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Hans-Jörg Rheinberger as a Philosopher of Time**

Michael F. Zimmermann*

Summary: When Hans-Jörg Rheinberger proposed the concept of *epistemic things*, he drew inspiration from the art historian George Kubler, who had considered the aesthetic object as resulting from problem-solving processes in *The Shape of Time* (1962). Kubler also demonstrated that a sequence of objects could retrace the progress that led to a solution that was afterwards accepted as the most classical. Parallel to Kubler, Rheinberger demonstrates how temporally extended activities of experimentation are condensed in the object, revealing the moments of innovation that lead to it. In the history of science as well as in art history, various *trajectories* can thus be grasped in the materially given. Rheinberger conceives of an object as a network of heterogeneous *time strings*. However, these are manifold: they cannot be thought of as making up a homogeneous temporality encompassing all the others as a temporal container and synchronizing them within it. Since the discovery of the Anthropocene, we no longer separate natural from cultural time, and no hegemonic historical narrative can be taken as unifying all the others. Historical epistemology as proposed by Rheinberger will be read as a contribution to constructing new models of natural as well as of cultural time.

Keywords: philosophy of time, multiple temporality, epistemic object, art work, trajectories, time strings, ontology of time, George Kubler, Hans-Jörg Rheinberger, Friedrich Nietzsche, Henri Bergson, Gilbert Ryle, Dipesh Chakrabarty

As a historian of science interested in the history of the arts, Hans-Jörg Rheinberger has long been widely discussed in the artistic field. Again and

M. F. Zimmermann
Art History, Katholische Universität Eichstätt-Ingolstadt, Germany
E-mail: michael.zimmermann@ku.de

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again, the biologist and philosopher has looked sensitively at art. Before he published on the subject, he drew important inspiration from art history, especially from George Kubler (1912–1996). This art historian, often considered as a formalist of time, had been a student of Henry Focillon (1881–1943), a formalist of space, at Yale University. He was an important key witness when Rheinberger reconstructed research processes and proposed the concept of *epistemic things*. In scientific experimentation, these reveal themselves; starting from the traces that become visible in experimental systems, they then take shape through model formations in different contexts.[1] In a scientific object, different processes of experimentation and interpretation seem to be condensed. They present themselves in such a way that the history, in the course of which an object was first seen and understood, appears in retrospect as its prehistory.

1. Rheinberger, His Reading of George Kubler, and His Significance for the Artistic Field

Rheinberger's methodological approach, his terms, and his model for conceptualizing research processes are inspired by Kubler's *The Shape of Time* (1962). The art historian considered the aesthetic object as the result of problem-solving processes. For him, works of art—also attractively designed everyday things, such as ceramic vessels of the kind found at the time in archaeological excavations of pre-Columbian cultures—were solutions to technical as well as aesthetic problems. Rheinberger is particularly responsive to the subtitle of Kubler's book, *Remarks on the History of Things*. Like Kubler, he sees temporally extended problem-solving chains condensed in the object, revealing the moments of innovation that lead to it. He replaces the notion of objectivity, which focuses on the validity of concepts, with that of objecticity, the history of which he writes. In doing so, he pursues the traces of innovative problem solutions that can be grasped in the materially given. These traces are manifold; thus, they cannot be thought as making up a homogeneous temporality, which would encompass them as a temporal container and synchronize their respective trajectories.[2]

Kubler tacitly embraced early avant-garde postulates such as Adolf Loos's "form follows function." For him, the problems solved in a convincing product had both a technical and an aesthetic side.[3] Concerned with products that came to light during archaeological excavations, he reconstructed series of developments. For example, when dealing with what was supposed to be a temporal sequence of ceramic vessels, these often culminated in jars that were perfect in two respects: They could hold a maximum volume of supplies in a minimum volume of fired clay, and they were considered to be aesthetically

[1] Rheinberger 1992, on 67–86; Rheinberger [1997] 2001, on 20–39; Rheinberger 2021, on 36–66.

[2] Rheinberger [1997] 2001, on 10–11.

[3] Kubler [1962] 2008, on 56–75; Rheinberger 2021, on 141–148.

more satisfying than previous or subsequent ones because of the elegance of their appearance. Without being able to rely on recent scientific methods of archaeological dating, Kubler often had to construct relative chronologies speculatively. The idea of progress in solving problems, at once technical and aesthetic, guided his research.[4] This paradigm from art history inspired Rheinberger to also reconstruct the relative chronology of scientific processes as problem-solving chains culminating in objects. Only he is not concerned with simultaneously functional and aesthetic products, but with what he calls epistemic things—such as the DNA.

The topic of Rheinberger's own mental experiment is not only these things themselves, but also the history of those experimental cultures stored in them —a history within which the epistemic object manifests itself in the first place. Experimental systems consist of apparatuses that have already proven to be useful in previous studies. In the case of the history of protein synthesis in the test tube, which he studied, these include high-speed centrifuges in which molecules settle out layer by layer according to their weight as homogenates, and scanning electron microscopes in which they first become visible. In Rheinberger's reconstruction, it turned out that scientists often spent a very long time looking for something different than what they found in the end. In this case, they looked for pathogens important for cancer research, before a molecule presented itself that could be interpreted as the one in which the genome is encoded.[5] The fact that such an object showed up was not at all expected. When the community of researchers in a laboratory succeeds in ensuring that a previously unobserved process not only occurs in an experiment, but can also be made visible, this is for Rheinberger, who had been an experimental biologist, always a surprise—a taming of chance. It is relatively easy to repeat experiments once they have been made. The ability, however, to arrange an experiment in such a way that a new epistemic thing becomes visible is regularly associated with serendipity. The role that chance and contingency play in experimental research casts doubt on a certain type of explanation: the epistemic thing does not emerge as a social construction to be brought about at will.[6] Experimentation is about making visible what can only show itself by itself.[7]

In this respect, contingency and serendipity stand for the emergence of the real. If experimentation must always arrange the processes it gets going in a way that they thereby also become visible, it is also about the mediality of the real: The history of science is also the history of the medial aspect of experimental systems. A telling example is Ernst Mach's experimentations about the speed of sound waves. Photographing a projectile in supersonic motion and the pressure waves in front of it was essential. Thus, the camera

[4] Kubler [1962] 2008, on 48–55.

[5] Rheinberger [1997] 2001.

[6] On early criticism of social constructivism, see Hacking 1999, on 36–99.

[7] On using the example of the molecular foundations of genetics, see Rheinberger 2006, on 221–244. See also Rheinberger 2018, on 160–184.

and the circuit through which the projectile activates the trigger are an indispensable part of the experimental system.[8]

Later, Rheinberger engaged with the work of Albert Flocon (1909–1994), a Bauhaus student who had immigrated to France. Flocon was particularly interested in reflecting on his own medium. In famous drawings in which he represented the hand drawing itself, the artist captured the very mediality of what he did.[9] Clearly, Rheinberger saw in the artist's metapoetic strategy a parallel to his own investigation into the process by which an object like DNA took shape—however, not through contours and shading, but through experimental research.

With Kubler and Rheinberger, once a novel object is found by a discipline, it becomes inevitable that its prehistory is rewritten as a development that led to that very object. Rheinberger's adaptation of Kubler has also contributed to a revival of his model of anchoring temporality in the materiality of the object in art history.[10] To some social historians of art, who define themselves in opposition to formalism, Kubler had long remained alien as the formalist of time they saw in him. So, he was often assigned to the type of modernism that postmodernism had overcome. Rheinberger's updating of Kubler, however, has nothing to do with the formalism of classical modernism, since he is not concerned with the supposedly pure temporality of an all-encompassing container time. From the history of science, many art scholars accepted the suggestion to rethink the mediality, the rhetoric, and the philosophy of historical time. Experimentation became the element linking the natural and cultural sciences: in the history of both, the methodical exploration of the unknown, or of what had previously been overlooked before it was deemed relevant, plays a key role.[11] Emergent knowledge is a central aspect of historical experience, which is increasingly reconstructed along the trajectories of experimental culture. In this respect, cultural historians likewise face the challenge of opening up the temporality of their own discipline anew.

It is not surprising that Rheinberger's conception of experimental culture was not only influenced by the study of culture and art, but conversely also influenced cultural studies. The starting point initially was the indispensable role that visualization, and the visual imagination, play in Rheinberger's model of experimental culture. Soon it was seen that *dispositifs* of visualization relevant to experimentation had repercussions also in the arts, for example in the representation of anatomy or movement. These had been elaborated since the early modern period, at the same time that experimental science was increasingly accepted. With the invention of new media such as photography and later also film, artistic representations of anatomy integrated physiological (and psychophysical) processes.[12] During the last years, artists have increasingly been inspired by experimental practice, as Rheinberger reconstructed it. Not

[8] Hoffmann and Berz 2001, on 17–35.

[9] Rheinberger 2016a, on 69–79, 113–120.

[10] See also Lee 2004, on 218–257; Maupeu et al. 2014; Rheinberger 2016b.

[11] Rheinberger 2021, on 182–219.

[12] Schmidgen et al. 2004.

only focusing on historic images, they increasingly view their own work as an experiment—for example, with social situations that are specially produced. Only recently have some art academies succeeded in obtaining their own right to award doctorates. Since at the same time the border regimes between art and pop, aesthetics and fashion, artistic and social media lost their effectiveness, all socially effective gaze regimes are by now a topic of artistic research.[13]

2. How Long Does the Present Last? The Paradoxes of Time—from Nietzsche to Praxeology

Rheinberger has not only recast the tradition of historical epistemology and proposed a model of the history of science that does not isolate it as a history of progress, but he views it in the context of cultural orientational knowledge. He is, moreover, a philosopher or, more precisely, a phenomenologist of time. A central aspect of his work is the reconstruction of multiple temporalities, of *trajectories* or *time strings*, each of which individually structures certain areas of scientific or cultural practice, before they link together to form complex networks.[14] In this way, too, he is already inspiring transdisciplinary debates. We will now attempt to summarize his strategy of analyzing time in the material object, thereby highlighting it in the context of the philosophical study of time in the twentieth century. Although neither Kubler nor Rheinberger start with Nietzsche, it is helpful to start with him, because he opened a new debate by reframing the traditional questions about the respective realities of the present, the past, and the future. Since antiquity, these questions have led to aporias: Is the true present only the exact here and now, and is it thus inevitable to claim reality only for this fleeting instant on the vector of time? Or is a more extended moment in becoming, always stretched out between past and future, in its current effectiveness truly to be considered as making up the reality of a given present?

Again and again, Nietzsche attempted to actualize the aporias of time—borrowed from Greek philosophy of the fifth and fourth centuries BCE—against the background of his own epoch deeply influenced by the natural sciences. Is the present alone really given, or is the moment a nothing, and, as Heraclitus had taught, the becoming alone real?[15] In the second essay of *Untimely Meditations* (*Unzeitgemäße Betrachtungen*, 1873–1876), entitled "On the Uses and Disadvantages of History for Life," Nietzsche plays off the weight of the past against the present.[16] In an "antiquarian history," historicism had expanded the knowledge of history to such an extent that it could be used as a yardstick against everything really new while at the same time offering refuge in the past. Historically educated contemporaries were for Nietzsche often

[13] Peters 2013, on 7–21, 205–256.

[14] Rheinberger 2021, on 141–163.

[15] For an introductory reading, see Christians [2000] 2011; for a thorough discussion, see Dries 2008.

[16] Nietzsche [1874] 1997, on 57–124. See also Jensen 2008.

unable to cope with the present, in which the future is always decided anew. Instead, they flew into fictional worlds of the past, which could be consumed as mere substitutes, precisely because decisions about life and death were no longer met in them. Another option was a "monumental" history that touched on "mythical fiction" in which contemporaries admired themselves as the peak of all kinds of evolution, even and especially after the Prussian-French War of 1870–1871, when victory was misinterpreted not only as a military triumph but also as one of culture. The *kairos*, the right moment for effective action, was thus bound to be missed. For Nietzsche, only a "critical history," was not condemned to betray the fullness of life; "dark, driving power that insatiably thirsts for itself," acting from the past, thereby only actualizes what meets present vital needs, and condemns or forgets other aspects.[17]

Later, in *Thus Spoke Zarathustra* (*Also sprach Zarathustra*, 1883–1885), Nietzsche pointed this out in the metaphor of the dawn, a time pregnant with future.[18] One does not have to share his vitalistic idealization of the will, even in the face of nihilism, to see a new beginning of the philosophy of time more soberly in Nietzsche's work: The counterimage to the dawn is the metaphor of the gateway, in which future and past constantly divide from each other. For a dwarf in the gateway, the current moment is only a point in the time continuum, and, along with the experience of its constantly fading away into nothingness, it is all we have.[19] But Nietzsche always sees whole strands of time in the given present, which are then passed on to the future and spun into it—even if the moment proves to be only an emergence in an eternal recurrence of what already had occurred.

From Nietzsche, two traditions can be reconstructed: The first is primarily concerned with the present insofar as it is extended, thereby raising the question of how long it lasts and how it points to the future (the "dawn"). The second focuses on the weight of the past, leading to a rapidly passing present (the "gateway"). Rheinberger, according to our reading, is committed to the first approach, already by seeing various scientific trajectories condensed in the epistemic thing, but in such a way that this object projects its efficacy into the future. So, also the second approach, which focuses on the memory of the past and its (however floating) crystallization in the here and now, plays a role in Rheinberger's model of temporality: but it seems to be suspended in it.

Nietzsche's privileging of the present in its fullness over the present as an expansive instantaneousness reappears in a less mythically-poetically exaggerated guise in contemporary epistemology—first in psychology, then in a philosophy already informed by it. If one puts the accent not on ontological questions about the reality of perceived time, but on epistemological ones concerning the validity of a specific conception of temporality, it makes sense to start with psychology, unlike in philosophical-historical accounts. Since the mid-nineteenth century, one scientific discovery concerning vital processes followed another one; we only have to mention Hermann von Helmholtz

[17] Nietzsche [1874] 1997, on 67–77, quotations on 70, 72, 76.

[18] Blumenberg 1979, on 271–275; Meier 2017, on 11–15, 109–159.

[19] Blumenberg 1979, on 271–275; Meier 2017, on 11–15, 109–159.

(1821–1894) and his research institutes' studies of the sense organs in Prussia or Claude Bernard (1813–1873) in France.[20] New biological insights into life as seen from the outside were soon transferred to the inner temporality of mental life. According to vitalistic ideas in vogue since the end of the century, the impulse behind the evolution of life can be experienced in psychic life as a stream of consciousness. This initially lent support to notions of constant flowing, whether in language or in images. Mental life was experienced as the interweaving of inner-world sensations and outer-world perceptions. The French Symbolists of the 1880s interpreted Wagner's orchestration technique for creating a timbre that flowed constantly between winds and strings, also the leitmotivs in his *unendliche Melodie* (endless melody), as consistent with scientific discoveries in acoustics, such as Helmholtz's research on harmonics, or in the psychology of sensory perception. Artists such as Odilon Redon (1840–1914) created sequences of images marked by the constant metamorphoses of one image into another and this in turn into the next.[21]

Gestalt psychologists opposed this conception of time as a continuous metamorphosis with their conception of a time already structured with every act of perception. A forerunner was Christian von Ehrenfels (1859 – 1932), even though his thinking was problematic in regards of his vitalistic views of wholeness in a time of estrangement. Already in 1890, he raised the question of how a melody is heard.[22] If it were understood as a mere sequence, every next tone would have to cancel out the preceding one, so to speak. Then one would hear only one tone after the other, but no melody. A melody, however, can only be perceived as an overall shape—which would also mark the threshold between a mere sensation of tones and a perception. For Ehrenfels, this notion was tantamount to the realization of a sound sequence. To hear a melody is therefore not reducible to listening to the individual tone sensations of which it is composed. So, the perception—and its presence—extends at least to the duration of hearing the sequence: a melody can be perceived as such only insofar as the beginning is still remembered when it ends. Subsequent Gestalt psychologists who, like Max Wertheimer (1880–1943), dealt with visual configurations were often, like Ehrenfels, musicians.[23] Thus, in Wertheimer's case, spatial configurations are also primarily concerned with rhythms, so that what is comparatively closely adjacent to something similar is seen in unity with this, and thereby more easily compared to what follows only in larger intervals. Rudolf Arnheim (1904–2007) was to transfer a corresponding conception of temporality to film, especially to the way an audience experiences editing and montage.[24]

[20] Wise 2018.

[21] Zimmermann 2020.

[22] Ehrenfels 1890; Ash [1995] 1998, on 84–93.

[23] Wertheimer 1922; Wertheimer 1923; Ash [1995] 1998, on 103–134; King and Wertheimer 2005, on 87–110. Harrington 1996, chapter 4, has convincingly shown that a longing for holistic thinking was one of the driving forces of Gestalt psychology, thereby however questioning the research of the Berlin Circle all too reductionistically as attempts at rationalization.

[24] Ash [1995] 1998, on 299–304, see there further references to the vast literature.

The philosophy of perception of Ernst Mach (1838–1916) has guided the formulation of Gestalt psychological laws since Ehrenfels. For Mach, perception is structured in such a way that it provides people with useful orientation knowledge. Therefore, it is always structuring sensations so that it offers the greatest possible reduction of complexity.[25] Finally, at the end of the 1920s, Kurt Lewin (1890–1947) attributed the perception of social structures and the way we socially and emotionally self-locate within them to Gestalt-like perception. Lewin became an important founder of social psychology. He renamed the Gestalten he analyzed social fields. For him, the concept of field better captured the interdependence of the perceived instances within a given framework made up of overarching relations of force and power.[26] Lewin in turn inspired Pierre Bourdieu (1930–2002) when the latter developed his theory of social fields.[27] In the context of Gestalt psychology, the question of the duration of the present could be answered in this way: it lasts as long as the Gestalten necessary for the situational location of individual and communal action are temporally extended. Presence is thus correlative to certain fields, and it can extend over quite long periods of time. Specific forms of presence are located in a time that never merely passes. The perception of time is generative: it is always already structured, and it is always already structuring.

In debates conducted in recent years in cultural studies, an extended present has likewise been put up for discussion under various auspices. Already after the end of classical modernism, literary historians such as Karl Heinz Bohrer (1932–2021) and Hans Ulrich Gumbrecht (*1948) revalorized the present against attempts at making it dependent from the social constructivist reconstructions of its respective past: what makes each present stand out over past and future temporality? Both rehabilitated the present over teleologies long-dominant in the 1990s: whereas Bohrer responded to postmodernism's skepticism about projections into a historical, often utopic future, Gumbrecht viewed the present with respect to its eventfulness, which for him tends to be explained away in hermeneutic explanations.[28] Today we seem to be confronted with the opposite problem: with the permanent presence of a media world that immediately forgets its pasts. A present that no longer distinguishes itself from the past or from traditions, but is instead based on their instant disappearance in archives hardly noticed anymore, becomes itself a phantom. Cultural scholars such as François Hartog (*1946), who had studied with Reinhart Koselleck (1923–2006), demonstrated how much the tyranny of the present has contributed to a sense of temporal placelessness everywhere. If the present is immediately analyzed as if it had always already become historical, this is only the other side of an absolute instantaneity. Against this background,

[25] Mach [1885, 1911] 2008, on 90–121, 200–210.

[26] Lewin 1936, on 11–13, 14–16, 19; Ash [1995] 1998, on 263–283; Lück 2001, on 50–53, 60–85.

[27] Bourdieu 1992, on 297–299; Kaufmann 1968; Kastner 2009, on 41–76; Joly 2018, on 137–151.

[28] Bohrer 1994, on 143–183; Gumbrecht 2004, on 70–110. See also Ullrich 1996 and Mersch 2002.

it seems to be necessary to rehabilitate a true sense of history in its vital duration, as it is practically experienced.[29] Rheinberger's path can be understood as a model of historical temporality incorporating not only various trajectories, but with them also different experiences of speed. In the last chapter of this essay, it will thus be considered in the context of new models of structuring historical time.

Reactions against presentism, such as Hartog's, can be situated within a second strand of tradition. If we try to reconstruct it, it seems to deal with the experience of time insofar as it is conditioned by the past. It looks at a given present insofar as it is already encoded not only by earlier events or earlier research, thus by chains of causality in the sense of scientific explanation, but also by our social practices and habitus, and thus by aspects to be studied with the means of hermeneutic understanding. Instead of celebrating the present as absolute, as Bohrer had done, it is now considered to be anticipated—or at least pre-structured—whether consciously or unconsciously, by historical strands of events, including the history of science, or within highly defined and institutionalized cultures of memory.

Fundamental to Henri Bergson's (1859–1941) philosophy of perception and memory, which is particularly consequential in the arts, is his conception of an image, which deviates from that which was common then and now.[30] He does not designate as an image a medially realized, stable icon, which Charles Sanders Peirce (1839–1914) argues gains its meaning through the representation of simultaneous relations.[31] Rather, for Bergson, an image is temporalized from the outset: it denotes an event, not a configuration of facts. It *is* not, but it happens. In this, Bergson anticipates later approaches to the eventfulness of pictorial cognition.[32] Anticipating cinema, he even does not trace a pictorial event as a mere process, but he conceives of it to as an action. It has a starting point or a "reason," e. g., something preceding its culmination, followed by a "moment of indeterminacy," as Bergson puts it, as for its outcome. This finally leads to further activity, whereby the whole of the action is configured in its figurative eventfulness in the first place. Gilles Deleuze (1925–1995) developed the concept of the *image-temps* on the basis of Bergson's expositions, which he used in 1983/84 as the basis for his comprehensive analysis of the poetology of cinema.[33]

According to his idea of perception, which is grounded in a theory of practice, memory is real for Bergson only insofar as it is called on the scene by actual perception, thus being actualized in the present. Nevertheless, he contrasts a memory of habit (*mémoire-habitude*), in which whole chains of actions are stored, with a memory of recollection (*mémoire-souvenir*), which separates past events from the present and isolates them in their uniqueness in

[29] Hartog [2003] 2015, on 11–18 [introduction, 2015], 257–271.

[30] Cornibert 2012, on 19–164.

[31] Peirce 1983, on 64–67, 123–127, 156–160; Schöneich 1990, on 136–150.

[32] Ullrich 1996, on 17–84; Mersch 2002, on 355–423.

[33] Deleuze 1983, on 9–22, 83–103; Marrati 2004, on 239–260; Moulard-Leonard 2008, on 105–122.

a past. But even this second form of memory, which we have to understand as only abstracted from the first, ultimately serves the goal of keeping the past ready for actualization. The difference consists primarily in the degree of spatialization of a radical present that for Bergson is primarily given only in an unextended temporality that he calls *durée*. The memory of recollection, by dislocating the events in a spatialized time, enables us to imagine a co-presence not only of things past, but also of everything that is given at the same time. For the coexistence of things, which we do not perceive in a given moment, cannot be granted by the single actual perception. Only as separated and distributed in space, the totality of the here and now can be imagined. Bergson thus models the consciousness of co-present sensations in analogy to the way we imagine past simultaneity. He visualizes his ideas of memory in a *cône inversé*. This memory cone ends, with his top, on a plane surface, which for him represents the totality of the present of coexistent things. Primarily, however, his theory of memory does not ascribe the central role to spatializing abstraction, but to bodily perception. In doing so, he attempts to overcome the opposition of idealism and materialism, of mind and body. In the conception of the body, which realizes effects perceptively and immediately strives to react to them, he thinks to arrive at overcoming a dichotomy of spiritual imagination as opposed to material activity.[34]

The contrast of Bergson's extremes of understanding memory is remarkably parallel to a pair of concepts introduced by Gilbert Ryle (1900–1976) in *The Concept of Mind*, 1949, that of *knowing how* as opposed to *knowing that. Knowing how* refers to that unconscious, partly motoric, knowledge of action that we recur to when physically performing it—the ensemble of those unconscious competencies that the individual must have at his or her disposal in order to be able to exist in the social space. The point of Ryle's philosophy is that he does not simply oppose *knowing that* to *knowing how*, but, similar to Bergson, introduces both terms so that they constitute a dynamic field stretched between habitualization on the one hand and rationalization on the other.[35] Ryle's point is to question a stereotypical demarcation between theory and practice. According to this conception, we would set up objectives, intentions, and procedures of an action in advance, in order to proceed to practice, so to speak, according to these patterns. For Ryle, this is not how we act. Our practice, instead, is always marked by habitual competence, and only by using it we can acquire *knowing that*, then performing actions more or less in a deliberate, intelligent way. We perform many actions instinctively, others quite unconsidered, habitually. Mere habit can pass into training, through which one learns more controlled sequences of action. Subtle abilities, moreover, demand acting by constantly readapting to the actual processes we thereby set in motion. Even previously trained patterns of action need to be deliberately controlled.[36] In his explanations of perception and imagination,

[34] Bergson [1896] 1970, on 316–356; Worms [1997] 2007, on 187–264.

[35] Savigny 1969, on 91–126. For an in-depth discussion of recent literature and further references, see Tanney 2017 and Tanney [2007] 2021.

[36] Ryle [1949] 2000, on 26–60; Bäckström and Gustafsson 2017.

Ryle also illustrates that, e. g., visual imagination follows patterns of interpretation that have been habitualized before, parallel to schemes of action.[37]

In the contemporary sociology of practice, which offers itself as praxeology, Ryle's *The Concept of Mind* is taken up again. Against the background of Bourdieu's concept of habitus, which is used to describe the typical behavior within social milieus such as classes or educational groups, the concept of *knowing how* is experiencing a new boom. It offers an alternative to the reconstruction of social fields, and of an overall picture of social types characterized by their respective behaviors. In contrast to such attempts at looking onto the social whole in a systematic, if not structuralist way, stands a participatory model of action. It is based on the observation that a certain type of *knowing how* becomes aware of itself only in moments of crisis. Only when alternatives and possible transformations of a given practice appear, a certain practice does not simply go on unconsciously in a given future. However, an appropriation of Ryle in which *knowing how* is simply opposed to *knowing that* as an alternative option misses the point of his philosophy.[38] The error is analogous to a mechanical opposition of memory of habit and memory of recollection in Bergson. Ultimately, the symmetrical opposition of the respective concepts would confirm the old dualism of body and mind, instead of overcoming it by focusing on the materiality of the body.

Praxeologic sociologists update Ryle's key argument: instead of relegating fixed schemes of action to an atemporal ideational realm of theory, he sees them—as Bergson did—as mere abstractions from actual action. For Ryle, reflection no longer precedes action, nor does it simply follow it—as intention or conscience, for instance. Rather, he regards reflection, whether conscious or unconscious, as integral aspect of any action. In the field of sociological praxeology, too, reflection is considered as an indispensable aspect of any practice: it is always already a component even of an action more or less habitualized, so even if the competence for acting has been acquired by unconscious imitation, or by training based on mimesis. Of course, actions can also be questioned only at a second stage of reflection, i. e., after having been executed, if the circumstances oblige the acting persons or groups to step back. Often, it is only when practices come into crisis or when unexpected alternatives appear that they are considered as specific actions in the first place.[39]

Similar to Bohrer's *absolute present*, an informed but not consistently planned *knowing how* thus cannot be reduced to rational explanations (*knowing that*). The famous paradox from Augustine's *Confessions* (I, 14) that we know what time is but cannot explain it is resolved anew by Bergson and Ryle—and by the theorists they inspired. In modern words: How does time in the sense of the lived presence of a *knowing how* that we cannot wholly explain relate to time in the sense of *knowing that* that we can certainly account for? The answer

[37] Ryle [1949] 2000, on 190–263.

[38] Schatzky 1996, on 88–132, 221–224. Against this kind of reductive appropriation, see Tanney 2017.

[39] Reckwitz [2000] 2006, on 91–104, 117–147, 293–362.

would be that in the actuality of action the pole of *knowing how* is always primary, and that the higher levels of reflection closer to *knowing that* are only derived from it.

The fundamental Augustinian contrast reappears also in the opposition of the absolute present or of the presentism lamented by Hartog, to strategies of explaining a given present by reducing it to one or the other line of tradition. Both perspectives together actualize a field marked by the tension between unconscious acting and rational reconstruction that is constitutive for reflexive action. Rheinberger contributes to both: to the absolute present by emphasizing the new, which shows itself in experimental discoveries, in the sense of serendipity, as an unpredictable, surprising event. With all sharpness he hints to the surprising moments in the discovery of DNA.[40] But he also contributes to the time of long chronologies. He explores in detail how the unexpected event seen in an experiment is pre-structured by previous traditions of research. Based on that, he also shows how earlier research is rewritten post festum or *après coup*, to use Derrida's term, as the prehistory of the discovery of new epistemic things.[41] Time as suspended in the present, or the present as shaped by time, and therein unconsciously continued or rationally handed down: Rheinberger provides suggestions concerning two constitutive poles of analyzing time, and he does so by analyzing it in the materiality of the object.

3. History as a Network of Multiple Temporalities

Rheinberger ties temporality back to praxis, and thus stands in different traditions of time analysis. In contrast to Kant and with Nietzsche, Ryle, and the praxeologists in sociology, time is not given in advance for him. Nor is it situated in the stream of consciousness, but it permeates social practice, including that of research. It is thus not a pre-existing, homogeneous milieu of what happens *in it*, prior to all experience, whether objective or subjective. Moreover, he demonstrates that temporality is encoded not only in experimental practice, but in the epistemic thing. He proposes a convincing, operative solution to the question of how time is stocked in the materiality of things, revealed in one kind or another bodily encountering with them (as ob-jects). According to Rheinberger, things transport—each in a different way—the specific temporalities that we experience in them.

Already in the experimental cultures of the natural sciences, different traditions of practically tested knowledge are crystallized in a variety of epistemic objects. Historians of science as well as natural scientists are therefore confronted with a multiplicity of traces and sequences that inscribe themselves in the protocols of successful experimentation as trajectories or also time strings. The different objects of knowledge, as soon as they have been constituted, carry them as traces with them, before they delegate their

[40] Rheinberger 2018, on 201–210.

[41] See: Rheinberger 2005, on 9–29; Rheinberger 2018, on 237–246.

continuity as well as their permutations to the future.[42] But the epistemic things never completely reveal the time condensed in them; they do not present it as a hidden essence that can, in principle, be revealed through ontology. The temporality stored in them as a multiplicity of trajectories is inexhaustible.

This thought brings an aspect, no less consequential, to the fore. It concerns actual global challenges: Since often, and especially when new discoveries are successfully made, the instrumentalities of different experimental systems are combined, even in a single epistemic thing different time strands come together. Thereby, the increasing opacity of the world of things surrounding us is constantly complicated. In an environment in which numerous forms of technical equipment (such as a smart phone) can no longer be understood by their users, and in which we are also surrounded by natural objects (such as the DNA) or by phenomena (such as global warming) of quite heterogeneous character and different modes of efficiency, old orders of knowledge lose their binding force. Traditional distinctions between nature and culture, between humans and animals have been questioned by now for decades.[43] Instead of definitions, demarcations, and fixations of essence, the effective power of things, and our interaction with them, are now in the focus of attention. In worlds of knowledge such as Science and Technology Studies (STS) or research on material culture, the reconstruction of multiple temporalities is about to become a decisive element of orientation knowledge. Also historians, including art historians, recur to practice, to give an example, when they link the natural history of materials (such as pigments) under the aspect of sustainability with that of their extraction and processing, their use and the waste management after that.[44] If one transfers the approach accepting multiple trajectories also to post- and decolonial historical studies, further stimulating aspects of the model become apparent.

The imagination of the natural sciences has always imprinted itself on the imaginaries of social and cultural history. The transfer of experimental knowledge gained in the natural sciences to the arts is only one part of this scenario. Alongside the history of science, historical lines of tradition are emerging, each establishing new strands of time and entering into a mesh with those reconstructed in the field of the history of science. The history of terms such as *crisis* or *milieu*, borrowed from clinical medicine or the chemically based physiology of the organs of a Claude Bernard, is especially revealing, first but not only for sociology. After the discovery of bacterial biology, categories of contagion and immunity (also of societies) were added. Researchers such as Leo Spitzer (1887–1960), Georges Canguilhem (1904–1995), and Roberto Esposito (*1950) traced how these concepts were metaphorically applied to the

[42] Rheinberger 2021, on 17–35.

[43] See: Rheinberger 2005, on 20–50; Rheinberger 2015.

[44] Felt et al. 2017; anchored in social sciences: Kalthoff et al. 2016. See also Rheinberger 2005, on 74–100.

study of social formations.[45] On this basis, nineteenth-century artists such as Gustave Courbet and Edgar Degas or writers such as Émile Zola likewise spoke of experimental art or experimental novels.[46] They examined various milieus, social fields, and generally speaking, forms of life, with an eye for the "physiognomic" characteristics, in Balzac's sense, for forms of life, and typical destinies portrayed in their works. They already naturalized the idea that time experienced by different individuals and social formations is structured differently than suggested by anthropological or existentialist generalizations focusing for example exclusively on mortality.

In the face of urgent planetary challenges, work is being done to restructure historical knowledge and memory culture as well, beyond the grand narratives of a Eurocentric history that, moreover, is still conceived in contrast, rather than interplay, with the natural evolution of planet Earth. In view of the current experience, for which the controversial term Anthropocene has become common, broader historical orientation knowledge is restructured. Rheinberger's proposal of a multiple temporality condensed in the object seems to provide unexploited potentials for modelling alternative forms of historical temporalities. Dipesh Chakrabarty (*1948) postulated a multicultural, postcolonial historiography some time ago. Recently, he suggested that also the spatiotemporal conceptual framework of a history reconstructed from multifaceted strings should be revised. Its horizon should no longer be found in the universe, the world or the globe, but on the planet on which the existence of mankind is contingently located. According to Chakrabarty, the exhaustion of its resources forces humanity together into a dialogical community.[47] Humanity is to be thought, in this context, as a contingent, not at all as an anthropological totality. Unlike in older, spiritualistic humanisms, the whole of mankind is not detached from its natural conditions of existence.

If one starts from the central element of contingency and relates it to serendipity—and thus to coincidence, however in a calculated form—instructive parallels between these new forms of history to Rheinberger's model become apparent. Both the history of science and sociocultural hermeneutics have to accept that temporality is narratively retrieved from the past. Rhetoric has its role, but time is not rhetorically constructed in the process of research.[48] Only in the supra-experimental view—beyond the teleologies of discovery stories—Rheinberger sees trajectories and their structure in the history of knowledge.[49] Models of explored and narrated time strings did not prevail in the history of the natural sciences solely because of their coherence and consistency, but they show up surprisingly in a way that is perceived as unpredictable but revealing by the historic actors as well as by historians. In cultural studies, temporal turning points emerging in a separately analyzed

[45] Spitzer 1942; Feuerhahn 2017; Esposito 2002; about Canguilhem: Rheinberger 2006, 55–72; Rheinberger 2007, 99–104.

[46] See various essays by the author not individually referenced here.

[47] Chakrabarty 2018, on 161–243; Chakrabarty 2021, on 49–92, 155–181.

[48] Rheinberger [1997] 2001, on 182–219.

[49] Ibid., on 222–235; Rheinberger 2021, on 137–140, 190–219.

sociocultural field constitute this very field in the first place, showing its coherence from the beginning with regard to its development. By analyzing a sequence as a time string, it only emerges as a specific topic of the historian's attention. A next level is reached if multiple trajectories are linked to one another in a way that they constitute a fabric of interconnecting and overlapping segments. Such a network transcends social as well as media and geographic spaces made up by a specific type of time strings retrieved according to disciplinary methodologies. This is a particular challenge for decolonial studies. In this field, it is not enough to refrain from using the chronologies of Euro-Atlantic narratives as a yardstick for others. Rather, it is a matter of considering planetary history as a temporal mesh, and in doing so, to conceptualize the decolonial gaze also on the respective own, i. e., also on Europe, for example.

The call for the decolonial consideration of hegemonic entanglements goes back to Walter D. Mignolo (*1941). He observed that early colonialism was accompanied by the enforcement of the *Gutenberg Galaxy*[50], with printed books and images through which European knowledge could assert itself as dominant.[51] Mediality, since then, became a key element of decolonial historical research. Again, it should be recalled that instruments of visualization are integral parts of experimental systems, as Rheinberger analyzes them. In this respect, experimental cultures are always also medial cultures. The production of evidence—and the enforcement of hegemonic, supposed world knowledge—within the framework of dominant visual regimes have a functional, not only an illustrative role in media regimes. Mediality proves to be a term corresponding to materiality, not a counter-term to it. A specific discursive practice around material experience is always conceived and developed within the framework of medial *dispositifs.* Practices of scientific-technical control or destruction of natural resources are a topic that has also aspects of modelling, simulation, fictionality and manipulation. Historical studies are faced with the task of reconstructing historical time lines, and in doing so, of critically considering their temporality—including that of their media. Even in a critical, decolonial—and thereby necessarily polyphonic, dialogical—research, the real does not emerge as *made*, but as unpredictable, transcending an individual's imagination.

Media are not only projections. What is real about history becomes apparent as soon as different groups of recipients from different cultures are brought into dialogue in the interpretation of their respective sources—in general media. The philosophy of time, as Rheinberger analyzes it in the very phenomenology of an object, is not to be reconstructed as a history of theories thought out by a few great geniuses. It presents itself as a history of social groups working in and around the laboratories. As a history of shared experience, it confronts us with the historically real—not only in experimental practices in the strictest sense, but also in the field of social, cultural, and media experience.

[50] A term that goes back to Marshall McLuhan (1911—1980)

[51] Mignolo 2011, on 1–26; Mignolo 2018.

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