Experimenting with Matter in the Works of Gabriel Platte

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This paper investigates the relation between Gabriel Platte’s (c. 1600–1644) cosmology and theory of matter, on the one hand, and his method of experimentation, on the other. In my view Platte based his cosmology and theory of matter on specific “principles of nature” expressed as alchemical qualitative relations between bodies, and these principles formed the theoretical framework for his experimental method and technologies. I also claim that Platte’s method of experimentation has heuristic purposes, acting as a tool to instantiate and illustrate these natural principles. By quantifiable manipulations of matter (expressed in terms of proportions and numbers), Platte made use of experimentation to provide technologies whose immediate purpose was to ameliorate or improve the material world.

1. Introduction

Gabriel Platte (ca. 1600–1644) was an English member of the Hartlib Circle. Only a few studies have been dedicated to him in particular (Fussell 1938, pp. 77–80; 1947, p. 39; Debus 1961, pp. 162–5; Hewins rev. McConnell 2004; Matei 2012, pp. 207–24; 2013a, pp. 84–102; McCormick 2016, pp. 339–52; Clericuzio 2018, pp. 550–83), while others have mentioned his name in the wider context of the Hartlib Circle and the reformation of the seventeenth century (Turnbull 1947, pp. 3, 97,

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He was an inventor and alchemist with a special interest in projects of amelioration, from the improvement of barren fields to producing new medicines, and to even more ambitious projects of advancing economic welfare. Little is known about Plattes prior to his association with the Hartlib Circle, to which he had apparently been introduced by the mathematician John Pell, the man also responsible, according to Charles Webster, for Plattes’ experimental style (Webster 1975, pp. 47–51, 471–3). Plattes dedicated his first two books (A Discovery of Subterraneall Treasure, viz., Of all manner of Mines and Mineralls and A Discovery of Infinite Treasure, Hidden since the Worlds Beginning, both published in 1639) to William Engelbert, whose assistant he claimed to have been (see also Hartlib 1639, HP 30/4/18B-27B, on 21A and 25A). Apart from these two books, designed to be complementary, Plattes also wrote a utopian tract (A Description of the Famous Kindome of Macaria, 1641), an alchemical tract on what the alchemical process requires (A Caveat for Alchymists, [1643] 1655), and a short pamphlet describing the ways in which people could improve their financial condition with less effort (The Profitable Intelligencer, [1644] 1655). A Discovery of Subterraneall Treasure and A Discovery of Infinite Treasure were popular in England and abroad.1 While in the first of

1. The text has a prefatory address to Parliament, dated 25 October 1641. Because it was anonymously published, and because it was Samuel Hartlib who addressed it to Parliament, it was long attributed to Hartlib. Charles Webster debated its authorship and demonstrated that Macaria was not written by Samuel Hartlib but by Plattes: Webster 1970b, pp. 147–64; 1972, pp. 34–49; 1979. See also Matei 2013b, pp. 7–33.

2. Among those interested in Plattes’ books, we can count John Beale (Letter John Beale to Hartlib, 23 February 1657, HP 62/22/1A-4B, on 1B (The Hartlib Papers, www.dhi.ac.uk/hartlib/ abbreviated HP); Sir Cheney Culpeper, who asked Hartlib several times to send him Plattes’ works and tried to put into practice some of Plattes’ advice concerning the cultivation of corn and the use of salpetre and pigeon dung (Letter, Culpeper to Hartlib, 20 November 1644, HP 13/55A-56B, on 55B; Letter, Culpeper to Hartlib, 4 January 1645, 13/59A-60B, on 59A; Letter, Culpeper to Hartlib, 21 January 1645, 13/65A-68B, on 66B-67A; Letter, Culpeper to Hartlib, 28 January 1645, 13/69A-70A, on 69A; Letter, Culpeper to Hartlib, 20 May 1645, 13/88A-89B, on 88B; Letter, Culpeper to Hartlib, 17 July 1645, 13/94A-98B, on 95A; Letter, Culpeper to Hartlib, 12 November 1645, 13/121A-122B, on 122A; Letter, Culpeper to Hartlib, [November 1645?], 13/277A-278B, on 278A; Letter, Culpeper to Hartlib, 20 September 1657, 42/15/11A-14B, on 11B); Johann Morian (Copy Letter in Hartlib’s Hand, Johannn Morian to ?, In German and Latin, 21 July 1639, HP 37/34A-35B, on 34B); perhaps Lord Robartes (Copy Letters in Scribal Hand F, Hartlib to
the two books Plattes grounds his theory of matter in the alchemical tradition, insisting on experiments with metals and transmutations, in the second he presents a cosmology and, asserting that every body in the universe is made of the same matter, proposes intensive schemes of husbandry and inventions for the improvement of the soil, the healing of diseases, and the economic advancement of the country.

The aim of this paper is to give an account of Plattes’ natural philosophy, arguing that it developed in the eclectic context of the Hartlib Circle and was founded on a set of influences that combined the alchemical tradition with a theory of magnetism and some elements of Bacon’s experimentalism. Although at first glance these traditions may seem incompatible, Plattes borrowed from them details that fitted well in his eclectic view of the natural world. Reading Plattes’ work in this context offers a clearer perspective on how he made use of his sources; it also helps to distinguish the influences that marked his natural philosophy, identifying the points where these traditions fitted into an eclectic project. As for the alchemical influence, the Paracelsian and Sendivogian investigation of the vital principle in nature stimulated research on plant generation and growth among the Hartlibians (Clericuzio 2018) and it also seemed to have had an impact on Plattes since, throughout his work, he devoted significant effort to the analysis of the composition of the soil, plant nutrition, and the use of fertilizers.3 The theory of magnetism, via Gilbert, according
to Debus (1961, p. 163), looks like another important source of inspiration as the magnetic virtue holds a central place in Plattes’ theory of matter. And the Baconian method of experimentation, apart from the dedication to utility so popular in the Hartlib Circle, provided Plattes a tool with a double function: on the one hand it had heuristic purposes and, on the other, it was meant to provide technologies of amelioration.

If previous scholarship emphasized the contribution to utility made by Plattes’ technologies of amelioration (Webster 1975; McCormick 2016; Clericuzio 2018), this paper states that, behind the utilitarian aim, Plattes developed an eclectic natural philosophy based on a theoretical system with practical applications. The theoretical system is founded on three “principles of nature”, expressed as alchemical qualitative relations between bodies. The term “principle of nature” is my reconstruction of Plattes’ fundamental ideas on cosmology and theory of matter, but if we accept them it will be easier to understand his eclectic natural philosophy. In constructing his theoretical system Plattes makes use of an important term, namely “law of nature” (Plattes 1639b, The Preface, B3, C and p. 40) but he does not clearly state what his understanding of the concept implies. However, the use of the concept in Plattes’ case cannot be regarded as just an irrelevant rhetorical addition, particularly because his magnetical law of nature and the other principles of nature I identify in his theory of matter express constitutive relations between types of matter and are meant to function and to produce effects in different domains (see the third section of this paper).

By presenting Plattes’ natural philosophy, this paper makes the connection between his theory and practice, emphasizing ways in which his cosmology and theory of matter relate to projects of material improvement, or amelioration, by means of technologies linked to experimentation. I argue that Plattes based his natural philosophy and the related cosmology and

the public and, at the same time, to promote its true benefits for the common good. A similar point was shared by Mersenne in *Quaestiones Celeberrimae in Genesis* (1623) and *Quaestiones Inomies, ou Récréation des Sçavans* (1634), who, in spite of his critical position towards alchemy, stressed the importance of writing reports of alchemical experiments. See Clericuzio 2000, p. 48.

4. There is a vast literature devoted to the topic of “law(s) of nature” and, as John Henry argues, before Descartes there was no precise application of the term “law of nature” as a foundational natural philosophical concept. Henry 2004, pp. 73–114. See also Daston and Stolleis 2008. Plattes is no exception.

theory of matter on specific “principles of nature” that were influenced by both alchemy and the theory of magnetism. In particular, these principles expressed qualitative alchemical relations that, by means of experimentation, introduced new qualities (such as hot, hotter, dry, dryer) where they had not been present before, or intensified them when they had previously been too subtle to observe. By means of the technology involved in producing such qualities, nature could be improved for human use.

2. Platten’s Cosmology and Theory of Matter
According to Platten, God created the universe using not only his power, “but also his wisdom and exquisite artifice”, proportioning all the things and the relations between them in “number, weight, and measure” (Plattes 1639b, p. 1). “Numero pondere et mensura Deus omnia condidit” (Wisdom, 11: 20) is a standard theological phrase from the Middle Ages, alluding to and praising God the Mathematician (Gabbe 2001, pp. 521–29). This might be a necessary position for someone like Platten, who wants to experiment by proportionality. If the proportions shifted at God’s will, then experimentation would not be reliable. Or, again, if the proportions were kept fixed only relative to the experimental setup, then the experiments would not be reliable in showing the nature of things; they could only show the contrived nature of things (the Aristotelian artificial–natural distinction would be in place). Third, if “the number, weight and measure” were man’s measure of the universe and not imprinted in the nature of things, then serious sceptical worries about the human possibility to know things would open up. By positing this, Platten intends to secure his project against such possible worries.

Platten writes that “the Terrestriall Globe” is in the middle of the universe, held in place by a magnetic virtue exerted by God’s wisdom and artifice and surrounded by “the vaste Element of Aire” that extends all the way up to the stars. The magnetic virtue is a universal property acting between stars and elements, but it also enables the growth of seeds and the attraction of iron by a loadstone. It has a double nature, both attractive and repulsive, equally exerted, that is manifested between the celestial and terrestrial orbs, keeps the earth in its central position with respect to the celestial orbs, and shapes the terrestrial globe giving the sea a spherical form (Plattes 1639b, p. 4). In Platten’s description, the North and the South Poles are two islands of ice. There is also a “continuall exhalation of Water,

6. Paul of Taranto (considered by Newman to be the author of Summa perfectionis—Newman 1985, pp. 76–90) argues that artisans have the power to manipulate both primary qualities (hot, cold, dry, moist) and secondary qualities (such as colour and taste). See Newman 1989, pp. 423–45.
and rarifying of the same into Ayre” in the “burning Zones” of the Earth, while at the Poles there is a continual “condensation of Aire into Water.” Therefore, water has a perpetual cyclical motion and transformation into air (Plattes 1639a, pp. 2–3). Because it is very cold at the Poles, “the condensed Meteors” will not “descend in the forme of Water, but in the forme of Snow, Haile, or some substance of like nature.” The weather being cold, the snow cannot melt and presses its weight down upon the poles towards the center of the Earth, where the “centrall heate melteth it off continually,” thereby conferring and preserving the spherical form of “both Earth and Water” (Plattes 1639a, p. 3).

“The Terrestriall Globe” is composed of earth and water and is the residence of the elements (Plattes 1639b, p. 1). Plattes departs from the Aristotelian tradition since his terrestrial globe is composed only of earth and water and there is no fire.7 His cosmology is not only different from the Aristotelian one (not including fire in the list of elements) but it also displays features that resemble the Paracelsian principles (mercury, sulphur, salt). Plattes builds his theory of matter on the supposition that every mixed body is composed of a double “fatness”: one combustible and one incombustible (or fixed). My assumption is that, for Plattes, this “fatness” is the alchemical principle of sulphur.

The combustible fatnesse causeth vegetation by its rarifying and vaporing qualitie, when it feeelth the heate of the Sunne; the incombustible or fixed fatnesse causeth coagulation of the said vapours by heate of the Sunne likewise by its adstringent qualitie, and of the two fatnesses, are all riches and treasures engendred.

The propertie of the incombustible fatnesse is to sinke in water, and the propertie of the other is to swim upon the Water, and that ground which aboundeth with the combustible fatnesse is apt for such Seeds and Plants as require a combustible fatnesse. (Plattes 1639b, pp. 23–4)

Plattes was not the first to make this association. The author of the Summa perfectionis, attributed to Geber and written around the end of the thirteenth century, also describes sulphur as “the fat of the earth,” stating that it can be of two types: one fixed (non-volatile) and the other unfixed

7. For the alchemical tradition, which seems to be partially influential for Plattes, this is not necessary atypical, similar positions being shared by Paracelsus and Duchesne. See Debus 1991, pp. 51–4; 1965, p. 92. Also, apart from alchemy, in the Renaissance tradition, Cardano, at the beginning of the second book of De subtilitate, argues that fire is not an element. See Cardano 2013.
(volatile). According to Plattes, this double fatness is the treasure of the earth, of which all riches are made. It is to be found in every element (air, water, earth), although in the earth it is frequently miscompounded due to that element’s double nature, “one Terrestriall, the other Celestiall or Aethiriall” (Plattes 1639b, The Epistle Dedicatory, (a)). The “Aethiriall” part of the earth, by the help of the heat of the sun, has the power to lift the “Terrestriall” part, while the “Terrestriall” part has the force to coagulate the “Aethiriall” part into fruits. Both these properties attached to the earth’s natures are expressed as quantities and forces:

...for if the Aethereall part be not of force and quantitie sufficient, by the heate of the Sunne, to lift up the Terrestriall part, then no fruit thereof springeth. Againe, if the Terrestriall part be not of force to coagulate and harden the other into profitable fruits, then all is turned into smoake, like the accustomed works of Alchymistes. (Plattes, 1639b, The Epistle Dedicatory, (a))

All the riches of the earth are made of congealed vapours. The fatness of the earth is elevated by the heat of the sun and turned into vapours with the help of the universal spirit of the world, then drawn together by the “Adamantine” virtue of the seeds and plants, which congeals it. Vapours arising from the earth create metals and stones according to the type of fat they meet in the process of rising upwards. For instance, vapours meeting lean earth will turn into stone (Plattes 1639a, p. 50). Also, the subterranean vapours impregnate the earth, making it firmer in some places than in others, creating either stones or loose earth. According to this theory, metals and plants grow out of subterranean vapours of the earth due to the rarefying property of the fatness of the earth. Trees, plants, and fruits are made of rarefied and then congealed vapours. In summer, the combustible fatness of the land produces vegetation in the presence of the heat of the sun, due to its rarefying and vapourizing property, and then “the Adamantine vertue of the Seeds, and Plants” congeals the vapours and gives them form.

For Plattes all bodies in the universe are created as a result of the same cyclical processes of combustion, rarefaction, and congealing. Everything

8. “You may draw forth the proof of this by a manifest test namely by its easy inflammation, and by its easy liquefaction through heat. For nothing is inflamed unless it be oleaginous, nor is anything liquefied unless it also have that nature.” Newman 1991, p. 720.

9. Again, this is not an innovative idea in the alchemical tradition. See, for instance, Sendivogius 1650, pp. 9–14, especially pp. 11–13, 37–8.

10. The idea that there were active principles in nature, sources of perpetual activity, was popular in this century and was shared by Newton in his early stages. See Newton to
in the universe, he explains, is made of the same matter, not only metals and plants but also animals and humans; and in his *A Discovery of Infinite Treasure*, he underscores the notion that humans are made of the same “Fabricke of the universe” (Plattes 1639b, p. 2). According to this theory, plants, animals, and humans are individually made of this double type of fatness: combustible and incombustible. The same matter is present in all natural phenomena (common and uncommon), and is the means by which Plattes explains the presence in nature of miraculous phenomena such as rains of frogs and thunderstones:

It is plaine that all Trees, Plants, and Fruits, are made of vapours congealed, for nothing vegetateth but in Summer when the heate of the Sunne is in force to rarifie and turne the said fatness of the earth into a vapour, ... let us consider of these things following, viz. the raining of Frogges, Thunderstones, Wheate, or a thing almost like to it: the cause of these things can be no other, but that when a convenient heate had almost formed them in their proper Spheare, viz. in the superficies of the earth, then a greater heate accidentally coming, raised up the spermaticall substance thereof into the common Aire, and there hatched the same, till such time as the magnitude and ponderositie thereof caused them to fall to their proper Sphere (Plattes 1639b, pp. 77–8).

Since the same matter and the same constitutive relations are to be found in every body, transmutation becomes for Plattes altogether possible. Between inferior and superior metals there is only a proportional variation of matter, as base metals contain a small quantity of matter of the same nature as that of precious metals (Plattes 1639a, p. 39). Gold itself, he writes, is “nothing else but the said fatnesse of the earth, elevated by the said universall spirit, and after depuration congealed into the splendorous Body” (Plattes 1639b, The Preface, C3 and 1639a, pp. 36–9).

For Plattes, knowledge of nature has been disclosed by God in order that mankind might understand the workings of nature. Each thing in nature, whether natural or artificial, instantiates, in some way, the processes of the created world (according to Plattes, this knowledge includes the means of maintaining and improving the land (Plattes [1643] 1655, p. 85, and 1639b, The Preface, D). By practice and experimentation human beings are thus able to imitate nature and to produce technologies of amelioration,
improving the land, producing metallic transmutations, and creating more efficacious medicines (Plattes 1639a, pp. 6–7).

3. **Plattes’ Principles of Nature**
At least three principles of nature can be derived from Plattes’ cosmology and theory of matter. In the particular case of magnetism, described as a universal virtue manifested as attraction and/or repulsion, Plattes acknowledges that it is a “law of nature” and claims that it is given by God so that humans will know how nature functions. Apart from magnetism, two other principles of nature, not specifically called “laws of nature,” emerge from close study of Plattes’ theory of matter. The first is that every body is composed of a double fatness (combustible and incombustible). The second is that, according to their composition (fatness), bodies will either float or sink in water. What makes magnetism distinguishable in comparison to the other two principles of nature is its fundamental character that prevails over every action in the universe, including those of the two types of fatness. In the following I will discuss what I take to be Plattes’ three principles of nature, leaving magnetism for last.

As proof of the alchemical provenance of his theory of matter and, subsequently, of his double fatness principle, Plattes uses the example of the burning tree, a very common example used by Paracelsians to illustrate the three hypostatical principles: mercury, sulphur (which, for Plattes, is the double fatness), and salt. Mercury is the universal transformative spirit of the world, which, with the help of heat from the sun, raises the sulphurous part of every body and lets the salt settle down:

… for first there riseth a sharpe vapour in the burning, which is the universall spirit of the world [i.e., mercury], and the vehiculum which by the helpe of the Sunnes heate, lifteth up the former fatnesse [the combustible fatness], then the combustible part consumeth into aire by the fire, then the ashes remaining [i.e., salt], being laid upon land fatneth it, whereby a fatnesse incombustible is discovered, and these two fatnesses are in mineralls as well as vegetables, and of the

11. “… which by its Magnetique vertue it is prone to draw to it; to increase his like according to the great Magna Charta or Grand-law of nature” (Plattes 1639b, p. 40).

12. Another argument favouring the position that these relations are similar to what Plattes calls “laws of nature” can be found in Ralph Austen’s interpretation of Plattes’ theory of matter. Austen refers to Plattes’ theory of subterranean vapours as a “law of nature” or “axiom” (Austen 1665, pp. 193, 199).

13. On the association of wood ashes with the saline principle, see also Plattes 1639a, p. 39: “For as a Tree or other vegetable being burned, doth yeeld a fixed salt or Ashes.” This salt is of two types: fixed and “volutill or fugitive.”
incombustible and fixed fatnesse minerall is Gold made by nature, and also by art, imitating Nature. (Plattes 1639b, p. 79; addition in brackets mine)

As stated before, Plattes associates fatness (which can be combustible and incombustible) with the alchemical principle of sulphur. When depicting the formation of rocks and mountains, Plattes notes that they are caused by “Bituminous and Sulphurious subterraneall substances” (Plattes 1639a, pp. 6–7). Metals, “generated in the belly of the Earth” through the vapourizing property of the combustible fatness of the earth, will putrefy in earth with the exception of gold, which “wil never putrifie by reason of his excellent composition, being made of a Balsamick Sulphure, or fatnes, which is incombustible”. Gold is different from the fatness or sulphur found in other metals, “though it be an oyle in shew, yet it wil sink in water, whereas all other oyles wil swimme upon the top of the water” (Plattes 1639a, pp. 36–7).

The translation of this principle of nature (stating the proportional combination of the double type of fatness) in the field of agriculture would require finding the proper proportion between the two fatnesses, according to the predominant nature of the earth (terrestrial or ethereal). Adding combustible fatness to soil that is predominantly of an ethereal nature and already has that type of fatness in its composition will cause overfatting of the land and barrenness. Seeds and plants will grow in the soil where they find the proper fatness to prevail (Plattes 1639b, p. 40). Plattes also says that fruits are made “of a double substance, the one terrestriall, and the other aethereall, and for the most part, the want of the terrestriall part causeth ill successe,” meaning that fruits are made of the two fatnesses and, in order to have them ripen, there must be an equilibrium between them (Plattes 1639b, pp. 14–15). Therefore, the relation between bodies described by this principle of nature is a proportional relation and it is made in reference to alchemical principles, such as sulphur, mercury and salt.

Another principle of nature presumes that, according to the composition of their fatness, bodies swim or sink in water (Plattes 1639b, pp. 23–4). Bodies abounding in combustible fatness will swim, while bodies abounding in incombustible fatness will sink. For instance:

…if you cast the body of a Nut tree which is combustible into the water, it will swim: but if you cast in the shells of the Nuts, which

14. “For it consisteth of a double nature, the one Terrestriall, the other Celestiall or Aethirial: if either of these predominate, then the earth is barren and bringeth forth nothing that is beneficial” (Plattes 1639b, The Epistle Dedicatory, (a)).
are lighter quantitie for quantitie, and lesse combustible, they will sinke. (Plattes 1639b, p. 24)

The reason why bodies sink in water is due to their composition, and not to other factors such as weight. The more incombustible fatness one body possesses, the sooner it will sink in water. Gold is mostly made of incombustible fatness, having very little of the type that is combustible, therefore it “sinketh eagerly” (Plattes 1639b, p. 24). One can tell the difference between real and counterfeit gold by simultaneously dropping two pieces in water. The one that will sink more rapidly is the real one. The explanation relies on the chemical nature of the two metals: the real gold has more incombustible fatness in its composition than the counterfeit one. This is how this principle of nature reads in the field of metallurgy: precious metals, being made of a great quantity of incombustible fatness, have the property to coagulate with heat, while base metals evaporate (because it is the property of the incombustible fatness to cause coagulation of subterranean vapours through its astringent attribute and the property of combustible fatness to cause vegetation through its rarefying character) (Plattes 1639a, p. 38).

The “law of nature” that Plattes only refers to explicitly is magnetism. As stated before, magnetism is present in the universe, between celestial and terrestrial orbs, between stars and elements, but it is also the property that makes seeds grow and the lodestone attract iron:

The Terrestrial Globe composed of Earth & Water, [...] wonderfully placed in the middle of the vaste Element of Aire, not by the power onely of the mightie Creator: but also by his wisdome and exquisite artifice: for the Magneticke vertue betwixt it and the celestiall Orbes, is so exquisitely proportioned, in number, weight, and measure; that no side is over-matched with vertue attractive or expulsive; therefore it abideth in the middle of the universe, with as great stability, as if it had a supporter, such a one as our understanding is capable of: if men could observe proportion, they might frame a kinde of module thereof, by hanging a bullet of iron covered with clay, in the middle of a Speare, beset about with Loadstones of equall vertue attractive. (Plattes 1639b, pp. 1–2)\(^\text{15}\)

\(^\text{15}\) Debus spotted the influence of Gilbert in this passage, where Plattes also states that the magnetic virtue, attractive and repulsive, is equal in all directions. Debus 1961, p. 163; 1965, pp. 165–6. Equality in all directions is a reference to the way that, for Gilbert, magnetic virtue is distributed within the orb of virtue around a body in the presence of another body. The orb of virtue is a concept that makes sense only relative to the magnetic body in interaction, and not relative to one body. In a similar way, for Plattes magnetism is a
Although inspired by the theory of magnetism, Plattes seems to follow more than one tradition. Therefore, in his opinion, seeds also have a magnetic virtue, which is manifested as the seed’s capacity to draw the earth’s fatness(es), thus generating growth, while flowers, by their attractive virtue, draw the morning dew (Plattes 1639b, p. 60).

For where the Seed or Plant requireth a greater part of the one of the fatnesses more then the other, there that Seed or Plant prospereth; where the congruent fatnesse doth predominate, which by its Magnetique vertue it is prone to draw to it. (Plattes 1639b, p. 40)

Magnetism is described by Plattes as a vitalist, chemical property acting between bodies, a kind of thirst for “airy salt”.16 For “all corporeal substances”, says Plattes, “the more they have lost their spirituall parts by naturall, or artificiall operation,” the stronger their attractive virtue becomes (Plattes 1639a, p. 58).17 For instance, it is the iron’s thirst for the airy salt contained within the loadestone that moves it towards the loadestone. Magnetism is a source of motion and activity determined by the nature of bodies and is manifested as a relation between the nature of a body and the airy salt present in air or in another body in contact with the first. Heat affects the magnetic relation between bodies. For example, if you burn a loadestone until its vapors are exhaled, it will not attract iron any more (Plattes 1639a, p. 58). Therefore, heat will not affect the nature of magnetism; it will only change the chemical nature of bodies and, subsequently, the effect of their magnetic relation. The cause of magnetism is to be found in the nature of things and in the chemical relations between them. However, magnetism implies proportionality between bodies. The proportion of the “spirituall parts” of a substance will determine its magnetic property that belongs to bodies but it is manifested as relations between bodies. Although it is true that for Gilbert the magnetic virtue extends equally in all directions, it is strongest at the poles and weakest at the equator (See Gilbert 1958).

16. Gilbert expressed a vitalist view in De magnete. The vitalism associated with Gilbert is not a thirst for airy salt, but a consequence of the strong association he makes between self-movement and soul. See Gilbert 1958, pp. 107–9, 308–312. For an interpretation of Gilbert’s magnetic philosophy, see Pumfrey 1987, pp. 1–22; Georgescu 2017, pp. 149–76. Also a tinge of the Baconian matter theory of appetites can be noticed here. “Appetites” are described by Bacon as primary properties of matter that cannot be altered or erased, but can be manipulated; they manifest themselves as tendencies to follow what is agreeable and to reject what is not. See Bacon [1857–1874] 1961–1963, 4: 402. See also Jalobeanu 2016, pp. 229–54; Gigliioni, 2010, pp. 149–67, 153.

17. Plattes does not specify what he understands by “spirituall,” but it is possible that he uses the vitalist vocabulary present in the alchemical and medical literature of the time (See Clericuzio 2012, pp. 329–37).
virtue, making it stronger or weaker; also the chemical equilibrium of a body is restored by use of magnetic relations.

According to Plattes, magnetism sets matter in action in order to preserve the "generall good" ("The law of Nature doth complie with the generall profite" Plattes 1639b, The Preface, B3).18 Magnetism, for Plattes, is a "law of nature" that orders and regulates nature by moving bodies for the preservation of the general good of the universe, and this distinguishes it from the other two principles of nature that I have reconstructed in this paper, which describe the behaviour of individual bodies. Therefore, although it is not clear what Plattes understands by "law of nature," it is reasonable to accept its universal character, as opposed to the other two principles of nature that determine individual relations between bodies. As a "law of nature" with a universal character, the relation between magnetism and the other two principles of nature is bivalent. On the one hand, magnetism governs the structure of the other two chemical principles of nature; on the other, it regulates the chemical relations between natural bodies, being fundamental and prevalent in respect to them, as it applies to fatness, as well.

The principles of nature that I associate with Plattes' theory of matter express constitutive relations and describe the nature of things (such as the causal explanation for the falling of objects to the ground or the natural law of magnetic interaction). They are qualitative (such as the relation between combustible and incombustible types of fatness), they assume alchemical principles (such as the hypostatical principles), and they depict relations that can be described as vitalistic (as in the case of magnetism). Even though the relations are not quantitative, proportionality can be found within them. For Plattes, their role is to provide the foundation and framework for experimentation, to take experimentation a step further and to produce technologies of amelioration.

4. Experimentation and Technologies of Amelioration

Plattes' cosmology, his theory of matter, and the principles of nature are meant to be used as the groundwork for practice and experimentation. The practice of experimentation has a heuristic role, serving as a tool to illustrate, specify in particular cases, and exemplify the action of the principles of nature in particulars. Plattes' own observations in the domain of husbandry, made over what he claims to be a period of "34 years," revealed to him "all accidentall occurrences, and the naturall causes" for the

18. A similar view was shared by Gilbert. According to his cosmology, magnetism regulates the motions of the stars in agreement with the "greater good" of the universe (Gilbert 1958, p. 344; see also Bennett 1981; Georgescu 2017).
generation and growing of natural things (Plattes 1639b, The Preface, C2; 1639a, The Epistle Dedicatory, B1; [1644] 1655, HP, PAM 17, sig. A2v–A2v). The process of experimentation, besides illustrating the action of the principles of nature, will also provide methods and technologies of amelioration that could work in different domains. Holding an integrated vision of a universe governed by principles of nature expressed as qualitative alchemical assumptions, Plattes intended to investigate the applications of the principles in certain domains of human action, such as agriculture, metallurgy, and medicine.

Plattes considers that man can imitate nature in practical activities. For example, Plattes describes an experiment where one could reproduce in a chemical laboratory the formation of rocks and mountains out of bituminous and sulphureous substances, with the veins of metals engendered in the cracks and crannies of the mountains. This experiment shows why Plattes needs his theory of matter and how he uses it to read experimental results both consistently and coherently. While doing this, it is possible to find an increasing number of specific applications of the principles in particular cases. The analogy is warranted because of the principle of unity.

Let there bee had a great retort of Glasse, and let the same be halfe filled with Brimstone, Sea-coale, and as many bituminous and Sulphurious subterraneall substances as can bee gotten: then fill the necke thereof halfe full with the most free earth from stones that can be found, but thrust it not in too hard, then let it bee luted, and set in an open Furnace to distill with a temperate Fire, which may onely kindle the said substances, and if you worke exquisitely, you shall finde the said Earth petried, and turned into a Stone: you shall also finde cracks and chinkes in it, filled with the most tenacious, clammy, and viscous parts of the said vapours, which ascended from the subterraneall combustible substances.

Whereby it appeareth that the same thing is done by Nature, and that the Rocks and craggy Mountains are caused by the vapours of Bituminous and Sulphurious substances kindled in the bowells of the Earth, of which there bee divers so well knowne, that they neede not bee heere mentioned: Also it appeareth that the veines of Mettalls are engendred in the crackes and crainnes of the said Mountaines, out of the most clammy and glutenous part of the said vapours there adhering, where the cold gave them leave to bee congealed and condensed. (Plattes 1639a, pp. 6–7)

19. Webster also considers Plattes to be the first member of the Hartlib Circle to devote his efforts to outlining a new approach to husbandry (Webster 1975, p. 471).
Plattes’ devotion to experimentation places him close to Bacon’s experimental method. Although the practice of experimentation is familiar in the tradition of alchemy, there are two elements in Plattes’ experimentation that I consider to be Baconian in nature. The first is his use of experiments to illustrate natural processes as in the aforementioned example of creating artificial mountains in the lab (see Jalobeanu 2015, pp. 251–80). The second refers to the ability of the experimenter to move recipes and experiments from one particular field to another, such as transferring experimental results from one experimental situation to another (as in the examples of the nut tree/nut shell, gold/counterfeit gold, and quicksilver). Furthermore, the commitment to utility and the desire to produce technologies of amelioration offered a very popular key of reading the Baconian project among the members of the Hartlib Circle (Plattes 1639b, ch VII).20

In spite of the qualitative character of the principles of nature, Plattes’ method of experimentation aims for quantitative results. For instance, based on the relations entailed by his theory of matter and the principles of nature, Plattes conducted experiments enabling him to develop a fertilization technology whose efficacy he assessed quantitatively. In addition to previous theories of fertilization, Plattes added his own view of technological improvement, a view based on a theory of plant nutrition and cyclical chemical change. As mentioned above, for Plattes, the earth has a double nature: it is both “Terrestriall” and “Celestiall” or “Aethiriall,” and this double nature has to be “tempered” by fertilization. Different types of soil, in respect of their predominant types of fatness, require different types of seeds and different types of fertilizer. Plattes’ technology says that, in a soil abounding in incombustible fatness, the proper type of fertilizer should have combustible fatness in its composition, to proportion the balance between the two. And, in different years, the same earth could necessitate different types of fertilizer (according to its “temperament,” which may vary) (Plattes 1639b, p. 27).21 The husbandman should go even further and find out through trial and error, experimenting with various compositions, and using a quantitative method, the technology (that is, the proper proportions for different types of earth) working in different years. Repeated


21. The view of the two oily principles of matter influenced Walter Blith, another figure associated with the Hartlib Circle that shared interest in husbandry (see Blith 1653; Clericuzio 2018).
trials with different mixtures of a variety of substances, in different quantities, would lead to the formulation of more particular technology:

Whereby it is plaine, that as the various temperament of earths doe require various Seeds and Plants: so they doe require various compositions of Manure, to bring them to a temperament: which composition can never be found out, but by practise and triall of sundry conclusions upon small quantities of Land, at the first, with sundry compositions, as to mixe Lime with dung in several proportions with 2,3,4,5,6 or more to one, as occasion shall require, and when the true proportion is found, then to proceed in greater works. (Plattes 1639b, pp. 40–41)

Observations and experiments also perform the role of exemplifying the principles of nature or they can even refute other theories. One of Plattes’ principles of nature says that bodies swim or sink in water according to their chemical composition: the more incombustible fatness they have, the more rapidly they will sink. His short demonstration with the nut tree versus the nut shell enabled him not only to show his principle “in action” but also to prove that “one generall opinion is manifestly found false by experience”. The demonstration allowed him to move from one particular to another, and, as mentioned before, claiming that gold is almost exclusively composed of incombustible fatness, to present a technology of establishing the difference between two objects of the same weight, one made of gold and the other of brass. From this principle of nature and its exemplification, through the use of experimentation, Plattes moves to another instance and finds that quicksilver, although “the most friendly mineral to the royall metals,” can be turned into superior metals only with great difficulty, because base metals, being made of a great quantity of combustible fatness, have the property to evaporate with heat and to congeal with cold, unlike the royal metals, whose property is to coagulate with heat (Plattes 1639a, pp. 38–9). These examples are good illustrations of how one principle can be observed as acting in nature and how, from one simple manifestation of it, one can move from one particular to another, observing the instance of the principle in different domains.

22. “That is, the opinion according to which bodies float in water because they are light and sink because they are heavy” (Plattes 1639b, p. 24).
23. “[...] let a twentie shillings piece of gold be weighed against his Brasse weight, then let the scales sinke an inch or two into a Bason of water, and you shall finde the Gold heavier in the water by about ten graines: because that the combustible fatnesse in the Brasse inclineth more to swimming then the Gold, that conteineth almost none of that kinde of fatnesse” (Plattes 1639b, pp. 4–25).
The same chemical principles are used in the medical domain. Plattes reveals more than one influence in the belief that animate bodies (humans and animals) should have a balanced, good temperament. In the case of illness, distemper occurs. In order to restore the body’s balance, the treatment should apply the proper cure for the disease, i.e., add the proper type of fatness (Plattes 1639b, p. 65). Plattes speaks of a particular disease, “the rotting of sheepe.” In Plattes’ opinion, this disease is caused by overmoisturizing the sheep’s body (especially the liver, which, according to him, is “of a cold and moist constitution”). If the grass the sheep eat abounds in combustible rarifying fatness, this will affect their liver and, eventually, will dissolve it. The cure for this is to move the sheep immediately to dry forests, abounding in incombustible fatness and having “an astringent nutriment.” If this is not possible, or in order to prevent the disease, Plattes’ specific rule recommends adding salt water in the sheep’s food to temper the combustible fatness (Plattes 1639b, p. 65). According to Plattes, the food ingested and the chemical composition of the nutriments produce proportional changes in the chemical constitution of a body (Plattes 1639b, p. 66, incorrectly numbered as 62). Treatments should seek to restore the chemical balance of the body.

Plattes’ interest in experiments and laboratories is also present in A Caveat for Alchymists, where he announces to his readers that he had petitioned Parliament and asked them to establish a laboratory in which to conduct

24. Although influenced by Galen’s theory of the balance between the body’s humours, Plattes’ vision is not Galenic, but is rather a combination of Galen and Paracelsian influences (he seems to take the theory of chemical equilibrium from the Paracelsian tradition). When the balance of the human body, which is also made of a combination of combustible and incombustible fatness, is affected, illness occurs. Plattes makes an interesting connection between his theory of the body’s constitution (the combination of the two fatnesses) and the climate in different countries that also affect the human mind and its form of judgement and argumentation, but also the pleasures people seek (see Plattes 1639b, The Preface, B, B2). For Plattes’ views on medicine see Macaria.

25. Foot rot, or infectious pododermatitis, is a hoof infection commonly found in sheep, goats, and cattle.

26. A direct reference to this can be found in John Evelyn’s Elysium Britannicum, proving the popularity of Plattes’ works among people in contact with Samuel Hartlib. Evelyn agrees with Plattes’ technology regarding the proper balance of the soil and moves even further, arguing the same in the case of animals and humans: “…over spiritual composts do much poysem hot & cholery grounds … that quantity of Salt which makes a cold & moist ground fruitfull will destroy the contrary as Dr: {Gabriel} Plott shewes us … For it is the same in … vegetable productions, as in the Animals, where complexions must be suited, & the …{neglect} of this through avarice of greate portions & other sordid circumstances make many a family childlesse” (Evelyn 2001, p. 69). For Plattes’ acknowledgement in the matter of the chemical balance of the body, see also Beale 1657, p. 54; Beale to Boyle, 9 November 1663, Boyle 2001, 2: 176–79.
experiments and improve the “Art of Physick,” and thus to find techniques of husbandry and to transmute metals (Plattes [1643] 1655, p. 87). Unfortunately, there is no independent record of this petition.²⁷ Also, in Macaria, in a very Baconian fashion, Plattes assigns to “The College of Experience” the major task of gathering materials for the advancement of knowledge and adopting practical solutions by making experiments and delivering medicines that are able to cure both physical and spiritual diseases (Matei 2013b, pp. 7–33).

Plattes’ technologies have multiple purposes. First, they illustrate the action of the principles of nature. Second, with the use of a quantitative methodology, they are intended to induce qualities where they have not been present before, or to change the existing ones. Third, they move observations from one particular to another. Finally, their aim is to produce immediate amelioration in different domains, such as agriculture, metallurgy, or medicine.

5. Conclusion
In this paper I have shown that what I claim to be Plattes’ principles of nature served as the foundational background knowledge for his applied projects of experimentation, providing the conditions for issuing technologies of amelioration. The principles of nature assert alchemical and qualitative relations between types of matter and bodies, expressing constitutive principles and describing the nature of things. Although qualitative, the principles of nature affirm proportional relations instanced in multiple domains, such as agriculture, metallurgy, and medicine.

In accordance with the principles of nature, experimentation is meant to produce technologies of amelioration. These technologies have a heuristic role, they illustrate the principles of nature, refute divergent theories, manipulate the condition of things (inducing new qualities or emphasizing existing ones), and produce immediate effects in different domains. These technologies would be developed gradually, through the constant observation of nature and experimentation. Relying on a theory of matter of alchemical provenance mixed with magnetic influences, while advocating a Baconian type of experimentation, Plattes’ contribution to natural philosophy lies in his eclectic and coherent approach based on a combination of theoretical/experimental and qualitative/quantitative elements that are meant to advance knowledge of nature and to produce technologies of amelioration.

²⁷. Indeed, Hartlib was to tell Winthrop that Plattes never made any demonstration in front of Parliament of the possibility of the Lapis Philosophorum. Copy Letter in Scribal Hand?, Hartlib to John Winthrop the Younger, 16 March 1660, HP 7/7/1A-8B, on 2B.
References


Austen, Ralph. 1665. A Treatise of Fruit-Trees...Whereunto is Annexed Observations upon S' Fran. Bacons Natural History... The Third Impression, Revised, with Additions, etc. Oxford: William Hall for Amos Curteyne.


Matei, Oana. 2013b. “Macaria, the Hartlib Circle, and Husbanding Creation.” Societate și Politică (Society and Politics) 7(14): 7–33.


Plattes, Gabriel. 1639a. A Discovery of Subterraneall Treasure, viz. Of all manner of Mines and Mineralls, from the Gold to the Coale; with plaine Directions and Rules for the finding of them in all Kingdomes and Countries. London: by I. Okes, for Jasper Emery.

Plattes, Gabriel. 1639b. A Discovery of Infinite Treasure, Hidden Since the Worlds Beginning. Whereunto all men, of what degree soever, are friendly invited to be sharers with the Discoverer. London: Printed by I. L.


