takes precedence over content. The Greek mathematicians formed a group: their writings were intended for each other and a restricted readership around their own circle. Caught in the middle of democratic society (in the case of Athens) and aristocracy, they were drawn to the latter. Democratic society had invented persuasive reasoning for use in the public realm. Greek mathematics was as much informed by that as it was a reaction against it: they improved upon mere persuasion.

Netz’ beautiful argument can be supplemented with a metaphysical layer. Netz correctly points out that the Greek mathematicians (who were rarely mathematicians only, they were philosophers as well), were not much interested in real world applications of their work. But Plato did hold that mathematical truth was truth of the cosmos and that the knowledge of truth in mathematics and truth about the world was guaranteed by a common origin of both world and humans in the World Soul. Plato explains this, of course, in the Timaeus (41 d-e) where he has the Demiurge taking the just created human souls for a ride in a chariot to explain to them the rational order of the cosmos. We, as the current reincarnation of the souls, should be able to remember the explanation, provided we receive guidance from philosophers such as Socrates.20 The contemplative attitude to the world that is implied in Plato’s view belonged just as much to a quiet aristocratic lifestyle as the formalist deductivism in mathematics. Aristotle, who rejected Plato’s recollection thesis, accomplished a similar metaphysical position arguing that humans have recourse to intuited first principles which must be true. All in all, the deductive style of science was (and insofar as still practiced: is) optimistic with regard to the possibility of knowledge of truth.

The experimental style of science germinated in a quite different historical setting: 16th Century Italy and 17th Century England, Holland and France. In fact, the experimental style was not the only one to erupt on the scene: the analogical-hypothetical style is of the same period, while the taxonomical style (which arguably has some beginnings in Aristotle), in its modern form had come to initial fruition just somewhat earlier in the Renaissance. (The other two styles are of more recent origin: they can both be traced to the beginning of the 19th Century). The new styles did push the original deductive style somewhat to the margin of science but they did not replace it. We will come back to the other styles below.

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18 On this stage of Riegl’s thinking, see especially Iversen (1993, pp. 92-147).
19 The word “crystallization” is borrowed from Hacking (2011).
20 Plato’s recollection thesis is expounded in Meno 81 e - 86b.
According to Crombie, the experimental style originally was developed in two different substy1es, as it were: the mathematical experimental style of the artists-engineers of the Renaissance and magical alchemical experimenting. Two different *personae* were tied to the substy1es of the experiment: the *virtuoso* and the magus, historically embodied in Galileo and Bacon, the latter, not himself an experimenter, in the role of its spokesperson. (Later in the 17th Century, we find that some of the great scientists were not at the same time virtuoso and magus, with Boyle, Huygens and Newton as examples, but even then the archetypes were not wholly fused, as they perhaps never would totally). There is an abundant literature on how the various types of social groups engaged with experimenting met with each other and interacted with each other. The seminal first account was by Edgar Zilsel (1942), who stressed the importance of the princely courts at which the early academies gathered and at which a kind of intellectual fusion occurred around the new experimental practice. Later studies have also shown that while the various social groups to some extent remained socially and intellectually distinct, they were important audiences for each other and they exchanged concepts and techniques. The natural philosophers were only one of these groups. About them we have the beautiful argument of Steven Shapin and Simon Schaffer (1985) which is deservedly so well known that it hardly needs another summary. Some main ingredients are: an international community of experimenters who knew about each other's work; the building of trust within that community; experiments performed in purportedly public, yet not-so-public spaces. The experimental style could not have developed in two different substyles, as it were: the mathematical and the magico-alchemical style as such, but tied to specific forms of analogy, such as cartesian mechanicism. They are in fact none other than the scientific communities (in the plural) which Kuhn saw as the social bearers of paradigms. While the various social groups to some extent remained socially and intellectually distinct, they were important audiences for each other and which it could understand for that reason. During the Middle Ages, technical metaphors for the cosmos were allegories at first, with moral lessons to convey, rather than research tools. But the Franciscan monastic orders, the main bulwark of voluntaristic theology, did not hold themselves apart from science, far from it. The paradox is that a deeply pessimistic epistemology played a decisive role in the so-called mechanization of the world picture and its mathematization.

When asking ourselves questions on the origin of the analogical-hypothetical style as a whole, we could usefully divide the analogies used in science in two classes: technical or mechanical metaphors and (far less important) body metaphors. The intellectual history of the 15th and 16th Century is, of course, enormously complex. My simplified speculative proposal here is that the latter type of metaphors have an origin in neo-Platonic thought of the Renaissance, while the former stem from a Christian theological position, known as voluntarism.

William of Ockham brought a long-standing current in Christian thought to a conclusion: God was not bound by necessity when He created the world. The necessity of a rational order would place limits on God's omnipotence. Laws of nature exist for no other reason than that God apparently ordained them. Voluntaristic theology also held that it could not be assumed that God created the world for humanity's benefit. A sharper break with the optimistic metaphysics and epistemology of Plato and Aristotle is hardly conceivable. No Demiurge taking the human souls for a ride through the cosmos here. Yet voluntarist theologians had a consolation to offer: if humans had no access to God's order, they could make sense of their observations of nature in terms of what humankind had created itself. In the domain of technics, Cusanus wrote, "man is a second God" (Blumenberg, 1982). Cusanus also made a distinction between divine mathematics, unreachable for ordinary mortals, and the mathematics which humankind had created itself and which it could understand for that reason. During the Middle Ages, technical metaphors for the cosmos were allegories at first, with moral lessons to convey, rather than research tools. But the Franciscan monastic orders, the main bulwark of voluntaristic theology, did not hold themselves apart from science, far from it. The paradox is that a deeply pessimistic epistemology played a decisive role in the so-called mechanization of the world picture and its mathematization.

One of the most surprising analogies can be found in Newton's gravitational theory. As is well known, Newton derived the law of gravitation inductively, from the second and the third law of Kepler. He had not used a "hypothesis", Newton declared. Should he have done so, he would have been found guilty of assuming beforehand the action-at-a-distance which gravitational force purportedly was to Newton, and which was held inadmissible by Newton's adversaries. However, since the discovery of Newton's alchemical writings in the 20th Century, it is known that Newton derived trust in the possibility of action-at-a-distance from his alchemical experiments (Dobbs, 1975). This means that gravitational force is modelled on the chemical concept of affinity. The significance of this particular reconstruction rises above mere anecdote, since it is an example of one scientific field influencing another, in this case a "low" science being a source for a "high" science. Metaphors in science usually fulfill a dual role: they are a heuristic, and they speak to a wider audience. There are several cases in the history of science where one particular metaphor can be found simultaneously in many diverse fields of science, such as the cybernetic metaphor in the 1950s and 1960s, with known uses and applications in meteorology, ecology, economics, military strategy (Vietnam), city planning and sociology. In the case of systems ecology, the cybernetic metaphor proved to be very attractive to members of the US Congress, when they were asked to provide funding to a large systems ecological research program (Kwa, 1989, 1994).

In the case of the taxonomical style, collectivities are somewhat easier to identify than in the previous cases: the collectors. Mostly collectors of plants, but also of animals, minerals, and coins and

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other antiquities, and of “wonders”. The materialities of the collections put taxonomists on an ever vaccilating combination of two diametrically opposed approaches to ordering: a deductive, Aristotelian one and an inductive table of similarities and differences. This resulted in a number of different “paradigms” within the taxonomical style during the past fourhundred years: the intuitive approach of Rembert Dodenius, the deductive approach of Cesalpi-no, the baroque way of Linnaeus, the typological/romantic way of Jussieu and Candolle. All the variants of the taxonomical style have in common that they isolate the objects to be classified and reconstruct or invent the contexts in which they are to be placed (Daston & Park, 1998: Larson, 1971: Kwa, 2011a).

In the case of the statistical style, there is room for making choices with how to identify it (and where to make it start historically). Crombie has “probabilistic and statistical analysis”, with early beginnings not in the 17th Century but in the classical period: Epicurus, Aristotle, Cicer. But Crombie (1994, 2012) also notes that “the most sweeping philosophical and scientific consequences of the statistical method, the general conception of nature as a system of statistical mechanisms entailing calculable probabilities of effects, appeared only in the 19th Century.” The early 19th Century saw the birth of the modern nation states, along with the invention of state bureaucracies. The statistical style originated in a practice of counting the populace, at the instigation of the new bureaucracies, to develop tools to assuage social unrest (Hacking, 1990). The modern evolutionary-historical style is, like the statistical style, an invention of the 19th Century. It was a transformation of what Crombie generously calls “historical derivation”, which had much older origins. Modern, i.e. darwinian evolutionary theory started when Darwin came to understand the biological species as similar to a historical actor in the new historical thinking of the beginning of the 19th Century, which is built on the dialectic between the individual and the nation-state to which he belongs.

In the preceding paragraphs I have, inspired by the work of Riegel, tried to give brief characterizations of the six styles of science from the point of view of the collectivities that sustained them and as aspects of the metaphysical assumptions on nature shared within these collectivities. But let me repeat Hacking’s warning, quoted earlier in this article: “There is no question of providing a definition or a demarcation a priori of a style of scientific reasoning.”

Like in every comparison, such as made here between styles of science and styles of art, there is a point where we encounter dissimilarities rather than similarities. In the case of styles in the history of science, this is not only that styles, once historically established, continue to exist side by side whereas in art they usually do not, or during comparatively brief periods only. Styles of science may also build alliances among themselves, such as between the analogical-hypothetical and the experimental, and between the experimental and the statistical, the latter so visible in the work of Ronald A. Fisher, whose innovations of the statistical method are now routine matter in medical biology and other fields (Kwa, 2011b). In contrast, an alliance between styles of art is probably a meaningless concept. But alliances between two styles of science, however ubiquitous in the sciences, does not lead to the formation of yet new styles. Their rationalities remain distinct, and individual scientists may forge alliances in different ways.

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Plato, Timaeus 41d-e.

Plato, Meno 81 e–86b.


