

CHAPTER 17

 HEGEL'S PHILOSOPHY
 OF NATURE

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 17.1. INTRODUCTION: NATURE AND
 SELF-DETERMINATION

ONE of the dominant themes of Hegel's philosophy is freedom, and in treating this theme he aims not only to develop a satisfactory concept of freedom, but also to show how developing such a concept is part of actualizing it, part of our being free. As is well known, Hegel devoted significant efforts to the ordering and articulation of the philosophical system he thought this goal demanded. So when we look at his most comprehensive systematic text—the *Encyclopedia*—and find at its literal center the *Philosophy of Nature*, we are justified in thinking that Hegel takes an examination of nature to be philosophically central to his larger freedom-oriented project.¹ Since for Hegel freedom is a kind of autonomy, pursuing this thought means explaining how the *Philosophy of Nature* contributes to the development of the proper concept of human autonomy, and why the actualization of that concept requires just such a contribution—explaining why, in Hegel's own phrase, the philosophy of nature is “the science of freedom” (NSR 24.8).

In terms of developing a concept of freedom, the need to think about nature can seem straightforward: humans are natural things; as self-conscious autonomy, human freedom requires self-understanding; thus human freedom requires an understanding of nature. But Hegel evidently has something more than this in mind when he says that the philosophy of nature brings about not just self-knowledge but “the freeing of nature”

¹ Nonetheless, the philosophy of nature has rarely been the focus of detailed commentary, and interpreters seldom draw on it to explain other parts of the system. Instead, they tend to draw on either the *Phenomenology's* section on Observing Reason or the *Logic's* on Mechanism, Chemism, and Teleology.

itself (E §246R). The study of nature not only tells us about our natural existence but reveals that other natural objects “have an existence just as justified and satisfied as ours,” and are therefore “self-contained and rational,” such that nature's “essence is our own, namely reason.” Yet because “humans are free only insofar as those next to us are also free,” knowing the rationality and hence freedom of nature partially actualizes our own freedom (NSR 24.5, 8). Lastly, since we are natural, the actualization of our freedom is also the actualization of nature's freedom, meaning that our knowing nature as free in fact completes nature's own freedom.²

Claims about nature being free are always striking, but especially so here, when we recall some of Hegel's more familiar claims contrasting the freedom of spirit with the necessity and ‘externality’ of nature.³ These claims have encouraged the idea that for Hegel, we may begin as animals, but we become free—become spirit, or *Geist*—only when we succeed in taking ourselves to be, and thereby in making ourselves, non-natural.⁴ This idea gets something right; after all, Hegel does make these more familiar claims, and the *Philosophy of Nature* is not the *Philosophy of Spirit*. But a few points about Hegel's conception of freedom can help us get a sense of how nature might be free in a way relevant to our freedom, while not being free precisely as we are free.

Consider Kant's claim in the *Groundwork* that we are autonomous to the extent that we can (rightly) regard ourselves as the ‘original authors’ of the laws to which we are subject (GrW 4:431). One popular interpretation of this original authorship criterion takes it to require that I be capable of a free act in which I legislate these norms to myself.⁵ But if that legislative act is to be a free act—as it must be, on penalty of leading not to my autonomy but to my heteronomy—it must itself be done from a norm self-legislated by some prior act. The threatened regress or paradox here has prompted interpreters to attribute various proposed remedies to the post-Kantian idealists.⁶ One alternate way of taking the original authorship criterion sees it as satisfied whenever the norms binding me either make up or follow from my essence—or in Hegel's own terms, my concept; on this interpretation I am their original author, and self-legislating, not through some imagined paradoxical act, but simply in that these norms are immanent to me, or

² It is “the determination and the purpose of the philosophy of nature that spirit should find its own essence, i.e., the concept, in nature. . . . So the study of nature is the freeing of spirit in her. . . . It is for the same reason the freeing of nature; nature is in itself reason, but this emerges as such into existence [*tritt als solche heraus in die Existenz*] in nature first through [*durch*] spirit” (E §246A).

³ See, e.g., PR §146R.

⁴ See Pippin, “Leaving Nature Behind,” where he pits his anti-naturalism against the second-nature naturalism of McDowell's *Mind and World*. Neither Pippin nor McDowell gets Hegel's view of nature right. Briefly put: *contra* McDowell, an updated Aristotelian second nature is not natural enough to do the work Hegel needs done; *contra* Pippin, natural autonomy is free enough to do that work.

⁵ As Kant says, the autonomous will “must be seen as giving the law to itself [*selbstgesetzgebend*] and precisely thereby subject to the law” (GrW 4:431).

⁶ See Pippin, “Hegel's Practical Philosophy”; Pinkard, *German Philosophy*, 59–60 (but compare his later *Hegel's Naturalism*); and the essays collected in Khurana and Menke, eds., *Paradoxien der Autonomie*.

constitutive of me, as the kind of thing I am.⁷ According to this view, being—and knowing myself to be—immanently self-determined counts as being self-consciously autonomous, even if the norms by which I determine myself prohibit me from doing things I am in some sense inclined to do.

The emphasis here on simultaneously being some way and knowing oneself to be that way implies that Hegelian ethical autonomy is actualized through robust (and, as it turns out, historically and socially mediated) relations of self-consciousness. Since according to Hegel such relations do not arise among non-human animals or among non-animal natural things, it can seem misleading to attribute a genuinely Hegelian freedom to such things (and thus to nature). But as Hegel's previously quoted remarks suggest, we need not regard ethical autonomy as the only species of autonomy. Even if the fact that they do not know themselves to be self-determined means that non-human natural things are not free in the way that we can be free, they can nonetheless actually be self-determined through their immanent concepts and thus free in a more limited sense—one in which they are in fact the 'original authors' of the laws to which they are subject, despite not regarding themselves as such (because they do not 'regard themselves' at all). Such a limited, natural autonomy, while distinguishable from ethical autonomy, is nonetheless relevant to it. This relevance consists not only in coming to grasp my environment as rational in the same basic way that I am rational, but also in my grasping my own natural life in a particular way. When we come to see some of our properties and dispositions as determinations we give ourselves in the course of living our lives as the sorts of animals we are, we see that they are neither externally imposed nor irrationally given.⁸ And insofar as our ethical autonomy depends on knowing ourselves to be self-determined, and thus on knowing ourselves, *qua* natural things, to be self-determined in the way natural things of our kind are, a study of nature that reveals its self-determination constitutes an essential step in achieving that autonomy.⁹

Put this way, and understood primarily in relation to living things, Hegel's take on nature's self-determination seems rooted in Kant's theory of natural teleology.¹⁰ Drawing on Kant's distinction between mechanical and teleological forms, approaches

⁷ See Rödl, *Self-Consciousness*, 114–120. Immanent conceptuality is front and center in some recent interpretations of Hegel's metaphysics; see Bowman, *Absolute Negativity*; and Kreines, *Reason in the World*.

⁸ Of course, not all of my natural properties and dispositions will ultimately count as self-determined, according to Hegel; those not essentially related to being the *kind* of animal I am will not count as self-determined in the relevant way. Furthermore, many, if not all, of my naturally given determinations will conflict in some way with others, such that fully self-conscious autonomy will require what Hegel calls the "purification of the drives" (see PR §§19–21 and McCumber, *Hegel's Mature Critique*, 118–122).

⁹ Consider episodes in which we accept aspects of ourselves—our capacities, looks, aversions, whatever—that we did not initially think conducive to the good life. Such acceptance is a kind of liberation, and it is assisted by the reflection, e.g., that I am the kind of animal that gets cranky when it doesn't get enough sleep.

¹⁰ The recognition of this connection, and of the importance of the category of life to Hegel's thought in general, is at the center of some recent literature on Hegel's logic, ethics, and action theory. See, for instance, the essays collected in Khurana, ed., *The Freedom of Life*, particularly those by Ng and Haase; Thompson, *Life and Action*; Rödl, *Self-Consciousness*; and Rand, "Animal Defect."

to Hegelian natural autonomy emphasizing the special status of living things stress how, through their life-processes, they are self-determining in a way not manifested by inanimate nature. That is, they emphasize how living things' activity of making themselves into the things they are combines the active aspect of self-legislation with the immanence of natural kinds or essences, letting us have both interpretations of Kantian ('original authorship') autonomy at once. Such views thus yield a kind of natural autonomy limited to the living and encourage us to see such a living autonomy as a prerequisite to full-fledged human spiritual autonomy, while also letting us reinforce a distinction between the free and the unfree, now understood as an intra-nature distinction between organism and mechanism. But while Hegel undeniably privileges the living, his *Philosophy of Nature* quite clearly aims to vindicate the claim that all natural things—including the inorganic—are immanently self-determining. It is this global claim that I will consider in what follows.

17.2. THE TRANSFORMATION OF THE SCIENCES

17.2.1. Preliminaries

Even if the idea of a natural freedom consisting in the immanent conceptual self-determination of natural things is intriguing, it is not obvious that the sciences give us much evidence of such freedom; on the contrary, the nature they show us often looks anything but self-determining. Thus, despite the importance he attaches to the study of nature, and despite his affirmation of the modern mathematized experimental sciences as indispensable to that study, Hegel cannot simply take their results into his system as is. Rather, he must present in his own terms the self-determination of nature both discovered and obscured by natural-scientific modes of thought. This presentation begins by characterizing those modes of thought as according unquestioned authority to 'the understanding'. Operating under this authority, Hegel tells us, the sciences do not "consider nature as free in its proper vitality" (E §245A) but treat it as "mere externality, immediacy, [and] sensibility." The philosophy of nature, by contrast, grasps nature through reason and lifts it "up into the unity of the concept, into freedom, into being-for-self" (NSU 24.218) by carrying out an '*Umbildung*' or transformation of the results of the natural sciences that removes these results from the domain of the understanding.¹¹

This transformation, then, is the method through which the *Philosophy of Nature* carries out its systematic task. At first glance, the method seems like a familiar one; put in Kantian terms, it seems to involve converting a posteriori knowledge into a priori knowledge by replacing empirical claims with purely rational ones (the latter derived,

¹¹ See, e.g., NSG 24.490.

presumably, from the *Logic*).¹² Although such a Kantian interpretation is initially plausible, it leaves Hegel in an awkward philosophical position. For even Kant's relatively modest ideas about what might be demonstrated a priori turn out not to have been modest enough, and more generally, any claim to derive natural laws a priori runs counter to the fallibilist spirit (and actual history) of the sciences. Neo-Kantian varieties of historicized and relativized apriority are designed to respond to these difficulties while maintaining a basically transcendental framework.¹³ Applied to Hegel, a neo-Kantian approach would assimilate the philosophy of nature to his deep historicism, arguing that he aims, first, to lay bare the constitutive presuppositions of contemporary natural science; second, to show how those presuppositions structure the relevant empirical results; and third, to demonstrate their connection to other areas of human inquiry and action. Yet there are reasons to be skeptical of such an approach to Hegel: for instance, the absence of any real history of natural science in Hegel's system or lectures suggests that the *Philosophy of Nature* is emphatically a philosophy of nature and not a philosophical history of, or a historicist philosophy of, natural science. Thus while there may be room in a broadly Hegelian program for the historicist study of the natural sciences as human practices, what Hegel actually gives us in the *Philosophy of Nature* is something else entirely.¹⁴

We can avoid the Kantian and neo-Kantian readings of Hegel's transformational method by noticing their decidedly un-Hegelian commitment to some version of the a priori/a posteriori distinction. Given his relentless dialectical critique of traditional philosophical oppositions, it would be out of character for Hegel to leave the a priori/a posteriori distinction intact, as even the historicizing strategy essentially must do.¹⁵ Certainly if he were to deploy this distinction in his system—as he does many inherited distinctions from the history of philosophy—he would have to subject it to dialectical critique first. But aside from occasional (though consistent) ironic and dismissive remarks, we do not find any such critique anywhere in his works, notes, or lectures. And indeed, 'a priori' does not seem to be one of Hegel's terms. He rarely uses it, and he nowhere tells us how to distinguish—even in a provisional way or by examples—a priori from a posteriori concepts, claims, knowledge, or warrant. Moreover, when he does actually use either term (particularly in the *Philosophy of Nature*), it is almost

¹² For a recent Kantian reading of Hegel's philosophy of nature, see Posch, "Hegel and the Sciences"; for other broadly Kantian-aprioristic interpretations see Stone, *Petrified Intelligence*; Houlgate, *Introduction*; and Bowman, *Absolute Negativity*.

¹³ See Friedman, *Dynamics of Reason*.

¹⁴ For Hegelian historicism about the natural sciences, see Meyerson, *Explanation*, and Koyré (e.g., *Astronomical Revolution*), along with Kuhn, who in *Structure* acknowledges the influence of his French Hegelian predecessors (but not Hegel). See also Hegel's deceptively Kuhnian-looking claim that "all revolutions, in the sciences no less than in world history, come about only because spirit, in order to understand and take possession of what is its own, has altered its categories, grasping itself in a truer, deeper, more inner, and simpler way" (E §246A).

¹⁵ See Sedgwick's similar line of thought about Hegel's critical orientation toward some (other) basic Kantian structural distinctions in her *Hegel's Critique*, which focuses on (among other things) Hegel's alleged endorsement of a form of intellectual intuition.

always to characterize a position he is about to attack.¹⁶ The evidence thus suggests that Hegel is not much interested in appealing to this distinction to characterize any of his own claims—either as a priori or a posteriori. If we want to understand the relation Hegel articulates between the natural sciences and his own philosophy of nature, then, we do well to put the a priori/a posteriori distinction aside and draw instead on other resources.¹⁷ Such resources are readily available; they offer both a Hegelian picture of the character of natural-scientific representations and the elements of a method for transforming these representations into properly systematic Hegelian concepts.

17.2.2. The Form of Natural Science

By characterizing the philosophical interpretation of the natural sciences as a transformation, Hegel emphasizes that the *Philosophy of Nature* will not augment, alter, or replace their content, but only put it in a new form. In the natural sciences themselves, and in the scientific metaphysical interpretations that arise with them, that content has a form Hegel calls representational and associates (as we saw) with the understanding, in contrast to what he identifies as conceptual form properly so called, linked with reason.¹⁸ But this representationally formed content, upon which Hegelian transformation will operate, is itself not simply given either to perception or to the understanding; it is rather the end product of a complex prior process of formation involving observation, experiment, and reflection. "In the first instance, we know about nature through the senses," or, in Kantian terms, "we intuit natural objects"; on this basis "our formal thinking then proceeds" (NSR 24.3). This thinking "should define the genera, classes, etc." or "determine them, [i.e.] the essential should be extracted from out of the mass of conditions that are found in immediate intuition" through "an activity of the understanding, an activity of abstraction" (NSU 24.189). Such abstraction brings about a reduction in the "naturalness, singularity, and immediacy of things" (E §246A), since it universalizes by treating determinations or properties not as they are found entangled with others in concretely existing things, but as separated and isolated in thought.¹⁹

¹⁶ 'A priori' (in its various forms) appears four times in the *Philosophy of Nature* (at E §§267R, §275A, §293R, and §305R). In no instance does the term appear in a main body paragraph. In all but one instance, Hegel uses the term to describe the claims of others, rejects those claims, and either asserts or implies that their (spurious) a priori status is part of the problem. In the other instance (E §275A), the term appears in a passage generated posthumously by Hegel's editors. The situation is similar in all of Hegel's mature works. Hence the direct lexical evidence in favor of Hegelian apriorism is either weak or nonexistent.

¹⁷ Of course, Hegel could be committed to a kind of crypto-apriorism, but his appropriation of most of the rest of the vocabulary of Western philosophy for his own systematic ends makes this idea implausible. Note that if I am correct, we are equally mistaken if we describe Hegel's claims as a posteriori: what he objects to is the distinction itself, and the dogmatic subjectivism that comes with it.

¹⁸ See, e.g., E §182R.

¹⁹ Many passages in his lectures (e.g., NSU 24.251) show Hegel's grasp of the varied and changeable factors, methods, and processes—often multi-generational and rarely the work of a single individual—involved in forming natural-scientific universals.

Hegel's conception of abstraction as an inherently universalizing operation is a component of his broader view that while natural things are singulars, and while much of our mental life deals in singulars, all thought properly so called is universal in form.²⁰ Hegel touches on this view in his Introduction to the *Philosophy of Nature* by discussing the role of singularity and universality in our practical and theoretical attitudes toward natural objects. When I adopt the practical attitude, I treat singular things as means to my ends; in consuming or altering them to bring about these ends, I negate or destroy them, either partially (as in milling trees into lumber) or completely (as in eating and digesting). This practical negation is sometimes simply an external, formal one (as when a bird arranges found sticks into a nest), sometimes a partially formal, partially contentful ('real') one (as with the lumber), and sometimes a more complete real and formal one (as when I metabolize what was an apple and nothing apple-like remains).²¹ When I adopt the theoretical attitude toward things, I also negate, through abstraction, the singular form of what I sense, perceive, and intuit; when I take a thing as an instance of one of its properties, by focusing on, for example, this rose's weight, color, or smell, I turn what I first encountered in the form of a singular thing into something that could, formally or in principle, be the weight, color, or smell of some other object. But in contrast to practical negation, theoretical negation preserves, or at least intends to preserve, the content unaltered within the new universal form given to it by abstraction; the point of abstracting away the other features of the rose is, after all, to get or keep hold of the one I am focused on.

Yet there is reason to doubt that abstraction can preserve its content in its new form, since singularity, according to Hegel, is the only form natural existence can take. The universals produced in natural-scientific inquiry "do not fall in the domain of perception[,] only their expressions do" (NSU 24,189); natural things are "singulars, and the lion in general does not exist" (E §246A). But if natural things are singulars, we might well ask why thinking by means of abstractive universals should count as thinking about natural things at all. The difficulty is deeper than a worry about whether this or that procedure leads us to abstract out the right properties from the 'mass of conditions', for even if we resolve that worry, the output of our abstractive efforts will always be a universal, while we wanted our knowledge to be about natural objects—which are and must be singulars. Nor, it seems, can we reconstitute the singularity of existent natural things by concatenating multiple abstract universal representations: as long as the universals we are using are abstractive, and are thus the representations of isolated properties or relations supposedly intelligible independently of one another, no concatenation of them could recapture the simple unity in which they are found together in the thing's natural singular existence.²²

²⁰ On mental form and content, see E §3. For the doctrine that thought is always (either abstractly or concretely) universal, see, e.g., the treatment of singularity in the *Logic* (SL 12.49 ff/546 ff). The interplay of universality and singularity in our sensory, perceptual, and experiential engagement with nature is discussed in E §§445–468.

²¹ See E §362.

²² Compare Hegel's attacks on this and related difficulties in the Perception section of the *Phenomenology* (PS 9.71–81/¶¶111–131).

17.2.3. The Form of the Philosophy of Nature

Hegel's method aims to give the sciences a form of generality that does not exhibit the shortcomings of abstraction, by transforming the "unconceptualized concept" of the understanding into an explicitly "conceptualized" one of reason (SL 12.40, 45/537, 542). As a "conceptualizing consideration" of nature, the philosophy of nature deals with "the same universals" produced by natural science, "but for themselves" (E §246); by means of a synthetically oriented thinking-through or *Nachdenken*, rather than an abstractive *Reflektion*, it "translates the universals delivered to it . . . into the concept" (E §246A).²³ This translation is possible to the extent that the natural sciences "play into the hands of philosophy" (E §246A) by putting their formally isolated, abstractive representations to work in explanatory and descriptive schemes. Such schemes do not just concatenate the representations they employ, but also display their determinate connections and distinctions—for instance, in genus-species hierarchies of natural kinds, in binary classifications (acid/base, positive/negative charge), or through mathematical natural laws.²⁴ And such schemes are part and parcel of the terms occurring in them: we do not first develop our natural-scientific representations (e.g., 'mass', 'motion', 'element', 'plant') independently, only later organizing them into explanations. Rather, our universals always already function within some kind of organized explanation and description (relating, say, mass to velocity in momentum). What transformative *Nachdenken* looks for, then, is the way the content of our natural-scientific representations is implicitly elaborated beyond their simple abstract determinacy through their explanatory and descriptive roles. Hegel's method aims to present that content entirely in terms of such roles, whose determinate general logical forms are laid out in the *Logic*; so understood, the content has become 'for-itself' in the sense that it now has the form that coincides with the way it, as a conceptual—that is, rational—content is actually determined.

In Hegel's terms, properly conceptual generality is 'concrete', as opposed to the abstract universality of the understanding and its representations. The presentation of natural scientific content in a system of concrete universals is not, however, an end in itself, but rather a remedy for the mismatch between the singularity of natural existence and the representational form of the natural sciences, a mismatch resting not on generality as such, but on the understanding's abstractive character. Yet that abstraction is still a necessary stage in arriving at the concrete concepts of the philosophy of nature, a point Hegel emphasizes by insisting that philosophy as a whole, and the philosophy of nature in particular, cannot develop without the sciences and their specific mode of investigation.²⁵ The simple unity of singular natural objects is undone by the elaborating and

²³ In the Introduction to the *Encyclopedia*, Hegel characterizes the activity of philosophy in general as a *Nachdenken*, or a re-thinking of what has already been thought, experienced, or known (E §§2–9). It is in this sense that Hegel later writes that "not only must philosophy be in correspondence with the experience of nature, but the *inception* and *formation* of philosophical science has empirical physics as its presupposition and condition" (E §246R).

²⁴ Of course, not all methods for organizing natural things into such structures are valid, on Hegel's view; see, e.g., his attack on various conceptions of natural series (E §249A).

²⁵ See note 23 and E §12.

abstractive power of the understanding, but the rational core of that unity is restored, as conceptual concreteness, in transformative systematization. Properly conceptual generality thus captures, in an explicit, concrete, 'for-itself' form, the very same unified content that appears in an implicit, simple, 'in-itself' form in natural existence, but only by first rendering it, via the understanding, into an abstracted array of apparently independent determinations.

But even the results of this transformative method are only intermediate ends, valuable for Hegel's project because of their contribution to our grasp of nature as self-determined and therefore autonomous. We see this contribution when we see that concrete unity and self-determination are two sides of the same coin. For concrete unity consists not in the various determinations of some existent thing jointly making up the concept of its kind through their mutual dependence. This dependence does not flow from some abstract logical or metaphysical principle, but is exhibited in the rationally structured explanatory and descriptive use to which the relevant representations are put—that is, exhibited in the content itself when it is rationally comprehended. The systematically articulated contents of a given concept thus express what we have discovered about the kind of natural thing in question, such that these contents are the properties and relations our study of nature has revealed to be jointly co-constitutive of individuals of the relevant kind. But if this is so, then for something to be an individual of that kind is just for it to have those determinations, and thus for all of them to count (jointly) as self-determined. Hence the determinations specified by the systematically articulated concept of a thing are those the instantiation of which in its natural existence actualize its natural freedom. To grasp nature as a domain populated and structured by naturally autonomous things determining themselves is to conceive of nature as "being an existence just as justified and satisfied" as ours and thus as "self-contained and rational."

17.2.4. Impotence, Self-Externality, and the System of Stages

Put in these terms, it seems that what Hegel regards as the content of the concrete concept of a thing is just what would traditionally be called its essence, and that for a determination to count as self-determined is just for it to be an essential one. But Hegel's characterization of conceptual self-determination as autonomy blocks this interpretation, since it commits him to the claim that natural things can be the kinds of things they are while failing to have determinations that, if they had them, would count as self-determinations. Hegel makes this commitment clear when he claims, for instance, that some ('mechanical') motions of a material body are free, or self-determined, while others are unfree, and then directly analogizes this distinction to the distinction between the ethical and unethical actions of a human agent.²⁶

²⁶ "Thus while finite matter receives motion from outside, free matter moves itself. . . . Similarly, the ethical person is free in the laws, and they are only external to the unethical person" (E §264A).

Hegel's most striking characterization of the possibility of failure inherent in natural self-determination attributes an essential 'impotence' to nature (E §250),²⁷ an attribution built in to the systematic definition of nature as "the idea in the form of otherness [*Andersseins*]" (E §247). 'The idea' is one of Hegel's technical terms, designating the unity of 'the' concept—the total system of all properly conceptual determinations—and that system's actuality—its real existence, for instance as nature. In the 'form of otherness', these two sides of the idea remain other to one another, opposed and distinct—that is, in this form the idea's existence is characterized precisely by a failure to match up with its concept. Yet that existence is still the existence of the concept, and the concept is still the concept of that existence. Hence in Hegel's words, nature—considered as the unity of the concept and its existence—is necessarily 'self-external'.²⁸

In saying that nature is self-external, Hegel is not saying that nature is essentially irrational or unknowable, nor is he saying that natural things are not self-determined.²⁹ On the contrary: to grasp nature as self-external is to know its concept, to know its existence, and to know the latter as failing to actualize the former. In other words, nature's failure here is not unspecified, such that Hegel could invoke it ad hoc to render his claims about nature irrefutable, but rather a specific one inflecting every aspect of natural existence in a determinate way. Hegel begins by arguing from nature's self-externality to its general spatiotemporal structure, in which each point and instant fundamentally has no other determination than that of being simply external to, or non-identical with, the others—from which it is otherwise indistinguishable. In giving a wholly general and yet determinate form to the essential non-correspondence of concept and actuality in nature, the self-external structure of space and time gives all natural things their characteristic singular existence, determining each as outside its neighbors and giving each thing's 'inner' properties and parts "the appearance of an *indifferent subsistence* and of *singularization over and against each other*" (E §248). When we grasp these properties and parts through the concrete concept of the thing in question, we know this indifference to be a function of nature's impotence, and thus to be 'only apparent'—we know that although the liver is a distinct organ, it is also essentially a member of the living organism and cannot survive excised from it. Yet the impotence of nature lies precisely in the necessity of this appearance and in the fact that although it is only an appearance, it is not an illusion: the liver is a distinct organ, and so can be separated from the body, destroying both.³⁰

²⁷ "It is the impotence [*Ohnmacht*] of nature, that it maintains conceptual determinations only abstractly and exposes the completion of the particular to external determinability" (E §250).

²⁸ Self externality, Hegel says, "constitutes the determination in which the idea is as nature" (E §247). Thus the self-externality of nature is not an error theory but marks a necessary non-correspondence of concept and actuality.

²⁹ For the view that Hegel *does* take nature to be fundamentally irrational and unknowable, see Bowman, *Absolute Negativity*, Ch. 4.

³⁰ As it turns out, the kind of distinctness exhibited by organs in their unity with the rest of the body provides the basis for 'accidental' death but also for 'natural' death, through a process Hegel identifies with habit. For Hegel's conception of habit, see McCumber, "Hegel on Habit"; Lumsden, "Limits"; Malabou, *Future of Hegel*; and Malabou, "Hegelian Wolves."

In contrast to the self-externality of natural existence, conceptual form exhibits a unity of multiple mutually dependent determinations. The question, parallel to the one that arose earlier regarding abstract representations, is how a natural, spatiotemporally extended self-external thing can count as the existence of an inner conceptual unity it is incapable of fully actualizing. Hegel's answer is straightforward: a natural, self-external thing counts as self-determined when it exhibits, in its natural existence and activity, not mere spatiotemporal juxtaposition of parts or moments (equivalent to a concatenation of representations), but a unity of both its parts and its activity isomorphic to the unity of its concrete conceptual content. In other words, Hegel conceives of the variety of logical connections articulating the content of a concrete concept as corresponding to a variety of natural—that is, spatiotemporal—relations. So, for instance, material bodies move freely when their motions are determined by laws expressing the concrete unity of space and time constitutive of the concept of a material body as such. As it turns out, these laws determine the motion of a given material body only insofar as it is one in a system of bodies with a common center of gravity.³¹ But if the only motion of a material body that counts as a self-determined motion is one in which it is determined as a subordinate part of a larger system, then a single material body, although self-determined in its motion, cannot count on its own as the full actualization of a spatiotemporal unity corresponding to the conceptual unity of its content. If anything in mechanics can do this, it is the total system of mechanical bodies (but then, such a system—if it exists—is not one material thing). By contrast, the body of a higher-order mammal—while dependent on its environment and other animals in many ways—exhibits a unity that is concrete to a high degree. Yet it, too, ultimately remains self-external—a fact Hegel illustrates by pointing to the sexual processes through which the individual and species are produced and reproduced.³²

Now, although its singular existence is a more complete actualization of conceptual unity than the motion of mechanical bodies, the living animal is still self-external and thus susceptible to external determination, just as a material body is. All natural things, of whatever kind, share this exposure. But by differentiating among natural things in terms of the extent to which they exhibit fully concrete unity, and thus also in terms of the modes and degree of this exposure, Hegel is able to order the totality of nature into a “system of stages [*Stufen*]” (E §§249–251). In this system, stages or levels of nature (Mechanics, Physics, and Organics) are differentiated in terms of the general kind of concrete unity the concepts belonging to them exhibit, while within each level, kinds, laws, activities, and properties are ordered in terms of the degree to which they in fact are self-determined in the ways available in principle to things at their level.³³ So, for instance, all living things are capable of a more complete self-determination than bare

³¹ See the discussion later in this chapter and note 41.

³² See Rand (“Animal Defect”) for a more detailed argument about the kind of individuality Hegel attributes to animal life and its relation to the logical unity of the concept. See also note 30 on habit, which arguably counts as a distinct basis on which the animal displays its self-externality.

³³ Although ‘*System von Stufen*’ is usually translated as ‘system of stages’, Hegel is clear that the stages (or, alternatively, levels) are neither temporally nor causally ordered (E §249).

material bodies can achieve, but within the organic level, plants are ordered prior to (‘lower’ than) animals because plants exhibit the self-determination characteristic of living things to a lesser degree. The system of stages is thus Hegel's way of organizing the contents of the natural sciences in light of both the self-externality of nature and the systematic goal of exhibiting nature's self-determination.

17.3. CASE STUDY: COLLISION AND FALL

The bulk of Hegel's texts and lectures on the philosophy of nature are concerned not with laying out the method but with using the method to carry out the task of the philosophy of nature. Thus while the size of the present chapter makes a detailed account of Hegel's transformed vision of nature impossible, a satisfactory overview of his idea of the philosophy of nature demands that we examine at least one case. While taking a case from the Organics would allow us to focus on certain undeniably important aspects of Hegel's project and strategy—the relation between embodied life and spirit, his appropriation of Kantian teleology, and his attempt to differentiate his project from Schellingian *Naturphilosophie*—these topics are generally well represented in the recent secondary literature.³⁴ Less well represented are topics treated by Hegel in the Mechanics and Physics. But the Physics—covering a wide range of material from chemistry to electromagnetism to acoustics—demands familiarity with superseded theories and so is ill-suited for our present purposes.³⁵ The Mechanics, by contrast, avoids that obstacle, since many of its basic concepts are familiar from high school physics, and it has the added advantage of dealing with precisely those natural phenomena that seem least likely to exhibit the self-determination Hegel is after. Thus if we can make sense of Hegel's claim that mechanical objects and phenomena are self-determining, our prospects for understanding his similar claims in other, more promising cases are good.

Hegel's main argumentative line in the Mechanics traces the relationship between the concept of motion and the concept of a material body. These concepts, Hegel claims, are implicitly ‘identical’ in the sense that material bodies are essentially in motion and that whatever is in motion is a material body; according to his argument, when this identity is fully, concretely articulated, there turns out to be one kind of motion—‘absolute’ or gravitational motion—whose laws best express that identity. A body moving absolutely is therefore as self-determined as is possible for a natural thing at this stage or level of nature.

Hegel arrives at the claim that the concepts of matter and motion are implicitly identical through an analysis of the concepts of space and time meant to show that the concepts

³⁴ On the first, see Pinkard, *Hegel's Naturalism*; on the second, see the contributions to Khurana and Menke, eds., *Paradoxien*; on the third, see Rand, “Hegel and Schelling.”

³⁵ On the Physics see Burbidge, *Real Process*, although the focus there is more on the logic of Chemism than on Hegel's interpretation of the details of contemporary chemistry.

of matter and motion both have the concepts of space and time as their contents; asserting that they have the same concepts as their contents is another way of asserting their implicit identity.³⁶ In the course of this analysis, Hegel argues that the concepts of space and time always come as a pair, in the sense that although space and time are qualitatively distinct kinds of quantitative multiplicity, neither can be assigned a determinate quantitative value—that is, neither can be employed as a physical quantity—without reference to the other. Hegel's argument here is relatively compact, but the mutual dependence of time and space he is after can be seen directly in our practices of measurement, in which we measure time elapsed by distance traversed and distance traversed by time elapsed.³⁷ Matter and motion, as unities of time and space, are two distinct forms of this mutual dependence: united as matter, space and time mutually determine each other's identity or persistence; united as motion, space and time mutually determine each other's differences or changes.

Insofar as they are simply two distinct ways in which time and space can be unified, matter and motion are independent, and a material body has no particular motion (or rest) proper to it *qua* material body. This simple independence is the core of the conception of matter as inert, captured famously by Newton's First Law.³⁸ Yet Hegel's method requires that he consider key theoretical terms not only as they are explicitly defined, but as they are actually deployed in description and explanation—which in the case of mechanics means considering how the defined terms relate to the physical quantities appearing in the relevant equations. We find here, too, key quantitative determinations that seem to express an external determination of motion. For instance, the quantitative independence of speed (as a quantity of motion) and mass (as a quantity of matter) in the equations expressing the basic laws of the inertial conception captures their essential 'indifference', according to this conception—that is, this quantitative independence captures the fact that inert matter is not self-determined to any motion but rather determined wholly 'externally' (E §§264–265).³⁹

³⁶ See E §§254–259; for commentary on details, see Wandschneider, *Raum, Zeit, Relativität*; Halper, "Nature, Space and Time"; Winfield, "Space, Time and Matter"; and Houlgate, *Introduction*, Ch. 6.

³⁷ In the SI system, for instance, units for time are determined through frequencies or cycles, and thus through spatial intervals; those for space are determined through distance traveled by light in a specific time-interval.

³⁸ "Every body perseveres in its state of being at rest or of moving uniformly straight forward, except insofar as it is compelled to change its state by forces impressed" (Newton, *Principles*, 416).

³⁹ 'Speed' translates Hegel's '*Geschwindigkeit*', which translates the Latin *velocitas*. We now reserve 'velocity' for the vector quantity and 'speed' for the scalar, but in Hegel's time the direction of a motion was understood not as an aspect of its quantitative determinacy but as a qualitative determinacy.—As a direct ratio of space to time, speed expresses a conception of motion on which space and time are indifferent. Their determinate essential relation is expressed in acceleration, while the implicit unity of matter and motion is expressed in momentum as a product of mass and speed (E §§267–268). It is harder to say what quantitative relation of space and time Hegel thinks is constitutive of mass as a physical quantity, though he appears to operationalize it in terms of the displacement of an arbitrary benchmark object under some standardized collision conditions. See E §265 and Kluit, "Gravitational Mass."

17.3.1. Collision and Communication of Motion

Having laid out the concrete contents of some basic concepts—space, time, matter, and motion, among others omitted here—Hegel considers further precisely how the inertial conception specifies the external determination of motion. He argues that implicit in the standard inertial account is a different conception on which matter, while still exposed to externally determined motions, is self-determined to other motions.⁴⁰

According to the inertial conception, he says, there is no state of motion or rest that is essential or immanent to any material body. Thus no matter what state of motion or rest a given body is in—and it must be in some such state—the inertial conception must understand it as having been externally determined to that state at some prior time by some other body. Consequently, the inertial conception cannot countenance the possibility of a lone material body existing by itself, and it follows from the inertial conception itself that any material body is both necessarily part of a system of such bodies and has had its current state of motion or rest determined externally by one or more of those other bodies.⁴¹

Hegel then considers the mode in which that necessary external determination happens. The simplest form of such determination, on his view, is the communication of motion in impact (*Stoß*). Hence Hegel begins by considering a highly idealized case: a perfectly elastic collision in one dimension with one of the bodies moving and the other at rest prior to impact.⁴² In such a case, he says, the communication of motion from one body to another is to be understood as involving the unification of the two bodies into one body at the instant of impact,⁴³ and their motions after impact are determined by redistributing this body's unified motion between them in a ratio determined by their relative masses.⁴⁴ Its use of this procedure shows that the inertial conception,

⁴⁰ Certain passages (particularly in E §266R) suggest a stronger interpretation, on which matter's capacity to be subject to external determination by collision would depend on the specific way in which it is self-determined to other motions—a point someone other than Hegel might express by saying that mechanical phenomena are grounded in dynamical properties and relations.

⁴¹ Thus Hegel speaks of "the inert body externally posited as in motion, which for this very reason is finite, and thus related to another . . ." (E §265). Hegel is probably not arguing from Galilean relativity of motion here, though such considerations arise elsewhere in his argument. He also does not consider forces operating independently of any bodies, for reasons relating to his critique of the concept of force (see PS 9.82–102/¶¶132–165, SL 11.359–364/455–459).

⁴² Hegel's discussion here follows the presentation of collision in Gren, *Naturlehre*, which Hegel owned (see Neuser, "Hegels privater Bibliothek") and which was widely used in German universities of the period (see Frercks, "Disziplinbildung"). See Pfeleiderer, *Physik*, for the kind of mechanics Hegel would have been taught in Tübingen.

⁴³ "The inert body, in motion externally . . . momentarily makes up *one* body [with the resting body it strikes] . . . the motion is in this way *one* of both bodies (*communication of motion*)" (E §265); "In the instant of impact, then, the bodies make up one body. The motion of the one is here also the motion of the other" (NSU 24.257).

⁴⁴ "But after the collision, in that the bodies are separated, the motion [i.e., the quantity of motion as momentum] remains the same as it was before the impact.—Thus if in the simplest case one body rests and another body, which is moved, collides with it, so each body retains its mass and the speed is divided then according to the relation of the magnitudes of weight" (NSU 24.257).

though superficially committed to the independence of mass and speed, is in fact implicitly committed to the idea that mass (as quantity of matter) and speed (as simple quantity of motion) stand in a determinate relation in any communication of motion.⁴⁵ And given the necessity of such communication for the inertial conception's understanding of material bodies, it follows that the inertial conception must in fact regard momentum—the physical quantity that captures or expresses this determination relation between mass and speed—as the most complete quantitative expression of matter and its motion.⁴⁶ Thus for the inertial conception to present mass and speed as 'in principle' independent is for it to prioritize an abstraction over its own explanatory/descriptive content.

Now, insofar as on this account communication of motion is understood essentially to involve the unification of the two bodies at impact, the account organizes its entire explanation of the communication of motion around what Hegel calls the system's 'center'. This orientation toward the center is evident from the way the motions of the bodies before and after impact are understood as directed toward and away from it, respectively. More precisely, the center in question is the center of mass of the unified body formed at the instant of impact, or what we would conceive as the origin point of the center of mass frame for the system made up of the two bodies. As this point, the center is non-identical with the center of either body taken on its own.⁴⁷ This is what Hegel is after when he points out that, although the communication of motion involves a unity of the two bodies, they remain two distinct bodies, and thus their unity is not complete or fully actualized. This overall situation is expressed by Hegel's description of the distinct motions of the bodies as 'striving' to occupy a common center,⁴⁸ and Hegel argues that for the inertial conception, even the resting body is in motion ('striving') in some sense.⁴⁹

⁴⁵ For Hegel the individuality each material body retains is its "being-for-self" or "relative heaviness [*relative Schwere*]" which is "further particularized through the quantum of mass" and also known as "weight [*Gewicht*] as the *heaviness* [*Schwere*] of a quantitatively particular mass (extensive as a multiplicity of heavy parts [*schwerer Teile*])—intensive as a determinate *pressure*" (E §265). For a careful treatment of Hegel's conception of mass in relation to Newton's, see Kluit, "Gravitational Mass"; and, more broadly, Ihmig's outstanding *Hegels Deutung*.

⁴⁶ For Hegel, the (inertial) mass "as the real determination makes up, with the ideal, with the quantitative determinacy of motion [as] speed, one determinacy (*quantitas motus* [momentum]), within which each can take the place of the other" (E §265).

⁴⁷ Compare our procedure of normalizing to the center of mass frame, in which the bodies have identical momentum (except for direction), and in which their motions prior to impact are explicitly taken as directed toward, and thus as organized or determined in reference to, the center of mass of the system (identical to the center of mass of the body formed by their unification at the moment of impact).

⁴⁸ "Impact and resistance, like the motion posited through them, therefore have a substantial ground in a *center* common to the single bodies and lying outside them, and their externally posited, accidental motion goes over into *rest*, in this middle point. At the same time, in that the center is outside the matter, this rest is only a *striving* for the center" (E §266). Compare here the Corollaries to Newton's Third Law.

⁴⁹ Although he does not invoke our center-of-mass frame normalization procedure (see note 47), Hegel insists that both bodies in a collision are moving (E §265A), indicating that his emphasis on their making up one body in collision is meant to assert that they constitute a single system of motion.

Thus by examining the standard procedure through which mechanics understands communication of motion, Hegel tries to show that the simple representation of matter as 'inert' in fact has a much more complex content, expressed in the ways the concepts of space, time, matter, mass, body, motion, velocity, momentum, impact, center, and so on, all relate to one another in the definitions, verbal formulas, and equations used to understand communication of motion. He concludes that, because the inertial conception requires that all states of motion or rest be 'externally' determined, and because it conceives of such external determination as communication of motion within a system of bodies where motion is essentially toward their common center, it ends up committed to an essential motion of all bodies with respect to the system of which they necessarily make up a part. But although this commitment is in some sense opposed to the conception of matter as inert, the resulting interpretation of the communication of motion does not require that we abandon any of the calculative procedures, equations, or major theoretical terms of the inertial conception, even as that conception gets transformed. In fact, Hegel retains them all, and his critical analysis displays the extent to which, and the basis upon which, they are valid. Thus Hegel's treatment of inertial motion provides a straightforward example of the method he employs to tease out the concrete content implicit in the understanding's natural-scientific representations. Through this analysis, that content—including the relevant laws, which are neither refuted nor rejected—is preserved in a new form.

17.3.2. Transition to Falling Motion

Hegel's analysis of the inertial conception, however, doesn't simply transform its content; it also reveals that the transformed contents require further distinct quantitative measures and laws for their full expression. More precisely, the analysis explicitizes the inertial conception's commitment to the claim that all bodies are self-determined to move toward a center outside themselves. Yet the mathematical laws governing the communication of motion and the physical quantities and measures appearing in these laws, although preserved in the transformation, do not themselves explicitly capture such a motion. But another law, discovered empirically and developed quite independently of Newton's conception of inertia, does capture such a motion: the Galilean law of fall.⁵⁰

The law of fall states that the distances traveled by two falling bodies (or by the same body considered over two appropriate intervals) are proportional to the squares of the elapsed times of their fall.⁵¹ Such motion, he says, is a '*relatively free*' one: free because it

⁵⁰ "This striving . . . is fall, the *essential* motion" (E §266). Note, however, that Newton himself, having discussed in the Corollaries to his three laws various points about conservation of momentum and inertial systems, asserts in the subsequent Scholium that Galileo's notion of fall follows directly upon that material. So Hegel's order of exposition here follows Newton closely.

⁵¹ Hegel refers specifically to the "Galilean law that the traversed spaces are related as the squares of the elapsed times" (E §267).

is “posited through the *concept* of a [material] body” and therefore “immanent” to every such body; only relatively free because, as a motion essentially oriented toward a point or center outside itself, falling motion begins with the falling body subject to an “*externally* posited, *contingent* determination” of standing at some given distance from that center (E §267). The merely relative freedom here is just the brute givenness, and hence non-self-determination, of that distance. According to Hegel, then, falling motion is more self-determined than inertial motion, in which all the quantitative determinations are simply given as or in initial conditions, and in which the total quantity of motion does not change as a result of its communication from one body to another. But while in fall the quantity of motion is determined in part by brutally given factors—not only the distance of the falling objects from its center, but also the constant or unit of fall—it is also determined in part by a determinate quantitative ratio of distance to time, which, on Hegel’s view, expresses quantitatively the essential conceptual relation between space and time themselves.⁵² All motions, of course, involve a quantitative relation of space to time, but unlike the uniform velocity characterizing inertial motion ($s:t$), the ratio characterizing falling motion is not a direct ratio but a power ratio, the proportion $s:t^2$ (visible in the standard equation for fall, $s = 1/2gt^2$). Hegel’s idea is that this power ratio expresses not a simple, immediate unity of space and time, but a mediated, determinate one, and that it therefore gives at least partial quantitative expression to the determinate qualitative unity of space and time making up the content of the concepts of mass and motion.⁵³ In sum, then, the essential motion toward a center implicit in the inertial conception of motion now gets its explicit quantitative expression in the law of fall, such that this law better expresses the concrete content of the concepts of matter and motion.

We can see Hegel’s point here by looking briefly at the standard interpretation of fall. On that interpretation, falling motion is caused by an attractive force exerted on the (essentially inert) falling body by the resting body toward which it falls. This interpretation puts the focus on explaining and quantifying an attractive force, whose effect on the motion of the falling body is wholly independent of the falling body’s mass. Newtonian theory understands this force’s quantity as a function of both the mass of the resting body and the distance of the falling body from its center, and interprets the constant g in the standard equation for the law as a measure of that force.

Hegel’s interpretation, by contrast, focuses not on identifying that dynamical cause of this motion, but on understanding the ratio of space to time in the motion itself. His interpretation is somewhat dense and depends in its details on a number of

⁵² For Hegel the law of fall “has an aspect that is determined out of the *concept* of a body,” and the connection between this concept and the Galilean law “is to be seen as simply lying in [the law] itself,” in which “the conceptual determinations of time and space become *free* with respect to each other, i.e., their quantitative determinations are related just as their conceptual ones” (E §267R).

⁵³ Hegel holds that the concept of ratio links quality and quantity, and that power ratios are the most complete type of ratio (SL: 21.318–320/278–279). He also understands the calculus in terms of power series (SL: 21.275/236) and regards it as the branch of mathematics with the highest philosophical standing (e.g., SL: 21.241/207). See the connections drawn between power series, fall, and the calculus in Hegel’s discussion of Lagrange’s analytical treatment of fall, in a note to E §267R.

commitments we cannot consider here, but its basic gist is not hard to get. Recall that for Hegel, space and time come as a pair or are mutually dependent in some determinate way, and the Hegelian question regarding any type of motion is about what determinate relation of space and time it asserts and whether that relation is the one actually constituting their concepts. Now, in fall the distances traversed are proportional to the squares of the times elapsed, so that if in the first second of fall a body falls 15 Paris feet, in the first two seconds it falls not 30 ($= 15 \times 2$), but 60 ($= 15 \times 2^2$) Paris feet. In his analysis here, Hegel emphasizes that in the ratio determining fall, the same number plays two roles: it both measures the time elapsed and shows up squared as the coefficient of the fall value (15 Paris feet), yielding as product the space traversed.⁵⁴ In this proportion, then, what is called ‘the square of the time’ does not itself determine a quantity of time but expresses the way in which the quantity of space is determined in concert with the fall value (that is, the constant of fall interpreted not as a measure of force but as a simple distance).

Through the double duty done by this quantity in the determination of the motion of fall, says Hegel, the proportion $s:t^2$ or s/t^2 expresses the mutual conceptual dependence of space and time by expressing both their identity and their determinate difference at once. The fact that the term for time appears in the denominator or divisor expresses the qualitative role time plays with respect to space generally: the unbroken continuity of space can only be limited and thus determined by means of a principle of division of the sheerly self-external, and this principle is time. Time is therefore essentially a divisor of space.⁵⁵ But the constantly flowing series of discrete instants of time, in turn, can only be given a positive, measurable existence through a principle for the totalizing unity of the sheerly self-external, and this principle is space. Thus space, for its part, is an expansive or extending principle: it is that in which whatever is delimited and determined stands in an essential unity with another outside it, or it is that which goes beyond itself to make up a new unified multiplicity or totality. Now, a motion that adequately exhibits the concrete concept of space can do so only by showing that the space of that motion is determined as a function of the time. But the time that determines space in such a motion cannot simply be time, on its own, but must be time mediated by space, or time understood in a way that expresses its essential mutual determination with space. If space is an expansive principle, then, the time component of the motion of fall must not be constant—that is, must not determine a simple constant additive increase in the space traversed—but must serve to determine the increase in the increase of space in the motion. Yet for this time component to be self-determined, it must determine the increase in the increase through itself. And this is how Hegel understands the fact that in fall, the distance traversed is not a function of the time *simpliciter* but of the time squared—since the square of the time is the time increased by an amount determined

⁵⁴ The fall value is not the same as (though it is related to) g as normally interpreted; while g is a measure of force, the fall value is simply a distance. Like Newton, Hegel doesn’t focus on our g (which they both express, in Paris feet, as 30 ft/s^2) but on the fall value, namely, the distance fallen in the first second (15 Paris feet).

⁵⁵ Hegel contrasts this case with the case of uniform velocity, in which time or space can function as divisor (E §267R).

by the time itself.⁵⁶ Hence the ratio $s:t^2$ expresses the qualitative conceptual relationship between space and time, and the motion determined (partially) through this ratio counts as a motion that expresses a relatively self-determined or free motion of matter.

17.3.3. Transition to Orbital Motion

In falling motion, then, we have a self-determined motion of matter, the law of which expresses explicitly the relations of space and time implicit in the inertial conception (and in the concepts of space, time, matter, and motion themselves). Hegel's interpretation of this law argues that a self-determined motion of matter is quantitatively determined through the qualitative conceptual relations constituting motion and matter as mutually determining unities of space and time. But the self-determination of falling matter is again limited or partial, insofar as it is still saddled with elements of givenness (e.g., the distance of the falling body from the center). Through a subsequent analysis, Hegel arrives at the conclusion that fall, too, implicitly involves a larger conception of matter and its self-determined motion (E §§268–271). According to this larger conception, the self-determined motion of material bodies is not a simple motion toward a center, but rather a motion of multiple bodies organized around, but not striving to become identical with, their common center—a motion in which both their 'ideal' unity with this center and their 'real' particular difference from it are given a determinate quantitative expression in the laws. For Hegel this motion is most directly expressed by Kepler's laws, which jointly determine orbital motions around a common center, relate the periods of those motions to the distances of the bodies from the center, and relate the speeds of the bodies along any portion of their orbital paths to a ratio of the distance traversed and the body's distance from the center. These laws, like the law of fall, are explicitly expressed as power ratios of space to time, though unlike the law of fall they are saddled with no constants representing sheerly given quantities.⁵⁷ If Hegel is right, then, Kepler's laws are quantitative expressions of the qualitative relations determining the concepts of motion and matter and thus capture a motion that is self-determined in the highest degree.

Although the very intriguing issues surrounding Hegel's relation to Newton are too complex to be treated adequately in the present format, it is worth mentioning that Hegel's frequent objections to Newton (on questions of both method and content) should not be overemphasized. It is true that Hegel attacks the brew of pure mathematics, metaphysics, and brute empirical fact that characterizes Newton's argument

⁵⁶ See note 53 on power ratios and E §267R on this ratio in particular.

⁵⁷ Kepler's first ('Ellipse') law states that the orbital paths of the planets around the sun are ellipses, whose equation includes two square/square power ratios; his second ('Area') law states that the areas swept out in equal times by a line connecting a planet and the sun are equal, and so relates time to an area, which is expressed as a power (units squared); his third ('Period') law states that the square of the period of the planet's orbit is proportional to the cube of the semimajor axis of its ellipse, and so relates two powers (square and cube).

style in the *Principia*, and it is also true that Hegel has few kind words for explanatory appeals to forces. But he also praises Newton as the discoverer of a properly *universal* attraction, specifically praises the insight his theory offers into orbital perturbations, and happily admits that Newton's equations are practically preferable in many circumstances (E §270R). Hegel's preference for Kepler's laws, then, is not to be understood as the claim that no progress has been made since Kepler—indeed, Hegel frequently refers to Lagrange's algebraic development of Newton's laws—but rather as the claim that Newton's way of conceiving of things does not deliver what we need philosophically: namely, a way to see the nature thus described as genuinely self-determining. Other, compatible laws, properly interpreted, do allow us to see nature that way, and if Hegel's arguments are correct, a philosophical focus on these laws does not require us to abandon anything of applied or technical importance.

The resulting Hegelian picture of material bodies and their motion is one on which the self-determined motion of any single body is always understood only within the context of the larger system of which it is a part. Absent the external determination of its motion in collision or fall—to which it is always exposed due to its being a spatiotemporally distinct single thing—it would self-determine to orbital motion. Yet in this orbital motion the body is not strictly self-determined as this single thing, but rather as one of many bodies differentiated from the others in its system. Thus the self-determination of matter in mechanics turns out to be the internal differentiation of a system of bodies into particular material bodies with specific determinations of their own, distinct from those of the other bodies in the system. For Hegel, matter's turning out to involve such an internal differentiating activity marks the transition from the mechanical to the 'physical' or chemical stage, so that the chemical view of matter and its actions and reactions appears as the unfolding of commitments inherent in the mechanical conception.

17.4. CONCLUSION

As this brief summary of some main points from Hegel's analysis of collision and fall suggests, his full argument for the self-determination of nature involves a complex and detailed engagement with contemporary scientific theory. But amidst the profusion of detail, the aim of the argument at each stage is clear: to show that the content of our best science can be given a new form that reveals nature to be thoroughly self-determining. This self-determination happens in many ways, culminating for Hegel in the self-maintaining life processes of higher-order mammals. Even self-determined human life is, of course, exposed to many kinds of contingent external determination. But whatever the sublation of this life into spirit may involve for Hegel—including the achievement of a form of activity and existence that no longer counts as essentially self-external—it cannot involve leaving nature behind. At most, it can show us how to take up our natural selves, and with them the entirety of the natural world in which they are embedded, in a new, self-internal way. Something like this seems to be suggested by the philosophical

anthropology Hegel develops in the opening section of the *Philosophy of Mind* under the heading of 'natural soul'. But ultimately, such an embrace of nature within and without us can happen only through the kind of extended philosophical confrontation with the natural sciences that characterizes the *Philosophy of Nature* and makes it an indispensable part of the Hegelian project.

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CHAPTER 18

HEGEL'S ANTHROPOLOGY

ANDREJA NOVAKOVIC

18.1. ANTHROPOLOGY FROM A SYSTEMATIC POINT OF VIEW

HEGEL's section entitled "Anthropology" appears, at face value, to be his contribution to the relatively new field of philosophical anthropology. It touches upon a number of topics usually treated in parallel accounts, including feeling, sleeping, dreaming, laughing, and crying. When Hegel began lecturing on these topics in Berlin in the 1820s, philosophical anthropology was emerging as an empirically informed discipline within philosophy, whose task was to determine human nature through reflections about (among other things) climate and geography, cultural differences, social behaviors, subjective faculties, and individual pathologies. Hegel's "Anthropology" can certainly be read as his version of such an account, and it is possible to take an independent interest in his conclusions. Even if many of them may not stand the test of time, they demonstrate a sincere effort to engage with the findings of his day, including research into animal magnetism and other occult phenomena, without compromising his picture of the human being as an essentially thinking creature.¹

It is, however, important to keep in mind that Hegel's "Anthropology" also has a pressing systematic function to perform. Given its placement in his *Encyclopedia of the Philosophical Sciences*, this chapter tracks the transition from 'nature' to 'spirit', more specifically, the development of consciousness out of mere animal life. In its opening pages we find a living individual who exhibits the same degree of independence from her environment that all living beings do, but who is not yet aware of herself as an individual, and so not yet aware of her difference from her environment. The standpoint

¹ Hegel was actually enthusiastic about research into animal magnetism because he thought that it provided evidence in favor of his speculative philosophy. For a helpful discussion of his topic, see Magee, "Dark Side of Subjective Spirit."

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HEGEL

Edited by

DEAN MOYAR

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