

Article

# Philosophia Naturalis Renovata: Natural Philosophy for the Twenty-first Century

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**Abstract:** A revitalized practice of natural philosophy can help people to live a better life and promote a flourishing ecosystem. Such a philosophy is natural in two senses. First, it is natural by seeking to understand the whole of nature, including mental phenomena. In particular, a comprehensive natural philosophy should address the phenomena of sentience by embracing first- and second-person methods of investigation. Moreover, to expand our understanding of the world, natural philosophy should embrace a full panoply of explanations, similar to Aristotle's four causes. Second, such a philosophy is natural by being grounded in human nature, taking full account of human capacities and limitations. Future natural philosophers should also make use of all human capacities, including emotion and intuition as well as reason and perception, to investigate nature. Finally, since the majority of our brain's activities are unconscious, natural philosophy should explore the unconscious mind with the aim of deepening our relation to the rest of nature and enhancing well-being.

**Keywords:** natural philosophy; philosophy of science; Jungian psychology; depth psychology; analytical psychology; phenomenological psychology; evolutionary psychology; active imagination; Aristotle's four causes; aesthetics in science; philosophy as a way of life.

## 1. Philosophia Naturalis

In the triumphant advance of science something essential has been lost, but I believe we can recover it by re-examining the idea of natural philosophy. I will begin my exploration with the term *philosophia naturalis* itself. Originally *philosophia* meant, of course, love of wisdom. According to tradition, Pythagoras coined the word because only the gods are truly wise; the best that mortals can do is to desire wisdom and to seek it. This realistic humility is reinforced by the last 2500 years of philosophical and scientific investigation with their continuing revision of previous conclusions. From its beginning philosophy recognized the limitations of human knowledge.

Traditionally *philosophia* was much more than a technical inquiry into the sorts of problems now considered philosophical. As recent commentary has reminded us, ancient philosophy was an all-inclusive way of life [1,2]. Students came to the ancient philosophers and joined their schools in order to live a better life guided by wisdom. The dogmas and technical investigations were important, but primarily as a basis for the art of living well. This goal was also supported by mental and spiritual exercises [1].

The scope of ancient philosophy is apparent in its divisions: *logica* (how to understand), *physica* (understanding of nature, *physis*), and *ethica* (character and how to behave) [3, v. 1, pp. 158–162]. Something like this could be a framework for a future natural philosophy as well. How do we learn and understand? What is the nature of existence? How then do we live? In reconsidering the concept of natural philosophy, I think it is important to take this wider view of philosophy, for we have learned that science and our attitude toward nature have important consequences for our lives. Therefore, in this paper I will consider a natural philosophy that will help us live better now and help our children to live better in the future.

Traditionally *philosophia naturalis* could denote the philosophical investigation of the natural world, as opposed to *philosophia rationalis* (logic), *philosophia moralis* (ethics), or *philosophia divinae*

39 (theology). But I think we can construct a more contemporary understanding of natural philosophy  
40 by contemplating the adjective *naturalis* [4, s.v. *naturalis*]. One meaning of *naturalis* is “concerning  
41 nature” (4b), and therefore *philosophia naturalis* has the traditional sense of an inquiry into nature.  
42 However, I think it is essential that we understand “nature” in the broadest way, encompassing all  
43 the phenomena of existence, including not just the objective and physical phenomena, but also those  
44 considered subjective, personal, or mental. A deep understanding of nature, which we require to live  
45 wisely, will require exploring outside narrowly empirical and physical phenomena. Later I will review  
46 some means for doing so.

47 Like the English word “natural,” Latin *naturalis* has another range of meanings that are especially  
48 important for our project. These describe things that have arisen from nature in general or are grounded  
49 in it in some way. Such things occur in nature, are part of nature, are produced by natural causes, or are  
50 determined by natural processes (1, 4a, c, 5a). Then again *naturalis* describes characteristics inherent  
51 or innate in a thing’s nature or typical of it (5e, 7a, 9). From this perspective, *philosophia naturalis* is  
52 philosophy grounded in nature, both in nature in general and in human nature in particular. That is, in  
53 the pursuit of wisdom and knowledge, with the goal of living a better life, we must be cognizant both  
54 of nature as a whole and of our own nature. Therefore, philosophy *grounded* in nature depends on  
55 philosophy *about* nature. On the other hand, our investigation of nature depends both on the nature of  
56 ourselves as epistemic agents and on the nature of the objects of our investigation, and so philosophy  
57 *about* nature reciprocally depends on philosophy *grounded* in nature.

58 As a means of living better, with a goal of human flourishing, natural philosophy should  
59 encompass an ethics and morality grounded in human nature and in nature as a whole. Natural  
60 morality and ethics and even natural religion and theology are old ideas, perhaps born prematurely, but  
61 I think the time may be right for their reconsideration and renovation as components of a twenty-first  
62 century natural philosophy.

## 63 2. Human Nature

64 “Know Thyself.” A natural philosophy of the sort I’m describing depends on an understanding of  
65 human nature, a large and ongoing project. But there is much that we know, and I will briefly mention  
66 some of the characteristics of *Homo sapiens* that are relevant to a future natural philosophy. For the  
67 most part they are uncontroversial and obvious, but we need to call them to attention.

68 Certainly, one of the most distinctive characteristics of humans is our ability to learn and adapt;  
69 our behavior seems to be more flexible than that of any other animal. This flexibility is a two-edged  
70 sword; whereas other species know instinctively how to live authentically as whatever they are, we  
71 have to discover and continually refine what it means to live most fully an authentic human life. For  
72 us, living a natural life entails investigating and understanding human nature so that we can guide  
73 our thought and behavior to promote human flourishing.

74 Because our learning and adaptation are fueled by knowledge, understanding, insight, wisdom,  
75 and experience, we are naturally curious. Our natural need to know should be considered a  
76 requirement for psychological well-being as essential as are our needs for companionship, love,  
77 care, security, stimulation, freedom, and peace. Therefore the quest for wisdom, which is central to  
78 natural philosophy, needs no further justification.

79 Unfortunately, humans have a limited cognitive capacity, a characteristic of our species all too  
80 familiar to most of us. Our perception, memory, and reason are limited in scope and subject to both  
81 systematic and random distortion. Our attention is limited and apt to be distracted. Therefore, in  
82 our pursuit of wisdom we need to develop cognitive and other tools to help prevent errors and to  
83 detect and correct them when they occur. The methods of logic, mathematics, and science are specific  
84 examples, but more generally, the social process of scholarship, in which parties with competing  
85 interests and agendas critique each other’s work, is a means toward eliminating, or at least identifying  
86 and mitigating individual, group, and cultural biases.

87 We are far from understanding the psychological complexity of human nature, which has  
88 profound effects on our understanding of ourselves and of the rest of nature and therefore on our  
89 well-being. Humans are *sentient* beings, by which I mean that they are sensitive to their environments,  
90 to their own bodies, and to their own interior states, and that this sensitivity is manifest in conscious  
91 awareness. Therefore, the natural phenomenon of consciousness, which was ignored by much of  
92 twentieth-century science, is a fundamental topic for any future natural philosophy. Consciousness  
93 has a rich phenomenology including perceptions, thoughts, memories, imagination, inner discourse,  
94 feelings, intentions, moods, and much else. In particular, our emotional response, which has often been  
95 neglected or even rejected by the philosophy of science, is crucial to our happiness and an important  
96 factor in how we reach conclusions, live our lives, and interact with other people and the world at  
97 large [5,6].

98 On the other hand, much of what goes on in our brains is *unconscious*, and so it is essential  
99 that natural philosophers strive to understand these unconscious processes and how they affect  
100 philosophers' own psychology as well as that of other people. We are still, a century or so after the  
101 invention of depth psychology, explorers of the complex structure of the unconscious mind, which has  
102 enormous effects on all aspects of human life. Central to human nature, it is still poorly understood.

103 *Homo sapiens* is a social species; we have evolved to survive best in groups, and therefore social  
104 organization is fundamental to our being in the world. Natural philosophy is also a social enterprise,  
105 benefitting from the diverse contributions of many people. As a consequence, humans are *encultured*  
106 psychologically and socially through their participation in various communities, and this affects their  
107 background assumptions, attitudes, expectations, skills, insights, etc. These cultural characteristics  
108 are largely unconscious, slowly acquired, and difficult to change. Ultimately, no human activity is  
109 culture-free or culture-independent, and it is important that the natural philosopher be aware of that  
110 fact (or they will be blindsided by it).

111 We humans are unique among animals in the complexity and precision of our communication.  
112 Language is a cultural artifact that promotes the growth and continuation of culture. It is also an  
113 important factor in cognition and even perception, with both positive and negative consequences.  
114 Therefore natural philosophy has to pay special attention to language as an essential characteristic of  
115 human nature.

116 Human beings are *embodied*, and the significance of that fact is that our brains have evolved to  
117 control our bodies in a physical world [7–10]. Our psychological structures are strongly conditioned  
118 on embodiment generally and on the specifics of *human* embodiment. Natural philosophy should not  
119 make the old mistake of treating humans as incorporeal minds contingently and inconsequentially  
120 attached to a body. Moreover, as in other animals, human cognition is fundamentally *situated*, that is,  
121 rooted in particular situations. Our cognitive faculties are better adapted to concrete physical, social,  
122 and cultural situations than to abstractions. General insight is harder to achieve and often derived from  
123 situated thinking and understanding. Narratives are often more convincing than abstract arguments.

124 Like other living things, humans have *evolved*, which means that we have inherited many  
125 characteristics that aided our survival in our environment of evolutionary adaptedness, but may  
126 be less adaptive in our present, very different environment. It behooves the natural philosopher to  
127 be aware of these characteristics of human nature and to take account of them. For example, for 95%  
128 of the history of *Homo sapiens* we survived as hunter-gatherers in small groups of related individuals  
129 [11, pp. 87–88]. That is our environment of evolutionary adaptedness, but that does not imply that we  
130 should live as paleolithic foragers, or that we should accept today the behaviors that were adaptive  
131 then. Important characteristics of human nature are that we learn, adapt, cooperate, and pass on our  
132 collective experience through culture, which itself evolves. Therefore, for us to live now as paleolithic  
133 foragers would be profoundly *unnatural*, contrary to authentic human nature. Indeed, I expect that the  
134 natural philosophy of the future will be an important contribution to the evolution of culture.

135 Finally, human beings are mortal, and so the continuation of humanity depends on reproduction  
136 and the ability of our offspring to survive and flourish. Therefore, a natural philosophy should be

137 forward-looking and focus on future generations. Like other animals, humans must act purposefully  
138 for their own survival and to ensure the survival of the species. Also in common with other species,  
139 human survival depends on the health of the ecosystem and, beyond mere survival, the well-being  
140 of humanity depends on a flourishing ecosystem. Indeed, *biophilia* is an evolved appreciation for a  
141 healthy environment, which is part of human nature and fundamental to our well-being [12].

142 As a future natural philosophy should be founded on human nature, so also it should start from  
143 the fact that humans are a part of nature. The global ecosystem is an integrated and organized whole,  
144 and as such we may ask what role humans play in it [13]. On the one hand, we now understand that  
145 humans have a greater effect on the environment than do other species. On the other, humans have  
146 unique capacities for understanding and influencing nature, and we may use them to enhance the  
147 survival and flourishing of the global ecosystem, on which we all depend. Just as we individually  
148 use our sense organs and minds to better adapt to our environments, so humankind can serve as an  
149 organ for the adaptation of the ecosystem as a whole. That is, we can make ourselves part of the Gaian  
150 feedback loop and work to enhance its health rather than to harm it. However, if humanity is going to  
151 fulfill this function well, it will need to strive to understand the whole of nature, and we may consider  
152 what that entails.

### 153 3. Three Perspectives

154 One of the facts about nature that a complete natural philosophy must accommodate is the  
155 existence of sentient beings, including of course human beings, but also many—if not all—other  
156 animal species. Sentient beings have two aspects: an exterior as physical object and an interior as  
157 consciously aware subject. These aspects necessitate two perspectives, commonly termed *third-person*  
158 and *first-person*.

159 From a third-person perspective a sentient subject or observer seeks to understand a physical  
160 object in terms of its external behavior and physical structure, that is, by addressing its non-sentient  
161 aspects. This is the perspective of the physical sciences and of behaviorist psychology, but also of  
162 much cognitive science and neuroscience, which treats cognition as a physico-chemical information  
163 processing and control.

164 Certain natural phenomena cannot be observed directly from a third-person perspective, and  
165 these include the subjective structure of sentience and phenomenal consciousness. For understanding  
166 these phenomena, first-person methods have been developed, as in phenomenological psychology and  
167 experimental phenomenology [14–16]. While third-person investigations can address these phenomena  
168 indirectly, the most fundamental problems (such as the Hard Problem of consciousness [17]) cannot be  
169 solved without evidence available only from a first-person perspective.

170 First-person investigations are more difficult than third-person research for several reasons. First  
171 of all, first-person methods have not been so extensively developed and refined as third-person  
172 techniques. Second, due to the private nature of first-person investigations, there is a greater danger of  
173 personal biases, presuppositions, and other subjective factors affecting observation. Third, and most  
174 importantly, this privateness makes public observation in principle impossible. Nevertheless, publicly  
175 validated understanding can emerge in a community of investigators through shared practices of  
176 introspection and experimentation [18]. (We already find this shared understanding in well-established  
177 contemplative and meditative communities.) Moreover, first- and third-person approaches can be  
178 combined, as in neurophenomenology [18–20].

179 The first-/third-person grammatical analogy encourages us to consider whether there is also a  
180 second-person perspective, and I believe that there is and that it will become an important part of  
181 natural philosophy [13]. The first-person perspective has a sentient subject striving to understand  
182 their own subjectivity, that is, to understand their interiority from the inside; and the third-person  
183 perspective has a sentient subject striving to understand an object from an external standpoint, that  
184 is, qua non-sentient thing. The second-person perspective, in contrast, has two or more sentient

185 beings striving to understand one another qua sentient beings, that is, each understanding their own  
 186 interiority in relation to the interiorities of the others. It is a cooperative activity of mutual growth.

187 I believe that the second-person perspective is fundamental to phenomenology, for we are social  
 188 beings relating to other sentient beings before we ever undertake first-person phenomenology, which  
 189 has a solipsistic orientation. The first-person perspective is a bracketing of experience from everyday  
 190 second- and third-person relationships. If we are to obey Husserl's "Back to the phenomena!" then we  
 191 must acknowledge the second-person perspective.

192 An everyday example of the second-person perspective is the mutual understanding that develops  
 193 between close friends, lovers, and family members. Good examples of systematic formal second-person  
 194 investigations might be the relation of Jungian analyst and analysand and other psychotherapeutic  
 195 or long-term counseling relationships. Second-person understanding can also develop between  
 196 humans and non-human sentient beings. A familiar example is the understanding that arises between  
 197 people and their companion animals. There is a partial recognition of the second-person relationship  
 198 in contemporary rules and guidelines in human subjects research and in animal research, which  
 199 acknowledge the objects of the research as sentient beings whose experiences, sensibilities, and  
 200 autonomy should be considered.

201 In summary, natural philosophy should investigate nature from first-, second-, and third-person  
 202 perspectives, which may be described as *intrasubjective*, *intersubjective*, and *objective* (more properly  
 203 *subjective-objective*) investigations. These three perspectives are necessary for complete understanding  
 204 in a world in which there are sentient beings.

#### 205 4. Four Explanations

206 Understanding the "why" of things is central to natural philosophy, but there are several sorts of  
 207 answers to "why" questions. In any given context, some kinds of answers, or explanations, may be  
 208 more or less informative—more or less able to improve our understanding—than others. However, the  
 209 contraction of natural philosophy that accompanied the expansion of modern science in the sixteenth  
 210 through eighteenth centuries led to a corresponding contraction in the notion of causality. The newly  
 211 dominant mechanical philosophy explained all causation in terms of efficient causation, which is still  
 212 the common scientific approach. In the broader context of natural philosophy, the efficient cause of  
 213 an event is not always the most informative explanation. Therefore, as a first step toward a broader  
 214 understanding, we can reconsider Aristotle's analysis of answers to "why" questions (Arist., *Phys.* II  
 215 194b–195a, *Met.* 983a–b, 1013a–1014a). These are commonly known as Aristotle's four causes, but that  
 216 terminology can be misleading due to the limited notion of causality typical of contemporary science.  
 217 Therefore, I prefer to call them *the four "whys"* or, compromising with tradition, *the four (be)causes*. A  
 218 brief review follows, which puts them in the context of future natural philosophy.

219 One fundamental kind of explanation can be termed the "what" (Grk., *to ti esti*), which answers  
 220 the question "What is it?" Traditionally, this is called the formal cause (*causa formalis*) because the  
 221 answer refers to the form, class, or category to which something belongs (Grk., *eidōs*). Why does this  
 222 thing have feathers? Because it is a bird, and birds have feathers. Why did this animal pounce on the  
 223 bird? Because it is a cat, and cats prey on birds. Why did this tissue contract? Because it is a muscle.

224 In the context of formal causation, "formal" refers to the Platonic forms or ideas (Grk., *eidōs*,  
 225 *idea*), and so formal causes also include mathematical explanations, which have been essential in  
 226 science since Galileo's time. Why do these two electrons repel each other with such and such a force?  
 227 Because electrons are charged objects, which obey Coulomb's law, and so the force is proportional  
 228 to the product of their charges and inversely proportional to the square of their distance. Why is  
 229  $D_x(x^2 + \sin x) = D_x x^2 + D_x \sin x$ ? Because differentiation is a linear operator.

230 A second sort of explanation is the "from what" (Grk., *to ex hou*), which answers a "why" in terms  
 231 of the material from which something is formed; this is the material cause (*causa materialis*). In this  
 232 context, "material" (Grk., *hylē*) is not limited to the sort of physical matter from which something  
 233 is made, but is relative to a thing's form. That is, the thing we are seeking to explain is analyzed in

234 terms of some form imposed on an underlying substrate, its “matter.” The formal (be)cause refers to a  
 235 specific abstract class, category, or form; the material (be)cause refers to the generic unformed stuff  
 236 from which the thing is formed. Why did the house burn down? Because it was made of wood. Why  
 237 did the cat fall? Because it is made of flesh and blood (which have mass etc.). Why did the muscle  
 238 contract? Because it is composed of thousands of muscle fibers, each of which can contract.

239 Form and matter are often relative terms, for the formed matter at one level becomes the generic  
 240 substrate for higher levels of formation. A statue (to use an old example) has many properties, some  
 241 better explained by its form (it is a statue of Apollo), others better explained by its material (bronze).  
 242 But the bronze metal is itself formed matter, for it is an alloy of copper and tin in a particular proportion,  
 243 and copper and tin are themselves structures of more elementary matter (protons, neutrons, electrons)  
 244 with a certain crystal structure, and so forth. At a higher level, statues may be the matter of a museum  
 245 exhibition.

246 A third sort of explanation is the “by what” (Grk., *to hupo tinou*) or efficient cause (*causa efficiens*),  
 247 which is the sort of causation privileged by contemporary science. Aristotle tells us that this answer to  
 248 a “why” question explains a change in terms of what initiated the change, maintains it, or brought it to  
 249 completion. Thus it explains a change, typically in terms of another change (Grk., *kinoun*), antecedent,  
 250 concurrent, or terminating. Why did the ball fly over the net? Because it was struck by the racket.  
 251 Why did the cat pounce? Because it saw a bird in range. Why did the muscle contract? Because it was  
 252 stimulated by motoneurons.

253 The most controversial kind of explanation, from a contemporary perspective, is the “for sake of  
 254 what” (Grk., *to hou heneka*), or final cause (*causa finalis*), which explains something in terms of its end or  
 255 purpose (Grk. *telos*). Why does the heart beat? To pump the blood. Why are there antibiotics? To fight  
 256 infection. Why did the cat pounce on the bird? In order to eat it. Why did this muscle contract? To  
 257 extend the cat’s legs so it could pounce.

258 Indeed, many things in nature—especially in living nature—exhibit *teleonomic* behavior; that  
 259 is, they behave in such a way that they fulfill purposes or achieve relevant ends [21, pp. 9–20].  
 260 Contemporary science prefers to explain them in terms of antecedent efficient causes (e.g., natural  
 261 selection and myriad contingencies), but especially in biological and technological contexts, final  
 262 (be)causes are often more explanatory. In fact, contemporary evolutionary theory explains how  
 263 teleonomic processes arise in the natural world, and all four be(causes) are essential to explanation in  
 264 modern evolutionary biology [22,23]; as Pigliucci has observes, “Darwin made it possible to put all  
 265 four Aristotelian causes into science” [24].

266 In summary, all four “why”s or (be)causes are necessary for a complete understanding of anything.  
 267 The material and formal explanations say what a thing is in generic and specific terms, the efficient  
 268 cause addresses the motive forces of its change, and the final explanation identifies the purpose or  
 269 function of the change. Certainly, for any particular thing and for any particular purpose, some  
 270 explanations will be more relevant, some less. But in order to achieve better understanding and greater  
 271 wisdom, natural philosophy should be open to them all.

272 We should not assume, however, that Aristotle said the first and last words on the categories of  
 273 explanation. Certainly, natural philosophy should be open to new forms of questions and answers  
 274 that better enable us to understand nature in all its manifestations. Nevertheless, there is something  
 275 fundamental about Aristotle’s framework, which looks for explanations in the past (*efficient*), in the  
 276 future (*final*), and in present nature combining general law (*formal*) and particular substance (*material*).

## 277 5. Philosophical Practice

278 How should we practice natural philosophy? I have argued that it is a philosophy grounded in  
 279 nature and, in particular, in human nature. Therefore, we must take account of all of human nature,  
 280 and not ignore some aspects of it or attempt to wish them out of existence. Rather, we should consider  
 281 every aspect of human nature as a means of achieving greater understanding with wisdom as our  
 282 ultimate goal.

### 283 5.1. Four Functions

284 The characteristic of the human nature most immediately apparent to us is our conscious mind,  
285 and therefore we may begin with its faculties and how they may be applied to natural philosophy. C.  
286 G. Jung identified four orienting and adaptive functions of the conscious mind: thinking, sensation,  
287 feeling, and intuition [25, CW 6, ¶¶7, 983–985]. Sensation refers to conscious perception of the external  
288 world, and thinking refers to our ability to reflect on our mental content, especially by discursive and  
289 rational means. Sensation and thinking have been the faculties most obviously applied in science for  
290 the last several centuries, and broadly align with empirical and theoretical investigation. The former is  
291 more extraverted in its orientation, the latter more introverted. Less obviously useful in science are the  
292 other two faculties—feeling and intuition—but we have testimony to their importance from some of  
293 the greatest scientists.

294 The feeling function provides an assessment of something which has the immediacy of sensation.  
295 (Indeed, its biological function is to provide an actionable assessment, when more thorough but slower  
296 thinking is not practical.) Feeling has a valence: positive or negative, attraction or avoidance, good or  
297 bad, but also other dimensions that are difficult to characterize [26, p. 90].

298 Many scientists have commented on the importance of aesthetic considerations in guiding their  
299 own work [27], even sometimes in opposition to empirical evidence, with eventual vindication of the  
300 more aesthetic theory [28, pp. 65–66]. There does not seem to be any a priori reason to prefer the more  
301 aesthetic theory, unless one takes the Platonic view that Truth, Beauty, and the Good are aspects of  
302 the ultimate principle of existence, but aesthetics is often a reliable guide. Perhaps it is simply that  
303 our brains work better on aesthetically appealing material. We are more likely to dwell on and even  
304 contemplate the beautiful, and thus find aesthetic theories more fruitful. Especially in mathematics  
305 and mathematical sciences, beauty is associated with order, symmetry, and harmony, which facilitate  
306 thinking. The pursuit of truth may be guided by aesthetics more efficiently than by slower discursive  
307 reasoning.

308 In any case, the role of aesthetics in understanding should be a topic for natural philosophers; it is  
309 a characteristic of human nature that needs to be better understood. Aesthetic cultivation is an implicit  
310 part of the training of most mathematicians and scientists, but it could be made taught more explicitly.  
311 Now it is learned now through apprenticeship and individual discovery, but we could have courses  
312 intended to cultivate the natural philosopher's aesthetic judgment.

313 Aesthetics is just one aspect of the feeling function, which has components that are both innate  
314 and learned. Our emotional responses have evolved over millions of years to make rapid—and on the  
315 average, reliable—evaluations in our environment of evolutionary adaptedness [29]. These responses  
316 are not necessarily adaptive in our contemporary, very different environment, and so we regulate  
317 and modify our emotional responses through cultural conditioning and learning. Nevertheless, as  
318 perceptual organs, our emotions give us valuable information, especially about people and, to a lesser  
319 extent, other animals. Therefore, they are especially important in second-person investigations.

320 As perception makes use of sense organs, which process sensory information unconsciously  
321 before it becomes present in conscious perception, the feeling function is also embodied, in brain  
322 structures such as the amygdala and other parts of the limbic system, with unconscious effects on  
323 the physiological state. Before an emotional response rises to the level of consciousness and becomes  
324 present to the feeling function, it has already had physiological effects, such as activation of the  
325 sympathetic nervous system, hormone secretion (e.g., adrenalin), and alteration of breathing and heart  
326 rate. Our conscious awareness of such effects is essential to the phenomenology of the feeling function  
327 [30, ch. 7][31, ch. 9]. Therefore, cultivation of the feeling function involves greater awareness of the  
328 somatic correlates of emotion. Where am I feeling this? In my gut? In my heart? In my breathing?

329 From ancient times up to the present day, science and to large extent also philosophy have been  
330 prejudiced against the feeling function, but it is essential. Indeed, people with a pathological absence  
331 of feeling cannot make decisions effectively [30, p. 67]. Nevertheless, the emotional faculties, which  
332 evolved in a very different environment from modern civilization, and often develop in the individual

333 without much conscious reflection, cannot be relied upon blindly. Like our sense organs and indeed  
334 our thinking, our feelings can be misleading. Therefore it is important to treat our emotional responses  
335 critically and to cultivate them to respond more appropriately in contemporary and future society.

336 In natural philosophy, the feelings are not sufficient on their own (nor are the other three functions),  
337 but they are often necessary for complete understanding. In particular, when properly cultivated, they  
338 may give us an early assessment of an idea and help us to decide whether it is worth pursuing by  
339 means of perception and thought. Moreover, after perception and thought have done their job, the  
340 feelings can help us evaluate the quality of the result.

341 This brings us to the fourth function, *intuition*, which is perhaps the least familiar. Jung compares  
342 intuition with the other functions as follows: “The essential function of sensation is to establish that  
343 something exists, thinking tells us what it means, feeling what its value is, and intuition surmises  
344 whence it comes and whither it goes.” [25, CW 6, ¶983]. He also defines intuition as “perception by  
345 way of the unconscious, or perception of unconscious contents” [25, CW 6, ¶899]; it “should enable us  
346 to divine the hidden possibilities in the background, since these too belong to the complete picture of a  
347 given situation” [25, CW 6, ¶900]. Intuition is the faculty that brings new possibilities into conscious  
348 awareness; it is the fundamental organ of creativity. From it arise novel ideas, hypotheses, images,  
349 visions, which then may be subjected to critical evaluation by the thinking, sensation, and feeling  
350 functions.

351 To make full, conscious use of their intuitive faculties, natural philosophers need to learn and  
352 practice techniques for bringing unconscious content and processes into conscious awareness. These  
353 techniques include active imagination and attention to dreams [32]. This may seem far outside the  
354 bounds of traditional science and philosophy, but there are many examples from history of the creative  
355 potential of intuition. Perhaps the most familiar is Kekulé’s discovery of the benzene ring; “Let us learn  
356 to dream,” he advised, “then perhaps we shall find the truth” [33,34].

357 A fundamental conclusion of Jungian psychological typology is that most people have one  
358 *dominant function*, which is the principal mode of their conscious engagement with the world. It is their  
359 most differentiated function, the most fully developed and precise, and the one they habitually use.  
360 The opposite function (thinking and feeling are opposites, as are sensation and intuition), which is  
361 called the *inferior function*, then is the least differentiated and developed, and may be quite primitive  
362 in its functioning, which is often unconscious [35, pp. 10–18]. A person is least likely to use their  
363 inferior function, and when they do, they often don’t use it effectively, due to its underdevelopment.  
364 The remaining two functions are called *secondary* or *auxiliary* and have intermediate degrees of  
365 differentiation and use.

366 Thinking is the dominant function for most scientists and philosophers, with sensation an auxiliary  
367 function, especially for empiricists. Feeling and intuition are usually the less developed functions. All  
368 four functions, however, are human faculties for conscious adaptation and orientation in the world,  
369 and Jung informs us, “For complete orientation all four functions should contribute equally” [25, CW 6,  
370 ¶900]. In this way we have complementary perspectives on any phenomenon, essentially seeing it from  
371 all four sides. Developing the secondary and inferior functions is part of the psychological process of  
372 *individuation*, of becoming psychologically whole and undivided (Lat. *individuus*), which is the goal  
373 of Jungian analysis [36]. An especially challenging, early phase of individuation is familiarization  
374 with and recruitment of the Shadow complex, which incorporates consciously rejected characteristics  
375 such as the inferior function [36, pp. 38–42][37]. The engagement with the Shadow integrates these  
376 unconscious characteristics into consciousness. So a thinking-dominant scientist would need to become  
377 more consciously aware of their largely unconscious feeling function, and to work with it so that  
378 it is a more adaptive, differentiated, and useful faculty. A goal for the education of future natural  
379 philosophers should be the cultivation of all four functions, so that they have all their conscious  
380 faculties available for understanding the world and living better in it.

## 381 5.2. Unconscious Faculties

382 Much of what takes place in our brains is unconscious, and it behooves us as natural philosophers  
383 to understand our unconscious faculties, both from the third-person perspectives of neuroscience  
384 and behavioral psychology and from the first-person perspectives of phenomenology and analytical  
385 psychology. In fact, the roots of all the conscious faculties are in the unconscious. We have seen  
386 that early phases of emotional processing are unconscious, and in perception both early stages and  
387 top-down processes (“seeing as”) are unconscious. So also the possibilities presented to the intuition  
388 arise from the unconscious. Even the thinking function leans heavily on largely unconscious processes,  
389 such as categorization and concept formation, memory, and language.

390 Like other animals, humans have evolved behavioral adaptations (“instincts”) that are  
391 characteristic of *Homo sapiens*. These lie deep in our nature and define the phylogenetic core of  
392 our unconscious minds; Jung called it the *objective psyche* [25, CW 7, ¶103n][38, p. 65][39] and the  
393 *collective unconscious* because it is common to all people [25, CW 8, ¶270]. The particular instincts  
394 structure our perception, affect, motivation, and behavior to achieve biological ends (e.g., reproduction,  
395 child rearing, cooperation, social hierarchy, defense). Experienced from a first-person perspective,  
396 these structures are the archetypes of the collective unconscious, which Jung described as “active living  
397 dispositions, ideas in the Platonic sense” [25, CW 8, ¶154].

398 As dynamic psychological forms, the archetypes shape the particular “matter” of our behavior  
399 and experience. Together, that is, they are (partial) formal and material explanations of our thought,  
400 feelings, and action. The final explanation lies in the biological ends served by the archetypes. The  
401 efficient explanation is the *releasing stimulus* that has activated the archetype, that is, engaged a  
402 cognitive-behavioral regulatory mechanism [38, pp. 64–65]. Of course, I am not claiming that every  
403 human thought, feeling, or action can be explained by the archetypes, but as evolved characteristics of  
404 our species, understanding them is essential to any *natural* philosophy.

405 There is more to the unconscious mind than the collective unconscious, for each of us also has  
406 a *personal unconscious*, which is ontogenetic rather than phylogenetic [36, p. 150n13]. It develops in  
407 each of us as individuals in particular families, communities, groups, and cultures. The personal  
408 unconscious is largely an adaptation of phylogenetic archetypes to the particularities of an individual’s  
409 life. This adaptation takes the form of unconscious *complexes*, which develop around archetypal cores.  
410 In common usage the word “complex” has a negative connotation, but in the context of analytical  
411 psychology complexes are normal components of the unconscious [35, pp. 36–39]. They are what makes  
412 the human instincts flexible and subject to individual, social, and cultural modification. Nevertheless,  
413 because complexes develop unconsciously through a person’s life experiences, they can become  
414 maladaptive. Therefore, an important goal of Jungian psychoanalysis is to bring the complexes into  
415 conscious awareness, so that the analysand can engage with them and so that their unconscious effect  
416 is mitigated. (This has been discussed above in Section 5.1 for the specific case of the inferior function  
417 and the Shadow complex.)

## 418 5.3. Active Imagination

419 Archetypes and complexes are unconscious and therefore not directly observable, even by  
420 first-person methods. But like other theoretical entities in science, they may be investigated through  
421 their observable effects, which allows hypotheses about them to be confirmed or refuted. When  
422 archetypes and complexes are activated or engaged, they have effects in experience and we can come  
423 to understand them through these experiences. In particular, Jung observed that archetypes and  
424 complexes often behave as autonomous subpersonalities with their own purposes (deriving from  
425 their biological function) [25, CW 8, ¶253]. Their inner workings and motivations are not directly  
426 accessible to consciousness (for they are opaque to us, like the phenomenological interiors of other  
427 sentient beings), but we can engage them in a second-person investigation. More concretely, the  
428 conscious ego and an unconscious complex/archetype can engage in a dialogue directed toward  
429 mutual understanding: the ego of the complex’s goals and needs, the complex of the ego’s individual

430 life and needs in the here and now, with the goal of a mutual accommodation [32, pp. 179–188]. In this  
431 way a cooperative relationship is established, rather than a situation in which the components of the  
432 psyche work at cross-purposes.

433 *Active imagination* is the name given in analytical psychology to the principal technique for  
434 achieving this accommodation [32,40]. The practitioner consciously interacts in their imagination with  
435 a personification of an activated complex or archetype. The dialogue (and, indeed, negotiation) is  
436 only partly under the control of the ego, for the activated subconscious personality is governed by its  
437 own autonomous structure. Active imagination depends on a complex or archetype being activated  
438 in the unconscious. Sometimes this happens spontaneously, for example, when a person has had an  
439 especially impressive dream. In this case, a significant person, animal, or object from the dream can  
440 be used as an imaginative stimulus to reactivate the relevant complex or archetype. In other cases, a  
441 person may invite a personification of a particular affect or condition (such as a mood or illness) that is  
442 intervening in their life.

443 More generally, complexes and archetypes are activated by *symbols*, which acquire their numinous  
444 character because they are the releasing stimuli of these deep psychological structures [41, pp. 12–44].  
445 Symbols *seem* significant because they *are* significant, signifying situations in which some associated  
446 archetype or its derivative complexes should be engaged. The symbol's numinosity is a conscious  
447 manifestation of the activation of an archetype or complex in the unconscious psyche. Some symbols  
448 are apparently innate, wired into our psyches through hundreds of thousands of years of evolution.  
449 Others are more particular—cultural or even individual—and become associated with archetypes by  
450 means of their mediating complexes. These are not new ideas. In particular, Neoplatonic theurgists  
451 used symbols (*sumbola*) and signs (*sunthêmata*) to engage with archetypal figures and complexes, which  
452 they understood as gods and *daimones* (mediating spirits) [42,43]. They accomplished this through  
453 ritual, which may be defined as “symbolic behavior, consciously performed” [32, p. 102].

454 Active imagination and similar techniques are not just for dealing with psychological problems,  
455 but can be valuable philosophical tools, as the Neoplatonists knew. The unconscious mind has long  
456 been recognized as a source of creativity [44–48], but creators have had wait for the unconscious to offer  
457 on its own terms new possibilities to the intuition. Active imagination enables conscious engagement  
458 with the wellsprings of creativity in order to discover new possibilities, which then may be evaluated  
459 according to the criteria of the other three functions (thinking, sensation, feeling). This too is an old  
460 idea, and ancient poets' invocation of the Muses as a source of inspiration could be more than a literary  
461 convention. By symbolic actions a person can activate the relevant archetypes and complexes and seek  
462 inspiration from them. So also the natural philosopher may seek insights about themselves and the  
463 rest of nature. Archetypes, complexes, and symbols are characteristics of human nature that we, as  
464 natural philosophers, need to understand better, both to understand ourselves more deeply but also to  
465 understand their effect on our understanding of other things.

#### 466 5.4. Natural Philosophy of Mathematics

467 The natural philosophy of mathematics illustrates the importance of the unconscious. It has been  
468 argued convincingly that the only viable philosophies of mathematics are *fictionalism* and *full-blooded*  
469 *Platonism*, but that there is no fact of the matter to decide between them [49, pp. 4–5, ch. 8]. In both  
470 cases mathematical objects exist (roughly speaking) if there is a consistent theory about them. This  
471 seems to be an impoverished view of mathematical reality compared to the experiences of many  
472 mathematicians and scientists. The gap arises from the fact that in philosophy mathematical objects  
473 are treated purely formally; in the case of the natural numbers, they are understood as pure quantities.  
474 In fact Pauli argued that contemporary work in the foundations of mathematics had failed because its  
475 formal approach “was one-sided and divorced from nature” [50, p. 64].

476 However, if we take the perspective of natural philosophy we see that the *natural* numbers also  
477 have a ground in human nature. For humans (like some other animals) exhibit *innate numerosity* [51,52],  
478 that is, the ability to directly perceive small numbers. There are regions of our brains that respond to

479 the numbers of things independently of their other properties (size, arrangement, density, etc.) [53].  
480 Like our phylogenetic capacity to see form, color, and arrangement, we have a phylogenetic capacity  
481 to see number (up to about seven). Innate numerosity together with innate symmetry perception [54]  
482 imply that these mathematical concepts are not arbitrary constructions for us; they are implicit in the  
483 human genome and have been with us for a very long time. They are archetypal.

484 Therefore certain small numbers have inherent qualitative aspects in addition to their more  
485 familiar quantitative aspects. This has been recognized by mathematicians such as Henri Poincaré,  
486 who said, “Every whole number is detached from the others, it possesses its own individuality, so to  
487 speak” [55, p. 60], and by physicists such as Wolfgang Pauli, who said the archetype concept should  
488 include “the continuous series of whole numbers in arithmetic, and that of the continuum in geometry”  
489 [55, p. 18n10]. In psychological terms, the first few numbers are individually archetypal, and they have  
490 all the potency of other archetypes. Therefore, “Jung devoted practically the whole of his life’s work  
491 to demonstrating the vast psychological significance of the number four,” according to his colleague  
492 Marie-Louise von Franz [55, p. 115]. Indeed Jung said number “may well be the most primitive element  
493 of order in the human mind” [25, CW 8, ¶870].

494 A complete natural philosophy of mathematics should acknowledge and incorporate the  
495 archetypal character of small numbers and geometric objects, for they are grounded in human nature.  
496 The more abstract qualities of symmetry are of course fundamental to the aesthetics of mathematics  
497 and physics. Pauli emphasized the importance of the archetypes in natural science; he concluded, “the  
498 archetypes thus function as the sought-for bridge between the sense perceptions and the ideas and are,  
499 accordingly, a necessary presupposition even for evolving a scientific theory of nature” [56, p. 221].

## 500 6. The Reanimation of Nature

501 The last natural philosopher, in the sense presented here, was perhaps Johann Wolfgang von  
502 Goethe, and the present proposal could be viewed as an attempt to pick up where he left off, but in the  
503 context of a twenty-first century understanding of nature. His approach, which he called a “delicate  
504 empiricism” (*zartre Empirie*) involved an empathetic identification with the object of study, so that  
505 exterior perception and interior cognition move in a tandem harmony; he said, “my perception itself  
506 is a thinking, and my thinking a perception” [57, p. 39]. His method was holistic and participatory  
507 [56, pp. 146, 258][58, pp. 3–26, 49–76, 321–30][59, pp. 12, 22, 28, 41, 48]. Archetypal patterns provide  
508 the unifying bridge between external forms and processes and an empathetic participation in them.  
509 Pauli agrees that understanding, and in fact the joy of understanding, arise from “a correspondence, a  
510 ‘matching’ of inner images pre-existent in the human psyche with external objects and their behavior”  
511 [56, p. 221]. (I have discussed Goethe’s natural philosophy more elsewhere [13,43].)

512 Natural philosophers, as described here, will interact with nature in a way that is more holistic,  
513 participatory, and sensitive than is the norm in science now. They will engage all four of their  
514 conscious functions with a goal of understanding phenomena that are intrasubjective, intersubjective,  
515 and extrasubjective (objective). They will cultivate relationships with the complexes and archetypal  
516 structures of the unconscious mind, and will be aware of the projection of these structures outside  
517 themselves. In this way they will attune their psyches to nature to achieve a fuller, more comprehensive  
518 understanding and gain the wisdom that is built on it. This resonance between inner and outer form  
519 and process will allow them to experience nature as animate, which is grasped and appreciated not  
520 just intellectually, but also sensually, emotionally, and intuitively [60]. I anticipate this will change the  
521 relationship of humanity to the nature of which it is part to the benefit of both.

## 522 7. Conclusions

523 In this paper I have presented what I believe natural philosophy should be in the twenty-first  
524 century. First of all, it should be a *philosophy* in the ancient sense, that is, a way of living better, of  
525 human flourishing grounded in the pursuit of wisdom.

526 Second, it should be a *natural* philosophy in that it finds wisdom by seeking to understand all of  
 527 nature, which includes all the experiences we have, both individual and collective. In particular, in  
 528 addition to understanding objects qua objects from an exterior, third-person perspective, it seeks to  
 529 understand experience from an interior, first-person perspective, and it seeks mutual understanding  
 530 among sentient beings through a second-person perspective. No phenomenon should be outside the  
 531 scope of a future natural philosophy. Moreover, natural philosophers understand that phenomena  
 532 have many causes, and the most informative explanation of a phenomenon may lie in antecedent  
 533 changes, but also in specific structure or organization, in generic constituents, or in the purpose or  
 534 function of the phenomenon, and that full understanding often depends on all of these.

535 Third, it should be a *natural* philosophy in that it is grounded in our nature as human beings. This  
 536 means that it is a natural philosophy developed in an ever improving awareness and understanding  
 537 of human nature, in particular, of human capacities and limitations. Therefore, future natural  
 538 philosophers should use all their faculties in the pursuit of wisdom: conscious and unconscious,  
 539 individual and collective. We are situated, embodied living agents with capacities for thinking,  
 540 sensation, feeling, and intuition, all of which are informative. Part of natural philosophy as a way  
 541 of life, then, is the cultivation of these capacities so that they function more effectively. In particular,  
 542 feeling and intuition need more attention than usually granted by science. To this end, particular  
 543 contemplative practices and exercises will be helpful.

544 As human animals who are part of nature, we may use our innate capacities to enter into a  
 545 comprehensive, empathetic understanding of nature, which is intellectually and emotionally satisfying,  
 546 and that leads to humanity better fulfilling its function as an organ of nature. A better understanding  
 547 of nature, including human nature, will show us how to fulfill our role better, and a better understanding  
 548 of our own nature will enable us to understand better nature as a whole. It goes without saying that  
 549 most if not all of these ideas have been proposed before, but the goal of a *philosophia naturalis renovata*  
 550 must take the best of the past while establishing a new foundation on which to erect a renovated  
 551 structure.

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